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PRO

LIST

OF THE

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OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1892.

ZOOLOGICAL SOCIETY OF LONDON

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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON

FOR THE YEAR

1892.

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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

January 5, 1892.

Professor Newton, F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the months of November and December 1891:—

The total number of registered additions to the Society's Menagerie during the month of November was 45, of which 20 were by presentation, 1 by birth, 15 by purchase, and 9 on deposit. The total number of departures during the same period, by death and removals, was 91.

Amongst these attention may be called to the four Spotted-billed Pelicans (*Pelecanus manillensis*), received from Calcutta. This species, which is new to us, is a close ally of the African *P. rufescens*. When the birds come into full plumage we shall be able to see how far they differ from their African relative.

The registered additions to the Society's Menagerie during the month of December 1891 were 82 in number. Of these 71 were acquired by presentation, 8 by purchase, and 3 by exchange. The total number of departures during the same period, by death and removals, was 74.

Amongst these special attention may be called to the second specimen we have received of the Formosan Fruit-Bat (*Pteropus morsus*), of which the original specimen was received in January, 1873 (see P. Z. S. 1873, p. 192, pl. xxii.[1]). The present example

[1] This specimen died Oct. 4, 1879, and was acquired by the British Museum. —P. L. S.

was presented to the Society by Thomas Perkins, Esq., F.Z.S., Dec. 1st, 1891.

Dr. E. C. Stirling, C.M.Z.S., exhibited some specimens of the new Australian Marsupial (*Notoryctes typhlops*), and gave a short account of the habits of this remarkable animal, as observed in a specimen recently kept in captivity by one of his correspondents.

The following extract was read from a letter received by the Secretary from Dr. F. A. Jentink, F.M.Z.S., dated Leyden, 4th December, 1891:—

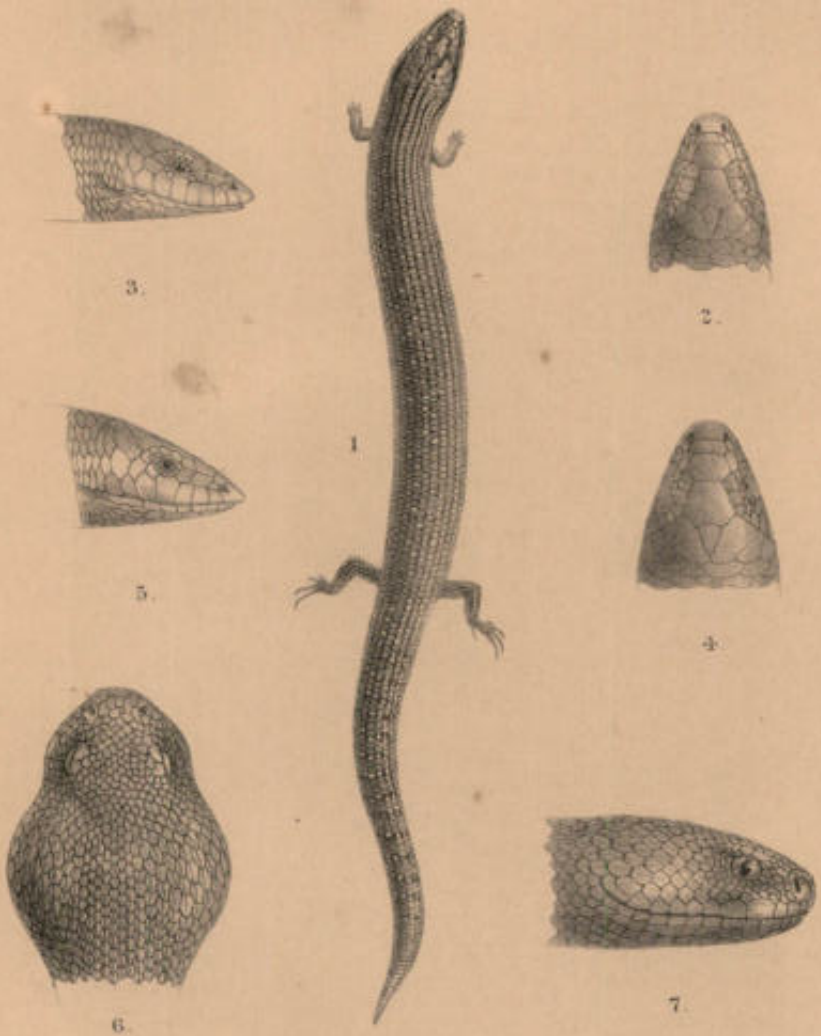
"In a paper published September 1890 (Notes from the Leyden Museum, p. 222) I called the attention of naturalists to the remarkable Bush-rat, *Pithechir melanurus*, from Java and Sumatra. The type of this black-tailed red Rat is a drawing in colours, by Duvaucel, reproduced in Cuvier's 'Mammifères.' No specimen of the *Pithechir melanurus* is in the Paris Museum, nor has it ever been observed by a naturalist, except by the late Dr. S. Müller, who procured in 1834 two skins from Padang and Batavia for the Leyden Museum, where they are still preserved. I think it will highly interest the members of the Zoological Society to know that I have just received a postcard from Mr. Pasteur, of Batavia, announcing that he has in his possession a whole family (♂, ♀ and young) of *P. melanurus*, captured in the neighbourhood of Batavia, which he intends to present to our Museum. Within a few weeks, I hope to get them, preserved in spirit, and to be able to give a more detailed description of the specimens and their skeletons &c."

Mr. Ernst Hartert exhibited 31 clutches of eggs of different birds' eggs associated with eggs of *Cuculus canorus*, mostly collected by himself and reliable friends. He made remarks about the mimicry of the egg in the *Cuculidæ*, and observed that some of the Indian species of this family illustrate this fact much better than the European Cuckoo.

Although attempts had been made to prove the contrary, one individual female Cuckoo in his opinion always laid similarly coloured eggs. To prove this fact he called attention to several series of eggs that had apparently been laid by one female. In every case the eggs of the same female were entirely similar to each other in form, size, and colour.

As a very remarkable fact Mr. Hartert mentioned that as regards the dark closed nests of the Common Wren no adaptation of the egg of the Cuckoo to the eggs of the owner had ever been noticed.

The following papers were read:—



Peter Smit del. et lith.

Mintern Bros. imp.

NEW TUNISIAN REPTILES.

1. On a small Collection of Mammals, Reptiles, and Batrachians from Barbary. By JOHN ANDERSON, M.D., LL.D., F.R.S.

[Received November 31, 1891.]

(Plate I.)

The Mammals, Reptiles, and Batrachians enumerated in the following notes were obtained either by myself in Algeria and Tunisia, or by my collector at Duirat, in the latter region, on the confines of Tripoli. But besides these, several species of Reptiles from the Sahara, purchased from a collector at Biskra[1], are also included in the list. The specimens collected by me were acquired between December and the beginning of May, and those captured by my collector between the middle of May and the end of June.[2]

The weather experienced in Algeria, in the winter and spring of 1889–90, was very unfavourable to collecting natural history specimens, and more especially reptiles. In Algiers itself, from the end of November until the 7th February, there was a succession of rainless intervals followed by protracted periods of wet weather accompanied with high winds, and so cold that fires were indispensable while the wet weather lasted. During these storms what fell as rain in the lower altitudes of the Tell, came down as snow on the Atlas and the high plateaux, a cold wind blowing from off their heights. On the 10th February I encountered snow a *mètre* in depth on Mount Beni Salah (5379 ft.) above Blidah, at an elevation of about 1200 to 1500 ft. below the summit; and M. Lataste records that, on the 22nd April 1881, the rain and hail that fell at that elevation on this mountain prevented him from passing beyond the farm called *La Glacière*, where snow is stored for use in summer at Algiers. This bad weather was not confined to the neighbourhood of Algiers, because, while there, there were constant reports coming in of heavy snow in Kabylia, at Setif, Constantine, and Batna, and indeed over the high plateaux generally, these storms occasionally making themselves felt as far south as Biskra, whence it was reported

[1] The localities in which the specimens had been captured were in every instance carefully noted on the bottles.

[2] The following is a list of the localities visited by me, with the altitudes of some of them, and the date when I was at each:—Algiers, Nov.–7 Feb.; Blidah, on the southern slope of the plain of the Metidji, 7th–12th Feb.; Hammam R'irha, 1800 ft., 12th–27th Feb.; Oran, 27th Feb.–6th March; Tlemçen, 2500 ft., 6th–11th March; Oran, 11th–13th March; Milianah, 2400 ft., 13th–19th March; Algiers, 19th–31st March; Tizi Ouzou, 31st March; Fort National, Kabylia, 3153 ft., 1st April; Tizi Ouzou, 1st–2nd April; Bordj Bouira, 2nd April; Bougie, 3rd–5th April; Kharata, Chabet-el Akhira, 1280 ft., 5th–8th April; Setif, 3573 ft., 8th–10th April; Constantine, 2093 ft., 10th–15th April; Biskra, 360 ft., 15th–22nd April; Constantine, 22nd–23rd April; Hammam Meskoutine, 23rd–28th April; Souk el Arba, plain of the Medjeida, Tunisia, 29th April; Tunis, 30th April–12th May.

that a heavy fall of rain had caused the collapse of some of the mud-houses of that oasis. While at Tlemçen, in the beginning of March, after experiencing two delightful days of bright sunshine, during which lizards began to show themselves, we were driven from it by a storm of rain and sleet, accompanied by a biting wind from the south-west, the direction from which these storms generally came, that lasted for two days. About this period, the railways that run southwards from Oran to the Sahara were blocked with snow. At Oran the weather was equally unsettled, clear intervals of sunshine alternating with days of heavy rain. At Miliannah, on the morning of the 18th March, we awoke to find the tops of the houses and the ground covered with snow, and, during a previous storm, towards the end of February, snow had fallen as low as Hammam R'irha. At Algiers we were delayed for thirteen days (19th March to 31st), waiting until the snow had disappeared from the mountain in Kabylia on which Fort National stands. At Kharata, at the head of the gorge Chabet el Akhira, we were storm-stayed for three days, as torrential rains, lasting for two days, had carried away parts of the road behind and in front of us. When we had arrived on the treeless plateau on which Setif stands, the frost was so intense on the morning (10th April) on which we left it, that every pool was frozen. The evening of the day following our arrival at Biskra, the wind rose with violence from the north accompanied by heavy rain which continued through the night and part of the next day. The Oued Biskra was so flooded by this storm from the Aures mountains, that the route to Sidi Okba which lies across it was closed for a day. My experience of an Algerian winter I was told was quite exceptional; but, since my return to this country, I have studied with interest the reports of the weather experienced in Algeria last winter, and I find that it has been even more exceptional than the previous winter. Snow fell in Algiers itself, and so heavily in Tunisia that native houses broke down under its weight, while some deaths from cold were recorded. In the west also it was very severe, as some anxiety was felt, during one of the storms, for an outlying village near Tlemçen which had become completely isolated, by reason of the snow that surrounded it. In connection with these observations on the winter climate of Algeria, I observe M. Lataste mentions the spring of 1881 was so little advanced by the middle of May, when he was at Bougie, that he was compelled to turn southwards. It was only when we had travelled as far west as Hammam Meskoutine, removed somewhat from the direct influence of the storms that come up from the Atlantic, that we began to experience genial weather and bright sunshine, under the influence of which snakes and lizards began to shake off the torpidity of winter, and by the time we had reached Tunis, 30th April, the heat in the sun had become so great that I abandoned the intention I had formed of going to Duirat, and sent my collector there instead.

I have given these details regarding the weather encountered in Algeria in 1889–90 because the character of the winter climate does not appear generally known, and as they serve to explain, to a

great degree, why the collection of reptiles made by me is so comparatively meagre.

M. Lataste, the most recent and successful investigator of the Vertebrate fauna of Barbary, has recorded his observations on the Mammalia inhabiting that region in two works[1]. He has been able, by his collections and extensive researches in the country and by the labours of other naturalists, to bring up the number of Mammalian species inhabiting Barbary to 84.

Among the eleven species of small Mammalia found by me the only one calling for special remark is *Plecotus auritus*, obtained by my collector in considerable numbers at Duirat. The interest attached to these specimens is that, while the species is an addition to the fauna of Tunisia, it is only the second time that it has been reported from Barbary. M. Loche had observed a specimen in the flesh, at Blidah, in the hands of a child who had caught it; but M. Lataste was of the opinion that the species was one of eight included by M. Loche in his list of Mammals of Algeria, all of which would probably be ultimately erased from the list. This however, is included by M. Lataste in his Catalogue along with the other seven.

Another valuable result of M. Lataste's labours was read before this Society on the 18th November last. I refer to Mr. Boulenger's "Catalogue of the Reptiles and Batrachia of Barbary, based chiefly upon the notes and collections made by M. Lataste in 1880–84." Long before his Catalogue was finally printed off, Mr. Boulenger very kindly gave me the use of a set of proofs to assist me in naming my specimens, and by their aid, and by means of the excellent keys and concise descriptions embodied in the Catalogue, the identification of the specimens was easily accomplished, even in so difficult a genus as *Acanthodactylus*.

Moreover, as the specimens, after they had been referred to their respective species, were compared with the representatives of the species in the British Museum, I have every confidence that each has been correctly named.

Mr. Boulenger's Catalogue enumerates 64 species of Reptiles and 10 species of Batrachians, whereas my small collection contains only 33 Reptiles and six ecaudate Batrachians, none of the caudate forms having been obtained. Mr. Boulenger has given a most instructive list illustrating in tabular form the distribution of the Reptilia and Batrachia of Barbary; and the only addition these specimens make to it is the extension of the range of *Lacerta ocellata*, var. *tangitana*, to the Tell region of Algeria, in the Province of Oran.

At Duirat, in Tunisia, a locality where apparently forms distinctive of the Tell and of the fauna of the Sahara meet, and which in position seems to bear much the same relation to the Tunisian desert that Biskra has to the Algerian Sahara, my collector obtained one

[1] "Étude de la Faune des Vertébrés de Barbarie: Catalogue Provisoire des Mammifères Apélagiques Sauvages," Actes de la Soc. Linnéenne de Bordeaux, t. xxxix. pp. 129–289. And as a separate work, 1885. Catalogue Critique des Mammifères Apélagiques Sauvages de la Tunisie, 1887.

well-marked new species of the genus *Chalcides*, of which I give a description and three figures, accompanied, for the sake of comparison, by two views of the head of its nearest ally, *C. sepoides*, Audouin.

At the same place my collector also found a Viper distinctly referable to *V. lebetina*, but, at the same time, differing so much from the typical form, in some of the details of its structure, that I have had no other course left me but to describe it as a variety.

MAMMALIA.

Order CHIROPTERA.

Family I. Rhinolophidæ.

Genus Rhinolophus, Geoffroy.

1. Rhinolophus euryale, Blasius; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 65.

1 ♂, cave at Hammam Meskoutine, Province of Constantine.

Family II. Vespertilionidæ.

Genus Plecotus, Geoffroy.

2. Plecotus auritus, Linnæus; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 66.

2 ♂ & 14 ♀, Duirat, Tunisia.

Beyond M. Loche's statement[1] that he saw a specimen of this Bat in the hands of a child at Blidah, I am not aware of any other notice of its occurrence in Algeria, and this is the first time it has been reported from Tunisia. The foregoing specimens, instead of being light brown, are pale ashy on the upper surface, the light colour generally distinctive of this Bat in desert regions.

Genus Vesperugo, Keys. & Blas.

3. Vesperugo kuhli, Natterer; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 70; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 2.

1 ♂ & 1 ♀[2], Duirat, Tunisia.

[1] Cat. des Mammif. et des Oiseaux observés en Algérie, 1858, sp. 43.

[2] The wing and interfemoral membranes of one of these Bats are torn and shrivelled up in places along the margins to such an extent that the flight of the animal must have been materially affected by it. Here and there over the surfaces of the membranes, and elsewhere on the body, there are dense colonies of a minute white *Acarus*, and it seems probable that the irritation produced by them had set up inflammation resulting in the partial destruction of the membranes, which also, when held against the light, were seen to be covered with small black spots, doubtless old inflamed areas due to the same cause. Mr. A. Michael kindly undertook to determine the nature of these *Acari*. The following are his remarks:—

"The Acari submitted to me belong to two species only, and are all immature.

"The first is a single specimen of the nymph of one of the Ixodidæ, and

This widely distributed Bat was recorded from the Tunisian Chotts by M. Lataste in 1885, and again, in 1885, from El Hammam de Cabes, at the eastern extremity of these salt-water lakes of Tunisia.

Genus Miniopterus, Bonaparte.

4. Miniopterus schreibersi, Natterer; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 75.

2 ♂ & 2 ♀, cave at Hammam Meskoutine, Province of Constantine.

The most easterly point in the distribution of this Bat recorded by M. Lataste was Cape Okas, near Bougie. This new locality brings it close to Tunisia, in which province, however, it has not yet been observed.

Order INSECTIVORA.

Family I. Macroscelididæ.

Genus Macroscelides.

1. Macroscelides rozeti, Duvernoy; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 77; id. Cat. Crit. des Mammif. Apélagiques Sauvages, 1887, p. 4.

2 ♂ & 2 ♀, Duirat, Tunisia; 1 ♀, hills behind Biskra.

This species has been found at Mount Santa Cruz, Oran (in the Tell), whence also probably came the specimen from which Duvernoy described the species. It likewise inhabits the high plateaux, and has been recorded from (north to south) Aïn Oussera, about 3000 ft. above the sea, Djelfa, 3792 ft., Aïn el Ibel, about 3700 ft., and also from the slopes tending to the Sahara, such as Laghouat, 2437 ft., and Bou Säada, 1900 ft. The specimen recorded by me from Biskra, 360 ft. above the sea-level, was not obtained at this elevation, but from the hills behind, at what height I cannot say. M. Lataste

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belongs to the genus *Hyalomma* (Koch). The species seems to be either the *Ixodes flavipes* of Koch or the *I. vespertilionis* of the same author; it is not possible in the present state of our knowledge to identify it with certainty from immature specimens, but it is probable that the two species are not really distinct; both have been recorded as bat-parasites, the former by Kolenati, the latter by Koch. According to modern classification this Acarid would belong to the genus *Hyalomma*, not *Ixodes*.

"The other Acarid, of which there are numerous examples, was found by Dr. Anderson upon the same Bat and upon *Plecotus auritus*; it is one of the creatures described by Kolenati as forming the genus *Peplonyssus*; the species is probably his *P. cruciplica*. These *Peplonyssi* are all bat-parasites; but, although I am not sure that the fact has been publicly recorded, I think there can be no doubt that all the species of the genus are larval forms of Ixodidæ, the adults of which we may or may not be acquainted with, but which cannot at present be identified with the larvæ."

has recorded it from Batna, 3350 ft., on the high plateaux immediately to the north of Biskra, and he has mentioned specimens from the region of the Tunisian Chotts, Feriana and Djebel Bou-Hedma, Tunisia, but none so far from the east as Duirat.

The female from Biskra I had alive in my possession from the 17th April until the 22nd May. I brought it alive to Switzerland, but, after it had been eight days in Europe, it died, possibly from eating food unsuited to it. In Algeria, but more especially in Tunis, I experienced no difficulty in obtaining house-flies wherewith to feed it, and on which it throve, but, on my arrival in Europe, these insects were so scarce that I had first to offer it the larvæ on which bird-fanciers feed small insectivorous birds. These it ate for a day or two, but, as it afterwards refused to touch them, I had next to try it with small cockroaches. These, however, did not appear to agree with it, and in two days more it was dead.

It was very expert in catching flies, and as it never attempted to jump off any great height, I used to place it on a table, covered with a white cloth, and to scatter maimed flies over the table. When it once caught sight of a fly it made a rapid rush at it, the mobile proboscis touched the fly, and it disappeared, the Shrew seldom allowing one to escape. The tongue is remarkably long, exceeding the length of the snout, on the under surface of which there is a well-marked groove along which possibly the tongue is projected, assisting in the seizure of the insect prey. In its natural haunts, the proboscis is probably introduced into crevices where insects lurk.

It was so tame that it was generally placed on the breakfast table, on which it ran perfectly at home, occasionally picking up minute hard crumbs from the outsides of "*croissants*" or fragments of biscuits. It used also to lap milk freely from a spoon, returning every now and again to do so, and, if it had had its own way, it would have gorged itself with butter, but with disastrous effects, as a small quantity acted on it as a laxative.

Its great delight while on the table was to get under a covert of some kind, and to run from one shelter to another, now and again darting out suddenly when it saw a fly. It never attempted to bite, and it seemed to enjoy being held in the hands, the heat and cover afforded by them being grateful to it. In this position it would remain for a long time, making no effort to move.

Its sense of hearing was acute, more especially to sharp sounds, any shrill call at once startling it, whereas dull sounds it seemed to heed but little. With regard to its vision, I may mention that while it had a keen eye for small objects in motion, I could wave my arms in front of it, a few feet off, without scaring it.

Its movements were extremely rapid, and in ordinary progression it never jumped, but was projected forwards, so to speak, in short runs, ever and anon stopping abruptly to look about.

Measurements of *Macroscelides rozeti*.

	♂.	♂.	♀.	♀.	♀.
	millim.	millim.	millim.	millim.	millim.
Tip of snout to vent	104	94	108	105	95
Vent to tip of tail without hairs	114	112	110	117	100
Tip of snout to upper incisors	14	13	13	14	14
Length of hind foot with claws	31	31	32	32	32
Height of ear	29	29	31	30	28
Breadth of ear	20	20	20	22	19

There were two fœtuses in the right horn of the uterus of one of these females, a similar number having been recorded by M. Lataste in an individual which he examined. In his specimen they were still very young on the 10th May, whereas in my specimen, captured in June, they were covered with hair and evidently mature. The weight of one of the fœtuses was 28 grains without the placenta.

Family II. Soricidæ.

Genus Crocidura, Wagler.

2. Crocidura aranea, Linnæus; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 82; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 6.

1 ♀, environs of Algiers.

Snout to vent 55 millim.; vent to tip of tail 35 millim.; hind foot and claws 13 millim.

Order RODENTIA.

Family I. Muridæ.

Subfamily *Gerbillinæ*.

Genus Gerbillus, Desmarest.

1. Gerbillus campestris, Levaillant; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 142; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 24.

1 ♂, Duirat, Tunisia.

Measurements of *G. campestris*.

	♂.
	millim.
Tip of snout to vent	90
Vent to tip of tail without hairs	114
Height of ear	15
Length of hind foot with claws	27
Occiput to vent	32

This form in its four subarticular and two tarsal tubercles= *Dipodillus*.

2. Gerbillus shawi, Rozet.

Meriones shawi, Rozet; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 114; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 27.

5 ♀ & 1 ♂, Duirat, Tunisia.

Measurements of *G. shawi*.

	♀.	♀.	♀.	♀.	♀.	♂.
	millim.	millim.	millim.	millim.	millim.	millim.
Tip of snout to vent.....	135	128	117	77	73	74
Vent to tip of tail without hairs	125	117	119	63	67	69
Height of ear	15	13	13	11	11	11
Length of hind foot and claws	33	33	33	26	26	27
Occiput to snout	41	39	38	30	29	30

The largest female was gravid (June), and had four fœtuses, well advanced, in each horn of the uterus.

Subfamily *Murinæ*.

Genus Mus, Linnæus.

3. Mus musculus, Linnæus; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 135; id. Cat. Crit. des Mammif. Apélagiques Sauvages de la Tunisie, 1887, p. 22.

1 ♀ juv., Biskra; 2 ♂, Hammam Meskoutine, Province of Constantine; and 1 ♂, Duirat, Tunisia.

Family II. Octodontidæ.

Genus Ctenodactylus, Gray.

4. Ctenodactylus gundi, Rothman; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 152; id. Cat. Crit. des Mammif. de la Tunisie, 1887, p. 31.

2 ♀ & 1 ♂, Duirat, Tunisia.

This species is said to be common on the hills behind Biskra.

Family III. Dipodidæ.

Genus Dipus, Gmelin.

5. Dipus hirtipes, Lichtenstein; Lataste, Etude de la Faune des Vertébrés de Barbarie, 1885, p. 150; id. Cat. Crit. des Mammif. &c. 1887, p. 30.

1 ♀, Biskra.

This female gave birth to two young ones while in my possession (27 April), but made no visible effort to rear them.

The animal burrowed in loose earth with great rapidity, completely disappearing in a remarkably short time, driving the earth backwards with its hind feet, and, as it accumulated behind them, turning and pushing it out of the burrow with its broad hairy snout.

REPTILIA.

Order CHELONIA.

Family I. Testudinidæ.

Genus Testudo, Linnæus.

1. Testudo ibera, Pallas; Boulenger, Trans. Zool. Soc. London, vol. xiii. pt. iii. 1891, p. 104.

5, neighbourhood of Algiers; 2, Duirat, Tunisia.

Genus Clemmys, Wagler.

2. Clemmys leprosa, Schweigger; Boulenger, *loc. cit.* p. 106.

3 ♀, Duirat, Tunisia.

I also obtained a specimen of this species at Biskra, but it escaped.

Order SQUAMATA.

Suborder I. Lacertilia.

Family I. Geckonidæ.

Genus Hemidactylus, Gray.

1. Hemidactylus turcicus, Linnæus; Boulenger, *loc. cit.* p. 115.

1 ♀, Hammam R'irha, Province of Algiers.

Genus Tarentola, Gray.

2. Tarentola mauritanica, Linnæus; Boulenger, *loc. cit.* p. 115.

1, Biskra; 3, walls of old tombs outside the Bab Alewa, Tunis; 21, Duirat, Tunisia.

Among these specimens there are examples of the typical form and of the variety *deserti*. The specimen from Biskra is an example of the latter, but the Geckos from Tunis belong to the typical form, which also occurs at Duirat, along with the variety, the Saharian and Tell faunæ meeting at that locality.

Family II. Agamidæ.

Genus Agama, Daudin.

3. Agama inermis, Reuss; Boulenger, *loc. cit.* p. 117.

2, from between Biskra and Tuggurt; 1 ♀, Tuggurt; 2 ♂ & 4 ♀, Duirat, Tunisia.

The largest female measures from the snout to the vent 94 millim., and the tail 125 millim.

These specimens illustrate the unequal lepidosis of the back mentioned by Mr. Boulenger, as no two are alike in the distribution of the enlarged scales.

The Duirat specimens collected in the months of May and June are gravid.

Genus Uromastix, Merrem.

4. Uromastix acanthinurus, Bell; Boulenger, *loc. cit.* p. 119.

2, Biskra; 2, Duirat.

Family III. Varanidæ.

Genus Varanus, Merrem.

5. Varanus griseus, Daudin; Boulenger, *loc. cit.* p. 121.

1 ♀, Duirat, Tunisia.

Mr. Boulenger gives the dimensions of this species as follows:—snout to vent 56 centims, tail 71; but this female, although it is 22 centimetres shorter in its body, is gravid, having 7 ova in the right, and 8 in the left ovary, the ova on the right side being pressed forwards almost as far as the axilla.

Family IV. Amphisbænidæ.

Genus Trogonophis, Kaup.

6. Trogonophis wiegmanni, Kaup; Boulenger, *loc. cit.* p. 122.

2, Hammam Meskoutine, Province of Constantine, under large stones on hill-sides.

Family V. Lacertidæ.

Genus Lacerta, Linnæus.

7. Lacerta ocellata, Daudin; Boulenger, *loc. cit.* p. 123.

Var. pater, Lataste, 1880; Boulenger, *loc. cit.* p. 123.

2 ♂, under hedges by the road-side, Tlemsen, Province of Oran; 1 ♀, under a large stone, Hammam Meskoutine, Province of Constantine; 2 ♂ & 2 ♀, Duirat, Tunisia.

M. Lataste was the first to point out that the large lizard of Algeria and Tunisia was a race or subspecies of *L. ocellata*, closely related to it, but having also some points of affinity with *L. viridis*. Mr. Boulenger adopts this view, with which I fully agree, and in his catalogue he clearly indicates wherein it differs from the European form.

In none of these specimens does the number of scales across the back exceed 80, nor are the femoral pores more than 16.

7a. var. tangitana, Boulenger, Catalogue of Lizards in the

Brit. Mus. 1887, vol. iii. p. 13, pl. iii. fig. 1; et *loc. cit.* p. 124.

1 young, Tlemçen, Province of Oran.

This variety was founded by Mr. Boulenger for the reception of some lizards from Tangier, very nearly allied to the previous variety, but differing from it and from *L. ocellata typica* in their much smaller dorsal scales, numbering from 77 to 100 across the middle of the body, and in their more numerous (17–21) femoral pores. On the other hand, in their smaller occipital and in the number (6–8) of the longitudinal rows of ventral scales, they manifest, as pointed out by Mr. Boulenger, marked affinities to the Spanish-Portuguese form of *L. viridis*, the var. *schreiberi*, Bedriaga, and so closely do they resemble it in these two respects that they are undistinguishable from it. Until the discovery of these specimens from Tangier, *L. ocellata* and *L. viridis* were unknown from Morocco. It is interesting therefore to find the Morocco variety occurring at Tlemçen, but not surprising, considering the proximity of this locality to Morocco. This specimen, however, presents one variation by which it can be distinguished from all the examples of var. *tangitana* in the British Museum, and that is, that the shields along the collar are much more numerous, being 22, whereas in vars. *pater* and *tangitana* there are only 10 or 11 shields. This is not at all likely to be an individual variation, and hence it is interesting to find the outlying members of the variety so modified.

The specimen in question is unfortunately young, as it measures only 47 millim. from the snout to the vent, but in all its other characters it resembles var. *tangitana*. The dorsal scales are very small, and number 87 across the middle of the body; there are 18 femoral pores, 8 longitudinal rows of scales on the belly, and the occipital shield is decidedly narrower than the interparietal, all distinctive features of *L. ocellata*, var. *tangitana*.

8. Lacerta muralis, Laurenti; Boulenger, *loc. cit.* p. 125.

3 ♂ & 3 ♀, Tlemçen, Province of Oran.

These lizards resemble the specimens of this species from Tangier described by Mr. Boulenger as having the scales very small, obtusely keeled and in 61 to 73 rows across the middle of the body, but in some of them they fall to 56. Their upper caudal scales are also strongly keeled as in specimens from Tangier. The femoral pores vary from 17 to 21, whereas in examples from the latter district they vary from 13 to 19, 17 being the usual number.

One of the above males is coloured exactly like the specimens from Tangier in the British Museum, but another and two females are less spotted with black, and the white spots on the tail, so marked in Tangier specimens, are absent, or only feebly indicated.

9. Lacerta perspicillata, Dum. & Bibr.; Boulenger, *loc. cit.* p. 126.

2 ♂, Santa Cruz, Oran.

In these specimens there are 56 and 60 scales across the middle

of the body, the highest number mentioned by Boulenger being 56; and in the smaller of the two specimens there are six upper labials before the subocular on one side and seven on the other, the usual number of these shields being five.

Genus Psammodromus, Fitzinger.

10. Psammodromus algirus, Linnæus; Boulenger, *loc. cit.* p. 128.

1 ♀, Tlemçen, Province of Oran.

Genus Acanthodactylus, Wiegmann.

11. Acanthodactylus boskianus, Daudin; Boulenger, *loc. cit.* p. 129.

1 ♂, Biskra; 1 ♂ & 1 ♀, Tuggurt; 1 ♂ & 3 ♀, Duirat, Tunisia.

The ventral plates in these specimens do not exceed 10, and the highest number of large keeled scales between the hind limbs is 11; but this occurs only in one specimen, all the others having 10 longitudinal rows.

Five of the seven specimens have 23 femoral pores on each side, one 19, and the other 24. The longitudinal series of scales round the middle of the body vary from 30 to 36, the lowest number occurring in a specimen from Duirat.

12. Acanthodactylus scutellatus, Audouin; Boulenger, *loc. cit.* p. 130.

1 ♂ & 4 ♀, Tuggurt; 3 ♂ & 2 ♀, Duirat, Tunisia.

These specimens are all distinguished by acute snouts, denticulated ears, and by the dorsal and ventral scales merging the one into the other, these scales conjointly varying from 60 to 70 (Mr. Boulenger gives 61–74); the scales referable to the ventral region vary from 12 to 14, the latter number being dependent on the degree of development of the outermost series of scales, but in Mr. Boulenger's specimens the number rose to 18. The lowest number of femoral pores, 18, occurs in a female specimen from Tuggurt, whereas the highest number 26, is found in a male from Duirat, the range of femoral pores recorded by Mr. Boulenger being from 18 to 25.

The three males from Duirat are reddish, with numerous black spots and indications of white ocelli on the sides, whereas the females from the same locality are uniformly reddish, with the white ocelli feebly visible, and the black spots only faintly traceable here and there. The Tuggurt specimens are olive-grey. In the male from this locality the black spots are more distinctly marked than in the females.

13. Acanthodactylus pardalis, Lichtenstein; Boulenger, *loc. cit.* p. 131.

3 ♂, Aures Mountains, north of Biskra; 7 ♂ & 8 ♀, route between Biskra and Tuggurt; 3 ♂ & 7 ♀, Duirat, Tunisia.

The specimens from the first-mentioned locality belong to the variety named *bedriagæ* by M. Lataste, whilst the others, which are distinguished from them by being more slender and somewhat smaller, may be taken as representing the variety *deserti* (*Zootoca deserti*, Günther). However, as Mr. Boulenger points out, not only are these varieties ill-defined, but the former approaches *A. vulgaris* in its structure and coloration, whilst the latter often closely resembles *A. scutellatus*. This species (*A. pardalis*) is thus a transitional form.

Among the specimens recorded above, the scales round the middle of the body, including the ventrals, vary from 61–74, whereas in Mr. Boulenger's specimens the variation is from 66–82. The femoral pores also are variable, as in my specimens the lowest number is 15 and the highest 22, whilst the numbers recorded by him are 15–25.

14. Acanthodactylus vulgaris, Dum. & Bibr.; Boulenger, *loc. cit.* p. 131.

4 ♂ & 3 ♀, Mount Santa Cruz. On old walls at the foot of the hill.

In these specimens the subocular enters the labial border, and in five out of the seven it does so more or less broadly. In one of the remaining two the sharp lower angle of the shield is wedged in between the labials as a fine point, while in the seventh specimen it is excluded from the labial border on one side, but preserves the same character as the previous specimen on the opposite side. Unlike Moroccan examples of this lizard, the tendency of this shield is to enter largely into the formation of the lip.

In none of the specimens does the number of the scales round the body, including the ventrals (8), exceed 77, nor fall lower than 73. The femoral pores vary from 23 to 26.

They are marked with six longitudinal whitish lines, separated from each other by broad dark brown bands; but in the largest specimen the white lines are more or less broken up into white spots, the intervening dark bands being reticulated with brick-red. The limbs are white spotted, and the end of the tail is pink.

Genus Eremias, Wiegmann.

15. Eremias guttulata, Lichtenstein; Boulenger, *loc. cit.* p. 132.

1 ♂, between Biskra and Tuggurt; 1 ♂, Tuggurt, and 1 ♀, Duirat.

These three specimens have the median disk of the eyelid broken up into 4, 5, and 6 scales respectively, with the collar distinct only at the sides. In the variations tabulated by Mr. Boulenger, the form with the collar distinct at the sides has only two scales in the transparent palpebral disk, the highest number, four, recorded by him occurring in specimens with the collar free all round. In specimens presenting these two kinds of variation in the collar and in the

palpebral disk, the number of scales round the middle of the body is 52, the femoral pores being 10–10 in the first variation, and 11–10 in the second, whereas in my specimens the scales round the body (including the ventrals) are 52–53, and the femoral pores are 11–14. In Mr. Boulenger's specimens with six scales in the palpebral disk, and with the collar distinct and attached in the middle, the femoral pores are 14–13, while in the above-mentioned specimen, with the same number of scales in the palpebral disk, there are only 11 femoral pores, associated with 53 scales (including the ventrals) round the body, whilst his specimens have 59 scales. Mr. Boulenger indicates another variation with 3 scales in the palpebral disk, 68 scales (including ventrals) round the body, and with 17–17 femoral pores. These facts attest the correctness of M. Lataste's opinion, which Mr. Boulenger shares, that no division of this species into subspecies or varieties can be made on characters derived from the palpebral disk and collar.

Family VI. Scincidæ.

Genus Mabuia, Fitzinger.

16. Mabuia vittata, Olivier; Boulenger, *loc. cit.* p. 135.

1, Djebel Ahmer Khaddon, south of Constantine; 1, Biskra; 1, between Biskra and Tuggurt.

The largest specimen is from the first-mentioned locality, and measures, from the snout to the vent, 75 millim., the tail 129.

Genus Eumeces, Wiegmann.

17. Eumeces schneideri, Daudin; Boulenger, *loc. cit.* p. 136.

1 ♂ & 2 ♀, Duirat, Tunisia.

Genus Scincus, Laurenti.

18. Scincus officinalis, Laurenti; Boulenger, *loc. cit.* p. 137.

1 ♂, Sand-dunes, Debila, Sahara; 1 ♂ & 3 ♀, Tuggurt; 1 ♂ & 3 ♀, Duirat, Tunisia.

In one of the specimens from Duirat there are 30 scales round the body, in the other 26–28. These specimens present two types of coloration, being either uniformly yellowish above or marked in addition with dark brown bars more or less continuous across the back, strongly or obscurely developed.

Genus Chalcides, Laurenti.

19. Chalcides ocellatus, Forskål; Boulenger, *loc. cit.* p. 138.

11, Biskra; 1, Djebel Ahmar Khaddon, south of Constantine; 6, Duirat, Tunisia.

The largest specimen is 116 millim. from the snout to the vent, and, in one measuring 104 millim., the hind limb is 25 millim. The scales round the body vary from 28–32 in number, whereas those

described by Mr. Boulenger had never more than 30. The specimens from Duirat are all marked with white ocelli or shafts in black spots, the general colour of the upper surface varying from dark brown to dark grey, without any trace of the broad dorsal band of a darker hue which occurs in all the Biskra specimens, none of which are of a grey tint. In some specimens from Biskra the ocelli are practically absent or only obscurely indicated.

19 *a*. var. TILIGUGU, Gmelin.

1, Tlemçen, Province of Oran; 1, Mount Santa Cruz, Oran; 1, Hammam R'irha, Province of Algiers; 2, Hammam Meskoutine, Province of Constantine; and 3, Duirat, Tunisia.

These specimens are stouter than the previous form and larger, reaching 144 millim. from the snout to the vent. The limbs also are longer, as in one individual measuring 105 millim. from the snout to the vent the hind limb is 29 millim. The scales round the body vary from 30–32. In all of them there is a broad dorsal band with a lighter-coloured broad band on either side of it, and all are ocellated. The Duirat specimens are much paler than those from the Tell.

20. CHALCIDES BOULENGERI, sp. nov. (Plate I. figs. 1, 2, 3.)

2 specimens, Duirat, Tunisia.

Snout wedge-shaped, not so broad as in *C. sepoides*, Audouin, but with a projecting labial edge; eye small, but slightly larger than in *C. sepoides*; ear-opening an oblique slit at the commissure of the mouth, but with a fringe of three pointed scales. The nostril is not in advance of the suture between the rostral and the first labial; supranasals fused into a single shield; frontal as broad or a little broader than long; four supraoculars, with four small scales below them; fifth labial enters the orbit. The limbs are weak, but stronger than in *C. sepoides*; the hinder pair are proportionally more developed than the front limbs. The hind limbs are penta- or tetradactyle, and in length each equals about the distance between the fore limb and the nostril; the latter limb equals considerably more than half its distance from the centre of the eye, and is pentadactyle [1]. The body is not quite so long as in *C. sepoides*, and the sides are angular as in that species. Twenty-eight rows of scales round the body.

Yellowish above, each scale finely margined with dark brown, their centres whitish and presenting, in some instances, the appearance of ocelli, recalling the ocellation characteristic of *C. ocellatus*, and this is unmistakably marked especially on the tail, on which the ocelli are arranged in more or less transverse rows. A black line through the eye, and two fine black lines on either side of the frontal. The

[1] In one specimen the *manus* is entirely absent on one side, but this is probably due to an accident.

black margins of the scales on the nape tend to form longitudinal lines.

No. 1. Snout to vent 83 millim., tail 60, hind limb 17.
No. 2. „ „ „ 83 „ „ 45[1], „ „ 17.

This species is distinguished from *C. sepoides* (Plate I. figs. 4, 5) by the nostril not being placed in advance of the suture between the first labial and the rostral; by the fifth labial entering the orbit, whereas in *C. sepoides* it is the fourth that does so; and by 28 rows of scales round the body, whilst in that species these scales never exceed 24.

The ear is much the same as in *C. sepoides*, but it is very different from the ear of *C. ocellatus* and that of *C. mionecton*, in which it is a round well-marked opening, further removed from the angle of the mouth.

It is linked by the character of its labial edge and rostral to *C. sphenopsiformis* (Senegambia), which through *C. mionecton* connects it with *C. ocellatus*. It thus supplies a link that was wanting in the chain of these species, so to speak.

I have much pleasure in connecting Mr. Boulenger's name with this new lizard from Barbary.

Suborder II. Rhiptoglossa.

Family I. Chamæleontidæ.

Genus Chamæleon, Laurenti.

1. Chamæleon vulgaris, Daudin; Boulenger, *loc. cit.* p. 142.

1, Tamerna, Sahara; 3, Duirat, Tunisia.

Suborder III. Ophidia.

Family I. Colubridæ.

Genus Zamenis, Wagler.

1. Zamenis algirus, Jan; Boulenger, *loc. cit.* p. 147.

2 specimens, Duirat, Tunisia.

No. 1. Total length 1000 millim., tail 250. Ventrals 218, subcaudals 104.

No. 2. Total length 920 millim., tail 200. Ventrals 231, subcaudals 87.

In the first specimen there are 8 upper labials on one side and 9 on the other, but in No. 2 there are 9 upper labials on both sides. In No. 1 the fifth labial enters the orbit on the left side, but on the right side the labials are excluded from touching the eye; and in No. 2 a labial, the fifth, enters the orbit on one side only, being excluded on the other by an additional subocular, the labial entering the orbit when there are only two suboculars. The præocular in these specimens has generally two small scales below it separating it from

[1] Renewed.

the labials. The temporals also are variable, as in No. 2 they are 3+3 on one side and 2+3 on the other. The number of subcaudals in No. 1 exceeds the maximum given by Mr. Boulenger, and its anal is entire, while in No. 2 these plates fall below the minimum recorded by him. His figures are 92–100. Their coloration is normal.

2. Zamenis hippocrepis, Linnæus; Boulenger, *op. cit.* p. 147.

1 specimen, Hammam Meskoutine, Province of Constantine; 1 specimen, neighbourhood of Algiers.

In the first specimen there are 10 upper labials on one side, and two temporals in contact with the postoculars.

3. Zamenis diadema, Schlegel; Boulenger, *op. cit.* p. 148.

1 specimen, Duirat, Tunisia; 1 specimen, between Biskra and Tuggurt.

The snake from Duirat has 25 rows of scales, and the Biskra-Tuggurt specimen 32. The head-shields present some of the variations usual to this species.

The Duirat specimen has the pale yellowish sandy coloration of a desert form; the typical dark rhombic markings are distinct, but the horn-colour has a faded appearance.

Genus Tropidonotus, Kuhl.

4. Tropidonotus viperinus, Latr.; Boulenger, *loc. cit.* p. 149.

1 specimen, Hammam R'irha, Province of Algiers; 1 specimen, Biskra; 6 specimens, between Biskra and Tuggurt; 1 specimen, Duirat, Tunisia.

The first specimen has the rare variation of 23 rows of scales.

Genus Macroprotodon, Guichenot.

5. Macroprotodon cucullatus, Geoffroy; Boulenger, *loc. cit.* pp. 149, 150.

1 specimen, Hammam Meskoutine, Province of Constantine, among stones.

Total length 539 millim., tail 93. Ventrals 171; subcaudals 54. It has 19 rows of scales, which is generally the case in Algerian and Tunisian specimens, as pointed out by Mr. Boulenger.

Genus Psammophis, Boie.

6. Psammophis sibilans, Linnæus; Boulenger, *loc. cit.* p. 150.

1 specimen, Duirat, Tunisia.

Total length 975 millim., tail 341. Ventrals 179; subcaudals 131. A partially divided præocular on each side; 9 upper labials, the 5th and 6th entering the orbit, as in the case of all Algerian and Tunisian specimens found by M. Lataste.

Genus Cœlopeltis, Wagler.

7. Cœlopeltis lacertina, Wagler; Boulenger, *loc. cit.* p. 151.

1 specimen, Duirat, Tunisia.

Total length 1275 millim., tail 347. Ventrals 170, subcaudals 105; 19 rows of scales.

8. Cœlopeltis producta, Gervais; Boulenger, *loc. cit.* p. 151.

2 specimens, Duirat, Tunisia.

No. 1. Total length 663 millim., tail 121. Ventrals 161, subcaudals 62.

No. 2. Total length 671 millim., tail 115. Ventrals 159, subcaudals 48.

The first has 9 upper labials on the right side, and the normal number 8 on the left, the 5th and 6th entering the right and the 4th and 5th the left orbit. The grooving of the scales of these specimens is very feebly indicated and in marked contrast to this character in *C. lacertina*.

This appears to be the second record of this snake from Tunisia, the first specimen having been obtained by M. Valéry-Mayet at Bou-Hedma near Gafsa. The species was originally based on a specimen from the Sahara.

Family II. Viperidæ.

Genus Vipera, Laurenti.

9. Vipera lebetina, Linnæus; Boulenger, *loc. cit.* p. 154.

Var. nov. deserti. (Plate I. figs. 6 and 7).

1 ♀, Duirat, Tunisia.

I have no hesitation in referring this specimen to *V. lebetina*, but, as it is devoid of a canthus rostralis and has the scales on the head from the parietal region forwards to the rostral perfectly smooth, I regard it as a variety which I propose to call *deserti*.

All authors who have hitherto had occasion to describe *V. lebetina* from Algeria have either directly or indirectly referred to the keeled character of the head-scales. Through the kind assistance of Mr. Boulenger, who examined for me the type (No. 4017) of *V. mauritanica*, Guichenot, in the Paris Museum, I have his authority for stating that the canthus rostralis of that snake is well marked, and that the interorbital scales are feebly but distinctly keeled. It has no large supraoculars, and the rostral is a little higher than broad. It is a female with 163 ventrals and 50 caudals. Another and young specimen, No. 4016 of Guichenot's Collection, is the same as the preceding, but with the canthus rostralis less distinctly marked. It has 166 ventrals and 39 caudals.

I have examined all the specimens of *V. lebetina* in the British Museum, and I give the leading details regarding them in the following table, and for comparison I have added in the last column those yielded by this variety.

Characters of *Vipera lebetina* and var. *deserti*.

	Algiers.	Algiers.	Cyprus.	Cyprus.	Cyprus.	Lake of Galilee.	Persia, Teheran.	Persia.	Persia.	Sang Hadji, Afghanistan.	Shoti Kaltigni, Afghanistan.	Duirat, Tunisia.
Total length (millimetres)	1040	740	1043	613	595	1079	1375	1250	955	Head and neck only.	Head and neck only.	707
„ „ of tail	110	95	134	76	75	130	185	135	115			103
Ventrals	157	156	156	158	154	170	177	173	180			167
Caudals	38	43	45	43	43	44	50	46	47			51
Scales round body	25	25	25	25	25	25	25	25	25	23	25	27
Canthus rostralis, absent (A) or present (P)	P	P	P	P	P	P	P	P	P	P	P	A
Scales on upper surface of head keeled (K) or smooth (S)	K	K	K	K	K	K	K	K	K	K	K	S
Number of upper labials	10	10	11	10	10	11	10	10	10	10	10	11
Rostral broader than high (B), higher than broad (H)	B	B	B	B	B	H B	B	B	B	B	B	H
Supraorbitals variable, some enlarged (V), distinctly enlarged and their number (1 E & 2 E)	V	V	V	V	V	V	1 E	1 E	1 E	1 E	1 E	2 E
Scales between eyes, including supraorbitals	12	12	12	11	11	11	11	9	12	11	11	11

I have also given two drawings of its head (Plate I. figs. 6, 7). If these are compared with Guichenot's figure of *V. mauritanica*[1], which Mr. Boulenger informs me is a good representation of the above-mentioned specimen No. 4017, the differences between this variety and the typical form will be seen to be considerable.

To summarize the features of this variety, the most striking is certainly the entire absence of any approach to keeling on the scales on the upper surface of the head from the parietal region forward to the rostral. As already stated, in all the hitherto recorded specimens of *V. lebetina*, the scales of the head over the foregoing area and over the upper surface of the head generally are keeled in various degrees of intensity, while at the same time they preserve to a great extent the general form and character of the scales on the body. In this variety, on the other hand, the head-scales, besides being perfectly smooth in the region specified, are somewhat unlike those of the body in that they are rounded at their margins and are very flat. The entire absence of the canthus rostralis is another feature by which this variety is distinguished from the typical form, in which it is always defined although less marked in some individuals than in others.

The rostral shield is higher than broad, but in an example of this species from the Lake of Galilee it is as high as broad, a modification which connects this variety with the other specimens mentioned in the foregoing table in which the rostral is decidedly broader than high. The supraoculars in the first six specimens enumerated in the table (p. 21) are not markedly differentiated from the ordinary head-scales as regards their size: occasionally one or more scales may be larger than the others, either on both sides of the head or on one only, but in none of them are two scales so developed as in this variety. On the other hand, the specimens from Persia and Afghanistan can be distinguished at once by the presence of a large supraocular occupying nearly the entire upper border of the eye. It will be observed that, in the labials and the scales between the eyes, the variations among these specimens are very insignificant. It is worthy of attention that the four specimens from the mainland of South-western Asia present a marked increase in the number of their ventrals as compared with the typical form from Algeria and Cyprus, and that the two groups are connected with each other by var. *deserti* from Eastern Tunisia.

In *V. lebetina*, var. *deserti*, the colour is pale yellowish brown above, with very faint indications of the dorsal and lateral dark spots distinctive of Algerian and Cyprian examples of the typical form; and the under surface is pale yellow, almost immaculate anteriorly, the finely powdered aspect of the species being only feebly indicated posteriorly. The specimen from the Lake of Galilee very much resembles the var. *deserti* in colour and general appearance, but it has keeled scales on the head and a canthus rostralis.

I have selected the term *deserti* to designate this variety, because reptiles received from Duirat, the locality from which this Viper

[1] Explor. Sc. Alg., Rept. pl. iii.

was obtained, establish the fact that the Saharian fauna extends to that district, and moreover the Snake has all the features of a desert form.

The majority of the specimens of *V. lebetina* hitherto recorded have come from the Tell region of Western Algeria, but examples of this species have also been mentioned from Batna on the high plateau and likewise from Bona on the coast, in the Tell region. As our knowledge of the northern portion of the Sahara intervening between Duirat and Egypt becomes more extended, it is probable that this variety of *V. lebetina* will be found to occur throughout that district, and, possibly, in Egypt itself.

Genus Cerastes, Wagler.

10. Cerastes vipera, Linnæus; Boulenger, *op. cit.* p. 155.

1 ♂ & 1 ♀, Duirat, Tunisia.

♂. Total length 252 millim., tail 32. Ventrals 107, subcaudals 32; rows of scales 23.

♀. Total length 248 millim., tail 22. Ventrals 117, subcaudals 22; rows of scales 23.

Mr. Boulenger mentions that although M. Lataste did not come across this Viper in Tunisia, several specimens from the southern part of that province are in the possession of Marquis Doria.

BATRACHIA.

Order ECAUDATA.

Family I. Ranidæ.

Genus Rana, Linnæus.

1. Rana esculenta, Linnæus; Boulenger, *loc. cit.* p. 157.

5, Algiers; 4, Hammam R'irha, Province of Algiers; 3, Biskra.

These specimens belong to the var. *ridibunda*, Pallas, the most widely distributed race, and the only one found in Barbary. Mr. Boulenger has recently given [1] the measurements of the largest of my specimens from the last two of the localities recorded above.

Family II. Bufonidæ.

Genus Bufo, Laurenti.

2. Bufo viridis, Laurenti; Boulenger, *loc. cit.* p. 158.

1 young specimen, Laurier-Rose Station on the railway to Tlemçen; 2 specimens, Duirat.

3. Bufo mauritanicus, Schlegel; Boulenger, *loc. cit.* p. 158.

1 specimen, Tlemçen, Province Oran; 2 specimens, Hammam R'irha, Province Algiers; 2 specimens, Algiers; 2 specimens, Biskra.

[1] Proc. Zool. Soc. 1891, p. 379.

A pair taken *in copulâ* at Biskra had the following measurements:—♂, snout to vent 124 millim.; ♀, 96.

4. Bufo vulgaris, Laurenti; Boulenger, *loc. cit.* p. 159.

1 specimen, Algiers.

Family III. Hylidæ.

Genus Hyla, Laurenti.

5. Hyla arborea, Linnæus; Boulenger, *loc. cit.* p. 159.

Var. meridionalis, Boettger.

1 ♀, Tlemçen; 1 ♂ & 1 ♀, Hammam Meskoutine, Province of Constantine.

Family IV. Discoglossidæ.

Genus Discoglossus, Otth.

6. Discoglossus pictus, Otth; Boulenger, *loc. cit.* p. 160.

2 ♂, Tlemçen, Province of Oran; 6, Hammam R'irha, Province of Algiers; 2, Algiers.

The condition of the tympanum in these specimens varies considerably, being distinct in some and wholly invisible in others. It thus supports M. Lataste's opinion, with which Mr. Boulenger agrees, that there is only one species of *Discoglossus*.

DESCRIPTION OF PLATE I.

Fig. 1. *Chalcides boulengeri*, nat. size.
Fig. 2. View of the upper surface of the head, twice nat. size.
Fig. 3. Side view of the head, twice nat. size.
Fig. 4. View of the upper surface of the head of *C. sepoides*, Audouin, twice nat. size.
Fig. 5. Side view of the head of the same species, twice nat. size.
Fig. 6. Upper surface of the head of *Vipera lebetina*, Linnæus, var. *deserti*, nat. size.
Fig. 7. Side view of the head of the same, nat. size.

2. On the Myriopoda and Arachnida collected by Dr. Anderson in Algeria and Tunisia. By R. I. Pocock.

[Received January 11, 1892.]

The Myriopoda collected by Dr. Anderson during his stay in Algeria and Tunisia in the winter of 1890 and 1891 are referable to 21 species, one of which appears to be new. This, which I call *Brachydesmus insculptus*, seems to be very nearly related to a species that was described two years ago by Dr. Latzel from the Azores. This fact is of interest, inasmuch as it affords another link to the chain of affinity between the fauna of these islands and that of the Mediterranean district of the Palæarctic region.

The rest of the species are principally remarkable for the light

that they throw upon the synonymy of old-established but little-known species.

The only circumstance to be noticed here with respect to the Arachnida is the vast amount of variation shown by the sexes and young of the Scorpion, *Prionurus australis*.

ARACHNIDA.

The only species of this group obtained by Dr. Anderson are the following:—*Galeodes olivieri*, Simon, *Prionurus australis* (Linn.), *Buthus europæus* (Linn.), and *Buthus leptochelys* (Ehrb.). All of them are well-known N.-African forms, but I am not aware that *B. leptochelys* has been ere this recorded so far to the West.

The species were obtained at the following localities:—*Galeodes olivieri* between Biskra and Tuggurt; *Prionurus australis*, Duirat, Biskra, Tuggurt; *Buthus europæus*, Algiers, Hammam Meskoutine, Hammam R'irha; *Buthus leptochelys*, Biskra.

CHILOPODA.

Fam. Scutigeridæ.

Scutigera coleoptrata (Linn.).

Hammam R'irha and Algiers.

Common in Madeira and in the southern parts of Europe.

Fam. Lithobiidæ.

Lithobius impressus, C. Koch.

Kherrata, Constantine, Tunis, Hammam R'irha, Algiers.

Originally described from Algeria, but abundant in many parts of Italy.

Lithobius castaneus, Newport.

Algiers, Hammam Meskoutine, Hammam R'irha, Kherrata, Constantine.

This species was redescribed as *eximius* by Meinert; see Pocock, Ann. Mus. Genov. (2) ix. p. 63, 1890. It occurs also in S. Europe.

Fam. Scolopendridæ.

Scolopendra morsitans, Linn.

The North-African form of the cosmopolitan *S. morsitans* was described by Koch as *S. scopoliana* and by Newport as *S. algerina*. For the synonymy of *S. scopoliana* see Pocock, Ann. Mag. Nat. Hist. ser. 6, vii. pp. 51, 52.

Scolopendra oraniensis, Lucas.

S. oraniensis, Lucas, Rev. Zool. 1846, p. 287; id. Expl. Sci. de l'Alg., Anim. Art. p. 344.

S. dalmatica, C. Koch, 1847, and other authors.

Hammam R'irha, Tunis.

At these localities Dr. Anderson obtained three examples of

a species of *Scolopendra*, which agree closely with Lucas's figure and description of *S. oraniensis*, and at the same time are not specifically distinguishable from the S.-European *S. dalmatica*; Lucas's name must consequently supersede that of Koch.

The two specimens captured at Hammam R'irha are smaller and very dark-coloured, being an exceedingly deep green. The Tunisian example, on the contrary, is very much paler and considerably larger.

Cupipes gervaisianus (Koch).

Hammam Meskoutine.

It is needless to repeat here the involved synonymy of this species. It may be found at length in my paper in the Ann. Mag. Nat. Hist. ser. 6, vii. pp. 51–53.

This species also occurs in S. Europe.

Otostigma spinicauda (Newport).

Branchiostoma spinicauda, Newp. Tr. Linn. Soc. xix. p. 412.

Otostigma deserti, Meinert, Vid. Medd. Nat. Forening, 1886, p. 121.

Biskra.

The above-given synonymy was published by me before it had been my good fortune to examine a specimen of this species from the locality where the types of *O. deserti* were obtained. Dr. Anderson, however, has supplied the missing link in the chain of evidence by procuring a specimen from Biskra. This example is undoubtedly co-specific with Newport's types of *B. spinicauda* and also with those that Meinert described as *O. deserti*.

This species is not known to occur in Europe.

Cryptops anomolans, Newp.

Constantine.

This species is the *punctatus* of Koch and all authors; see my paper on the Chilopoda of Liguria, in the Ann. Mus. Genov. (2) ix. p. 68 (1890). It is probably also the same as the species Lucas described as *C. numidicus*; but to this last were assigned only 12 antennal segments.

Fam. Geophilidæ.

Orya barbarica, Gervais.

Constantine, Kherrata, Hammam Meskoutine.

Himantarium rugulosum, Koch.

Algiers.

Himantarium mediterraneum, Mein.

Constantine.

Geophilus pusillus, Mein.

Algiers.

GEOPHILUS FERRUGINEUS, Koch.

Hammam Meskoutine.

DIPLOPODA.

Fam. GLOMERIDÆ.

GLOMERIS FUSCO-MARMORATA, Lucas.

Algiers, Hammam R'irha.

This species appears at most to be but a variety of the S.-European *G. conspersa*.

GLOMERIS FLAVO-MACULATA, Luc.

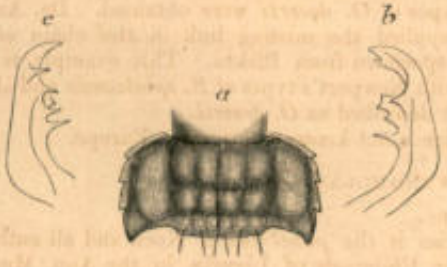
Hammam R'irha.

This species also is most probably but a variety of the European *G. connexa*.

Fam. POLYDESMIDÆ.

BRACHYDESMUS INSCULPTUS, sp. n.

Colour pale brown or ochraceous. Moderately robust. Antennæ much longer than the width of the body. The first tergite sub-



a, *Brachydesmus insculptus*, sp. n.; 8th tergite from above.
b, " " " copulatory foot, external view.
c, " " " " " internal view.

carinate, marked with two transverse depressions, between which run two or three longitudinal grooves with an anterior row of 6 small tubercles, the posterior large tubercles very distinct; the rest of the tergites with the sculpturing very strongly marked, the grooves sharply defining the tubercles; the anterior angle of the keels obtuse but subdentate at the apex, the posterior angle acute and produced; the side margin of the pore-bearing keels tridentate, of the others bidentate (not including the anterior and posterior angles). Legs short and robust. Copulatory feet strong and falciform, narrower before the apex, which is curved; below the apex on the inside and on the outside there is a single process, and there are

three other processes and a membranous expansion on the posterior aspect of the appendage. Length up to 13 millim., width 1·6.

Closely allied to, if not identical with, *B. proximus* of Latzel from the Azores.

Hammam R'irha.

This is probably the species that Lucas records as *Polydesmus complanatus*.

STRONGYLOSOMA GUERINII, Gerv.

Strongylosoma guerinii, Gerv. Ann. Soc. Ent. Fr. iv. p. 686.

Hammam R'irha.

This species was originally described from Madeira, whence the British Museum has examples. It is widely distributed in the Atlantic Islands, occurring both in Teneriffe and the Bermudas.

I suspect that this is the species which Lucas identified as *S. pallipes* (Oliv.).

Fam. IULIDÆ.

IULUS FUSCO-UNILINEATUS, Lucas.

Kherrata, Hammam R'irha, Constantine.

IULUS DISTINCTUS, Lucas.

Constantine.

The synonymy of these two species of *Iulus* requires reinvestigation.

Fam. POLYZONIDÆ.

DOLISTENUS SAVII, Fanz.

Hammam R'irha.

This interesting Millipede is a great rarity. It has been found in Italy, but is new to the African shore of the Mediterranean. The repugnatorial pores begin on the fifth somite.

3. On the Earthworms collected in Algeria and Tunisia by Dr. Anderson. By FRANK E. BEDDARD, M.A., Prosector to the Society.

[Received January 5, 1892.]

As nothing appears to be known of the Earthworms of the northern part of the African Continent, excepting Egypt, I am very glad to have had the opportunity, afforded me by Dr. Anderson's kindness, of examining a small collection made by him during the spring of last year in Algeria and Tunisia.

Earthworms show in so very plain a manner the effect of barriers to dispersal in their distribution, that I had expected to find the Algerian forms identical with or closely allied to those of Europe. The Earthworm-fauna of Central and South Africa is evidently very

rich, though at present but little known; but the Sahara has proved here, as it has in the case of other animals, to be a barrier preventing the northward range of these forms. Only in Egypt are there any genera found also in Tropical Africa; the very remarkable genus *Siphonogaster* occurs in Egypt and in the neighbourhood of Lagos, W. Africa. But the banks of the Nile, or even the river itself (for many species of Earthworms can withstand a prolonged immersion in fresh water), have furnished, no doubt, the opportunity of migration.

Mr. Alvan Millson, Colonial Secretary at Lagos, kindly collected for me a number of Earthworms in Egypt; all these species were members of the genera *Lumbricus* and *Allolobophora*.

Besides Levinsen's paper upon *Siphonogaster* and *Digitibranchus* (=*Alma*) we do not possess, I believe, any further information upon the Oligochæta of Egypt than that which has been given in the preceding sentence.

Dr. Anderson's collection contains examples of two recognizable species, *Allolobophora complanata* and *Microscolex modestus*. Besides these, there are two or three immature forms of the genus *Allolobophora* which are not old enough for identification.

ALLOLOBOPHORA COMPLANATA (Dugès).

Lumbricus complanatus, Dugès, Ann. Sci. Nat. t. viii. pp. 17, 22.

This species is a well-known South-European form, having been met with in S. France, Italy, Portugal, and the Balearic Islands. I now add Algeria to the list of localities whence it has been obtained. The principal information as to the structure of this species is to be found in Dugès's memoir upon the Earthworm, in Rosa's account of the Lumbricidæ of Piedmont [1], and in a paper by myself devoted to this species [2]. In neither of two specimens belonging to Dr. Anderson which I dissected was there any trace of the peculiar diverticula of the spermathecæ which I described in the paper last referred to.

As neither Dugès nor Rosa observed anything of the kind, it is possible that the individual I described should be regarded as a variety of the more typical form, the occurrence of which in Algeria I here record.

MICROSCOLEX ALGERIENSIS, n. sp.

There is only a single specimen of this species, which I investigated by means of longitudinal sections of the head end. The structure of the posterior segments was examined by mounting portions of the body in glycerine after having been cut open.

It is a small worm, measuring only an inch or so in length and composed of 80–90 segments. Being curled into a circle in the preservation, I am not able to give exact measurements, which are, however, not of very great importance.

[1] 'I Lumbricidi del Piemonte,' Turin, 1885.

[2] "Observations on the Structure of *Lumbricus complanatus*, Dug.," Proc. Roy. Soc. Edinb. xiii. p. 451.

The *prostomium* is large, being larger than the diameter of the first segment.

The *setæ* are disposed precisely as in *Microscolex modestus*: that is to say, the setæ are not in closely approximated pairs, and the distance between seta 1 and seta 2 is less than that between setæ 3 and 4. The diagram given by Rosa of the setæ of *M. modestus* would express, so far as I can make out, the relations of the setæ in *M. algeriensis* exactly. There is nothing noteworthy in the form of the setæ. As in other Earthworms, the four setæ of each side of the body in each segment are connected by muscular strands which favours, it may be supposed, their simultaneous movement. This muscle in *Microscolex* is easily overlooked, owing to its great thinness; it is not more than two fibres thick.

The *clitellum* is complete (forming, that is, a ring) and occupies segments xiv.–xvii. with a part of xiii. Its structure is like that of other Earthworms.

I could find no *dorsal pores*.

The *alimentary tract* is peculiar from the absence of a gizzard, of which traces appear to exist in other species of *Microscolex*; for in *M. dubius* Rosa speaks of "un ventriglio rudimentale, piatto, in forma di coppa;" as to the only other known form, *Microscolex modestus*, Rosa found that "il ventriglio esiste, ma così rudimentale da non potersene veder le traccie che nelle sezioni." It is not always possible to detect the presence or absence of a gizzard without having recourse to section cutting. *Pontodrilus*, for example, is stated by Perrier to be without this special region of the œsophagus; but it is obviously present, though certainly much reduced, when the anterior region of the worm's body is examined by means of sections.

The *pharynx* ends in the third or fourth segment, and, as in other Earthworms, there are masses of glands upon the dorsal surface. These glands, which seem to represent a part of the system of septal glands in the lower Oligochæta, are not confined, in *Microscolex algeriensis*, to the pharyngeal region of the alimentary tract; they extend back as far as the ninth segment, and therefore suggest more clearly the septal glands, with which they must surely be homologous. It is interesting to recall the fact that these glands occur also in *Ocnerodrilus*, which is another form near to the border line between the terricolous and limicolous Oligochæta, though nearer to the latter than is *Microscolex*.

The *œsophagus* of *Microscolex algeriensis* is divided into two regions; up to the end of segment vii. it is not markedly vascular, and the living epithelium is composed of more densely packed cells, which gives it a more deeply stained appearance under the microscope. The rest of the œsophagus has a richly-developed vascular network, and the epithelium appears to have a looser texture, the cells being less tightly packed; from this circumstance the posterior region of the œsophagus looks paler in sections. In the xvth segment the œsophagus becomes much narrower and then suddenly widens into the intestine which commences in the xvith segment.

The *intestine* has no typhlosole. The *intersegmental septa* are first visible after segment v. Those separating segments vii./viii., viii./ix., ix./x., x./xi., xi./xii., xii./xiii. are thicker than the following ones. Their insertion ventrally does not correspond with the intersegmental furrows, and this absence of correspondence is found also further back. It is by no means unknown in other Earthworms, and is, as a rule, limited to the anterior segments. *Microscolex algeriensis* has *nephridia* in all segments of the body commencing with the second. They are paired and open in front of and a little to the outside of the third seta. In dissection the nephridia are seen to lie between the second and third setæ on each side. There is a long muscular end-sac, which in section was invariably much crumpled owing to the thinness of its walls.

The series of nephridia in this species is more complete than in either of the other two species of the genus. It is important to notice that after the xviiith segment the nephridia have a thickish coating of peritoneal cells. A difference of this kind often exsist between the anterior and posterior nephridia in Earthworms, though nothing of the kind has been mentioned by Rosa in this particular genus.

With regard to the *vascular system* the most noteworthy point is the presence of three pairs of "hearts" in segments x., xi., and xii. There are periœsophageal vessels in some of the segments anterior to the xth, but these are not so well developed as those of the three segments mentioned. The hearts of segment xii. are by far the stoutest; their diameter is at least twice that of the preceding vessels, which are themselves of rather greater calibre than those of segment x. There is no sub-nervian vessel.

The *brain* is situated in the second segment, near to its posterior boundary; the forward position of the brain is of interest.

The *generative system* conforms to the general type met with among the Cryptodrilidæ. The testes are two pairs in segments x. and xi. Opposite to them are the not remarkably large funnels of the vasa deferentia; the testes of segment xi. are partly attached to the vas deferens just where it perforates the segment. The sperm-sacs are in segments xi. and xii.; they involve neither the testes nor the funnels. The two vasa deferentia of each side of the body remain perfectly distinct from each other up to their point of opening on to the exterior. The two tubes run side by side in a rather sinuous course, just below the peritoneum. In the xviiith segment are a pair of "prostates," or, as I prefer to call them, atria. They are of the tubular form, and, as usual, are separated into a glandular and a muscular portion. The minute structure of this tube is precisely as in *Acanthodrilus*, *Pontodrilus*, &c. The atria are not long, and are entirely contained within the xviiith segment, instead of being, as is frequently the case, prolonged into adjoining segments. The exact mode in which the vasa deferentia open, I have not been able to ascertain. In any case the two tubes, still retaining their individuality, bore their way into the body-wall a little in front of the point where the atrium opens; they then pass

beyond the atrium, and, I imagine, open just at the atriopore, as in *Ocnerodrilas*; but I am not certain about this. The atriopore is situated just to the outside of the ventralmost seta, which is not modified in any way; there are, in fact, no penial setæ, such as occur in the other two species of the genus.

The ovaries are in segment xiii. The oviducts open by funnels into this segment opposite to the ovaries, and open to the exterior on segment xiv. Receptacula ovorum are present, and are of considerable size relatively to the sperm-sacs.

There is a single pair of spermatothecæ present in segment ix.; each opens on to the exterior just behind the septum which separates this segment from the one in front and in a line with the ventral seta. Each spermatotheca consists of an oval pouch and a single narrow diverticulum opening into it in front.

MICROSCOLEX POULTONI, n. sp.

It may be permissible to append to this paper the description of a fourth species of *Microscolex*, of which a number of examples were kindly collected for me in Madeira by Mr. E. B. Poulton, F.R.S. They measure, when preserved, about an inch in length; they are of a brown colour, the clitellum being orange.

The *clitellum* is variable in extent, always, however, including segments xiv.–xvi.; in some specimens a part or the whole of segments xiii. and xvii. belonged also to the clitellum. Segments xiv.–xvi. were much broader than those immediately adjoining.

The *setæ* are disposed as in other species of the genus; but upon the clitellum the ventral pair of setæ of each side get very much closer together.

On segments xiv., xv., xvi., and xviii. the ventral setæ (see drawing, fig. 1, p. 33) are separated from each other by a distance which is less than half that which separates the corresponding setæ of segment x. From segment xix. backwards, and from segment xiii. forwards, the distance between the two ventral setæ of each side gradually increases.

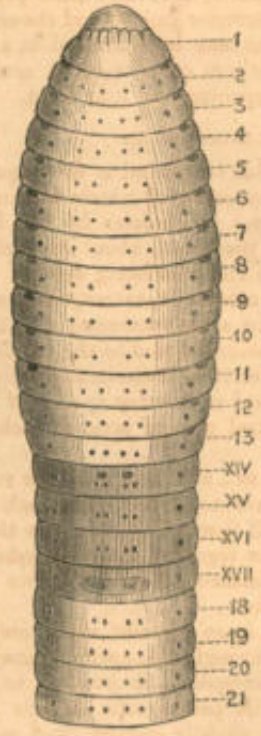
The *male pores* are upon segment xvii.; each is situated upon an oval elevation, and through the aperture itself protrudes a single penial seta, which corresponds in position to the innermost seta of the ventral pair. The penial setæ of this *Microscolex* are (see fig. 2, p. 34) long, slightly curved, and not ornamented at the free extremity; when examined under a high power they show a faint transverse striation which marks the successive deposits of chitinous matter in the formation of the seta. There is a slight notch some little way in front of the distal extremity.

The *pharynx* occupies the first 5 segments or so; there is not a great development of glands upon its upper surface, and there is no continuation of these septal glands into the œsophageal segments, such as occurs in *Microscolex algeriensis*. The *œsophagus* immediately following the pharynx has, perhaps, slightly thicker walls than the hinder part; but there is nothing that can be fairly termed a gizzard.

The epithelial lining of the *œsophagus* is folded; this folding is perhaps more marked in segments xi., xii., and xiii. In segment xv. the œsophagus forms a globular dilatation, the walls of which are perfectly smooth without any folding; a very narrow aperture puts this into communication with the intestine which commences in the xvith segment.

In the terminal dilatation of the œsophagus, the epithelium

Fig. 1.



Anterior segments of *Microscolex poultoni* from the ventral surface.

The segments are numbered consecutively, those of the clitellum in Roman numerals, the others in Arabic numerals. On the anterior thirteen segments the nephridiopores are shown in front of the dorsal setæ. The oviducal pores are on segment xiv., the male pores on segment xvii.

gradually gets higher until its cells are identical in appearance with the tall narrow columnar cells which form the lining membrane of the intestine. Just at the opening of the œsophagus into the intestine, the cilia are very long and conspicuous; but the œsophageal epithelium is also ciliated throughout the xvth segment; in front of

this point I could not be certain of the presence of cilia. The *intestine* has no typhlosole.

The *brain* is situated further back in the body than in the last species; it lies towards the posterior boundary of segment iii.

The first *intersegmental septum* separates segments v./vi.; the septa separating segments vi./vii., vii./viii., viii./ix., ix./x., x./xi., xi./xii., xii./xiii., xiii./xiv., xiv./xv. are shorter than those which follow, but there is not a very great increase of thickness in their

Fig. 2.



Penial seta of *Microscolex poultoni*.

muscular layers—not so much, for instance, as in the last species. The ventral insertion of the anterior septa does not coincide with the intersegmental furrows.

The *nephridia* commence in segment iii. Their structure appears to be identical with that of the last described species. The first

pair, although they lie chiefly in segment iii. in front of the nerve-cord, open on to the exterior between segments i. and ii. On account of the large terminal end sac, which is prolonged on both sides of the aperture, and may be thus said to have a cæcum, it is always easy to make out the external aperture. I am therefore able to be confident about this point, which distinguishes the present species from both *Microscolex dubius* and *Microscolex modestus*, and allies it with *Microscolex algeriensis*. The external pore is to the inside, and slightly in front, of seta 3 [1].

The three strongly developed hearts of segments x., xi., xii. are present in *Microscolex poultoni*.

The *generative organs* show no great differences from those of other species. As in *M. algeriensis*, the true vasa deferentia retain their independence until close to the external aperture; they pass a short way beyond the muscular duct of the atrium, and unite to form one tube, which is surrounded with a thick layer of muscular fibres chiefly circular; this tube is quite indistinguishable in its structural characters from the muscular duct of the atrium; in a section the two tubes cannot be distinguished except by their position. In the thickness of the body-wall, and near to the external pore, they unite. The penial setæ have already been referred to.

The sperm-sacs are racemose, and occupy the same position as in *Microscolex algeriensis* and all the other species of the genus.

The funnels of the sperm-ducts are larger and more folded than in that species.

I could find neither spermatothecæ nor egg-sacs.

This latter character connects *Microscolex poultoni* with *M. dubius*, but it is quite clear from the above description that the species described here is perfectly distinct from *M. dubius*.

The principal differences are :—

(1) The fusion of vasa deferentia in *M. dubius* to form one tube, which opens into the muscular tube of its prostate.
(2) The commencement of the nephridia in the vth segment in *M. dubius*.
(3) The absence of any alteration in the position of the seta on the clitellum in *M. dubius*.

It shows much the same resemblances to *M. dubius* that *M. algeriensis* shows to *M. modestus*. If Dr. Rosa were not so careful a worker as he has proved himself, I should be almost inclined to suspect an identity.

The genus *Microscolex* has been investigated by Rosa and Fletcher. It was first met with in Italy by Dr. Rosa [2], who, in a later

[1] The ventralmost seta on each side is seta 1, the next seta 2, &c.

[2] "*Microscolex modestus*, n. gen., n. sp.," Boll. Mus. Zool. Torino, vol. ii. no. 19 (3 cuts).

paper[1], surmised that Fletcher's[2] *Eudrilus dubius* would prove to be a *Microscolex*. This suggestion was later[3] shown to be correct by the description of a species of *Microscolex* evidently identical with *Eudrilus dubius* from the Argentine. I received myself, some time since, a number of examples of a *Microscolex* from Madeira, through the kindness of Mr. E. B. Poulton, F.R.S., which are described above. The existing knowledge of the distribution of the genus is as follows:—

1. *Microscolex modestus*. Italy, Argentina.
2. *Microscolex dubius*. Australia, Argentina.
3. *Microscolex algeriensis*. Algiers.
4. *Microscolex poultoni*. Madeira.

The characters of *M. algeriensis* evidently necessitate a revision of Rosa's generic definition given on p. 511 (3 of sep. copy) of his memoir on the Argentine Earthworms.

The following points are, I think, sufficient to distinguish this genus from any other genera among the Cryptodrilidæ.

Genus Microscolex, Rosa.

Microscolex, Rosa, Boll. Mus. Zool. Torino, vol. ii. no. 19.

Setæ 8 *per segment, distant. Clitellum on segments* xiii., xiv., xv., xvi., xvii., *complete.* ♂ *pores on* xvii. *No dorsal pores. Subnervian vessel absent. Nephridia paired, present in genital segments. Hearts,* 3 *pairs in segments* x., xi., xii. *Gizzard absent or rudimentary. Intestine without typhlosole. Atria tubular, with or without penial setæ. Spermatotheca* (*if present*) *one pair in* ix., *with diverticulum.*

The affinities of the genus have been discussed by Rosa, who compares *Microscolex* with *Photodrilus* and *Pontodrilus*. I may point out that the absence of penial setæ in *Microscolex algeriensis* lessens the distance between the genus and *Pontodrilus*.

The species which I describe here is quite clearly distinct from the two others. The table (on p. 37) indicates the principal resemblances and differences between the four species *Microscolex dubius, M. modestus, M. algeriensis*, and *M. poultoni*.

[1] "Sui generi *Pontodrilus, Microscolex*, e *Photodrilus*," *l. c.* vol. iii. no. 39.

[2] "Notes on Australian Earthworms," pt. iii., Proc. Linn. Soc. N.S.W. vol. ii. ser. 2.

[3] "I terricoli Argentini raccolti dal Dott. Carlo Spegazzini," Ann. Mus. Civ. Genova, vol. ix. ser. 2.

	M. dubius.	*M. modestus.*	*M. algeriensis.*	*M. poultoni.*
Clitellum	On segments 13–17.	13–17.	$\overline{13}$–17.	$\underline{13}$–$\overline{16}$ [1] (17).
Nephridia	Commence in 5.	Commence in 4.	Commence in 2.	Commence in 2.
Gizzard	Rudimentary.	Rudimentary.	Absent.	Absent.
Spermatotheca	Absent.	One pair.	One pair.	Absent.
Vasa deferentia.....	Unite to form one tube on each side, which opens into muscular tube of atrium.	?	Remain separate, and open into atrial duct just before (?) external pore.	Remain separate up to atria, when they fuse and become invested in a muscular sheath ; the tube thus formed unites with atrial tube just before external aperture.
Penial seta	Present.	Present.	Absent.	Absent.
Receptacula ovorum	Absent ?	Present.	Present.	Absent.

[1] The line above or below the number indicates that a part only of the segment in question is included in the clitellum.

4. On the Milk-Dentition of *Procavia* (*Hyrax*) *capensis* and of the Rabbit (*Lepus cuniculus*), with Remarks on the Relation of the Milk and Permanent Dentitions of the Mammalia.

By M. F. Woodward, Demonstrator of Zoology, Royal College of Science, London[1].

[Received January 5, 1892.]

(Plate II.)

I. *Historical.*

The dentition of such an interesting Mammal as *Hyrax*, as may readily be supposed, has been carefully studied by many zoologists, who, probably owing to the fact that many of them based their descriptions upon one or two *dried* skulls only, have given the most varied interpretations of the teeth. As a result we find a great discrepancy in the dental formulæ given in their various monographs and in the text-books compiled from them.

Most of the earlier authorities agreed as to the absence of canines, but disagreed as to the total number of teeth present (viz. 34 or 36) and as to the number of true molars and incisors, the most commonly accepted formula being i. $\frac{1}{2}$, c. $\frac{0}{0}$, pm. $\frac{4}{4}$, m. $\frac{3}{3}$=34. Many observers, however, state that there are present at one time 8 cheek-teeth above, and as they regard the extra tooth as a molar, they formulate the molars as 3–4 above and 3 below. More rarely we find the incisors described as being $\frac{2}{2}$; and lastly, two observers[2] have described a pair of canines as being present in the upper jaw.

All are agreed as to the number of teeth present in the lower jaw of the adult, viz. 9; but there is much disagreement as to the total number of teeth present in the upper jaw (viz. 8–9), and also as to the homologies of the individual teeth and sets of teeth.

Most state emphatically that there are no canines present in either jaw. Cuvier, however, asserted (**4**) that there was a pair of small canines present in the upper jaw of the young animal, and he regarded them as the accessory teeth of Pallas (**25**), but this opinion he afterwards retracted (**5**).

It remained for Lataste (**19**) to be the first to show definitely that there is present in the upper jaw of all young specimens a pair of small canines; he has shown that these are shed early in life and that they rarely persist till the completion of the second dentition. He bases his conclusions on the shape and position of these teeth together with the characters of the 2nd maxillary tooth (1st premolar) as exemplified in a very large series of skulls of all ages, and finally on a comparison with the teeth of the near allies

[1] Communicated by Prof. Howes.
[2] Cuvier (**4**) and Lataste (**19**).



M.P. Woodward del.
M.P. Parmer lith.

West, Newman imp.

Milk-dentition of Hyrax and Lepus.

of *Hyrax* (viz., the Rhinoceros, Tapir, and Horse), which never possess more than seven cheek-teeth (molars and premolars), while showing all stages in the development of the canine. He has succeeded in showing that many of the earlier observers figured and described these canines, mistaking them for the 1st premolars, on account of the resemblance between the latter in the second dentition and the milk-canines. But although the 1st premolar in the second dentition is much reduced and has sometimes only one fang, it is situated some distance from the premaxillo-maxillary suture, and in the first dentition has a large crushing crown and is two-fanged. He considers that the canines, together with the 1st premolar, are undergoing suppression, and that as a consequence of this the former teeth have lost their more typical characters.

With the exception of Giebel (12, 13) and Brandt (2), all observers state that there is only a single pair of incisors in the upper jaw. These two authorities, however, have described in the young animal a second small and posterior incisor, which is early shed and is situated in the premaxilla behind the large first milk-incisor. This tooth is not to be confounded with the milk-incisor No. 1, which is a large tooth situated between the two permanent ones, as figured by Cuvier (5) and Blainville (1); it undoubtedly represents a 2nd upper incisor, although in all probability it is only a milk-tooth, always present in the fœtus, but seldom, I believe, persistent after birth. Giebel and Brandt were of opinion that Cuvier mistook these small incisors for canines; but as the former are situated in the gum which covers the premaxilla, while the latter lie well within the maxilla, their position implies that he did not understand what is generally supposed to be the fundamental distinction of the canine, viz., that it is typically a single-fanged pointed tooth implanted in the maxilla just behind the premaxillo-maxillary suture.

It has been already noted that no observer has seen more than 9 teeth in the upper jaw; none of those who describe the presence of a canine make the slightest allusion to the presence of 2 upper incisors, and further perusal of the descriptions alluded to shows that those who described the 2nd incisor almost certainly were dealing with Cuvier's canine. This is probably due to the fact that the earlier observers do not seem to have had access to some of the monographs of their predecessors, but it does not excuse a modern European writer like Lataste having apparently failed to consult a classical work like Brandt's Monograph on *Hyrax*, or a standard one such as Bronn's 'Thier-Reich.'

II. *Results of the present Investigation.*

The material which I have examined was kindly placed at my disposal by Prof. Howes, and consisted of 5 fœtal examples of *Hyrax capensis* preserved in spirit, being the specimens the placenta of which was described by Prof. Huxley before this Society in 1863[1]. The

[1] P. Z. S. 1863, p. 655.

specimens measure about 12·5 centim. long and only show a few of the larger hairs.

The method adopted for the examination of the teeth is, I believe, the only reliable one (if employed in connexion with serial sections) by which the true relations of developing teeth in a young animal can be made out.

The skin was carefully removed from the sides of the jaw, and the whole jaw, with gum covering it intact, was placed in absolute alcohol and thoroughly dehydrated; it was then clarified in clove-oil, and either examined in that medium or mounted in Canada balsam. By this treatment the teeth are seen through the bones in their natural position in relation to one another and to the surrounding parts, whereas by dissection they are apt to be displaced. Further, some teeth when undergoing suppression are so minute as to be practically invisible to the unaided eye, so that under manipulation by ordinary dissection they would be entirely overlooked. On the other hand, if exclusively examined in serial sections it is doubtful if their exact position and relationships could be determined with absolute accuracy. This is notably the case with the anterior milk-incisors of the Rabbit (the upper of which measures only ·13 millim. in length) described by Huxley (16) (figs. 4 & 5, di^1), and which were discovered by this method, Huxley being, I believe, the first to apply it to the examination of tooth relationships.

It is worthy of note that the method does not prevent one afterwards sectionizing the jaw; in fact, it is best to examine the jaw first in this way in order to see exactly what teeth are present and what are their positions, as it then becomes much easier to interpret the appearances presented by serial sections.

A microscopic examination of the clarified jaw (Plate II. fig. 1) shows that there are present at this age 8 teeth in the upper jaw and 7 in the lower one.

Those of the upper jaw may be divided into premaxillary and maxillary teeth, there being 3 of the former (fig. 1, di^1, di^2, di^3) and 5 of the latter (fig. 1, *c*, I., II., III., IV.). The first premaxillary tooth is very large and roughly conical; it lies completely buried in the bone and, from a comparison of a series of skulls, it becomes evident that it is the milk predecessor of the large permanent incisor; it attains a considerable size and persists for a long period after birth. As the fœtus was very young, the permanent incisor had not yet been differentiated.

The two posterior premaxillary teeth (fig. 1, di^2, di^3) are very small, and variable; both were present in three out of six preparations, one only was present in two, and both were wanting in the other.

In two cases they were very fully developed (fig. 2, di^2, di^3), although small, and the anterior one was in all cases the largest. In the specimen figured the measurement of the anterior one (di^2) is ·62 millim. long × ·35 millim., that of the posterior one (di^3) being ·31 millim. long × ·19 millim.

The anterior one presents a small conical crown composed of a distinct layer of enamel and dentine (fig. 2, di^2, *e*, and *d*), a well-

marked cervix, and a simple single fang, slightly constricted at its base. The smaller posterior one (fig. 2, di^2) is much simpler and not so much calcified, and although it had no distinct fang yet the pulp-cavity was already partially constricted.

In position the two teeth lie close to the surface of the gum, and though they overlap the premaxilla they are really external to it, alveoli being undeveloped [1]. The anterior one lies just in front of the premaxillo-maxillary suture (fig. 1, *ms.*), while the smaller posterior one lies just between the two bones, but under cover of the premaxilla and quite in front of the maxilla.

In the two cases where only one of these teeth was developed, it was obviously the anterior one from its position; it was larger and rounder than the one figured (figs. 1 & 2, di^2), and was evidently younger and still undergoing development.

The maxillary series of teeth are 5 in number: the first (fig. 1, *c*), a small uncalcified tooth-germ, which lies close to the anterior border of the maxilla, is obviously the canine; while the four remaining ones (fig. 1, I., II., III., IV.) represent the deciduous premolars and have not yet developed their fangs. They are simple calcified cappings of the pulp, the only points of interest about them being their proximity to the premaxillo-maxillary suture and the manner in which the first one is displaced so as to partially overlie the second.

Examining the teeth of the upper jaw as an entire series, we see at once that the most fully formed ones are the two small posterior premaxillary teeth (di^2, di^3). Unlike the remaining teeth, all of which lie deep down in the bone, these small ones are situated close to the surface of the gum, so that they must evidently cut the gum first if not absorbed.

A tooth whose crown is once calcified does not, as a rule, increase in transverse diameter, because the dentine composing the greater part of it is deposited from within outwardly; so that when dealing with a tooth possessing well-marked layers of dentine and enamel, one is fairly safe in saying that the crown will not enlarge much transversely. When the fang is formed and partially constricted at its base, one is justified in regarding that tooth as being fully formed, as the constriction of the pulp-cavity only takes place after the completion of the tooth.

The small teeth (fig. 2, di^2, di^3), in possessing the above characters, may be safely regarded as having attained their full size and being ready to cut the gum.

We have now to determine the homologies of these teeth. As we have seen, they are situated in the premaxilla behind the large incisor and immediately in front of the canine. The only teeth they can represent are the 2nd and 3rd incisors; so that the large incisor is thus proved from its position to be the first or anterior one. From the earlier development and small size of the 2nd and 3rd

[1] Jaeger (JB. nat. Ver. Würzb. 1860, xvi.) regards Cuvier's "*trous incisifs*" as the remainder of a deciduous 2nd incisor; but as the 2nd incisor very rarely persists and is generally external to the premaxilla, it is improbable that this depression, which is fairly constant, can represent its alveolus.

incisors it is highly improbable that they could persist after birth, whence we may reasonably look upon them as destined to be in all probability either absorbed or shed *in utero*.

Giebel and Brandt, as already mentioned, have described two incisors on either side of the upper jaw of young animals, and it seems, therefore, probable that the 2nd incisor may persist occasionally, especially as in two of my preparations, where only one of these teeth was present, the second incisor had undergone an increase in size, although it had not yet developed a fang; in fact, it was much more in the condition of the other milk-teeth, being more normally developed. It will be observed from this that there is nothing which will justify the unqualified assertion of Giebel and others before alluded to, that two upper incisors normally exist in the permanent dentition; for these small teeth never, I believe, persist till the permanent teeth appear; although they are only represented in one dentition, I incline to the belief that they should be regarded as milk-teeth.

In the lower jaw (Plate II. fig. 1), in addition to the 2 typical incisors and 4 premolars, we find on either side a small well-developed tooth (fig. 1, *c*) situated between the incisors and the first premolar. It lies close to the surface of the gum and is intermediate in size between the two vestigial upper incisors, measuring ·4 millim. long × ·3 millim. wide, and is correspondingly well developed (fig. 2, *c*). It possesses well-marked enamel and dentine layers to the crown and a small simple fang. Like the small teeth in the upper jaw, its parts are all fully developed; but it is so small that, as in the case of the 3rd upper incisor, it has never before been observed. It certainly never persists after birth, even if it ever cuts the gum at all.

When the jaws are closed, this tooth is situated just between the upper canine and the third upper incisor, a position which suggests that it is the lower canine; but it is so close to the lower incisor that it might very well be the missing tooth of that series.

When, however, we note the order of suppression going on in the upper jaw, we find that while the two posterior incisors rarely persist, the canine is occasionally present even in the second dentition; this suggests that the latter is not so fully reduced as the incisor, wherefore we might, by analogy, fairly expect to see the canine more pronounced in the lower jaw. Further, recent observers[1] find in the Rhinoceros, one of the immediate allies of *Hyrax*, where only one of the anterior series of mandibular non-cheek teeth remains, that that is in all probability the canine and not an incisor.

From argument by analogy, I am therefore inclined to regard this small disappearing tooth as the lower canine, the 3rd and posterior incisor having apparently completely disappeared.

From the foregoing it may safely be concluded not only that the canines have, in *Hyrax*, ceased to have any functional importance, but that the incisors are being reduced in number by the suppression of the posterior ones.

In the permanent dentition the first premolars, both above and

[1] Lydekker, in Flower & Lydekker (9).

below, are much reduced (though well developed as milk-teeth), often bearing but a single fang, and are early shed.

It appears to be generally the rule amongst herbivorous animals that there is a suppression of the anterior teeth of the maxillary series, often accompanied by a reduction in number of the incisors and an increase in size of the remaining teeth. From this it would seem probable that *Hyrax*, in which the food and habits are very similar to those of the Rodentia and herbivorous mammals, would find it more serviceable to possess one or two pairs of large cutting incisors than three smaller ones; and the very early development and large size of the anterior incisors and of the large grinding premolars becomes readily intelligible upon this hypothesis.

If the jaws of the fœtus be examined in relation to the entire milk-dentition and to the rest of the skull, they will be seen to be relatively very small. Comparison of a series of skulls shows that the elongation of the jaws is attained very late, and that above it mainly involves the premaxillary and anterior maxillary regions. The conditions are such that in the young animal the jaws are uncomfortably crowded with teeth; this is especially noticeable in regard to the position of the first premolars (fig. 1, 1.) and in the vestigial condition of the 2nd and 3rd upper incisors and of both canines.

The clue to the ultimate suppression of the hinder incisors and the lower canine, and to the vestigial nature of the upper canine and both first premolars in the second dentition, appears to me to lie in the consideration of the above facts.

The large size and early development of some of the teeth render it obvious that these would take up more than their proper share of space and nourishment in the already overcrowded jaw, and we accordingly find that some of the teeth, which were of least functional importance, become either stunted or entirely crowded out of the jaw before it elongates.

The premolars of the fœtus (fig. 1) extend forwards to the premaxillo-maxillary suture; and comparison with the adult shows that the diastemata possessed by the animal are more nearly the result of a secondary elongation of the jaws themselves than of the mere suppression of certain teeth.

III. *General Considerations.*

It will be seen from the foregoing description that *Hyrax* possesses several teeth which are only represented in one dentition. The question then arises whether these are to be considered as belonging to the 1st or to the 2nd series, and the answer to it involves a brief consideration of the relations existing between the two dentitions in the class Mammalia.

Prof. Flower (6, 7, 8, 9), in his various contributions to the study of Mammalian odontology, has all along sought to show that mammals were primitively monophyodont, and that the original single set of teeth is represented in the permanent (successional) teeth of the Diphyodonts, the possession of a milk or first dentition being a

secondarily acquired character, developed comparatively late in the evolution of the class.

Detailed perusal of his writings shows these conclusions to be drawn to a large extent from the study of the Marsupialia and especially of *Thylacinus*; the solitary tooth shed by that animal he regards as the sole representative of the milk or first dentition of its higher allies (Eutheria), believing the rest of its teeth to represent the permanent or successional second dentition of the latter. At the same time (7. p. 2) he has pointed out (and laid great stress on the fact) that the milk-teeth of the Eutheria invariably show a more primitive pattern and shape than those of the permanent or second series which replace them. The latter are often highly specialized; while the former often (as is especially the case with the Ungulates) agree more or less closely with the permanent teeth of the extinct ancestors of the order.

He concludes that when one set of teeth only are present, as in the Cetacea, it is invariably the permanent or 2nd one, the milk or 1st set being either not developed or suppressed.

Arguing along the same lines, he considers that when a tooth such as the 1st premolar in many diphyodont mammals is only present in one dentition (even though in many cases it is very early lost), it must belong to the 2nd or permanent series.

Thomas (26, 27) has lately accepted Flower's views as to the relation of the two dentitions, and has added largely to our knowledge of the dentition of Marsupials, Edentates, and Monotremes. He shows conclusively that it is invariably the 4th premolar (not the 3rd as Flower thought) which is replaced by a vertical successor in the Marsupials, thus bringing the dentition of Marsupials and Placentals into more complete harmony; while among the Edentates he has proved the existence of a milk-dentition in *Orycteropus* (26).

More recently Kükenthal (18), in a preliminary account of some researches on the development of the Cetacean teeth, has sought to show that, exclusive of the Monotremes, there is no such thing as a monophyodont mammal. In all Cetacea (the typical monophyodonts) he finds that rudimentary successional teeth appear in connexion either with the more fully developed functional ones of the toothed-whales or with the functionless tooth-points of the Mysticeti. He argues from this that these supposed typical Monophyodonts are really modified Diphyodonts, and further that their functional or most fully developed teeth belong to the 1st or milk-dentition, and not, as Flower supposed, to the 2nd set. He also advances some reasons for believing that the homodont condition may be arrived at by a splitting up of the primitive complex teeth of an original heterodont type.

In the Marsupials[1], from a careful examination of the developing

[1] Since the above was written Kükenthal has published (Anat. Anz. 1891, p. 658) the details of his work on *Didelphys*, giving figures of the rudimentary successional teeth in connexion with the incisors, premolars, and even molars, the last being thus shown in the Marsupials to belong to the 1st dentition. These observations I can confirm so far as the incisors and molars of *Didelphys* are concerned, but in *Trichosurus* I can find no trace of the teeth successional to the molars. This may be owing to the embryo being too young.

teeth of *Didelphys*, he claims to have found that, besides the successional tooth to the 4th premolar, there are present indications of the enamel organs of the successional teeth in connexion with all those which remain; showing that the adult dentition of the Marsupials, with the exception of the 4th premolar, corresponds with the 1st or milk-dentition of the Placentalia, and not, as Flower and Thomas have held, with the 2nd or permanent one.

From these and other considerations he argues that the two dentitions among mammals are much more constant than has generally been supposed, and that they are probably of equal value—being developed side by side in the jaw from a common enamel ridge; and he further points out that while the 1st dentition attains its maximum development in the Marsupials and Cetacea, as we ascend in the mammalian series it diminishes in importance, so much so that in many animals (*e. g.* the Seals) it becomes quite rudimentary, while in others (*i. e.* Rodents) it possibly disappears altogether.

Should further enquiry substantiate Kükenthal's deductions that all mammals develop representatives of both sets of teeth, the advisability of retaining the terms Monophyodont and Diphyodont will have to be considered.

The facts to which I have herein drawn attention (above, pp. 40–42), taken in conjunction with Kükenthal's assertions just alluded to, show that with regard to teeth present in one dentition only, it is impossible to say for certain, upon mere examination of the dried skull, to which set they belong, and even comparative anatomy does not help us much (as in the case of the 1st premolar of Ungulates). We must rely entirely upon the study of development, and must base our determination upon the examination of a series of fœtal jaws.

In view of this I am of opinion that we shall sooner or later find in the rest of the Edentates, the Sirenia, and probably in some Marsupials, that vestigial milk or rudimentary successional teeth, which probably never cut the gum, are almost certain to be present in some form or other—either as calcified structures or simply as enamel organs.

Should there be found teeth in the fœtus showing no signs either of duplication or replacement by vertical successors, there will be good reasons for regarding them as belonging to the milk or first dentition, as this is invariably developed first in time.

From these considerations I should conclude that the vestigial teeth which I have described in *Hyrax* (viz., the two posterior upper incisors and the lower canine), together with the upper canine described by Lataste, which has not been seen to be replaced by a successional tooth although sometimes persisting with the permanent teeth, belong exclusively to the 1st or milk series, which would then read as follows, viz.:—

$$\text{i.}\,\tfrac{2}{2},\ \text{c.}\,\tfrac{1}{1},\ \text{pm.}\,\tfrac{4}{4} = 30,$$

while the adult dentition would be

$$\text{i.}\,\tfrac{1}{2},\ \text{c.}\,\tfrac{(1)}{0?},\ \text{pm.}\,\tfrac{4}{4},\ \text{m.}\,\tfrac{3}{3} = 34\ (?\,36).$$

IV. *The Milk-Dentition of the Rabbit* (Lepus cuniculus).

Although the Rabbit is so universally studied in our own laboratories and its anatomy is described in detail in so many of our practical hand-books, not one of the latter rightly describes its milk-dentition, in spite of the fact that all the details concerning it have been long ago recorded.

If one examines the jaws of a Rabbit from 2–3 weeks old (Plate II. fig. 3), one finds on each side of the upper jaw 6 incisors arranged in two linear series, 3 on each side of the middle line; the anterior tooth of each set is known to be the great permanent front incisor, while the others have been variously interpreted.

F. Cuvier (3), in the first place, described them as representing the 2nd and 3rd upper incisors; his statement has been copied by several authors (9, 15, 29), who have thus ascribed to the Rabbit at birth 3 incisors, stating that the outer one is soon lost.

This determination of Cuvier's was refuted by Owen (23) as long ago as 1868 and later by Krause (17). These two observers show that the middle tooth of each series (fig. 3, di^2) is in reality the 2nd milk-incisor; it is a functional tooth for the first three weeks of the animal's life, after which time it is shed, being pushed out by its successor (fig. 3, pi^2). The deciduous tooth in the specimen figured is small and wedge-shaped, its crown being much worn, while its successor presents a conical unworn extremity, having only just cut the gum. This latter tooth is the one described by Cuvier as being the 3rd incisor and by others as being early lost (9, 15, 29).

The probable reason that the 2nd milk-incisor and its successor are present for some time side by side, after the latter has cut the gum, may be implied in the fact that the deciduous tooth is as it were wedged in between the great anterior incisor and its own successor and is rather worn away by attrition than shed.

The study of the development of these teeth shows at once that these two (fig. 3, di^2, pi^2) are formed from a common enamel organ, and that they possess the relations of a typical tooth of the 1st to its successor in the 2nd dentition. The fact that the permanent tooth cuts the gum posteriorly to the milk-tooth, instead of developing underneath the latter and gradually pushing it out, goes for nothing, when we consider that the permanent tooth is typically developed on the inner side of its milk predecessor and not below it.

We see from the above that there are only 2 incisors on each side of the adult upper jaw, and no examination of even the youngest fœtus in which the teeth are appearing shows us any trace of a 3rd one.

The deciduous premolars of the upper series are 3 in number, and, as may be seen, they persist until the animal is between 3 and 4 weeks old (not, as stated by Marshall and Hurst (22), being shed before birth). These teeth have been long known and are figured by Owen (23); the principal point of interest about them is their possession of true fangs and their replacement by more specialized teeth which grow from persistent pulps.

Completing the cheek-teeth above we find at the same age 2 molars in use, and a 3rd developing one buried up in the maxilla.

The lower teeth at this age call for no special comment; there are the characteristic inferior incisors (1 on each side), 2 deciduous premolars, having the same characters as those of the upper set. Behind these are 2 molars, the 3rd not having yet cut the gum.

In a footnote to a paper printed in the 'Proceedings' of this Society, Prof. Huxley (16) in 1880 mentioned that he had discovered in the fœtal Rabbit vestigial milk predecessors to the large upper and lower incisors, thus making the full milk or 1st dentition to be i. $\frac{2}{1}$, pm. $\frac{3}{2}$. This discovery has been generally overlooked by the writers of works dealing with the Mammalia and the Lagomorpha.

Having examined his preparations and subsequently worked out this point in a number of fœtal Rabbits from the time when the teeth first appear until birth, I can entirely confirm Huxley's statement.

Fig. 4 is a drawing of the clarified jaws of a fœtal Rabbit.

At this period there are present 7 teeth in the upper and 5 in the lower jaw. Of those in the upper jaw the first 3 are incisors, the large tooth (pi^1) being the permanent anterior one and the smallest tooth (di^2) being the milk 2nd incisor, the permanent one not being yet differentiated. The cheek-teeth are 4 in number and represent the 3 deciduous premolars (*d.pm.*) and the 1st molar (m^1).

In the lower jaw the large incisor (pi_1) is well developed, but there are only 3 cheek-teeth, viz. the two milk premolars (*d.pm.*) and the anterior molar (m_1). In front of each of the large incisors (pi^1, pi_1), above and below, is a small tooth (di^1, di_1), rather irregular in appearance, but with its crown composed of typical layers of enamel and dentine (fig. 5, di^1, di_1), and possessing all the essential structures of a tooth. In size these teeth are the smallest in the jaws and measure as follows:—the upper one (di^1) ·13 millim. long × ·09 wide; the lower one (di_1), which is much larger and varies somewhat, being ·19–·34 millim. long and ·12–·16 wide.

Examination of young jaws shows that these minute teeth are among the first to develop, and when they appear they attain with their enamel organs a relatively large size in proportion to the jaw. Their growth is early arrested and they remain in a dwarfed condition; if carefully examined they are seen to present an irregular contour, and this I regard as expressive of their partial absorption. They are eventually forced out of the gum, about birth, by the growing permanent teeth.

These small teeth develop in common enamel organs with the permanent cutting-incisors, of which they are, as Huxley pointed out, the milk predecessors. As has been shown, they are never functional, and, like the milk-premolar of the Guinea-pig (*Cuvier*), they are shed *in utero*.

The Rabbit, so far as we know, is the only Rodent possessing milk predecessors to both incisors; while it and the Common Hare are the only Rodents known to possess deciduous incisors.

There can be very little doubt that the Duplicidentata, as concerns their teeth, are the most primitive living Rodents; and as the deciduous front incisors have almost disappeared in them, we could hardly expect to find them present in the more modified forms, where the teeth are reduced in number. It is, however, highly probable that we might find them in the Hare and possibly in *Lagomys*.

Krause (17), in describing the deciduous teeth of the Rabbit, gives the formula i. $\frac{2}{1}$ pm. $\frac{3}{2}$, which, as I have shown, is the correct one; but although he gives the correct formula, he cannot have seen the small deciduous first incisors; in fact, he says (*op. cit.* p. 199) "the four large incisors persist from the beginning"; so that he counts the large cutting-incisors twice over, first in the deciduous and afterwards in the permanent dentition, solely on the grounds that they happen to be formed very early, when none but milk-teeth are present in the jaw.

The discovery of these teeth is entirely due to Huxley, but as he only mentioned it in a passing footnote appended to a paper dealing with much wider questions, and as he never figured them, I append figures, in illustration of my more detailed account of them.

In concluding, I should like to express my thanks to Mr. Oldfield Thomas for his kind assistance in allowing me access to a fine series of *Hyrax* skulls in the British Museum, and to Prof. Howes for his valuable advice and suggestions during the progress of this work.

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EXPLANATION OF PLATE II.

Milk-dentition of *Hyrax capensis* and *Lepus cuniculus*.

n = nasal.
pmx = premaxilla.
mx = maxilla.
md = mandible.
ms = premaxillo-maxillary suture.
di^1, di^2, di^3 = upper deciduous incisors.
di_1, di_2, di_3 = lower deciduous incisors.
pi^1, pi^2 = upper permanent incisors.
pi_1 = lower permanent incisor.
c = upper canine; c_1 = lower canine.
I, II, III, IV = the 4 deciduous premolars.
$d.pm$ = deciduous premolars.
m^1 = 1st upper molar; m_1 = 1st lower molar.
d = dentine; e = enamel; f = fang; $p.c$ = pulp-cavity.

Fig. 1. Clarified jaws of a fœtal *Hyrax*, showing the teeth *in situ*, × 4.
2. Enlarged drawings of the 2nd and 3rd upper incisors (di^2, di^3) and the lower canine (c_1) of the above, × 50.
3. Clarified vertical longitudinal section through the premaxilla of a Rabbit, showing the relation of the permanent front incisor (pi^1) and the deciduous (di^2) and permanent (pi^2) second incisor.
4. Clarified jaws of a fœtal Rabbit, shortly before birth, to show the vestigial milk anterior incisors (di^1 and di_1).
5. Enlarged drawing of the vestigial anterior milk-incisors of the Rabbit, × 100.

5. On the Species of the Hyracoidea.

By Oldfield Thomas, F.Z.S.

[Received December 1, 1891.]

(Plate III.)

The present paper is an attempt to work out the species contained in the group Hyracoidea, a group which has of late years attracted the attention of several prominent systematic workers, but which, owing partly to its inherent difficulties and partly to want of material, has remained in a terrible state of chaos. The difficulties of the subject are indeed so great, owing mainly to the slight differences and great variability of the species, that in spite of my material being many-fold greater than that available for any of my predecessors, I can only feel that my results are quite provisional, and will need further revision when larger and better series from more localities are obtained.

The material before me consists of about 120 skins and spirit specimens, and 122 skulls and skeletons, a number far in excess of what any previous worker has had. This number is made up, firstly, of the Museum series (71 skins &c., 67 skulls), which contains the types of the species described by Gray[1] in his many papers on the subject, and the large series of Abyssinian specimens collected by Mr. W. T. Blanford and used as the basis of his work on the group.

Secondly, the fine series (47 skins &c., 48 skulls) belonging to the Genoa Museum, containing large numbers of the Abyssinian and Shoan forms and also the only good specimens that I have seen of the Senegal Hyrax (*Procavia latastei*). This collection formed the basis of M. Lataste's work on the group[2]—work only just begun, and of which only a few preliminary remarks had been published, but work nevertheless of the highest and most thoughtful character, so that it has been a great misfortune in this respect that M. Lataste has had to throw up the Hyracoidea on quitting Europe for S. America. All his drawings and notes, however, have been transmitted to me by the Marquis G. Doria, to whom I also owe the loan of the collection itself, and to whom therefore my most sincere thanks are due.

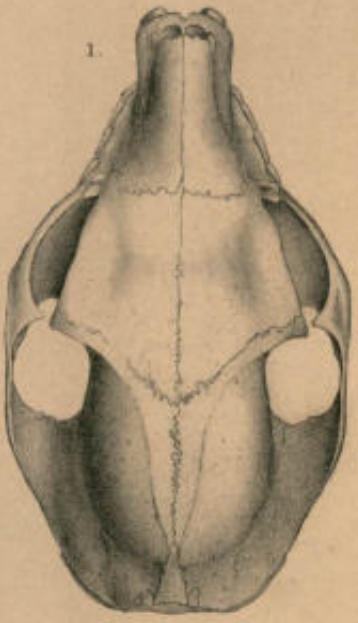
Thirdly, four skulls of the Angolan species, including the type skulls of both *P. welwitschii* and *P. grayi*, kindly lent me by Prof. Barboza du Bocage of the Lisbon Museum, these being the skulls described and figured by him in his excellent paper on the genus published in 1889.

Fourthly, two skulls of *P. syriaca* lent me by Dr. P. Matschie of the Berlin Museum, with the permission of Prof. Möbius. I am also indebted to the former for much assistance in reference to the

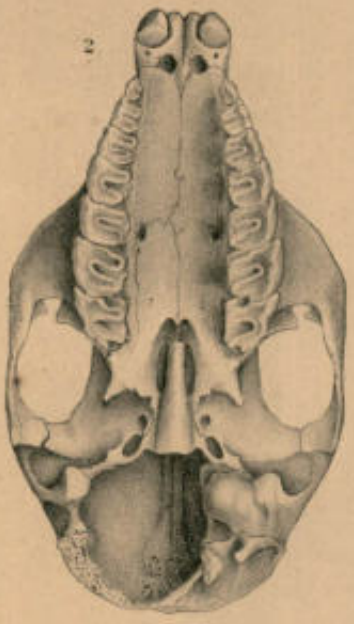
[1] Except that of *P. welwitschii*.

[2] Ann. Mus. Genov. (2) iv. p. 5 (1886).

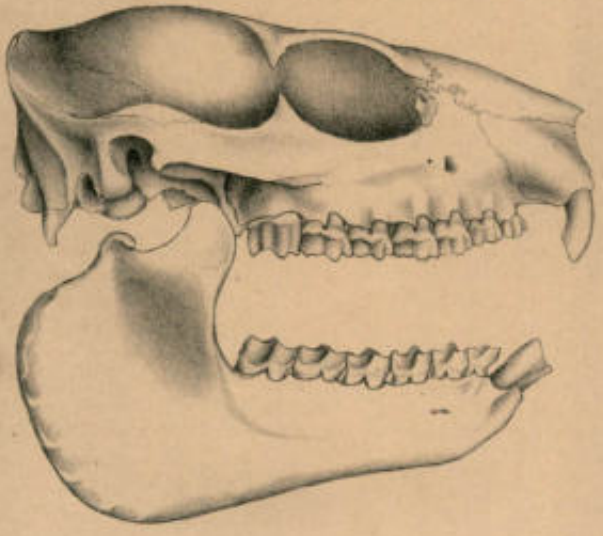
1.



2.



3.



M. Forman-Fisher del. et lith.

Mintern Bros. imp.

SKULL OF PROCAVIA PALLIDA.

type specimens of Hemprich and Ehrenberg's species preserved in Berlin.

Fifthly, a skin of the same species lent me by Canon H. B. Tristram of Durham.

It will be seen therefore that not only is the present series unprecedently large in point of numbers, but that it contains the actual specimens referred to by all the chief writers on the subject of recent years, viz. Gray, Blanford, Lataste, and Bocage.

Of their papers I would call special attention to that by M. Lataste, already briefly referred to, on the skulls and dentitions of the different "subgenera," and especially to his theory that the minute anterior maxillary tooth of the milk-dentition is a milk-canine which does not have a successor. This theory I believe to be perfectly correct, and am most glad to be able independently to confirm Lataste's observation. This tooth appears most certainly to be homologous with the milk-canine of other mammals, even though it is ordinarily situated some way behind the maxillo-premaxillary suture.

M. Lataste's other work on the group, being in the form of drawings and rough notes, I have found it very difficult to utilize, especially as our opinions are naturally very frequently divergent. If, however, I have published any observation which he has previously discovered and recorded, I must ask his pardon and plead as an excuse the very rough character of the notes which he has made.

The excellent paper by Prof. Barboza du Bocage[1] should also be referred to, as he has given in it not only full and detailed descriptions of the three Angolan species, in some ways the most interesting, because the most annectant, of the genus, but he has also given a complete list of all the known species, with notes on their characters and localities. This paper has therefore naturally been of much service to me while going over the same ground.

To pass now to the subject-matter of this paper. In the first place, it must be admitted that, as pointed out by Lataste, the time-honoured name of *Hyrax*[2] should be superseded by that of *Procavia*[3], earlier by three years than *Hyrax*. The family name will therefore be *Procaviidæ*, but the ordinal or subordinal name will remain Hyracoidea as before, a name of this rank not necessarily being based on that of a constituent genus. "Hyrax" might, however, be adopted as an English vernacular name, the species of *Procavia* not having as yet one generally and correctly applicable to them.

Secondly, there arises the important question as to whether all th Hyraces should be placed in one genus, or whether "*Heterohyrax*" and "*Dendrohyrax*," both proposed by Gray and admitted by Lataste and others, should be recognized as distinct genera or subgenera.

Now on this point I find it very difficult to come to a definite conclusion. Within the group there are two extremes, typified, for example, by *P. abyssinica* and *P. dorsalis*—the former with their

[1] J. Sci. Lisb. (2) iii. pp. 186–196 (1889).
[2] Herm. Tab. Aff. Anim. p. 115 (1783).
[3] Storr, Prodr. Syst. Mamm. p. 39 (1780).

molar teeth very large, hypsodont, and like those of a Rhinoceros in character, while the latter have small, brachyodont, Palæotherium-like teeth; and these two extremes have been commonly looked upon as the types of distinct genera, respectively *Procavia* (=*Hyrax*) and *Dendrohyrax*. But unfortunately there is really almost a perfect graduation in characters from the one extreme to the other, the chief link being formed by *P. brucei*, a species which has been made the type of a third genus or subgenus, *Heterohyrax*. Now this *Heterohyrax* has the essential dental characters of *Dendrohyrax* combined with the skull of *Procavia*; while the one cranial peculiarity supposed to be characteristic of it, the early closure of the interparietal sutures, is not present in *P. latastei*, a species otherwise in every respect identical with *P. brucei*. On the other hand, the perfect orbits characteristic of *Dendrohyrax* occur in a form called "*D. grayi*," which, except for this one character, does not differ either cranially or externally from *P. bocagei*, and will perhaps prove to be only a variety of that animal. One single external character, however, distinguishes the three most typical Dendrohyraces, *P. dorsalis*, *arborea*, and *valida*, from all the other species in which the point has been noticed, namely the number of the mammæ. These three species have a mammary formula of 0—1=2, while certainly in *P. syriaca*, *ruficeps*, *abyssinica*, *shoana*, *welwitschii*, and *brucei*, and therefore, judging from analogy, probably in *P. capensis*, *pallida*, *bocagei*, and *latastei*, there are 1—2=6. The mammary formulæ of "*Dendrohyrax grayi*" and *P. emini* cannot be forecasted, and therefore particularly need observation. In any case, however, this character cannot be used as of generic value, for it separates "*Dendrohyrax*" equally from both "*Heterohyrax*" and "*Procavia*," although the teeth prove that, if anywhere, the division should come between *Heterohyrax* and *Procavia*. But even then one would not know into which group to place such an anœctant form as *P. welwitschii*. Balancing, therefore, these considerations for and against the retention of *Dendrohyrax* and *Heterohyrax*, I have come to the conclusion that it is better on the whole to recognize only a single genus for the whole of the Hyraces, which will of course bear the name of *Procavia*.

Before passing to the actual descriptions of the different species, a few words are necessary as to the cranial, dental, and external characters found in the group, as a proper understanding of these is essential to anyone trying to work out the species of this most difficult group.

Firstly, it may be noted that, thanks to the work of Lataste already quoted, and still more to the important paper by Mr. Woodward just read to the Society (*suprà*, p. 38), the homologies of the teeth are fortunately quite clear throughout. Especially noteworthy is the discovery of rudimentary outer milk-incisors, a discovery which proves the persistent incisors to be really homologous with the first incisors of normal mammals. Lataste's determination of the anterior upper cheek-tooth of the milk-series as $\frac{m^2}{}$ is fully confirmed by Woodward, whose discovery of a corresponding lower milk-canine is of much interest.

Owing to the comparative lateness in life at which apparently the Hyraces become fully adult, and the consequent frequency with which more or less immature specimens have to be dealt with, special attention has to be paid to the age of every specimen described. For purposes of comparison therefore the period of tooth-development has been divided into eight stages, mostly determinable by the relative development of a single tooth, and thus by the comparison of specimens of similar ages the true inherent differences in size between different forms become easily definable. A single tooth only is taken as the main determinant of each of the stages, no account of the general state of the dentition at any given stage being practicable for all species, owing to the fact, observed by Lataste, that the time of the fall of the milk-premolars as compared with the development of the permanent molars varies in different species.

The following are the stages which I have found divide the specimens most conveniently into groups of individuals of similar age. The actual age, in time, at which in the different species these stages are attained may perhaps be found out later at a more advanced period of knowledge:—

Stage I. Before the milk-dentition is fully in place.
II. Milk-dentition all up and in use. $\underline{m^1}$ not visible.
III. m^1 up; $\underline{m^2}$ below level of bone.
IV. m^2 just appearing or partly up.
V. m^2 nearly or quite up; $\underline{m^3}$ below level of bone.
VI. Tip of m^3 appearing.
VII. m^3 partly or nearly up, but still unworn.
VIII. $\underline{m^3}$ up and in use.

No doubt Hyraces are practically adult, and are probably breeding, some time before Stage VIII, is attained, just as in the Kangaroos and other animals in which there is a horizontal succession of the teeth owing to the movement forward of the tooth-row, and the consequent replacement of the crushed and worn-down anterior teeth by the newly formed posterior ones. Of course the process is not nearly so highly developed as it is in the Kangaroos, Manatees, and others; but there is evidently a commencement of this remarkable provision for the replacement of the worn-out teeth in the Hyracoidea, especially in the hypsodont species, such as *P. capensis*, *abyssinica*, and their allies.

Thanks to this process, the actual size of the teeth, however valuable for the discrimination of the species, cannot be defined satisfactorily by a simple antero-posterior measurement of the tooth-row or any part of it, for the larger posterior teeth as they push forwards gradually crush together the whole of the teeth and make their combined length less and less as time goes on.

To gain an idea of the actual size of the teeth, it has therefore been found best to take the exact horizontal breadth of $\underline{m^1}$ at its broadest point, this tooth being present and available in specimens at all ages from Stage III. upwards.

As to the height of the teeth, by which their hypsodontism or brachyodontism can be gauged, the height of the crown of $\underline{m^3}$ has been taken as the basis. It is measured, in a tooth as unworn as possible, from the top of the main anterior cusp[1] to the bottom of the valley on the outer side of the cusp; when there is any trace of a cingulum it is placed at this point, but when there is not, the point at which the valley merges into the smooth basal outer surface of the tooth may always be clearly made out.

The upper incisors of the Hyraces are of two forms, the one sharply ridged and angular in front, and the other more or less rounded or even flat anteriorly. This difference, though often incidentally noticed, never seems to have been referred to sex, of which, however, I believe it affords a constant index. The study of so large a series of specimens as the present proves conclusively that all the specimens with ridged incisors are males, and those with them rounded are females. It is of the greatest value to have this ready index to the sex of skulls, as so large a number are either without skins, or if these exist they are unsexable. It should be noticed, however, that in certain species, notably *P. dorsalis*, *arborea*, and *brucei*, the female incisors are also to a certain extent ridged, but to a degree very slight in comparison with those of the male sex.

Other differences due to sex seem to be few and unimportant. Even as to size, although male skulls on the whole are rather larger than female ones, yet individual female skulls often exceed the great mass of the males. To take an instance, in *P. shoana* 5 male skulls give the following lengths—89, 90, 91, 92, 93, and 6 females the following—82, 84, 84, 85, 87, 88; but one of the types of the species, unquestionably a female, has a length of 96 mm., thus exceeding any of the males as yet recorded. Almost precisely the same thing occurs in the series of *P. capensis*, where our largest specimen is a female. No general rule therefore can be laid down as to the relative sizes of the two sexes.

Throughout the history of the systematic arrangement of the Hyraces the interparietal bone has had a large share in causing confusion owing to the alterations that take place in its shape during life not being allowed for or understood. It was early seen that different specimens had very differently shaped interparietals, and in the absence of good series at different ages these differences were naturally supposed to be of specific value. Thus Hemprich and Ehrenberg in 1828 laid primary stress on the shape and form of this bone in separating the four species they recognized; while much later Gray referred a great deal to it, and the retention of "*Heterohyrax*" as a subgenus by Lataste practically depended on the age at which it is united to the other bones of the skull. On the examination of a large series of specimens, however, it appears that this bone is by no means really so important as has been supposed for diagnostic purposes, and that its differences in shape are really due to

[1] Not the extreme antero-external cusp, which has no valley on its outer side; the cusp measured from is nearly always the highest one of the tooth.

age, while its fusion or non-fusion with the other bones of the skull, although generally constant, is a character rather more variable than has been supposed.

In a young specimen of one of the species in which it is generally distinct through life, the bone is clearly marked, ordinarily broadly trigonal in shape, its broad posterior end generally embraced by two little processes of the supraoccipital, but these vary very much in their development. At this stage its edges are vertical to the plane of its surface, or if there is any slanting, it is in such a direction that the inner cerebral aspect is rather smaller than the outer. This condition of things remains constant up till somewhere about Stage V., when the ever extending temporal muscles begin to encroach in its vicinity. These muscles seem to induce the development as part of the parietals of a roughened surface-layer of bone, which, with the muscles, gradually creeps onwards over the brain-case, and by degrees encroaches on and covers up the interparietal bone. The two parieto-interparietal sutures therefore constantly get closer together, the interparietal bone naturally appearing narrower and narrower, and at last the two temporal ridges, which have already met some time before anteriorly, gradually coalesce further and further back, and finally block out all trace of the interparietal bone on the upper surface. Even then, however, for a long period the bone may remain uncoalesced, its sutures, in section, describing a curved line following the increase of the parietal bone over it. This gradual narrowing upwards of the interparietal may be seen well in the British Museum skull, No. 69. 10. 24. 41, of *P. abyssinica*, in which, although the bone itself is broken away, the sutural edge of the parietal clearly exemplifies the steady extension of their upper layers at the expense of the smaller bone between them.

Now as to the closing of the parieto-interparietal sutures, the early obliteration of which is the main character on which the group "*Heterohyrax*" rests, some words are necessary, as although really useful in many cases for specific determination, yet the character is not one that can be used for breaking the family up into smaller groups. In the great majority of the species these sutures are ordinarily persistent and visible, except in so far as they are covered up in the manner above described. On the other hand, in *P. brucei* they close up so soon that in two specimens as young as Stage III. they have quite disappeared, and in one of Stage II. they are only faintly visible. But two closely allied species, here provisionally admitted as such, but really only doubtfully distinguishable from *P. brucei*, have either persistent sutures (*P. latastei*), or temporary ones, closing up as the animal gets fully adult (*P. bocagei*), thus proving that the character is at most only of specific importance.

A second character on which much stress has been laid, and one which has been supposed to be above all suspicion of variability, is the completion or non-completion of the orbit behind by bone. This is always accepted as the essential character of the group "*Dendrohyrax*," and certainly, in the most typical species, *P. dorsalis*,

the orbit is closed, even in the youngest specimens available, down to Stage I. In *P. arborea*, however, the South-African form, one of our four specimens, already fully adult (Stage VIII.), has the postorbital processes of the frontal and malar separated by at least 2 mm.[1], the other three having closed orbits. On the other hand, the type of *Dendrohyrax grayi* has them completely closed, as has also a second specimen from the same region; but I am nevertheless most strongly inclined to consider these two specimens as only representing an individual variation of *P. bocagei*[2].

As it appears therefore from both these characters that the Angolan Hyrax is the one which presents the greatest difficulty, I would strongly impress on collectors having the opportunity the great desirability of obtaining more specimens from that country. In this connection I must again thank Prof. Barboza du Bocage for the loan of the valuable Angolan specimens preserved in the Lisbon Museum, a loan which has been of the very greatest service to me.

The development of the anterior lower premolar ($\overline{p^1}$) is worthy of some notice. In the large-toothed, hypsodont species, such as *P. capensis*, *abyssinica*, &c., it is a simple slender tooth, with only one root, and is pushed out by the teeth behind it at a very early age, so that it is quite unusual to find it present in fully adult animals. On the other hand, in the small-toothed brachyodont species it is elongated, has two distinct roots, and is practically persistent throughout life. These differences are clearly correlated with the amount of the wear and tear of the teeth and their movement forwards in the jaw, characters at their maximum in the hypsodont and their minimum in the brachyodont species.

The predecessor of this tooth ($\overline{mp^1}$) is always long and double-rooted, showing clearly which of the two adult forms is the primitive one of the group.

The number of the ribs has also been used as a distinguishing character of the genera and subgenera, but, so far as I have seen, all the species examined (including such widely separated species as *P. dorsalis*, *brucei*, and *abyssinica*) have 21 (rarely 20), while *P. capensis* alone has 22. I have, however, thought it worth while to record the numbers in the specific descriptions wherever I have direct knowledge of them.

Of the external characters by which the different species may be determined, the most important are the coloration, shape, and size of the dorsal spot, a patch of hairs growing on and around the dorsal gland, and almost invariably of a colour markedly contrasting with that of the body in general.

The following are the chief variations in the dorsal spot met with in the different species:—

[1] On one side; the other is broken.
[2] See below p. 72.

A. Dorsal spot wholly black ..... *P. capensis, shoana.*
B. Dorsal spot whitish, yellowish, or orange,
  a. Spot comparatively small, roughly oval in shape.
    a^1. Hairs of spot, or at least the central ones, wholly yellow.
P. syriaca, pallida.
    b^1. Hairs of spot with dark bases and generally black tips.
P. ruficeps, abyssinica.
  b. Spot elongate, linear.
    c^1. Hairs pale coloured to their bases.
      a^2. Spot orange or cinnamon ..... *P. valida.*
      b^2. Spot pale yellow or whitish.
P. brucei, bocagei, latastei, welwitschii, and *arborea.*
    d^1. Hairs black at base, white terminally ..... *P. dorsalis.*

The central part of the dorsal gland is very commonly quite naked, notably in *P. dorsalis*, where the naked part is two or three inches long, and about half an inch broad. Owing, however, to the way in which the hairs round the naked part converge towards each other, this fact is very seldom observable without separating the hairs, but occasionally in old specimens the naked skin is clearly visible from above. The distinctions given above between the different sorts of spots are by no means to be taken *au pied de la lettre* for every specimen examined, many of the groups passing quite imperceptibly into each other, while in some species the spot itself varies so much as to be not easily definable.

As to the geographical distribution of the different species the accompanying sketch-map (see p. 58) will show more clearly than any amount of description where the different forms are found, and will be a guide to anyone wishing to know what species may be expected to occur in any given locality. It may, however, be just noted that while many places have only one species known from them, most have two, and that these are almost invariably one of the hypsodont (*Procavia*) and one of the brachyodont (*Dendrohyrax* and *Heterohyrax*) groups. Thus in N. Abyssinia we have *P. brucei* and *abyssinica*, in Shoa *P. brucei* and *shoana*, in Angola *P. bocagei* and *welwitschii*, and in S. Africa *P. arborea* and *capensis*.

The two tables exhibited (see pp. 59, 60) show respectively (1) the basal lengths[1] of considerable series of specimens of each species taken at as many age-stages as possible, and (2) (*a*) the breadth of $\underline{m}^1$, (*b*) the height of $\underline{m}^2$, measured as already described, and (*c*) the horizontal length of $\underline{p}^1$. It is to be hoped that, without a more formal synopsis, which at present I hardly feel capable of drawing up, these measurements, combined with the rough synopsis of the dorsal spots just given, will enable anyone to determine specimens without much difficulty.

[1] Basion to gnathion.

Map showing the Distribution of the Species of Procavia.



1. Procavia capensis.
2. —— shoana.
3. —— syriaca.
3 *a*. —— —— jayakari.
4. —— ruficeps.
5. —— abyssinica.
5 *a*. —— —— minor.
6. —— pallida.
7. —— welwitschii.
8. Procavia latastei.
9. —— bocagei.
10. —— brucei.
10 *a*. —— —— somalica.
11. —— emini.
12. —— valida.
13. —— arborea.
14. —— dorsalis.

TABLE I.—*Basal Lengths* (in millim.).

	Stage I.	Stage II.	Stage III.	Stage IV.	Stage V.	Stage VI.	Stage VII.	Stage VIII.
1. capensis	.....	.....	.....	.....	69.	69.	.....	82, 87, 93.
2. shoana	.....	57, 58, 62.	.....	.....	74, 74, 75, 77, 79, 79.	83.	82, 84.	84, 85, 87, 88, 90, 92, 93, 96*.
3. syriaca	.....	.....	61, 67.	.....	.....	.....	.....	77.
3*a*. „ jayakari	.....	.....	.....	.....	.....	.....	72.	73*.
4. ruficeps	.....	.....	.....	.....	.....	.....	.....	78, 86.
5. abyssinica	.....	52.	61.	68, 71.	75*.	76.	73.	75, 78, 80, 82, 83, 84, 87.
5*a*. „ minor	.....	.....	.....	.....	.....	65*.		
6. pallida	.....	.....	.....	.....	.....	.....	.....	(*c*) 72*.
7. welwitschii	.....	.....	.....	.....	.....	.....	.....	78*.
8. latastei	.....	51.	.....	66, 67, 70*.	.....	73, 75*.		
9. bocagei	.....	.....	.....	73*.	.....	.....	.....	79.
10. brucei	.....	.....	64, 67.	.....	76.	75.	75, 76, 78.	79, 80, 81, 82.
10*a*. „ somalica	.....	.....	.....	.....	64.	67.	.....	65, 74*.
[grayi	.....	.....	.....	.....	.....	(*c*) 82*.]		
11. emini	56*.							
12. valida								
13. arborea	.....	.....	.....	.....	.....	.....	.....	82, 86, 87, 92.
14. dorsalis	56, 56.	.....	77.	.....	.....	.....	.....	93, 100, 113.

* *Types* or *co-types.*

TABLE II.—*Sizes of Teeth* (in millim.).

	(*a*) Breadth of $\underline{m^1}$.	(*b*) Height of crown of $\underline{m}$.	(*c*) Length of $\overline{p^1}$.
1. capensis	7·0, 7·5, 8·0.	7·1, 7·5.	2·5, 2·7.
2. shoana	7·1, 7·3, 7·8, 8·1.	7·3.	2·6, 2·8.
3. syriaca	7·1, 7·2, 7·4.	7·0.	2·2.
3*a*. „ jayakari	6·2, 6·4.	(*c*) 5·5.	.....
4. ruficeps	7·0, 7·3, 7·7.	6·9.	2·5, 2·6.
5. abyssinica	6·7, 7·0, 7·4, 7·8, 7·9.	6·9, 7·0.	2·0, 2·2.
5*a*. „ minor	6·3, 6·6.	.....	.....
6. pallida	6·9.	5·4.	.....
7. welwitschii	6·5, 6·7.	5·2.	4·1.
8. latastei	6·0, 6·3, 6·5.	.....	3·0, 3·1.
9. boengei	5·4, 5·6, 6·4.	4·5.	3·7, 3·9.
10. brucei	5·4, 5·7, 6·0.	4·5.	2·8, 3·0, 3·4.
10*a*. „ somalica	5·0, 5·2.	4·5.	3·0, 3·1.
[gruyi	6·0, 6·1.	.....	4·0.]
11. emini			
12. valida			
13. arborea	6·0.	3·5.	3·5, 3·8.
14. dorsalis	6·6, 6·8.	4·1, 4·3.	4·7, 4·8.

1. PROCAVIA CAPENSIS.

Cavia capensis, Pall. Misc. Zool. p. 30 (1766).

(?) *Hyrax semicircularis*[1], Gray, Cat. Carn. Pachyd. p. 285 (1869); Hand-l. Edent. &c. p. 44, pl. xii. fig. 2 (1873) (skull).

Fur of medium length, soft and fine; neither so long nor so fine as in *P. shoana*. Ears short, rounded. General colour dark sepia-brown, finely speckled with white or pale yellow. Straight upper-fur hairs dark brown, with a small pale yellow subterminal band; underfur along the centre of the back dark smoky grey throughout, but along the sides, grey basally, and shining silvery yellow distally. Belly dirty yellow or brownish.

Dorsal spots entirely black, irregularly oval in shape, not so large as in *P. shoana*.

Skull[2] broad, stout and strong; muzzle short; interparietal sutures always persistent. Diastema short, 8 to 10 mm. Teeth large and hypsodont, but very variable in size; of the few specimens with exact localities the eastern ones, from Natal &c., seem to have smaller teeth than those from the Cape itself. Diameter of $\underline{m^1}$ 8·0 in a Cape specimen, 7·0 in a Natal one, those being the extremes observed. Height of crown of $\underline{m^3}$ 7·1 to 7·5. $\overline{p^1}$ minute, single-

[1] The young skull on which this species was founded has not got completed orbits as stated by Gray, the connections being only ligamentous. There appears to be nothing to distinguish it from skulls of *P. capensis* of the same age, but the skeleton shows only 21 pairs of ribs. It is also just possible that *Hyrax nigricans*, Peters, SB. Ges. Fr. 1879, p. 10, belongs here, in which case the species extends very much further north-west than has been supposed. The type specimen, however, is too young for certain determination.

[2] Good figure: De Blainville, Atl. iii. Hyrax, pl. ii.

rooted, early deciduous, rarely or never present in adult specimens. Ribs 22.

Hab. Cape Colony, from the Cape[1] to Natal[2].

2. PROCAVIA SHOANA[3].

Euhyrax abyssinicus, Gray, Ann. Mag. N. H. (4) i. p. 47 (1868) (nec *Hyrax habessinicus*, Hempr. & Ehr.).

Hyrax scioanus, Gigl. Ann. Mus. Genov. (2) vi. p. 21 (1888).

Size very large, form stout and heavy. Mammæ 1—2=6. Fur very long, soft, and fine. General colour grizzled olivaceous grey, the straight lines of the back brown basally, with a broad dull yellow subterminal ring and black tip. The greater breadth of the yellow ring and the larger number of the straight hairs as compared to the woolly underfur quite take away the appearance of fine speckling characteristic of *P. capensis*, and produce a much coarser mottled appearance. Underfur coloured as in *P. capensis*, but the yellow band on both of the sides is broader, and its colour is duller and more tinged with olivaceous. Belly dirty yellow or brownish.

Dorsal spot very large and diffuse, wholly black, very prominent in well-marked examples.

Skull large and heavy, but very variable in its proportions, especially in the length of the muzzle, and consequently in the length of the diastema. In the female co-type[4] the latter is fully 14 mm. long, while in another specimen it is only about 5 mm., but in the large Genoa Museum series nearly all the intermediate links are represented. On the whole the skull cannot be definitely distinguished from that of *P. capensis*, although ordinary specimens run rather larger of the northern than of the southern form. Teeth also very variable in size: m^1 from 7·1 to 8·1 in breadth; crown of m^3 about 7·2 or 7·3 high; $\overline{i^1}$ small, single-rooted, about 2·6 or 2·8 in horizontal length. 22 ribs (in one specimen).

Hab. S. Abyssinia and Shoa.

Co-types (♂ & ♀) from Ankober, collected by Major W. C. Harris. Other specimens from the Dalanta and Wadela Plateaux, S. Abyssinia (*Blanford*), Lit Marafia, Denz, Askalena, Monte Mabrat, and other neighbouring localities in Shoa (*Antinori*, *Ragazzi*, and *Beccari*).

This fine Hyrax, almost if not quite the largest of the genus, has been the cause of great trouble and uncertainty among writers on the group ever since Gray first described the specimens obtained by Capt. Harris at Ankober, these specimens being therefore the co-types of the species as renamed by Giglioli. Gray's reference of this

[1] I have myself seen these animals in numbers on the rocks near Fishhoek, a small village on the eastern side of False Bay. Further west than this I know of no exact record of their occurrence.

[2] The Museum owes to the Rev. W. D. Newnham a beautiful pair of skulls obtained by him in Natal. Lieut. H. Trevelyan has also presented several specimens from Kingwilliamstown.

[3] This alteration in the spelling of the name is necessary to bring its pronunciation into conformity with that of the country on which it is based.

[4] 705 *b* of Gray's Hand-list Edent. &c. p. 42; not that figured pl. x. fig. 1, which is probably *P. capensis*.

form to Hemprich and Ehrenberg's *H. habessinicus* has been frequently questioned, and, as will be seen below in the remarks to that species (p. 66), I have come to the conclusion that it cannot be supported. The species therefore requires the new name given it by Giglioli, if it is considered to be distinct from *P. capensis*, to which it is most certainly allied. However, although its skull cannot be with certainty distinguished from that of the Cape animal, yet its longer softer fur, its more olivaceous colour, its much larger dorsal spot, and its great difference in locality induce me to consider it as requiring specific distinction.

The Genoa Museum possesses a large series of this handsome animal, obtained at many different localities in Shoa by Messrs. Antinori, Beccari, and Ragazzi, while there are in the British Museum the two typical specimens, besides several skulls, collected by Capt. Harris at Ankober. In addition I refer to this species the two specimens from the Dalanta plateau spoken of as "*Hyrax* sp. nov." by Mr. Blanford [1], this locality being the most northern recorded for the present species, and yet considerably south of any place at which he obtained *H. abyssinica* (his *H. brucei*) [2].

3. Procavia syriaca.

Hyrax syriacus, Schreb. Säug. iv. pl. ccxl. B (1784), p. 923 (1792).

Hyrax sinaiticus [3], Gray, Ann. Mag. N. H. (4) i. p. 45 (1868).

Size medium or rather small. Mammæ 1–2=6. Fur long, rather soft and shaggy, not so smooth as in the other species. General colour a sort of dull orange-yellow or fawn, not so sandy as *P. ruficeps*. Belly yellow or brownish yellow, but very variable in tone.

Dorsal spot large and clearly marked, yellow, the hairs yellow throughout, to their extreme tips and bases; the yellow paler basally and darker terminally.

Skull [4] broad and strongly made, rather narrower, however, in the S. Arabian subspecies. Interparietal sutures persistent. Diastema about 9 mm., very slightly longer in the southern specimens. Molar teeth variable in size.

Ribs 20 (in one young specimen and also in that figured by De Blainville).

Hab. Syria, Palestine, the Sinaitic Peninsula, and the whole of Arabia.

This species was first described by Bruce in 1790 [5], but as he confounded the Abyssinian and Palestine Hyraces, the name *syriaca*, based on his description, has been rejected by some authors on the ground that his "Ashkoko" is the Abyssinian species and not the Palestine one. It is, however, quite clear that his main description

[1] Zool. Abyss. p. 257.
[2] *L. c.* p. 252.
[3] See footnote [1] to *P. ruficeps*, p. 64.
[4] Good figures: De Blainville, Ostéogr. iii. *Hyrax*, pls. i. & ii.
[5] Bruce, Travels, v. p. 139.

was based on a specimen obtained by him on Mount Libanus, and the name *syriaca* given by Schreber is evidence as to what country he considered the home of the species. I am therefore glad to be able to retain the name by which the species has so long been known.

Thanks to the energy of Dr. A. S. G. Jayakar, of Muscat, I am enabled to announce a very considerable extension of the known range of this species, and at the same time of the genus, for he obtained an adult female with its young at Dofar, on the southern coast of Arabia, about halfway between Muscat and Aden, no Hyracoidea having been previously known in Southern Arabia at all.

Although agreeing in most of its characters with the typical *P. syriaca* of N. Arabia, this Dofar specimen differs so markedly in the size of its teeth, as also does a Central Arabian one kindly lent me by the authorities of the Berlin Museum [1], that I feel compelled to consider the southern form as subspecifically distinct from the northern. I propose to name it in honour of its discoverer Dr. Jayakar, to whom the British Museum is indebted for examples of so many members of the Arabian Fauna.

Subspecific diagnoses :—

A. *P. syriaca typica*.

Size rather larger; skull broader; teeth markedly larger and heavier, very hypsodont; breadth of $\underline{m^1}$ about 7·1 or 7·2 mm., height of crown of $\underline{m^3}$ about 7·0. Horizontal length of $\underline{p^2}$ about 2·2 mm.

Hab. The northern half of the whole range of the species.

B. *P. syriaca jayakari*, subsp. n.

Size rather smaller, and skull narrow; teeth smaller; breadth of $\underline{m^1}$ 6·2 [2] mm.

Hab. South-eastern half of Arabia.—Dofar, S. Arabia (*Brit. Mus., Dr. Jayakar*). Melhan, Central Nejd (*Berlin Mus., Coll. Schweinfurth*).

Judging only from the type-specimen, this southern subspecies seems to have a rather darker coloration, and less ragged, shaggy hair, than the typical form, but of course one can lay no stress on these characters without further specimens for comparison.

4. PROCAVIA RUFICEPS.

Hyrax ruficeps, Hempr. & Ehr. Symb. Phys. decas i. pl. ii. (upper figure) (1828).

[1] I must thank Prof. Möbius and Dr. Matschie for the loan of this skull, and also for one of the typical variety from Sinai. In spite of the time that it has been known, specimens of *P. syriaca* are by no means common, and the British Museum possesses only one stuffed specimen without a skull. However, besides the two Berlin skulls just mentioned, Canon H. B. Tristram has kindly lent me a skin and skull from Palestine, and there are two Syrian examples in the Genoa Museum collection, originally obtained by Dr. Lortet.

[2] 6·4 in the specimen from Melhan.

Hyrax burtoni, Gray, Ann. Mag. N. H. (4) i. p. 43 (1868); Cat. p. 285 (1869).

Hyrax dongolanus[1], Blanf. P. Z. S. 1869, p. 642; Bocage, J. Sci. Lisb. (2) iii. p. 192 (1889).

Size rather large; form elongated. Ears apparently more sharply pointed at the tip than in the other species. Mammæ 1–2=6. Fur long, but harsh and thin. General colour sandy fawn, grizzled with black, not so pale as in *P. pallida*, but paler than in *P. syriaca*.

Dorsal spot small and very little prominent amid the general sandy colour. Its hairs coloured very much as in well-marked specimens of *P. abyssinica*—*i. e.* brown at the bases, bright orange-yellow subterminally or terminally, with or without black tips.

Skull and teeth large and strong, not definitely distinguishable from those of *P. abyssinica*. Interparietal sutures persistent. Breadth of m^1 7·0 to 7·7 mm.; height of crown of $\underline{m^3}$ 6·9 mm.; horizontal length of $p^{\underline{1}}$ 2·5 or 2·6.

Type in the Berlin Museum.

Hab. Dongola (*Hemprich & Ehrenberg*); Egypt (*Burton*).

This species, to which I follow Mr. Blanford in assigning *Hyrax burtoni* of Gray, appears to be essentially a northern desert form of *P. abyssinica*, and leads on towards *P. syriaca* of the other side of the Red Sea. All these species are very closely allied to one another, their skulls being practically indistinguishable, and their distinctions resting mainly on colour. *P. ruficeps*, however, has decidedly more pointed ears than the others, at least so far as the three typical specimens of "*H. burtoni*" are concerned, but I do not know how far this is likely to be a constant character. It is unfortunate that the name *ruficeps* should stand for this species, as the rufous on the vertex is far less strongly marked than it is in many specimens both of *P. abyssinica* and *P. shoana*.

5. Procavia abyssinica.

Hyrax habessinicus, Hempr. & Ehr. Symb. Phys. decas i. pl. ii. (the dark-coloured specimen) (1828).

Hyrax abyssinicus[2], auctorum plurimorum; Blanf. P. Z. S. 1869, p. 642; Bocage, J. Sci. Lisb. (2) iii. p. 122 (1889).

Hyrax alpini, Gray, Ann. Mag. N. H. (4) i. p. 45 (1868); Cat. p. 287 (1869).

Hyrax ferrugineus, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869); Cat. p. 288 (1869).

[1] The use of this name is due to a mistaken idea of Hemprich and Ehrenberg's meaning in first founding the species. Their work being written throughout in Latin, the simple statement of the locality of the animal "*Hyrax ruficeps* (*dongalanus*)" was taken for an alternative name, and then preferred to *ruficeps* as more appropriate. No doubt Gray's misquotation of "*Hyrax ruficeps vel dongolanus*" was the first cause of the mistake. The same remarks, *mutatis mutandis*, apply to the use of the word "*sinaiticus*" for *H. syriacus* by Gray.

[2] Now that "Abyssinia" and not "Habesh" is the form of the name invariably used, it seems better to adopt the amended spelling "*abyssinica*" rather than "*habessinica*." Mr. Blanford also comes to the same conclusion; *vide* his footnote, P. Z. S. 1869, p. 639.

Hyrax irroratus, var. *luteogaster*[1], Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869) (excl. description of dorsal spot)[2]; Cat. p. 288 (1869).

Hyrax brucei, Blanf. P. Z. S. 1869, p. 642; Zool. Abyss. p. 252 (1870); Bocage, J. Sci. Lisb. (2) iii. p. 193 (1889) (*nec* Gray).

Size medium, smaller in var. *minor*. Mammæ 1—2=6. Fur ordinarily fairly long, at least in the highland specimens, but always rather coarse and harsh, never long, soft, and fine, as in *P. shoana*; quite short and crisp in the subspecies from the Assab region. Colour a coarsely-mottled grey-brown, varying towards either olive or ferruginous; some specimens marked by rufous over the greater part of the back. The hairs dark brown at their bases, and black at their tips, with a broad subterminal band of dirty yellow.

Dorsal spot very small, oval, more inconspicuous than in any other species, often only to be found after the most minute search, below and between the ordinary hairs, and sometimes not at all. It consists simply of a broadening and brightening of the ordinary subterminal yellow band of the hairs, and when well developed is of a bright orange-yellow colour. In the great majority of specimens the black tips to its hairs so hide the yellow that the spot is not visible at all unless specially searched for.

Skull[3] stout and strongly built. Muzzle short. Coronal and parieto-interparietal sutures persistent[4]. Temporal fossæ extending backwards to within 3 or 4 mm. of the hinder edge of the skull. Diastema rather constant in its length, generally about 9 mm., but considerably less in var. *minor*. Teeth ordinarily very large and heavy in proportion to the size of the animal, the breadth of $\overline{m^1}$ commonly being about 7·4 to 7·9, but in some specimens, which I cannot otherwise distinguish, they are much smaller and lighter, all the intermediate links being, however, present. The least breadth of $\overline{m^1}$ among those before me is 6·7 in the type of "*H. irroratus*, var. *luteogaster*," but here the two teeth are considerably worn down, and probably the true breadth would have been somewhat greater. Height of crown of $\overline{m^3}$ 6·9 or 7 mm. $\overline{P^1}$ very small, styliform, single-rooted, early deciduous; the horizontal length of its crown only about 2 or 2·2 mm. Ribs ordinarily 21 (but 20 in one specimen and 22 in another).

Type in the Berlin Museum.

Hab. Abyssinia from Bogos and Massowa in the north, through the highlands, as far south as Adigrat. Represented in the lowlands more to the east by the variety *minor*.

[1] Misprinted "*leucogaster*," Hand-l. Edent. &c. p. 42 (1873).

[2] See footnote, p. 70.

[3] Good figures: Gray, Hand-l. Edent. &c. pl. x. fig. 2 ("*brucei*"), pl. xi. fig. 1 ("*ferrugineus*"), pl. xii. fig. 3 ("*irrorata*"), 1873.

[4] In one specimen (B.M. 69. 10. 24. 37), an old male, the parieto-interparietal sutures are closed, but the suture down the centre of the interparietal bone itself still persists. The latter condition also obtains in 6 out of 18 very young skulls (stages I. and II.) of different species, but in no other specimen of adult age. Among the 12 very young skulls with the central suture closed is at least one taken from a fœtus.

Subspecific diagnoses :—

A. *P. abyssinica typica.*

Size larger. Fur longer. Colour as above described.

B. *P. abyssinica minor*, subsp. n.

Size smaller (see skull measurements in table). Fur short and crisp. Colour much as in the typical subspecies, but, owing to the shortness of the fur, there is an appearance of a greater general uniformity on the back.

Dorsal spot not more prominent than in var. *typica*, its hairs being equally tipped with black.

Skull small, with a comparatively very short diastema, almost rivalling that of *P. pallida*, 6·2 and 6·5 mm. in the two co-types. In neither specimen is p^1 present, so that the tooth is evidently dropped very early in the present form.

Hab. Alali, between Beilul and Assab, on the west shore of the Red Sea, about 13° N.

Two specimens of this peculiar little form were obtained from the above-mentioned locality by Dr. V. Ragazzi for the Genoa Museum. Both are somewhat immature, being at stage VI.

P. abyssinica minor is interesting, as leading on from the true *P. a. typica* towards *P. pallida*, found still further east in Somali. Both in size and in its shortened diastema it approaches that species, although in colour it shows no tendency to the greater paleness of the back and conspicuousness of the dorsal spot characteristic of *P. pallida*.

P. abyssinica, with its variations in colour and size, has always been and still is the most difficult form to work out of all the family, and I cannot at all hope to have satisfactorily settled the many problems which arise in the contemplation of any considerable series of specimens apparently belonging to it. In the first place, the original description was founded mainly on a specimen with a black dorsal spot, a character found in the Shoan species, but not ordinarily in the Abyssinian one, but with this specimen there was a second showing the typical black and yellow spot of the ordinary Abyssinian form. Now, as Mr. Blanford [1] states so directly that "the species identified by Gray with Ehrenberg's *H. abyssinicus* [2] is a very distinct form," and geographical considerations point so strongly in the same direction, I am induced to look upon Ehrenberg's black-backed specimen from Massowa as one of those troublesome individuals of the present species in which the yellow dorsal spot is practically absent, and the black tips to the hairs are so developed as to form a small dorsal black spot [3]. In any case I feel I cannot allocate this Massowa specimen [4] to the Shoan black-backed form

[1] Zool. Abyss. p. 251.

[2] *I. e.* the Shoan Coney.

[3] See, for instance, Mr. Blanford's specimen No. 886 (B.M. 69. 10. 24. 28).

[4] Dr. Matschie, of the Berlin Museum, however, is inclined to hold the opposite opinion, believing at the same time that the Massowa form is a small local race of the black-backed Shoan one. Should this view be correct, and I am

in the face of the fact that Mr. Blanford thoroughly hunted all the country between, specially looking out for Hyraces, without finding any trace of *P. shoana* until he penetrated as far south as the Wadela plateau, while the yellow-backed form was exceedingly common throughout the country from Massowa southwards. The skulls of the two forms unfortunately give no help in the matter, as they differ only in size; and although *P. shoana* ordinarily is far larger than what I consider as *P. abyssinica*, yet dwarfed individuals seem occasionally to occur, in which the skull is scarcely larger than in the latter species. Still, as a fact, the sizes of the skull and teeth of Ehrenberg's type specimens agree closely with those found in the ordinary Abyssinian form to which I refer them.

6. Procavia pallida. (Plate III.)

Procavia pallida, Thos. Ann. Mus. Genov. (2) x. p. 908 (1891).

Size small, form stout and squat. Fur very short, close, and crisp. Colour pale sandy grey, the hairs chocolate-brown basally, with a broad cream-coloured subterminal ring and a black tip. Rump rather more rufescent.

Dorsal spot small, oval, pale creamy yellow, the peripheral hairs with a broader and the central ones with a narrower brown basal part, but none of them with darker tips.

Skull (Plate III.) short, broad, and stout, in general appearance a miniature of the large-toothed Abyssinian forms *P. abyssinica* and *ruficeps*; coronal and interparietal sutures persistent. Molars very large in proportion to the size of the animal, and in consequence of this the diastema is shorter than in any other known species, being only 5·6 mm. between the alveoli, and 5 between the teeth above, while in the lower jaw it is practically non-existent, p_2 almost touching the outer incisor basally and only distant from it about 1 mm. terminally. It therefore leaves no room for p_1, occasionally present in other species. $\underline{M^1}$ 6·9 mm. broad in the type; $\underline{m^3}$ with a high crown, but, as it is somewhat worn, I can only say that it is more than 5·4 mm. high, that being its present height. $\overline{P_3}$ gone in the type; no doubt small and early deciduous.

Hab. N. Somali-land.

Type in British Museum (85. 11. 16. 4).

This peculiar little species bears, within the typical *Procavia* with open interparietal sutures and large teeth, very much the same relation to *P. abyssinica* that *P. brucei somalica* does in the "*Heterohyrax*" group to *P. b. typica*, the geographical relations of each pair

by no means positive about the opinion advocated in the text, the name of the Massowa Hyrax would be *P. abyssinica typica*, of the Shoan one *P. abyssinica shoana*, and of the ordinary N. Abyssinian one with yellow dorsal spot *P. alpini*, Gray. In this connection I must again express my sincere thanks to Dr. Matschie for the patience and kindness with which he has borne the brunt of question after question about this unfortunate type of Hemprich and Ehrenberg's, a specimen which, in spite of all, must still remain a stumbling-block for naturalists until it is supplemented by a proper series of fresh examples collected exactly at the same place.

being just the same. Its differentiation has, however, proceeded so much further that I have had little hesitation in erecting it into a distinct species, even though *P. abyssinica minor* approaches it in some respects. The type is a fully adult female obtained on the 25th of December, 1884, by the well-known collector Herr J. Menges, on the Hekebo plateau, N. Somali-land.

It is much to be hoped that further specimens of this little species will be soon obtained, so that we may gain an idea of its variation and geographical distribution.

7. PROCAVIA WELWITSCHII.

Hyrax arboreus, Peters, P. Z. S. 1865, p. 401 (*nec* Smith).

Hyrax welwitschii, Gray, Ann. Mag. N. H. (4) i. p. 43 (1868); Cat. p. 286 (1869); Bocage, J. Sci. Lisb. (2) iii. p. 186 (1889).

Size medium. Mammæ 1—2=6. Fur short, very coarse and hispid, quite unlike that of any other species. General colour of back coarsely grizzled sandy brown, the hairs dark blackish brown for five-sixths of their length, dull yellow terminally or subterminally, the tips, however, more rufous on the face and along the centre of the back; the brown bases of the hairs showing through and materially darkening the general colour.

Dorsal spot, in the single specimen available, rather elongate, although not so much so as in *P. brucei* and its allies. Its hairs dull pale yellow throughout.

Skull[1] stout and strong; muzzle short; frontal region unusually broad, the ledges overhanging the orbits, more developed than in other species; interparietal sutures persistent; diastema short, about 8 mm. in each of the two specimens before me; temporal fossæ extending backwards quite to the occipital ridges. Teeth rather small, breadth of m^1 6·4 and 6·5 in two skulls; height of crown of m^3 5·2; p^3 elongated, two-rooted, more as in the *Heterohyrax* and *Dendrohyrax* groups, its crown 4·1 mm. long horizontally.

Hab. Angola, coast-region (*Bocage*).

The only specimens of this rare species that I have been able to examine are the skull of Dr. Welwitsch's original type, most kindly lent me by Prof. B. du Bocage, and a skin with its skull received in 1888 by the British Museum from the Lisbon Museum. Both these specimens have been examined and the typical skull figured by Prof. Bocage, so that I have no material by which to supplement the excellent description he has there given to the species.

The true position of *P. welwitschii* in the genus is somewhat doubtful, as its skull agrees best with those of *P. syriaca, abyssinica*, &c., its elongated dorsal spot and rather small teeth but long p^3 approach those of *P. brucei* and *bocagei*, while the peculiar quality of its fur separates it from any other species.

Dealing only with the Angolan species, Prof. Bocage has taken it as a type of the *Procavia* group; but I consider that if anything it is further from *P. capensis* and *abyssinica* than it is from *P. brucei* and

[1] Good figure: Bocage, *l. c.* pl. i. fig. 1.

bocagei. More specimens, however, to show its variability and geographical distribution will be needed before its true relationship can be cleared up.

8. Procavia latastei, sp. n.

Fur close, soft and fine. General colour soft fawn-grey, more pallid than in *P. brucei*. A large patch on the side of the neck pale yellowish white, the hairs pale at their bases; this patch is not, however, conspicuous amid the general pallor.

Dorsal spot narrow, elongate, clear pale yellow to the bases of the hairs; in fact, just as in *P. brucei* and *bocagei*.

Skull in general form much as in *P. brucei*, except that it appears to be rather broader and more stoutly made. Muzzle short and conical. Interparietal and coronal sutures persistent. Diastema long, 10 to 12 mm. Teeth small, but proportionally rather larger than in *P. brucei*. Breadth of $\underline{m^1}$ 6 to 6·5 mm. P^1 small, but two-rooted, 3 or 3·1 long.

Co-types nos. 55-3238 (skin) and 2684 (skull) of the Genoa Museum (*coll. Lataste*).

Hab. Senegal.

M. Lataste obtained several specimens at Félou and Medine, Upper Senegal, and there is a young one in the British Museum received in 1844 from the dealer Parzudaki, and referred to "*H. burtoni*" by Gray (Cat. Carn. &c. p. 285).

From M. Lataste's notes and drawings I gather that he referred his Senegal specimens to *P. bocagei*, a reference by no means very wrong, as they are unquestionably closely allied to that form. I am, however, induced to separate them, at least for the present, by the fact that the whole of his specimens, 7 in number, besides an eighth, fully adult, of which he gives a drawing, have their interparietal sutures persistent, thus differing from *P. bocagei*, in which the sutures are all closed by about stage IV. or V.

The close alliance of this species to "*Heterohyrax*" *brucei* in general characters, while it has the open sutures of *Procavia s.s.*, is a striking proof of the necessity for abolishing *Heterohyrax* as a separate genus.

It is with great pleasure that I attach to this species the name of the distinguished author of the paper "Sur le système dentaire du genre Daman"[1], who collected the specimens himself, and after whom it is particularly suitable that a member of this interesting genus should be named.

9. Procavia bocagei.

Hyrax bocagei, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869); Cat. p. 289 (1869).

Heterohyrax bocagei, Bocage, J. Sci. Lisb. (2) iii. p. 188 (1889) (general description, habits, &c.).

Size rather small. Fur soft and close. General colour soft

[1] Ann. Mus. Genov. (2) iv. p. 5 (1886).

grizzled grey, very much as in *P. brucei*. Posterior back not tinged with rufous. Belly white or yellowish.

Dorsal spot inconspicuous, nearly hidden by the surrounding hairs, but on separating these it is seen to be well-developed, elongate, its hairs white or pale yellow to their bases.

Skull [1] light and slender, with a narrow elongated muzzle and flattened frontal region. Parietal, interparietal, and coronal sutures closing at about stage V., always closed in adult animals. Diastema long, about 13 mm. in adults.

Teeth small and delicate, markedly brachyodont; breadth of m^1 5·6 to 6·4; height of crown of m^3 about 4·5. $\overline{p^3}$ elongate, two-rooted, long, persistent, its crown about 3·7 or 3·9 mm. long.

Type in British Museum (68. 12. 19. 3).

Hab. Angola ("région moyenne, et les hauts plateaux," *Bocage*).

The retention of this species as distinct from *P. brucei* rests on very much the same, rather slender, foundation that the separation from it of *P. latastei* does, namely the age at which the interparietal sutures ordinarily close. This seems to take place in *P. brucei* at about stage II., in *P. bocagei* at stage V., and in *P. latastei* never, or at least not until fully adult life is reached. The longer and slenderer muzzle of *P. bocagei* and its more developed $\overline{p^3}$ may also serve to distinguish it from both, which then, the intermediate link being gone, seem more than ever distinct by their interparietal characters.

10. Procavia brucei.

Hyrax brucei, Gray, Ann. Mag. N. H. (4) i. p. 44 (1868); Cat. p. 287 (1869) (excl. syn.—not of later authors [2]).

Dendrohyrax blainvillei, Gray, Ann. Mag. N. H. (4) i. p. 50 (1868); Cat. p. 293 (1869).

Hyrax irroratus, Gray, Ann. Mag. N. H. (4) iii. p. 242 (1869) (excl. description of dorsal spot [3]); Cat. p. 288 (1869).

Hyrax mossambicus, Peters, SB. nat. Fr., 1869, p. 25.

Dendrohyrax bakeri, Gray, Ann. Mag. N. H. (4) xiv. p. 132 (1874).

Size small; forms lender. Mammæ 1—2 = 6. Fur short and close, but fine and generally soft. Colour clear grey, finely grizzled with white; underfur pale silvery fawn, rather darker basally. Posterior back generally quite similar to the rest, very rarely more rufous, and then only just above the anal region.

Dorsal spot narrow, elongated, white or yellow, the hairs often white at base and becoming more fulvous terminally, but never with any admixture of brown.

[1] Good figures: Gray, Hand-l. Edent. &c. pl. xi. fig. 2 (1873); Bocage, *t. c.* pl. i.

[2] Nor of the same author's Hand-l. Edent. &c. p. 40 (1873), where the great majority of the specimens mentioned, and the figured skull, belong to *P. abyssinica*.

[3] By some curious error the descriptions of the dorsal spots of "*H. irroratus*" and "*H. ferrugineus*" were interchanged in Gray's original paper, but the error was corrected in the "Catalogue" published shortly afterwards.

Skull[1] as described in the so-called subgenus "*Heterohyrax*"[2], of which this is the typical species. Interparietal early united to the parietals, and the latter to each other; the coronal suture seldom visible in adult animals. Temporal fossæ only extending backwards to within about 8 or 10 millimetres of the lambdoid crest. Diastema long, generally about 10 or 12 mm. in adult specimens.

Molars very small and light; m^1 rarely or never exceeding 6 mm. in breadth; generally from about 5·6 to 5·9; rather less in the Somali subspecies. Height of crown of m^3 4·5 mm.; p^1 small but double-rooted, its horizontal length 2·8 to 3·4 mm.

Ribs 21 (in the type of var. *somalica*).

Subspecific diagnoses:—

A. *P. brucei typica.*

Synonymy as above.

Size comparatively large, basal length about 80 mm.

Hab. Abyssinia [Senafé and Adigrat, Tigre (*Blanford*); Shoa (*Antinori*)]. Central Africa [Latiko, near Wadelai (*Baker*); Usambiro, Victoria Nyanza[3] (*Emin*)]; Taita (*Wray*). Mozambique (*Peters*).

B. *P. brucei somalica*, subsp. n.

Size markedly smaller than in the typical form, the skull of an old female having a basal length of only 74 mm.; colour rather paler.

Hab. Somali-land.

Two specimens, male and female, sent in spirit by E. Lort Phillips, Esq., from Berbera (the female the type of the subspecies); and a skin (♀) from Gerbatir, N. Somali-land, by J. Menges.

This species has been peculiarly unfortunate in the large number of names that have been applied to it, and still more in the frequency with which its proper name has been applied to other species. The chief cause of the confusion has been the fact that the skull of the type has never been extracted until now, and that on this account the common large-toothed N. Abyssinian species (*P. abyssinica*) was, without much close examination, dubbed with its name.

On extracting, however, the skull of the specimen in the Museum collected by Dr. Rüppell, and specially mentioned as the type by Gray, it is found to belong without question to the small-toothed species, which must therefore bear the name of *P. brucei*. To this species also belongs the "aberrant specimen of *H. brucei*" (No. 786) referred to by Blanford (Zool. Abyss. p. 254, 1870), aberrant really only in so far as it differs from the large-toothed form, to which, naturally following the founder of the name, he wrongly applied the designation *P. brucei*. The fact of the skull of this

[1] Figures: Gray, Hand-l. Edentata, &c. pl. xi. fig. 3 (1873).

[2] See Gray and Lataste, *ll. cc.*

[3] This specimen was marked by Dr. Emin: —"Iride fuseo-umbrina.—Native name 'Pembe'".

specimen being crushed, as mentioned by him, sufficiently accounts for his not realizing that the animal belonged to quite a different species from the rest of his specimens.

P. brucei is the most widely distributed of all the Hyraces, extending from Senafé, N. Tigre, its most northern recorded locality in Abyssinia, straight southwards as far as Mozambique, while its subspecies extends eastwards into Somali-land.

The typical race of *P. brucei* seems to be a highland form, as Mr. Blanford's specimens were taken at 7500 feet and 8000 feet in Abyssinia; the inland examples come from the great lake plateau, and Mr. Wray's Taita one was taken in the mountains at an altitude of 4500 feet. On the other hand, Mr. Lort Phillips tells me that var. *somalica* occurs at an altitude of three or four hundred feet only, about 20 or 30 miles inland of Berbera.

In Abyssinia *P. brucei* seems to be far rarer than the two large-toothed species occurring with it, *P. abyssinica* in the north and *P. shoana* in South Abyssinia and Shoa; as both Mr. Blanford from the former and the Italian collectors from the latter each obtained only two or three specimens of this species as compared with some twenty or more of its rivals. This is of course only what one might expect, judging from the lesser specialization of its teeth, which presumably put it at a disadvantage compared with its hypsodont competitors.

[PROCAVIA GRAYI.

Dendrohyrax grayi, Bocage, J. Sci. Lisb. (2) iii. p. 190 (1889).

External characters as in *P. bocagei*. Mammary formula unknown. Skull and teeth also as in that species, except that the orbits are completed behind by bone.

Type in the Lisbon Museum.

Hab. Angola; Quissange, Capangombe (*Anchieta*).

Basing his allocation on the presumably important character of the completed orbits, Prof. du Bocage assigned the only specimen of this form of which he had seen the skull to *Dendrohyrax*, and then naturally distinguished it from "*D.*" *arborea* and *dorsalis*; but I am much more disposed to consider it as an abnormal variation of *P. bocagei* for the reasons set forth below. In fact I give it a separate heading chiefly to stimulate inquiry, so that the point may be later settled with certainty. Its position, if a good species, would be here between the *brucei* group and the more typical *Dendrohyraces*.

To begin with, I am a disbeliever in species only distinguishable by a single character of nearly or quite generic rank, and believe that if *P. grayi* really were a distinct species of a different group there would be some other characters besides the completed orbits that would betray the fact to an eye so trained as that of the describer himself. As a matter of fact, however, the British Museum received from Prof. du Bocage in 1888, under the name of "*H. bocagei*," a skin (88. 12. 6. 1) which, when its skull was extracted, proved to have completed orbits, and therefore to be a "*P. grayi*." No

better proof could be needed of the close external resemblance which *P. grayi* bears to *P. bocagei*. But this specimen is of further interest, for while it has the completed orbits of *P. grayi*, it has the closed coronal sutures ordinarily characteristic of adult *P. bocagei*; while the type of *P. grayi*, most kindly lent me for comparison by Prof. du Bocage, has at stage V. the coronal and the parieto-interparietal suture of the right side still open, the left one was closed. This closure at stage V. is very characteristic of *P. bocagei*; but, had it not been for the second specimen, one might have been doubtful whether the coronal suture was destined to close in *P. grayi*.

While leaving the question still open, however, I may point out that one external character, when observed, will really settle it. If a *P. grayi* is found with only $0-1=2$ mammæ, it will be a *Dendrohyrax* and a distinct species; but if, as I expect, it has $1-2=6$, as in *P. brucei*, &c., there will be no longer any reason for keeping it separate from *P. bocagei* [1]. Both the examples before me are males, and therefore the discovery of its mammary formula must wait until more specimens are collected.]

11. Procavia emini.

Dendrohyrax emini, Thos., Ann. Mag. N. H. (5) xx. p. 440 (1887), P. Z. S. 1888, p. 15, pl. ii. (animal).

Not having received any further examples of this remarkable species, I can only reproduce the salient points of my original diagnosis, which is based on a young specimen still only at stage I.

Fur very long, soft, and fluffy. General colour pale yellowish white, not unlike the belly colour of *P. arborea*. Hairs above brown for their basal, and pale yellow for their terminal halves. Belly hairs white to their roots.

Dorsal spot white, the hairs white throughout.

Skull about the same size and shape as that of a *P. dorsalis* of the same age, markedly narrower and more elongated than that of similarly aged specimens of *P. shoana*. Orbit not closed posteriorly. Interparietal sutures open.

Teeth not distinguishable at this early age from those of *P. dorsalis*, except that $\underline{mp}^4$ is decidedly narrower. Breadth of $\underline{mp}^4$ 5·6 mm.; height of its crown 4·1 [2].

Hab. Monbuttu, Central Africa (*Dr. Emin Pasha*).

I am unable to give further particulars about this animal, owing to the want of adult specimens, but an increased knowledge of the group in general only convinces me more of its distinctness from any other species. In one respect it is especially interesting as showing a general relationship to *Dendrohyrax*, while it has not the one particular cranial character supposed to be distinctive of that group, the completed orbit.

[1] The mammary formula of *P. bocagei* itself is not as yet absolutely known, but I have little doubt that it is the same as that of its close ally *P. brucei*.

[2] By mistake the dimensions of this tooth were given in 1888 as those of $\underline{m}^1$; but the specimen is younger than I then realized, and $\underline{m}^1$ has not yet been developed.

12. Procavia validа.

Dendrohyrax validus, True, P. U. S. Nat. Mus. xiii. p. 227 (1890).

Fur thick and close, but rather coarse. Ears short and rounded. Mammæ 0—1=2. General colour dark grizzled brown, with a strong suffusion of dark fulvous. Hairs of back dark slaty grey, with a subterminal ring of orange and a black tip. Belly bright deep fulvous, quite different to anything found elsewhere in the genus. Upper surfaces of hands and feet dark brown or black, darker than the general body colour.

Dorsal spot prominent, narrow, elongate, bright cinnamon or fulvous, the hairs rather darker basally.

"Skull depressed, muzzle elongate, nasal bones rectangular, slightly expanded posteriorly. Orbit completed behind." (*True.*)

Type in the United States National Museum.

Hab. Mt. Kilima-njaro, E. Africa (*H. H. Johnston*, *Dr. W. L. Abbott*).

This species is of course that referred to by me with much doubt as "*Hyrax brucei*, Gray (?)," when working out the collections of Mr. H. H. Johnston from Kilima-njaro. As the skins had no skulls with them, and I did not then know how much reliance might be placed on the peculiarities of the coloration, I naturally referred them to a previously known species, rather than run the risk of describing them unnecessarily.

13. Procavia arborea.

Hyrax arboreus, A. Smith, Trans. Linn. Soc. xv. p. 468 (1827).
Dendrohyrax arboreus, Gray, Ann. Mag. N. H. (4) i. p. 49 (1868).

Size medium; form thick and squat; head not disproportionally large. Fur very long and soft; muzzle always hairy; ears fringed. Mammæ 0—1=2. General colour coarsely mottled fawn or yellowish grey with a certain infusion of rufous; the hairs black for their basal seven-eighths, then with a subterminal band of dirty fawn-colour, becoming darker distally, and with a decided black tip. Belly pale yellowish white, sharply defined.

Dorsal spot elongate, very prominent, wholly white, the hairs white to their bases, their tips with a yellowish tinge.

Skull[1] flattened, but not in so exaggerated a manner as in *P. dorsalis*. Muzzle not so markedly elongated; distance from between the postorbital processes to occiput equal to that to the tip of the nasals. Orbits ordinarily, but not always, quite complete behind. Temporal crests as in *P. dorsalis*. Diastema about 16 or 17 mm. in adult specimens.

Molar teeth very small, rounded, brachyodont. Breadth of m^1 about 6 mm.; height of the crown of m^3 3·5; p^1 elongate, two-rooted, 3·5 to 3·8 mm. in horizontal length.

[1] Good figures: De Blainv. Ostéogr. iii. *Hyrax*, pl. ii. (this clearly is *P. arborea*, and not *P. dorsalis* as stated by Gray); Gray, Hand-l. Edent. &c. pl. xiii. fig. 2 (1873).

Hab. Eastern and South-Eastern Africa. Taita Mountains inland of Mombasa, 4500 ft. (*Brit. Mus., J. Wray*). Mozambique (*Peters*). Kingwilliamstown (*Lieut. H. Trevelyan*) and Elands Post (*T. C. Atmore*), Eastern Cape Colony.

14. PROCAVIA DORSALIS.

Hyrax dorsalis, Fraser, P. Z. S. 1852, p. 99, pl. xxxiii. (animal).
Hyrax sylvestris, Temm. Esq. Guin. p. 182 (1853).
Dendrohyrax dorsalis, Gray, Ann. Mag. N. H. (4) i. p. 48 (1868); Bocage, *t. c.* p. 194.
Hyrax stampflii, Jent. N. L. M. viii. p. 209 (1886).

Size large, but, owing to the great proportionate length of the head, the general size is not nearly so large as measurements of the skull would imply; bulk of the body apparently never equal to that found in fine specimens of *P. shoana*. Fur very long, coarse and shaggy. Muzzle in adult specimens nearly or quite naked in front of the eyes. Mammæ 0—1 = 2. General colour dark purplish brown or black, the hairs black for about four-fifths of their length, with reddish or purplish-grey tips. Hairs of belly similar but paler.

Dorsal spot elongate, very prominent, its hairs very long, their basal halves black and their terminal white or pale yellow; the dorsal glandular region quite naked in adults.

Skull[1] very large, much flattened; muzzle elongate, distance from a point between the postorbital processes to the occiput much less than that to the tip of the nasals. Frontal region markedly concave. Temporal ridges thick, much developed, but not extending back nearly to the occipital edge, more closely approaching each other in the centre lines of the skull. Interparietal sutures quite obliterated in adults[2]; clearly visible in a skull at stage III. Orbit completely closed behind in all the specimens examined, however young. Diastema very long, from 17 to 20 mm. in adults.

Teeth.—Incisors becoming exceedingly large and strong in old males, further apart than in the true large-toothed species, such as *P. abyssinica* &c. Incisors of female more ridged than usual. Molars and premolars small, rounded, brachyodont, their series more parallel than in most species. Breadth of $\underline{m^1}$ 6·6 or 6·8; height of crown of $\underline{m^3}$ about 4·1 to 4·3 mm. $\underline{P^3}$ very large, larger than in any other species, double-rooted, its horizontal length about 4·7 or 4·8 mm.

Ribs 21.

Hab. W. Africa from Liberia to the Cameroons and Fernando Po, probably extending further both north-west and south-east, but as yet no trustworthy record has been given beyond the above limits.

[1] Good figures: Gray, Hand-l. Edent. &c. pl. xiii. fig. 1 (1873); Jentink, Cat. Ost. Leyd. Mus. pl. iv. (1887).

[2] The suture at the anterior edge of the interparietal seems to close first in this species as in *P. bruce*i, while in *P. arborea* the reverse appears to be the case. Gray's distinction of the skulls of the two species by the positions of the sutures is based on a misconception, the sutures compared by him with each other not being homologous ones. That shown in the figure of *D. dorsalis* is the posterior, while that in the figure of *D. arborea* is the anterior suture.

P. dorsalis is one of the few species of the group that is quite distinct from all its neighbours, and presents therefore but little difficulty as to its determination. Its long shaggy fur, peculiar coloration, and proportionately large head and small body distinguish it at once from all its allies. Dr. Jentink's *Hyrax stampflii* presented a remarkable degree of variation in the shape of its lower jaw, and in other characters—variations so great that without a very large series of specimens he naturally considered them to be of specific value. Other specimens, however, since obtained both in Liberia and elsewhere prove the essential identity of *H. stampflii* with *dorsalis*.

February 2, 1892.

W. T. Blanford, Esq., F.R.S., F.Z.S., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1892:—

The total number of registered additions to the Society's Menagerie during the month of January 1892 was 56, of which 29 were acquired by presentation, 7 by birth, 6 by purchase, 8 were received in exchange, and 6 on deposit. The total number of departures during the same period, by death and removals, was 71.

Mr. W. Bateson, F.Z.S., exhibited some Crab's limbs bearing supernumerary claws. It was shown that these extra parts are really a complementary (right and left) pair of indices or pollices, according to their position of origin, and not repetitions of the two pincers of the claw, as was commonly stated.

A letter was read from Prof. R. Ramsay Wright, F.Z.S., of the University of Toronto, enclosing and calling attention to some photographs of the heaps of skulls of the American Bison (*Bison americanus*), which are commonly collected on the plains of the Saskatchewan, and are piled up on the sidings of the Canadian Pacific Railway awaiting transport, and which testify to the enormous number of these animals recently exterminated in this district.

Mr. Sclater laid on the table two specimens, in spirit, of chicks of the Partridge Bronze-wing Pigeon (*Geophaps scripta*) which had been hatched in the Society's Gardens on the 7th of June last; also an egg of the same species of bird, laid in the Gardens, and made the following remarks:—

I cannot at all agree with Dr. Bowdler Sharpe in his recent proposal to divide the very natural order "Columbæ" into two portions, and to associate the *Geophabes* or Ground-Pigeons with the Gallinaceous birds [1].

According to the observations we have made from time to time in

[1] See 'Review of Recent Attempts to Classify Birds,' pp. 69, 70.—N.B. The correct plural of *Geophaps* is *Geophabes*, from φάψ, gen. φαβός.

the Society's Gardens, where several species of the Ground-Pigeons [1] have bred repeatedly, the young of the Ground-Pigeons when hatched are nearly naked and quite helpless, and differ in no respect from the young of the typical Columbæ. In proof of this I exhibit two specimens of the young of the Partridge Bronze-wing Pigeon (*Geophaps scripta*), hatched in the Gardens on June 7th last, and about 14 days old when they died. It will be observed that at this date they were barely covered with feathers and hardly fledged. In fact one of them was actually killed by falling from a slight elevation in the Aviary, having been hatched in the nest of a Barbary Turtledove (*Turtur risorius*), to which the egg had been removed in consequence of the bird that laid it refusing to sit upon it. It cannot therefore be said that these birds are "able to run soon after birth." Nor, in the reference given by Dr. Sharpe, does Mr. Gilbert, so far as I can gather from his remarks, say so; he merely states that "the young bird on emerging from the egg is clothed with down like the young of the Quail" (Gould's 'Handbook to the Birds of Australia,' vol. ii. p. 134). I cannot therefore allow that on this ground there is any justification for the important step that Dr. Sharpe proposes to take.

As regards the other point put forward by Dr. Sharpe in justification of his proposal, it is no doubt the fact that the sternum of the Australian Ground-Pigeons is longer and narrower than the corresponding organ in the typical Columbæ. But the general characters of the sternum in *Geophaps* and its allies remain the same as in the typical Columbæ, so that on this point also I see no sufficient ground for the alteration proposed.

I prefer to keep all the Columbæ together, as heretofore, in one group of ordinal value, as constituting a very well-defined and very natural division of the class of Birds, and I even doubt whether more than one family can be properly made of them.

The following papers were read :—

1. On a remarkable Sirenian Jaw from the Oligocene of Italy, and its bearing on the Evolution of the Sirenia. By R. Lydekker, B.A., F.G.S.

[Received December 9, 1891.]

Among a series of Tertiary Vertebrate fossils recently acquired by the British Museum my attention was specially directed to one labelled by the dealer from whom it was received, "Sirene, Oligocaen, Monte Grumi, Vicenza." At the first glance I felt convinced that the assignation of the specimen to the Sirenia was correct; but, at the same time, one of the two teeth contained in the specimen struck me as presenting a peculiarity of form such as I had never seen in any other Sirenian. Further examination led me to the conclusion that the specimen had an important bearing on the

[1] Viz.: *Ocyphaps lophotes, Phaps chalcoptera, Leucosarcia picata, Phlogænas crinigera, Calœnas nicobarica*, and others. See List of Vertebrate Animals (1883), pp. 459 *et seqq.*

unsolved problem of the evolution of the Sirenian order, and that it was accordingly worthy of being brought under the notice of this Society.

Before proceeding to the description of the specimen a few words are necessary as to the Sirenian remains hitherto recorded from the Venetian Tertiaries. Some years ago the late Baron Zigno[1] described and figured a certain number of Sirenian remains from the Miocene of Belluno, in the north of Venice, which were referred to four species, under the names of *Halitherium bellunense*, *H. angustifrons*, *H. curvidens*, and *H. veronense*. At a later period these four species were reduced by Professor Lepsius[2], of Darmstadt, to two; *H. bellunense* being transferred to *Metaxytherium*, while *H. angustifrons* and *H. curvidens* were merged in *H. veronense*. Since to my mind the distinction between *Metaxytherium* and *Halitherium* is not of sufficient importance to be regarded as a generic one, we may, so far as this information goes, reckon the Venetian Sirenians as indicating two species of *Halitherium*, under the names of *H. bellunense* and *H. veronense*.

Vicenza, where the specimen under consideration was obtained, is situated, I need hardly say, in the south-western half of the Province of Venice, a little north of the parallel connecting Verona and the city of Venice. In spite, however, of its distance from Belluno, it is most probable that the mammaliferous beds of both localities are of the same horizon; in which case those of Belluno should be reckoned as Upper Oligocene.

Of the Sirenians from Venetia the types of *Halitherium bellunense* and *H. veronense* exhibit the cheek-teeth in a good state of preservation. In the latter species[3] the upper premolars are very small teeth, with nearly cylindrical crowns. On the other hand, the upper molars are relatively large teeth, with oblong crowns, carrying two transverse ridges, with fore-and-aft talons. The anterior talon in these teeth is very large and prominent, while the posterior one is considerably smaller. Their first transverse ridge is more nearly continuous than the second. When somewhat worn, as is the case with those of the type specimen, these transverse ridges show nearly straight bands of dentine, and not the distinct trefoils observable in the molars of *Halitherium schinzi* from the Oligocene of Hessen-Darmstadt. A distinct tubercle occurs in the inner half of the median transverse valley of these teeth. In Baron Zigno's figures there is no indication of what I shall allude to as a masked selenodont structure in these molars.

Coming now to the consideration of the specimen forming the subject of this communication, of which a representation of the teeth is given herewith (see fig. 1, p. 79), it may be observed, in the first place, that it is a fragment of the left maxilla of a very young mammal of comparatively large size. It shows part of the palatal surface, the

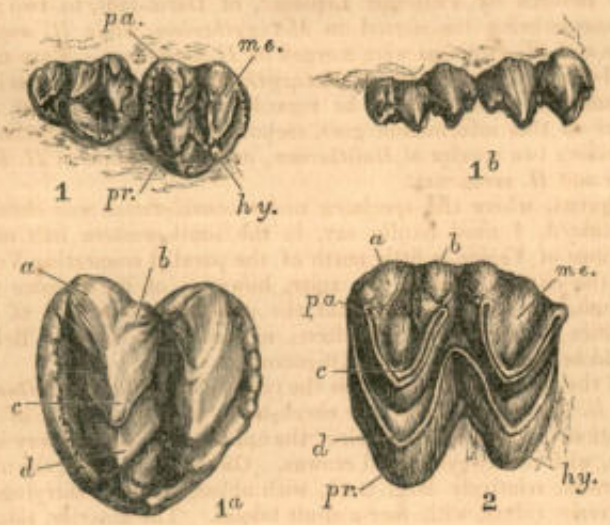
[1] Mem. R. Ist. Veneto, vol. xviii. pp. 438–449, pls. xiv.–xviii. (1875); see also Zigno, *op. cit.* vol. xxi. pp. 291–298, pl. iv. (1880).

[2] Abhandl. mittelrhein. geol. Vereins, vol. i. pp. 1–179, pls. i.–x. (1881–82); see also Capellini, Mem. R. Accad. Ist. Bologna, ser. 4, vol. vii. pp. 39–53 (1886).

[3] Zigno, *op. cit.* vol. xviii. pl. xviii.

external wall, the anterior root of the zygomatic arch, a portion of the floor of the orbit, and the aperture of the canal for the fifth nerve. At the hinder extremity of the palatal surface are preserved two molariform teeth, which are almost or quite untouched by wear, and are, fortunately, uninjured. By filing away the alveolar parapet in front of the anterior one of these teeth, there have been revealed the two roots of a third tooth. Behind the last remaining tooth there is a portion of the alveolus of a fourth tooth which had evidently not been protruded from the gum.

Now the unworn condition of the two remaining teeth and their



Figs. 1, 1 *a*, 1 *b*.—The third and fourth left upper milk-molars of a young individual of *Prorastoma veronense*, viewed from the oral and outer aspects; 1 *a* is ½, the others ¼. *pr.*, protocone; *pa.*, paracone; *me.*, metacone; *hy.*, hypocone. The letters *a*, *b*, *c*, *d*, indicate the parts of the hinder tooth which correspond with those similarly lettered in fig. 2.

Fig. 2.—The third left upper molar of *Merycopotamus dissimilis*. Letters as in preceding figure. ¼.

position with regard to the anterior root of the zygomatic arch, coupled with the alveolus of the unprotruded fourth tooth, clearly indicate that the jaw belonged to an exceedingly young animal. And, apart from their structure, we should further be justified in regarding the two entire teeth as belonging to the deciduous series if their owner were a diphyodont mammal, or to the premolar series if the animal were monophyodont. There are, however, considerations which enable us to determine the serial homology of the teeth more definitely.

Each of the two teeth carries on its crown well-marked but discontinuous transverse ridges, separated by deep valleys. In the hinder tooth the crown is oblong and nearly symmetrical, and carries

two such ridges; while in front it has a long and prominent talon, and behind a shorter one, which runs upwards to join the inner extremity of the second transverse ridge. In the inner half of the transverse median valley there is a small double tubercle. I shall have more to say on the structure of the ridges of this tooth by-and-by.

The anterior one of the two teeth differs from the other in being much more elongated, and in narrowing gradually from back to front, where it terminates in a blunt point. It has, moreover, three, instead of two, transverse ridges: the second and third ridges corresponding closely in structure with the two ridges of the hinder tooth, while the first ridge is more irregular in shape, and has on its anterior surface a rudiment of the anterior talon of the hinder tooth.

Reverting to the latter, an examination shows that the transverse ridges are not simple continuous ones, but are formed by an inner and outer column, closely pressed together; the whole four columns corresponding to those of an ordinary bunodont molar, like that of a Pig, and representing the proto-, para-, meta-, and hypocone of Professor Osborn's system of notation of these dental elements. A further examination will, moreover, show that these four columns are not of a bunodont type, but are modelled on a peculiar modification of the selenodont structure.

In order to illustrate this I have had figured a left upper molar (fig. 2, p. 79) of the extinct Siwalik genus *Merycopotamus*, which is a specialized representative of the Artiodactyle Ungulate family *Anthracotheriidæ*. It will be apparent from that figure that the external surfaces of the outer columns (paracone and metacone), instead of being nearly upright, are inclined very much towards the centre of the tooth, so that the summits of these columns are squeezed into the crescents formed by the inner columns (protocone and hypocone). It will further be observed that the external surfaces of the paracone and metacone of the *Merycopotamus*-molar carry a median ridge (*c*) flanked by two lateral ridges (*a*, *b*).

Now if the metacone of the hinder tooth in our specimen be compared with that of the *Merycopotamus*-molar, there cannot be any hesitation in recognizing their close similarity in structure—the external surfaces of the outer columns showing the same inclination towards the centre of the crown and having the same general contour. In the present specimen, however, the metacone has assumed a more oblique position to the axis of the crown, and has been squeezed right into the heart of the crescent of the hypocone. In consequence of this the postero-external ridge of the metacone has been lost, and its central and anterior points have come into line with the central cusp of the hypocone to form the imperfect transverse ridge of the molar. A precisely analogous condition obtains with regard to the paracone and protocone[1].

It appears, therefore, to be quite evident that the hinder tooth of the specimen under consideration is constructed on an extreme and

[1] Although these points are apparent enough when the actual specimens are compared, it seems to be impossible to indicate them clearly in a figure.

apparently degenerate modification of the brachydont selenodont molars of certain extinct Artiodactyle Ungulates.

We may, however, go a step further than this. It is, I believe, an attribute of all Artiodactyle Ungulates, whether their cheek-teeth be of the bunodont or of the selenodont type, that while the last upper deciduous or milk-molar resembles the permanent molars in form, the penultimate milk-molar is an elongated tooth of a more complex type than either the last milk-molar or the two succeeding permanent molars. In the adult dentition, on the other hand, the last upper premolar of Artiodactyles is nearly always simpler than the first molar, and in none is it more complex or longer.

Now the two teeth of the specimen under consideration present precisely the same structural relationship to one another as is presented by the penultimate and last (third and fourth) upper milk-molars of Artiodactyles. I take it, therefore, not only that these teeth are third and fourth upper milk-molars, but likewise that they belonged to an animal showing decided indications of Artiodactyle affinities—these affinities being with an Artiodactyle that had assumed selenodont molars more or less closely approaching the *Merycopotamus* type.

This being so, the question arises whether the specimen under consideration may not have belonged to an actual Artiodactyle. To this it may be replied that, so far as I am aware, no Artiodactyle has hitherto been described possessing molar teeth of the type under consideration; so that if the specimen were really Artiodactylate, it would indicate an entirely new form.

Apart, however, from this, the structure of the second tooth in the specimen presents such a marked Sirenian facies that, as I have said, one is prompted to at once refer the specimen to that group of mammals. If, moreover, it be compared with Baron Zigno's figure of the upper molars of *Halitherium veronense*, it will be seen that the last milk-molar of the present specimen accords in almost all respects with these teeth. Both have two interrupted transverse ridges, with a large anterior and a small posterior talon; and in both there is a tubercle a little to the inner side of the middle of the transverse valley. Moreover, both teeth agree in the shape of the crown; while the excess in the size of the teeth of Baron Zigno's specimen over those of the one under consideration is precisely such as we should expect to find between the milk and permanent molars of one and the same animal. It is true, indeed, that in Zigno's figure what I may call the masked selenodontism of the teeth under consideration is not apparent. This may, however, be due to the circumstance that the teeth of the type of *H. veronense* are considerably worn; while it may also be in part owing to the difficulty of expressing such features in a lithograph. Moreover, there is the possibility that the masked selenodontism of the milk-molars may not have been retained in the permanent dentition.

In regard to the existence of a deciduous dentition in the Sirenia, it is already known that milk-molars and premolars were developed in *Halitherium schinzi*. It is, however, probable that in that species

the milk-molars were not like those of the present specimen, since the permanent molars were of a more Hippopotamus-like structure than are those of *H. veronense*, and show no indications whatever of selenodontism.

Conclusive evidence of the Sirenian nature of our fossil is, however, afforded by the orbital region, which is almost exactly the same as in the Sirenian from Jamaica described by Sir R. Owen[1] as *Prorastomus sirenoides*. In both we have the same peculiar eversion and projection of the lower border of the orbit which is absolutely characteristic of the Sirenia. In both, again, we notice the extraordinary size of the foramen for the exit of the fifth nerve, and its immediate proximity to the anterior border of the orbit, these being also distinctive Sirenian features.

Then, again, a comparison of the last milk-molar with the upper molars of *Halitherium schinzi* (*e. g.* B.M. No. 40859) clearly shows the ordinal identity of the two forms.

I take it, therefore, that the Sirenian nature of the Vicenza specimen is certain; and since its milk-molars agree in general structure and relative size with the permanent molars of *Halitherium veronense*, which occurs in the same country and probably on the same geological horizon, the evidence appears to be very strongly in favour of the reference of the specimen in question to that animal.

Apart, however, from any question of specific reference, the specimen before us undoubtedly throws a flood of light on the origin of the Sirenia, and points clearly to their derivation from an ancestor belonging to an Artiodactyle Ungulate with short-crowned and selenodont molar teeth. It is, indeed, no new idea that the Sirenians show Ungulate affinities, this presumed origin having been very strongly urged by many zoologists; although Professor Flower, writing in the article "Manatee" in the 'Encyclopædia Britannica,' expresses his opinion that the few facts at present known relating to the ancestry of the Sirenians "lend no countenance to their association with the Cetacea, and on the other hand their supposed affinity with the Ungulata, so much favoured by modern zoologists, receives no very material support from them." If, however, my interpretation of the affinities of the present specimen be accepted, it will go a very long way towards solving the problem of the Sirenian genealogy.

So far as I am aware, the component elements of the molar teeth of the Sirenians have not hitherto been homologized with those of mere typical teeth. The molars of the present specimen clearly show us, however, the homology of the elements of the simple and continuous transverse ridges found in *Manatus* and *Halitherium schinzi*, such ridges being clearly only one step more in the degeneration from a selenodont type exhibited in the molars of the specimen before us.

I may add that although the upper permanent molars of *H. veronense* differ considerably from those of more typical species of *Halitherium*, while there is no evidence that the latter had milk-molars of the type of the present specimen, yet I should not on

[1] Quart. Journ. Geol. Soc. vol. xxxi. p. 559, pls. xxxviii., xxxix. (1875).



West, Newman ad nat. lith.

Coleoptera from Kina-Balu.

these grounds be disposed to regard the former as the representative of a distinct genus.

I find, however, by a comparison of Baron Zigno's figures with skulls of *Halitherium schinzi* and *Prorastomus sirenoides*, that the skull of *Halitherium veronense* differs altogether from the former and agrees with the latter. This is shown in its long and narrow contour, narrow and elliptical narial aperture, slight deflection of the rostrum, and the form of the inferior border of the orbit; all of which are in marked contrast to those of *Halitherium schinzi*. Further, although the molars of *Prorastomus sirenoides* are much worn and are only imperfectly shown, yet one of them clearly exhibits the large anterior talon characteristic of the so-called *Halitherium veronense*, such talon being represented in *H. schinzi* by a much smaller one. The extremities of the jaws of the Venetian species being unknown, I can of course say nothing as to the incisors, which are present in *P. sirenoides*. From the other evidence *H. veronense* may, however, be pretty confidently transferred to the genus *Prorastomus*, or, as it should be, *Prorastoma*, under the name of *P. veronense*.

2. Descriptions of Coleoptera collected by Mr. John Whitehead on Kina Balu, Borneo.—Families *Hispidæ*, *Erotylidæ*, *Endomychidæ*, *Lycidæ*, *Lampyridæ*, &c. By the Rev. H. S. GORHAM, F.Z.S.

[Received December 23, 1891.]

(Plate IV.)

The Coleoptera of which it is the purpose of this paper to give an account were collected by Mr. J. Whitehead during his residence from 1886 to the middle of 1887 in the neighbourhood of Kina Balu, and for the most part in the early months of those years.

This mountain is a plutonic mass rising abruptly on one side to an altitude of about 13,000 feet, clothed at its base and to about 4000 feet with forest and low trees. Owing to its summit being bare, a denuded granitic surface, few insects were obtained by Mr. Whitehead above that height.

The best collecting grounds were found to be the river-beds, and at the altitudes mentioned the usual tropical conditions obtain. Representing as Kina Balu does the primitive upheaved portions of this part of the world, which have been in all probability above the sea during geologic ages, it was to be expected that both its fauna and flora would prove of the most interesting type, and judging from the few species of insects now under review this certainly appears to be the case.

Several species were unfortunately only represented by single specimens, and some of these I am unable at present to determine. The collection is now in Mr. Alexander Fry's possession, who has kindly placed a portion of it at my disposal for description.

Hispidæ.

Prionispa, Chapuis.

Prionispa pulchra, n. sp. (Plate IV. fig. 2.)

Rufa, supra metallico-viridis, prothorace elytrisque subopacis, rufo-marginatis, grosse punctatis, his tuberculis tribus conicis; humeris costatis, et angulo posteriore spiniformi. Long. 6 *millim.*

Hab. Borneo, Kina Balu (*Whitehead*).

Body beneath and legs red; head red except the crown; antennæ blackish, their basal joint sometimes wholly red; the front produced and with a carina between the bases of the antennæ; thorax subquadrate, coarsely punctured at the sides, obsoletely so in the middle, green above and opaque, red beneath. Elytra with the shoulders elevated, with a double costate elevation in addition to the costate submarginal interstice, and three conical elevations, of which the middle is the larger and which on its exterior side is excavated, and metallic and not green in that part; the spine-like production of the hind angle is large and sharp and compressed horizontally, it is green in the middle but fiery copper at its apex; the sutural angle is yellow, and the margins of the elytra external to the humeral callus are brownish with a coppery or purple reflexion. The apical margin is not toothed, but there are one or two minute serrations at the base of the spine.

Six specimens of this beetle were obtained by Mr. Whitehead at about 1000 feet altitude on Kina Balu.

Hispopria, Baly.

Hispopria grandis.

Hispopria grandis, Baly, Cat. of Hisp. in Coll. Brit. Mus. 1858, p. 95.

Kina Balu (*Whitehead*), 2 specimens.

Anisodera (Chevr.), Baly.

Anisodera, sp. n. (*a*).

Kina Balu. A dull red species apparently belonging to Sect. A. *b* of Baly's Catalogue. The species of *Anisodera* are so difficult to distinguish, that I do not feel disposed to describe this till I have further acquaintance with them.

Anisodera, sp. n. (*b*).

Kina Balu (*Whitehead*).

A single specimen of a smaller species with black legs and antennæ, and much rougher elytra and coarsely punctured thorax.

Erotylidæ.

Tetralanguria splendens, Wied.

Kina Balu, many examples.

TRIPLATOMA ATTENUATA.

Triplatoma attenuata, Crotch, Cist. Ent. 1876, p. 405.

Nesites attenuata, Bedel, Rev. Triplatoma, Ann. Mus. Civ. Gen. 1882, p. 10, t. x. f. 5.

Kina Balu. Has occurred also at Sarawak and in Sumatra. Bedel's figure does not give a correct idea of the narrowness of the thorax in proportion to the width of the elytra.

TRIPLATOMA GESTRÖI.

Triplatoma geströi, Bedel, *l. c.* p. 440, t. x. f. 4; Gorham, P. Z. S. 1883, p. 80, t. 18. f. 1.

Labuan, Sarawak.

Also occurs in Sumatra.

ENCAUSTES MARGINALIS.

Encaustes marginalis, Crotch, Cist. Ent. 1876, p. 477.

Kina Balu.

ASMONAX, genus novum.

Characteres plerumque sicut in Encauste; *differt antennarum articulo tertio vix longiore quam secundus, prothoracis lateribus compressis, sinuatis, angulis anticis depressis, disco inæquali, bicostato, elytris interstitiis alternis costato-elevatis.*

This new genus is nearly allied to *Encaustes*, but has a very different facies owing to the form of the thorax, and the costæ on it and on the elytra. The front of the prosternum is plain as in *Encaustes*, that is to say, not elevated nor brought into a point in front as in *Micrencaustes*.

ASMONAX WHITEHEADI, n. sp. (Plate IV. fig. 5.)

Anthracinus, niger, nitidus; antennis articulis octo globuliformibus, tertio vix elongato, tribus ultimis transverso-compressis, pubescentibus; capite opaculo, fere lævi, inter antennas transverse impresso; prothorace transverso-subquadrato, ad angulos posticos parum angustato, lævi, in medio nitidulo, obsolete haud acute bicostulato, ad margines subopaco, antice posticeque obsolete fossulato, punctis nonnullis hic illic dispersis, margine laterali tenuiter elevato; elytris tenuiter punctato-striatis, costis tribus elevatis, quarta etiam externa cum suturali ad apicem conjuncta, seriebus duobus inter costas singulas. Abdomen fortiter sparse punctatum. Long. 18–19 *millim.*

Hab. Borneo, Kina Balu and North Borneo (*Whitehead*).

Wholly black and shining, subopaque in places, as the sides and lateral reflexed underside of the thorax. Owing to the form of the thorax, which has the sides sinuate, turned in and downward at the front angles, and the strong double ridge on the centre of the thorax, this species has a remarkable and Endomychid appearance; the costate elytra are an exaggeration of what takes place in such species as

E. opaca, Crotch. The shortening of the third joint of the antennæ and their bead-shaped appearance show this to be a strongly modified form. The femora are compressed and sinuous just as in *Encaustes*; the middle tibiæ have a tooth-like projection externally, just above the insertion of the tarsi, and are pubescent internally at their apices. The elytral epipleura are pitchy brown, but not noticeably so, and have obsolete transverse wrinkles.

I have only seen four examples of this species, viz. those obtained by Mr. Whitehead. I cannot distinguish the sexes.

Endomychidæ.

Amphisternus armatus, n. sp. (Plate IV. fig. 3.)

Niger, opacus, obsolete varioloso-punctatus; thorace subquadrato, angulis anticis acutis, valde productis; elytris spinis duabus acutis æneo-micantibus, una subhumerali, altera conoidea in medio, apice acute mucronato, tuberculisque duobus nigris nitidis, uno basali uno apicali; femoribus clavatis, apicibus piceis. Long. 8 *millim.*

Hab. Borneo, Kina Balu (*Whitehead*).

Rather larger than *A. spinicollis*; and at once distinguished from both the described species of *spinous Amphisterni* by the two *black* tubercles, the produced front angles of the thorax, which are like those of *A. auriculatus* but not reflexed, and by the fiery coppery or æneous colour which is seen on the shining parts. The head is thickly punctured, rather shining, and the antennæ have all the joints from the third to the eighth elongate, the third longer than the two following united; the sides of the thorax are slightly angulate in the middle and narrow a little to the base; the disk is quite opaque, with coarse confluent large punctures. Of the elytra the anterior tubercle has a pitchy tint, the humeral angle is reflexed and smooth, as is the basal margin; the first lateral spine is a little below the shoulder, very long and acute, wide at its base, but compressed if viewed from behind, brassy black; the middle spine more upright but still divaricating, conoidal at its base; both spines punctured at their base, as the elytra are. The posterior tubercle is bluish black and smooth; the apical production of the elytra is external to and independent of the sutural angle, which is itself quite distinct—it is in fact part of the margin itself, the epipleural fold being continued along it as a groove. The legs are brassy black, the club of the femora distinctly pitchy.

Several specimens of this interesting new species were obtained by Mr. Whitehead.

Eumorphus tumescens, n. sp. (Plate IV. fig. 4.)

E. marginati *statura et similitudine; niger, elytris nigro-cæruleis, late (humeris minus) marginatis, apicibus subacutis, maculis quatuor magnis aurantiacis. Long.* 17, *lat.* 13 *millim.* ♂.

Mas, elytris in medio conjunctim alte et acute elevatis, prothoracis angulis posticis acutis, haud longe productis; tibiis

anticis infra medium dente acuto valde distante armatis; haud compresso-sinuatis.

Hab. Borneo, Kina Balu (*Whitehead*).

Antennæ longer than in *E. marginatus*, all the joints from the third, and the club, being longer. The thorax is not so broad, especially at the base, the hind angles in the male not being nearly so much produced, but still they are acute; its disk is more uneven, there being in the single male before me an impressed pit on each side of the centre; the elytra have the expanded margin more gradually widened, so that it is narrower at the shoulders than in *E. marginatus*. The four spots are larger in proportion, and placed nearer together than in that species, and they are more acuminate at the apex, and the middle of their disk is much more acutely raised, the summit of this raised part being conical and nearer the two anterior spots than the corresponding part in *E. marginatus*. The front tibiæ in the male are nearly straight, not strongly sinuous nor distorted as in *E. marginatus*, but a little compressed laterally with a short external groove at their apices (for the reception of the tarsi), but not grooved along their whole length.

This insect has also some analogy with *E. turritus*; but the larger yellow spots and the dark blue colour of the elytra, as well as the structure of the tibiæ, will at once distinguish it.

One specimen, a male, obtained by Mr. Whitehead.

EUMORPHUS COSTATUS.

Eumorphus costatus, Gorham, Endom. Rec. p. 34.

Mas, tibiis anticis dente acuto valde distante in medio armatis; tibiis intermediis et posticis mediocriter curvatis, his intus ciliatis.

I believe a single male and female from Kina Balu to be identical with the species described by myself from two female specimens from Celebes. The male has the elytra shining, and with an indistinct violet tint, while the female is subopaque and is distinguished by a short keel on the elytra at their base near the scutellum. The yellow spots are large, and cause the species to recall *E. quadrinotatus*. The male has the hind angles of the thorax acutely produced, by which it is at once separated from *E. quadrinotatus*.

EUMORPHUS GUERINI.

Eumorphus guerini, Gorham, Endom. Rec. p. 33.

Many specimens of this were obtained by Mr. Whitehead; all I have yet seen are males. Hitherto only seen from the Malay peninsula.

EUMORPHUS LUCIDUS, n. sp. (Plate IV. fig. 1.)

Nigro-subviolaceus, nitidus; elytris ovatis, apice acuminatis, maculis duobus rotundatis aurantiacis nitidis, anteriore parum tumida; thorace (feminæ) subopaco. Long. 9 millim. ♀.

Hab. Borneo, Kina Balu (*Whitehead*).

It is difficult to compare this species with any other of the genus;

the elytra are very slightly margined, but are acuminate at their apex, and not very strongly convex. It is entirely black, with the exception that the elytra have a faintly violet tinge and are very smooth and shining, the four spots are moderate in size, and round, very smooth, but not raised; the thorax (of the female) is opaque, with two rather obsolete basal impressions and a central channel, its sides are a little angular in the middle, contracted to the front angles. The antennæ are of moderate length, the fourth to the eighth joints a little longer than wide, the three club-joints subequal, transverse, not much compressed.

Four specimens were found by Mr. Whitehead. This species may be placed after *E. guerini*, Gorh.

Lycidæ.

Metriorrhynchus, sp. inc.

Hab. Borneo, Kina Balu (*Whitehead*).

A single example (♀) of a *Metriorrhynchus* allied to *M. geometricus*, but larger, and precisely similar in colour to *Xylobanus reticulatus*, Gorh., of which there is an example from the same region. It is also very close to *M. infuscatus*, Gorh., Notes from Leyd. Mus. iv. 1882, p. 96.

Metriorrhynchus, sp. inc.

Kina Balu (*Whitehead*).

A single specimen of a species allied to *M. sericeus*, but with much brighter red elytra, apical half black.

Metriorrhynchus, sp. inc.

Kina Balu (*Whitehead*).

Unfortunately also a single specimen only of a species with the double rows of cells distinct and wide, black with red elytra, of which the apical quarter is black, and black marks at their base. Allied to *M. cinnabarinus*, Gorh.

Xyloranus reticulatus. (Plate IV. fig. 6.)

Xylobanus reticulatus, Gorh., Notes from Leyd. Mus. 1882, p. 96.

Hab. Borneo, Kina Balu (*Whitehead*).

A single specimen, apparently of this species.

Telephorus viridanus.

Telephorus viridanus, Gorh., Notes from Leyd. Mus. vol. iv. 1882, p. 105.

Hab. Borneo, Kina Balu (*Whitehead*).

A single specimen.

Lyropæus, n. sp.

Kina Balu (*Whitehead*).

A single specimen of a new species of this remarkable genus.

Lampyridæ.

Vesta aurantiaca. (Plate IV. fig. 9.)

Vesta aurantiaca, Ern. Oliv., Notes from Leyd. Mus. vol. viii. 1886, p. 192.

Hab. Borneo, Kina Balu (*Whitehead*).

M. Ernest Olivier has separated under this name specimens of a *Vesta* referred by me to *Vesta urens*, described by myself from Borneo (*cf.* Notes from Leyd. Mus. vol. v. 1883, p. 3). Three specimens collected by Mr. Whitehead on Kina Balu agree precisely with one of these specimens from Sumatra in my possession. As the specimen which M. E. Olivier redescribes as the type of my *V. urens* is now at Leyden, I have no means of forming an opinion on the specific distinction of *V. aurantiaca*, but it certainly occurs in Borneo, as these specimens prove.

Pyrocœlia, Gorham.

Pyrocœlia collaris, n. sp. (Plate IV. fig. 7.)

Oblonga, subparallela, opace nigro-fumosa; prothorace brevi, transverso, flavo, distincte at tenuiter carinato, margine antico late et alte reflexo, basi recte truncato, angulis posticis subrectis, nullo modo productis; pygidio flavo. Long. 20 *millim.*

Hab. Borneo, Kina Balu (*Whitehead*).

Head black, eyes moderate; antennæ long and thin for this genus, nearly as in *P. fumigata*, the joints much longer than wide and not serrate; thorax almost semicircular, with the margins much reflexed, the diaphanous lunules not very translucent. Elytra entirely smoky black, two costules moderately distinct for about two thirds of the length of the elytra, the intermediate one very obsolete; scutellum, head, legs, and body entirely dull black, with the exception of the apical ventral segment and pygidium and of the two luminous patches.

This insect is apparently allied to *P. opaca*, Bourg., described and figured in the 'Annali del Museo Civico di Storia Naturale di Genova,' vol. ii. 1885, p. 349, t. v. f. 2, from which, however, it differs by the scutellum being black, by the entirely black legs and body, and by the absence of the pubescence, and (judging by the figure) by the thinner and not serrate antennæ.

One specimen.

Diaphanes, Motschulsky.

Diaphanes apicalis, n. sp. (Plate IV. fig. 8.)

Breviter oblongus, subopacus, ochraceus; prothorace brevi, margine antico elevato, lunulis duabus translucidis; disco antice tenuissime carinato; elytrorum apicibus, antennis, palpis, pedibus, abdomineque (apice excepto) nigris. Long. 14 *millim.*

Hab. Borneo, Kina Balu (*Whitehead*).

This species resembles rather closely *Pyrocœlia terminata*, Gorh., but from the thin antennæ and the size of the eyes and the clear

translucent spaces of the thorax it ought rather to be placed in the genus *Diaphanes*. The thorax is shorter and has the hind angles less produced than is usual in this genus; the apical ventral plate and the pygidium are yellow; the head, breast, and the extreme base of the legs are yellow, but clouded in parts with fuscous.

One specimen.

EXPLANATION OF PLATE IV.

Fig. 1. *Eumorphus lucidus*, ♀, p. 87.
2. *Prioniepa pulchella*, p. 84.
3. *Amphisternus armatus*, p. 86.
4. *Eumorphus tumescens*, ♂, p. 86.
5. *Asmonax whiteheadi*, p. 85.
6. *Xylobanus reticulatus*, p. 88.
7. *Pyrocalia collaris*, p. 89.
8. *Diaphanes apicalis*, p. 89.
9. *Vesta aurantiaca*, p. 89.

3. On the Coleoptera collected by Mr. W. Bonny in the Aruwimi Valley, Central Africa. By the Rev. H. S. Gorham, F.Z.S., and C. T. Gahan, M.A.

[Received December 23, 1891.]

In the following paper the Coleoptera of the families Cleridæ, Bostrychidæ, Chrysomelidæ, Galerucidæ, Cassidæ, Hispidæ, Erotylidæ, and Coccinellidæ collected by Mr. W. Bonny during the Emin Relief Expedition are noticed and the presumed new species are described, in continuation of the accounts already furnished by Mr. Bates (P. Z. S. 1890, pp. 479–492, and Mr. Champion, pp. 637–646). The species of which examples were represented were not numerous, but the same remarkable coincidence specifically with the Coleoptera of the West Coast, especially of Old Calabar, will be noticed.

The Phytophaga, with the exception of the Cassidæ and Hispidæ, have been kindly worked out by Mr. Gahan of the British Museum.

Family Cleridæ.

1. Cylidrus fasciatus, Laporte.

Cylidrus fasciatus, Laporte, Cast. Silb. Rev. iv. p. 35.

Var. B. spinolæ.

While the type of this species is from Senegal, the var. B is recorded from Madagascar. It is also in my collection from Natal.

Family Bostrychidæ.

2. Apate terebrans, Pallas.

Apate terebans, Pallas, Spicil. Zool., Ins. p. 7.

3. Apate sp. inc.

Probably *A. productus*, Imhoff.

Family Chrysomelidæ. (By C. J. Gahan, M.A.)

Megalopodinæ.

4. Pœcilomorpha murrayi, Baly.

This species was founded upon specimens from Old Calabar.

Eumolpinæ.

5. Corynodes bonnyi, n. sp.

C. cyaneo *simillimus, sed differt elytris crebre punctatis vix nitidis, et articulis antennarum quinque ultimis plus dilatatis. Long.* 10½ *millim.*

Resembling very much in colour and general appearance *C. cyaneus*, Fabr. The last five joints of the antennæ are strongly dilated, the seventh joint triangular, the eighth to eleventh subquadrate, transverse, the ninth and tenth each almost as broad as long. Prothorax shining, sparingly and not very distinctly punctured. Elytra rather dull, thickly punctured. Claws of tarsi cleft, with the inner division acute, shorter than the outer.

The species may be distinguished from *C. compressicornis* (which it resembles in the punctuation of the elytra) by the greater dilatation of the apical joints of its antennæ and by the sparser punctuation of its pronotum.

6. Colasposoma aruwimiense, n. sp.

Cyaneum, nitidum; pedibus viridescentibus; prothorace quam latior vix duplo longiore, dense punctulato; elytris crebre et sat fortiter punctatis, lateribus utrisque obtuse vel obsolete unicostatis. Long. 8–10 *millim.*

Dark blue, with the legs metallic green; head, prothorax, and scutellum varying to metallic green. Head rather thickly and not very strongly punctured. Prothorax with its median length rather more than half the width measured across the base; thickly and not strongly punctured above; lateral margins rather feebly convex. Scutellum sparsely punctured. Elytra very thickly and rather strongly punctured, with the punctures running together to form a feeble rugosity on the sides just below and behind the shoulders. Beginning a little behind the shoulder there is a single obtuse and slightly elevated costa, along the side of each elytron; this costa is sometimes obsolete. The shoulders of the elytra are slightly prominent.

The present species may perhaps be only a local variety of a species (*C. fairmairei*, Lefèv.) occurring in Old Calabar. The latter has the prothorax much more distinctly punctured, the punctures being larger and less closely placed together. The colour is very variable—dark blue, metallic green, and bronze-purple.

7. Colasposoma, sp.

A single specimen, differing from the preceding in its colour—a

bright metallic green—and in having a slight depression on the outer disk of each elytron a little below the base. There is no trace of a costa on the sides of the elytra. Possibly only a variety of the preceding.

CHRYSOMELINÆ.

8. CHRYSOMELA OPULENTA, Reiche.

Chrysomela opulenta, Reiche, Voy. Galin. Abyss. p. 405, t. 25. fig. 7.

GALERUCINÆ.

9. OÏDES TYPOGRAPHICA, Ritsema.

Oïdes typographica, Ritsema, Tijdschr. Ent. xviii. p. 21.

One example.

10. CEROCHROA MACULICOLLIS, Baly.

Cerochroa maculicollis, Baly.

11. HYPERACANTHA HYPOMELÆNA, Thoms., var.

In this variety, which occurs also at Old Calabar, the abdomen is entirely fulvous. In other respects it agrees with the typical form.

(Specimens of this insect stand in Murray's collection as *Diacantha beninensis*, H. S. G.)

12. HYPERACANTHA FLAVONIGRA, Thoms., var.

Elytra black, with a submedian transverse yellowish band, which does not reach the outer margins, and each with a small testaceous spot at the extreme apex. This variety is represented by a single female specimen, which I refer to *H. flavonigra*, Thoms., on account of the similarity in the contour of the last abdominal segments. The ventral segment is rather deeply incised on each side at the apex, while the median lobe thus cut off bears a shorter incision or notch placed a little *to the right of the middle line*. The dorsal segment is emarginate in the middle at the apex.

13. BONESIA SERRICORNIS, Thoms., var.

Elytra black; each with two testaceous patches—one behind the shoulder and extending inwards on to the disk, the other just behind the middle. In the typical forms of *B. serricornis* the elytra are black with a varying proportion at the apex testaceous.

Mr. Jacoby has referred *B. serricornis*, Thoms. (*Ootheca*), to the genus *Æthonea*, Baly; but I can find no sufficient difference by which to distinguish the latter from *Bonesia*, Baly. The one genus was founded upon a male, the other upon a female specimen, each belonging to a different species. The anterior cotyloid cavities are usually only very slightly open behind, and may in certain cases (some specimens of *B. murrayi*, Baly) be completely closed in.

14. Pachytoma obscura, n. sp.

Obscure ferrugineo-testacea; scutello, corpore subtus, pedibus antennisque (his basi testaceis exceptis) nigris; prothoracis lateribus a basi usque ad tertiam partem anticam divergentibus, deinde convergentibus; elytris crebre punctulatis.

Resembles *P. gigantea*, Illig., but differs from this and the other species known to me by the shape of the pronotum, which, narrowest at the base, gradually widens up to about the anterior third or fourth, thence narrowing again to the apex. The last ventral segment of the abdomen in the female has a rather deep longitudinal pit or groove along the middle of the apical half of the segment.

15. Ornithognathus generosus, Thoms.

Family Hispidæ. (By H. S. Gorham, F.Z.S.)

16. Cryptonychus murrayi, Baly.

Cryptonychus murrayi, Baly, Cat. Hisp. p. 76, t. 6. f. 5.

One example and one var.

The variety has the thorax narrower, more thickly punctured all over the surface, with confluent elongate sculpture; the elytra have a large dorsal black patch, widest in the middle and extending to the sides, and the apex more narrowly black than in the type; and the whole upper surface is more opaque. It possibly represents a different species.

All the species of *Cryptonychus* hitherto described have been from the West Coast of Africa; the specimens of the late Mr. Murray are now in my collection.

Family Cassidæ. (By H. S. Gorham, F.Z.S.)

17. Aspidomorpha spectabilis, Bohem.

Aspidomorpha spectabilis, Bohem. Mon. ii. p. 245.

A single specimen.

18. Aspidomorpha tigrina, Oliv.

Aspidomorpha tigrina, Oliv. Ent. vi. no. 97, p. 957, t. 5. f. 8.

19. Aspidomorpha westermanni, Bohem.

Aspidomorpha westermanni, Bohem. Mon. ii. 262.

This is the female of *A. quadrimaculata*, Oliv., sec. Gemm. and Harold, Cat.

A single specimen.

20. Aspidomorpha stolata, Bohem.

Aspidomorpha stolata, Bohem. Mon. ii. p. 274.

Several specimens referable to this or a closely allied species.

21. Aspidomorpha togata, Thoms.

Aspidomorpha togata, Thoms. Arch. Ent. ii. 1858, p. 227.

One example.

22. Aspidomorpha, sp. ?

A single example. The disk of the elytra is wholly black.

23. Aspidomorpha aruwimiensis, n. sp.

Ovata, nigra; prothorace elytrisque pallide testaceis, his irregulariter (dorso subseriatim) punctatis; illo basi quam elytra angustiore, maculis duabus rotundis nigris, margine antico subreflexo. Long. 12, *lat.* 9 *millim.*

The body, head, legs, and antennæ of this species are wholly black, the latter about as long as to reach to the hind angles of the thorax, their third joint half as long again as the fourth. The thorax has the extreme edge of the margin blackish; there are a few obsolete punctures on each black spot and on the lobe just before the scutellum. The scutellum is black, but has a yellow mark at its apex, it is indistinctly impressed. The humerus is prominent; the elytra are destitute of marks above or beneath, the extreme edge is very faintly brownish; the punctuation is distinct but irregular, here and there, as near the suture and in one row starting from the callus, forming series.

Two specimens of this insect were obtained by Mr. Bonny in the Aruwimi Valley. It has not very much the appearance of an *Aspidomorpha*; the claws are, however, pectinate at their base; and in general structure it seems to me to agree better with that genus than with any other known to me.

24. Laccoptera intricata, Klug.

Laccoptera intricata, Klug, Bohem. Monogr. iii. p. 59.

One example. This species is extremely common at Old Calabar and at other places in Guinea.

25. Cassida signatipennis, Bohem.

Cassida signatipennis, Bohem. Monogr. ii. p. 345.

One specimen. This species is also common at Sierra Leone and in Senegal.

26. Cassida bonnyana, n. sp.

Cassidæ hepaticæ *statura et summa similitudine; nigra, prothorace elytrisque brunneis, his vix nitidis, creberrime minute punctatis, illo punctis duobus discoidalibus nigris, margine antico elevato. Long.* 13, *lat.* 9 *millim.*

The inner side of the first four joints of the antennæ, the epistoma, and a dot on the crown of the head are rufous; the thorax and elytra reddish brown, on each side of the middle of the disk of the former is a black dot of medium size, and this together with the rather dull surface will at once distinguish this species from *C. hepatica*

or any other of its near allies. The prosternum is black and has the process deeply impressed (as in the allied species); the metasternum is black and shining; and the abdomen is black, with the fifth and apical segments rufous, and the three segments preceding these with a yellow spot at the side of each.

One specimen obtained by Mr. Bonny.

27. Cassida strigosa, n. sp.

Elliptico-ovata, nitida; elytris marginibus subexplanatis, subviridibus, irregulariter punctatis, disco concinne punctato-striatis; corpore nigro; capite, antennis (articulis duobus ultimis prætermissis), femorum apicibus, tibiis, tarsis, margineque toto flavis. Long. 9, lat. 7 millim.

Not very nearly allied to any species known to me. The outline is very evenly elliptical, with the whole (both thoracic and elytral) margin rather widely but evenly flattened. The green colour has apparently extended over the whole but faded to brown; the suture is narrowly reddish, and is hardly more distinctly marked beneath than above. The striæ are rather deep, with closely packed punctures and convex interstices; a row of larger punctures entirely surrounds the disk, separating it from the expanded margin.

Two examples.

28. Cassida fuscopunctata, n. sp.

Breviter ovata, lutea, nitida; antennarum articulo ultimo toto, penultimo partim nigro; elytris nitidis, disco seriatim fusco-punctatis, marginibus subreticulatis, prothoracis angulis externis rotundatis. Long. 6–7, lat. 5–6 millim.

Hab. Aruwimi valley (*Bonny*), W. Africa (*coll. Gorham*), Old Calabar (*coll. Murray*).

I propose this name for a very plain-looking *Cassida*, which I obtained from the collection of the late Mr. A. Murray, standing as "*C. pallidula*, Boheman," but the species so named by that author is referred to Mexico. The same insect as Murray's is in my collection from other sources named "*C. pallidula*." It therefore appears that Boheman had suggested this name for the African insect when he examined Mr. Murray's collection, but that he subsequently described another species under that name.

C. fuscopunctata is very shining and even, nearly as broad as long; in life it would seem to be greenish, from the tint on the disk and on the thorax in the fresher examples. The reticulation of the thorax and of the sides in the elytra is very distinct, and there is a submarginal row of larger cell-like punctures at the edge of the disk. The disk of both elytra and thorax is evenly and moderately convex; the underside and antennæ except the apex are wholly luteous.

One example from Central Africa (*Bonny*); many in Murray's collection from Old Calabar, now in my own collection.

Family Erotylidæ.

29. Linodesmus cæcus.

Elater cæcus, Fabr. Gen. Ins. Mant. p. 234 (1777).
Episcapha cæca, Lacord. Mon. Erotyl. p. 62.
Triplatoma cæca, Crotch, Rev. Erotyl. p. 406.

The specimens of this species, about twelve in number, from Central Africa present a slight difference from those of Old Calabar in that the posterior fascia returns towards the apex along the suture for a little way. It is the species which Mr. Champion remarks as mimicking or mimicked by *Tarasides pictus*. The resemblance is, however, rather general than very close.

30. Megalodacne furcata, Gorham.

Megalodacne furcata, Gorham, Proc. Zool. Soc. 1883, p. 79.

Described from W. Africa.

31. Episcaphula obliquata, Lacord.

Episcaphula obliquata, Lacord. Mon. Erotyl. p. 60.

Var., three specimens.

The basal fascia has not the outer denticulation in the middle so much produced, nor is it obliquely recurved towards the suture as in Old Calabar specimens, and two of the specimens (which are males) have the elytra more acuminate than is the case in any of the West Coast specimens I have seen.

32. Episcaphula interrupta, Lacord.

Episcaphula interrupta, Lacord. Mon. Erotyl. p. 57.

One example.

33. Palæolybas dorsalis, Gorham.

Palæolybas dorsalis, Gorham, Notes from Leyd. Mus. x. p. 144 (1888).

Described from Liberia and Niam-Niam.

Family Coccinellidæ.

34. Chilomenes lunata, Fabr.

One example.

35. Epilachna reticulata, Muls.

Epilachna reticulata, Muls. Spec. Trim. p. 794.

36. Epilachna 14-signata, Muls.

Epilachna 14-signata, Muls. Spec. Trim. p. 741.

One example.

37. Epilachna hirta, Thunb.

Epilachna hirta, Thunb. Nov. Ins. Spec. i. p. 23; Muls. Spec. Trim. p. 756.

Var.

Widely distributed "over the whole of Africa" (*Crotch*).

One example.

4. On a small Collection of Mammals brought by Mr. A. Sharpe from Nyassaland. By Philip Lutley Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received January 13, 1892.]

Mr. Alfred Sharpe, H.B.M. Vice-Consul for Nyassaland, has kindly shown to me a collection of hunters' skins and horns of Mammals formed during his recent stay in the Shiré Highlands and in other parts of that territory.

A selection of these I have the pleasure of exhibiting this evening, and I have written a few notes upon them.

1. Colobus angolensis, Scl.

Colobus angolensis, Scl. P. Z. S. 1860, p. 246, 1880, p. 68; Bocage, Jorn. Lisb. ser. 2, i. p. 9.

Colobus palliatus, Peters, Monatsb. Berl. Ak. 1868, p. 637, 1879, p. 830, t. iv. *a*.

A flat skin of a fine adult example of this species with the elongated white hairs on the shoulders well developed, as shown in Peters's excellent figure of this well-marked species (*op. cit.* 1879, pl. iv. *a*).

Mr. Sharpe informs me that this skin was obtained at the north end of Nyassa in the Kondé country.

2. Cercopithecus pluto, Gray, P. Z. S. 1848, p. 56, Mamm. pl. 3.

A flat skin of this species, which, like *Colobus angolensis*, was originally described from Angola. It is from the interior, on the west side of Lake Nyassa.

3. Viverra civetta, Schreb.

4. Genetta tigrina (Schreb.); Bocage, *op. cit.* p. 177.

Flat skins of both these species, which appear to be abundant in the Shiré Highlands and all along the coast of Nyassa.

5. Herpestes albicauda, G. Cuv.; Thomas, P. Z. S. 1882, p. 75; Bocage, *op. cit.* p. 180.

Mr. O. Thomas has kindly named this skin for me. This *Herpestes* is a wide-ranging species in Eastern Africa, extending from Upper Nubia to Natal. The present specimen was obtained on the route between Lake Tanganyika and Lake Mocro.

6. Sciurus mutabilis, Peters, Reise n. Mossamb., Zool. i. p. 131.

The single flat skin of this Squirrel has likewise passed under Mr. Thomas's supervision.

7. Cobus vardoni.

Antilope vardoni, Livingstone, Miss. Trav. p. 256 (Barotsi Valley), and pl. p. 71.

Heleotragus vardoni, Kirk, P. Z. S. 1864, p. 657 (Zambesia).

Onotragus vardonii, Gray, Cat. Rum. (1872), p. 17.

Cobus vardoni, Selous, P. Z. S. 1881, p. 759; id. Wand. pp. 111, 147, 219, pl. v.

Vardon's Antelope was found occasionally by Mr. Sharpe about the south end of Lake Tanganyika, and in vast numbers on the route between Tanganyika and Lake Moero. It goes in large herds [1].

I exhibit a fine pair of horns of this species procured by Mr. Sharpe.

8. Tragelaphus angasi, Gray.

Tragelaphus angasi, Brooke, P. Z. S. 1871, p. 487.

Mr. Sharpe brings a flat skin of what is apparently a male of this Antelope, hitherto not known to occur so far north. He gives me the following notes on it:—

"This Antelope is found in a piece of thick scrubby country bordering the Moanza, which enters the Shiré on the right bank near the Murchison cataracts. I have never seen it alive myself, but have heard of it frequently from the natives, by whom it is called 'Bō'—the *o* being pronounced very long.

"It frequents the thick scrub, and only occasionally comes out to the edges of the grass-flats.

"I have never heard of it in any other part of Nyassaland."

5. On a New Antelope from Somaliland, and on some other Specimens of Antelopes from the same Country. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received January 28, 1892.]

(Plate V.)

I have now the pleasure of exhibiting the skull and scalp of an apparently new Antelope of the genus *Bubalis*, which I propose to name *B. swaynei*, after Capt. H. G. C. Swayne, R.E., who has kindly furnished me with the specimen.

The existence of an Antelope of this form in Northern Somaliland has long been known to me (*cf.* P. Z. S. 1885, p. 932), but it is only within the last few days that I have succeeded in obtaining specimens of it.

In a series of Mammals from Somaliland lately received from Capt. Swayne are a good adult skull and head-skin of what he terms the "Hartebeest" or "Sig" of the Somalis. One glance at this

[1] *Cf.* Sharpe, Pr. R. Geogr. Soc. 1892, p. 39.



J. Smit del. et lith. Mintern Bros. imp.

HEAD OF BUBALIS SWAYNEI.

head is sufficient to show that the "Sig" is not the same as the Hartebeest of the Cape (*B. caama*), but more nearly allied to the Tora (*B. tora*) of Upper Nubia and to Coke's Hartebeest (*B. cokii*) of British and German East-Africa, being in some respects intermediate between these two species.

Fig. 1.



Skull of *Bubalis swaynei*.

The horns of *Bubalis swaynei* expand widely, after rising from the base, nearly in the plane of the forehead. They then turn upwards and slightly inwards. The whole horns are strongly ringed anteriorly, as in the allied species.

In *B. cokii* the horns are shorter and not so widely expanded.

In *B. tora* the horns are quite as long as in *B. swaynei*, but rise much more rapidly from the basal portion, then come further forward and project much further backwards.

The face-skin of *B. swaynei* is of a dark chestnut, much darker between the eyes, and with a large black patch on the nose. The ears are brown exteriorly and light rufous interiorly.

In *B. tora* the whole face is of a uniform pale isabelline like the body.

In *B. cokii*, of which there are fine examples in Mr. Holmwood's collections, which I now exhibit, the whole front of the head is dark rufous and the sides of the head pale fulvous.

Thus *B. swaynei* differs from its two allies both in the structure of its horns and in the colour of its face.

It may be characterized as follows:—

1. Bubalis swaynei, sp. nov. (Plate V.)

Capite fuscescenti-castaneo, facie nigra; labiis et naso isabellinis; cervice brunneâ nigro irroratâ; mento nigricante; auribus brunneis, intus pilis rufescenti-albis limbatis; cornubus in plano faciali latè divergentibus, indè antrorsùm leniter exsurgentibus, apicibus ipsis retroversis; magnitudine B. caamæ.

Hab. In terrâ Somalicâ.

Besides the new *Bubalis*, Capt. Swayne's last collection contains specimens of the following Antelopes:—

2. Neotragus saltianus (De Blainv.); Thomas, P. Z. S. 1891, p. 211.

A skull and two skins of the male of this species, which is locally known as the "Dik-dik" or "Sakaroo."

3. Oreotragus saltator (Bodd.); Thomas, *l. s. c.*

A flat skin of a female, and a skull and head-skin of a male of this species, locally known as "Alikhud."

4. Gazella pelzelni, Kohl; Thomas, *l. c.*

A flat skin and a head-skin of this species, which Capt. Swayne terms the "Low-country Gazelle" or "Dero" of the natives.

I fear it was I that led Mr. Lort Phillips into the error of calling this Gazelle "*spekei*"—a name which, as Mr. Thomas has shown, belongs to the next species of the "High-country."

There is now a fine mounted specimen of this Gazelle in the British Museum and several skins. The present flat skin is decidedly rather paler in colour than the mounted specimen in the British Museum, but not otherwise different.

5. Gazella spekei, Blyth; Thomas, *op. cit.* p. 210.

Capt. Swayne sends a skull and head-skin of a female of this Gazelle, which he calls the "Big-nosed Gazelle." The horns of this example are particularly long and straight.

There is now also a good mounted specimen of this Gazelle in the British Museum, obtained from Herr Menges. Besides the points of difference pointed out by Mr. Thomas, it may be noted that the lateral stripe is much darker, nearly black in the present species.

6. Gazella sœmmerringi (Cretschm.); Thomas, *l. c.*

Three good skulls of males and five head-skins are in the collection.

This Gazelle seems to be abundant (*cf.* Lort Phillips, P. Z. S. 1885, p. 932), and is locally known as "Awal" or "Aiwal."

7. AMMODORCAS CLARKEI, Thomas, P. Z. S. 1891, p. 207.

Of this Gazelle Capt. Swayne sent me two heads in a former collection. See P. Z. S. 1891, p. 197.

8. LITHOCRANIUS WALLERI (Brooke); Thomas, *l. c.*

Of this very peculiar form of Gazelle (the "Gerenook" of the

Fig. 2.



Head of *Lithocranius walleri*.

natives) there are four flat skins of males, four head-skins, and one skull in the series.

The British Museum have now fine mounted specimens of both

sexes of this Gazelle, received from Herr Menges, which show well the extraordinary long neck of this animal, as represented in the accompanying drawing (see p. 101). No other Antelope has a similar structure, which at once reminds one of a Giraffe.

9. Oryx beisa (Rüpp.); Thomas, *l. c.*

A skull and two flat skins of a female *O. beisa*, which is locally known as "Baet."

10. Strepsiceros kudu, Gray.

A flat skin of this Antelope, locally called "Arrah Gôder."

11. Strepsiceros imberbis, Blyth.

A flat skin of this Antelope, which is said to be known as "Goriali Gôder."

This makes 11 species of Antelopes of which Capt. Swayne has forwarded specimens from Berbera. I much regret that he has not sent me accompanying notes on their habits and exact localities, but he promises to do so.

At least two other Antelopes are found in Somaliland, namely, a Water-buck (*Cobus* sp. inc.), as mentioned by Mr. Lort Phillips (P. Z. S. 1885, p. 932); and a "small red Antelope of the Klipspringer kind; horns about 2 inches long; female hornless; same size as Alikhud: called 'Beira' by the natives": as described by Capt. Swayne in his letters. Capt. Swayne's brother, Lieut. E. J. Swayne, Bengal Staff Corps, met with this species in the Gadaburri country, but was not able to shoot a specimen. It may possibly be a *Cephalophus*.

6. On Numerical Variation in Teeth, with a Discussion of the Conception of Homology. By W. Bateson, M.A., Fellow of St. John's College, Cambridge.

[Received February 2, 1892.]

The following paper is an abstract of facts regarding the Numerical Variation of Teeth and of certain conclusions as to the nature of the conception of Homology as applied to Teeth which those facts have suggested. The observations concerning teeth form part of an investigation of the Variation of Multiple Parts in general, and I hope that before long the results of this work will be published in a complete form by Messrs. Macmillan, to whom I am much indebted for leave to use the blocks with which this paper is illustrated.

In an abstract it is clearly impossible to set forth the precise value and significance of the Study of Variation as a clue to the problems of Descent; but since by most this subject is wholly neglected, it may be well to state in the fewest words why it is that

this method of investigation is not merely a good one, but perhaps the best open to us.

The reason, then, is this. We assume that the transition from one form to another takes place by Variation. If, therefore, we can see the variations, we shall see the precise mode by which Descent is effected. Now the problem of Descent includes the problem of Homology, and, therefore, in any case of supposed Homology between organs the ideally best proof or disproof of such a supposition is to be had by appeal to the facts of Variation. For the statement that an organ of one form is homologous with the organ of another form means that there is between the two some connexion of Descent, and that the one organ has been formed by modification of the other or both by modification of a third. The precise way in which this connexion exists is not defined, and, indeed, has scarcely ever been considered, and though such a consideration must be hereafter attempted, the matter cannot be discussed here. We must be content for the present with the belief that in some undefined way there is a relationship between homologous parts, and that this is what we mean when we affirm that they are homologous. In the case of the homologies of Teeth, we are concerned with the application of this belief or principle to the case, not of a single organ, but to Multiple Parts arranged in Series. If, then, the whole series of teeth in one form is homologous with the whole series in another, we have now to consider how far we can extend the principle to the case of individual members of the two series. This is the question which is again and again arising with regard to Multiple Parts, but there are still no general principles by which it may be decided.

But though no one has told us the steps by which the Numerical Variation of teeth proceeds, there is nevertheless a received view by which it is sought to interpret the phenomena, and though there are several schemes upon which the homologies of teeth are defined, all are alike based upon one principle, which may be stated as follows.

It is believed that in the case of mammals, perhaps excluding the Cetacea, the series of teeth consisted originally of some maximum number from which the formulæ now characteristic of the several forms have been derived by successive diminution. On this view the series is believed to be always *composed of definite and individual members, which in any given form are either present or absent*; and the business of the homologist is then to determine which in each case is present and which absent. This hypothesis, of course, involves a definite conception of the mode in which Variation works, and it is most important to realize this clearly. For if it is true that each member of the Series of Teeth has in every form an individual and proper history, it follows that if we had before us the whole series of ancestors from which the form has sprung, we should then be able to see the history of each tooth distinctly and severally in the jaws of each of these progenitors. In such a series the rise of one individual tooth and the decline of

another would then be manifest. Each would then have its individual history, just as a Fellowship of a College or a Canonry of a Cathedral has an individual history, being handed on from one holder to his successors, some being suppressed and others being founded, but none being merged into a common fund. In other words, the received view of the nature of homologies in teeth *assumes that in Variation the individuality of each member of the series is respected.*

The difficulty in applying this principle is notorious, not only in the case of teeth but in all cases of Multiple Parts, such as digits, phalanges, &c.; and when the actual evidence of Variation is before us, the cause of this difficulty will become apparent enough, for it will be found that though Variation may sometimes respect the individual homologies, yet this is by no means a universal rule; and, as a matter of fact, in all cases of Multiple Parts, as to the Variation of which any considerable body of evidence has been collected, there are numerous instances of new forms arising in which what may be called the stereotyped or traditional individuality of the members has been superseded.

The present paper concerns the case of Teeth only, and even of this part of the evidence only a fragment can be given in this abstract, but perhaps it may suffice at least to indicate some of the possibilities which are opened up by the Study of Variation.

The material examined has consisted chiefly of specimens in the British Museum and the Museums of the College of Surgeons, Leyden, Oxford, and Cambridge, the Paris Museum of Natural History, and several smaller collections. I have to thank the authorities of these several museums for the great kindness I have received from them in the course of my work; and in particular I must express my indebtedness to Mr. Oldfield Thomas, of the British Museum, for the constant help and advice which he has given me, both as regards the subject of teeth generally, and especially in examining the specimens in the British Museum.

For various reasons I have for the most part limited myself to the following groups:—Primates (excepting Lemuroidea), Carnivora (Canidæ, Felidæ, Viverridæ, Mustelidæ, and Phocidæ), Marsupialia (Phalangeridæ, Dasyuridæ, Didelphyidæ, part of Macropodidæ, &c.).

Except in the case of teeth which are the terminal members of series, such as the first premolar or the last molar, very few facts of importance concerning the process of reduction in number were seen. From the fact that such cases are generally more or less ambiguous, they must be reserved for fuller treatment. For the present it must suffice to give a brief account of some of the more remarkable phenomena relating to increase in number of teeth.

The statistics relate to about 2500 skulls belonging to various orders, and the comparative frequency of supernumerary teeth in some of the different groups is interesting if only from its paradoxical character.

Primates.—Of the three larger Anthropoids—Orang, Chim-

panzee, and Gorilla—141 normal skulls were seen, and 11 cases of supernumerary teeth, or nearly 8 per cent. (in addition to 7 recorded cases known to me). On the other hand, no case was seen in 51 skulls of *Hylobates*, which were all normal. And of Old World Monkeys other than these, I found only two cases in 423 skulls, or less than ·5 per cent.

In the species of Cebidæ and in *Ateles* supernumerary teeth are common, five cases being found in 131 skulls, or nearly 4 per cent. (in addition to 4 recorded cases); while in 92 skulls of other New World Monkeys there was not one case.

Phocidæ.—139 normals, 11 cases of supernumerary teeth, or 7·5 per cent.

Otariidæ.—121 normals, 5 cases of supernumerary teeth, or 4 per cent.

Canidæ.—Of *wild* Canidæ, 289 normals were seen, and 9 cases of supernumerary teeth, or 3 per cent. (in addition to numerous recorded cases).

Of Domestic Dogs, including Pariahs, &c., 200 skulls were normal and 16 had supernumerary teeth, or 8 per cent. (besides many recorded cases).

Felidæ.—Of *wild* Felidæ, 278 normals and 6 cases of supernumerary teeth, or more than 2 per cent.

Of Domestic Cats, 35 normal and 3 cases of supernumerary teeth, or 9 per cent.

Viverridæ.—94 normals (not regarding variations affecting the first premolar only) and 4 cases of supernumerary teeth.

Owing to the great variability of the dentition of some groups of Marsupials and the difficulty of deciding on the normal formula, it would not be profitable to give summary statistics which should be satisfactory.

It will be seen that, so far as the statistics go, supernumerary teeth were more common in domestic Dogs than in wild Canidæ, and though the number of Cats seen was small, the same is true in their case also as compared with wild Felidæ. But though it is received by many almost as an axiom that domestic animals are, as such, more variable than wild ones, and though the figures somewhat support this view, it is necessary to point out that such a deduction should be made with great caution. For while it is true that the domestic Dog is more variable in its dentition than wild Dogs, it is not true that it is much more variable than many other wild animals, as, for example, the Anthropoid Apes, some of the Phocidæ, several genera of Marsupials, and others. The doctrine that domestication induces or causes Variation is one which will not, I think, be maintained in the light of fuller evidence as to the Variation of wild animals. It has been suggested by the circumstance that so many of our domesticated animals are variable forms, and that so little heed has been paid to the variation of wild forms. To obtain any just view of the matter, the case of variable domestic species should be compared with a species which is variable though wild.

The case of the great variability of the teeth of the large Anthropoids, which is shown not merely in numerical changes, but in frequent abnormalities of position and arrangement, is most striking, both when it is compared with the great rarity of variations in the teeth of the Old World Monkeys and the *comparative* rarity of great variations even in Man. If the Seals or the Anthropoids had happened to be domesticated animals, I do not doubt that many persons would have seen in this variability a consequence of domestication. When the whole evidence is examined, it will be found that we can make no generalizations of this kind, and that the variability of a form is, so far as can be seen, as much a part of its specific characters as any other feature of its organization. A few curious cases may be given in illustration. Of *Canis cancrivorus*, a S. American Fox, I know the following specimens only (in the British Museum)—normals (numerically): one whole skull with lower jaw, one skull without lower jaw, and one lower jaw without a skull, and in one of these right m^3 is much larger than the corresponding left tooth; abnormals: two skulls have $\overline{m}^4$ on both sides, and a third has a large "odontome" formed as 4 small molars growing from right $\overline{m}^3$. Of *Felis fontanieri*, an aberrant Leopard, two skulls only are known (British Museum), and both of these show dental abnormalities, one having supernumerary left $\overline{m}^3$, and the other having an additional talon to right $\overline{p}^3$, making it almost a "bigeminous" tooth. In the Seals only three cases of reduplication of the first premolar were seen, and two of these were in *Cystophora cristata* (Leyden and Cambridge). Evidence of this kind might be multiplied indefinitely.

The following cases are chosen as representative examples or "Prerogative Instances" of different classes of phenomena which occur in connexion with increase in number of teeth. It will be understood that the cases are selected as illustrations, and that in order to have a full appreciation of their significance, the whole body of evidence must be taken together, for scarcely any two cases are exactly alike.

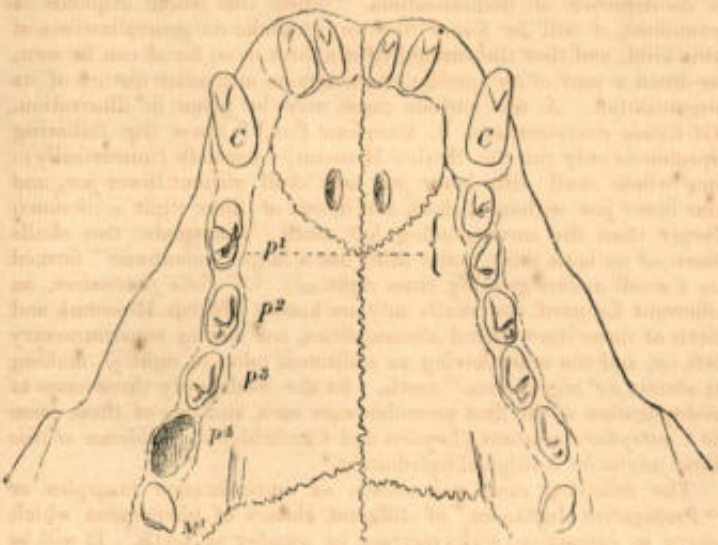
Division of individual Teeth.

Ommatophoca rossii.—Of this form two skulls only are known, namely, those in the British Museum. One of them has the arrangement usually found in Phocidæ, viz., five teeth behind the canines, giving the formula:—i. $\frac{2-2}{3-3}$, c. $\frac{1-1}{1-1}$, p. + m. $\frac{5-5}{5-5}$. By the analogy of other Seals, these five teeth are p. $\frac{4}{4}$, m. $\frac{1}{1}$. The other specimen is exceedingly remarkable (fig. 1). In it the incisors and the canines are the same as in the first specimen, but the first tooth behind the canine on both sides in the lower jaw and on the right side in the upper jaw has a very peculiar form, having a deep groove passing over the whole length of the tooth on both its outer and inner sides. These grooves extend from the tip of the root along both sides of the crown, and thus imperfectly divide each tooth into an anterior and a posterior half. The cusp of each tooth

is also divided by the grooves so as to form two small cusps. Each of these teeth is therefore an imperfectly double structure, and may be described as being just halfway between a single tooth and two teeth.

On the left side in the upper series, as the *vis-à-vis* to one of these double teeth, there are two complete teeth, standing near

Fig. 1.



Osmatophoca rossii, having the first upper premolar on the right side bigeminous, and on the left side represented by two complete and similar teeth. In the lower series the first premolar was bigeminous on both sides. From a specimen in the British Museum.

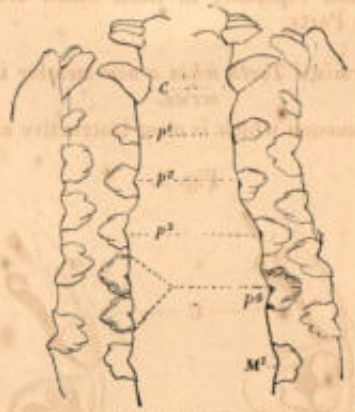
together, but having separate sockets divided from each other by a bridge of bone. The dental formula for this skull taken as it stands is :—i. $\frac{2-2}{2-2}$, c. $\frac{1-1}{1-1}$, p. + m. $\frac{5-6}{5-5}$, for since the bigeminous teeth are not completely divided into two, they must be reckoned as single teeth.

Phoca groenlandica.—A specimen is preserved in the Leyden Museum having the arrangement shown in the figure (fig. 2[1], p. 108). The dentition of the lower jaw is the same on both sides. In the upper jaw there are on the left side *six* teeth behind the canine, while on the right side there are *five*, the normal number. But upon examination, one of these teeth, namely $\overline{p^3}$ of the usual nomenclature, is an abnormally large tooth, being especially thick in a transverse direction, and has besides a deep cleft in the crown,

[1] This figure was kindly drawn for me by Mr. J. J. Lister.

which is thus partially divided into two. Upon comparing this with the series on the left side, it appears that *two* of the six teeth stand level with this bigeminous tooth, and both bite between p^4 and m^1 of the lower series, though there is no crowding in the jaw owing to the large spaces which exist between the normal teeth of this species. There is, therefore, no doubt that the fourth premolar is on the left side bodily represented by two distinct teeth, each of

Fig. 2.



Phoca grœnlandica, having the fourth upper premolar on the right side bigeminous, and on the left side represented by two complete teeth (shaded). Right and left profiles; from a specimen in the Leyden Museum.

which is perfect and complete, while on the right side the process of division is incomplete.

In the Paris Museum (A 2897) there is a specimen of *P. grœnlandica* in which the second upper right premolar is represented by two teeth, each of which has two roots; but these two teeth stand at the same level in the arcade, one being external and the other internal. On the left side the second upper premolar is incompletely double, the crown being partially divided by an oblique constriction into an anterior and internal portion and a larger posterior and external part. The former has one root and the latter has two.

It is thus seen that reduplication of teeth may occur in such a way that a tooth which is normally single may be represented by two teeth, and that the two teeth thus formed may either (1) both take places in the ordinary series, or (2) may stand externally and internally respectively.

Substitution of two teeth for one, both being in series, was seen in *Ommatophoca rossii* (p^1), *Phoca grœnlandica* (p^4), *Otaria ursina* (p^2), *Brachyteles hemidactylus* (p^1), *Phalanger orientalis* (p^1), ditto (p^3), *Myrmecobius fasciatus* (i^3), ditto (i^4). Probably also cases of the presence of two similar small teeth in place of the first premolar in the Canidæ and Felidæ should be looked on as belonging to this

class, though the materials which support this view cannot easily be given in brief.

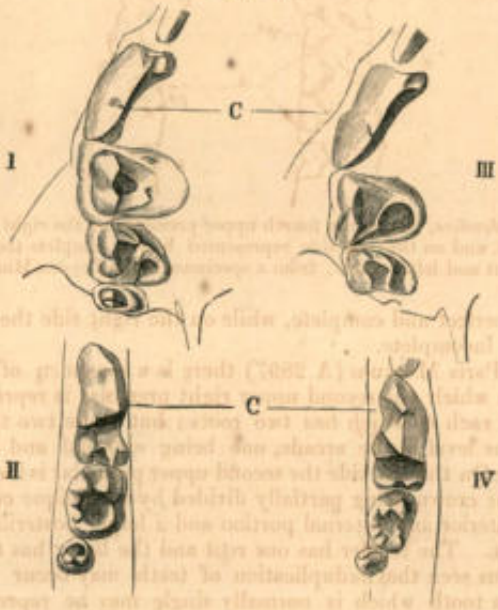
Partial or complete reduplication of teeth occurring in the second way was seen in *P. grœnlandica* (p^2), *Otaria cinerea* (m^1), *Canis mesomelas* (p^3), *Vison horsfieldii* (p^1), *Herpestes orientalis* (p^2), *Herpestes gracilis* (p^3), *Felis domestica* (p^4), ditto (p^3), *Phalanger orientalis* (i^3), &c.

The power of a single organ to reproduce itself is of course not confined to teeth, but will be shown to be present in many different kinds of organs, and especially in those which are arranged as a Series of Multiple Parts.

Variation in Terminal Teeth when a new member is added to the series.

This is a phenomenon which is most instructive as a guide to the

Fig. 3.



Canis azaræ, from specimens in the Leyden Museum.

I. Right upper molars of a specimen having a supernumerary third molar on each side. II. The right lower jaw of the same. III. and IV. The right upper and lower jaws of a normal skull of rather larger absolute size, to show the increased size of the teeth in the abnormal specimen. C. The carnassial tooth.

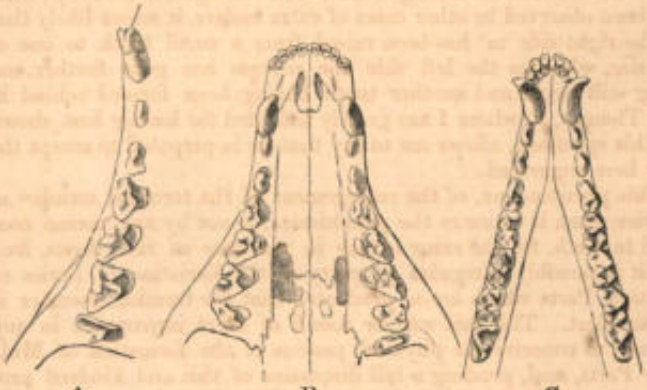
nature of the process by which Multiple Parts are formed. It may be stated generally that if the tooth which is the last of a normal

series is relatively a small tooth, as, for example, $\overline{m^3}$ or m^3 in the Dog, then in cases of an addition to the series by which this terminal tooth becomes the penultimate it will be found that this penultimate tooth is larger and better developed than the corresponding ultimate tooth of a normal animal of the same size. Of this phenomenon two examples must here suffice.

The first is a skull of *Canis azaræ* in the Leyden Museum (fig. 3[1], p. 109). In this figure, I and II represent the back-teeth of this abnormal specimen, I being the upper, and II the lower jaw. By the side of these are shown the upper and lower jaws of a normal specimen of rather larger absolute size. In the upper jaw there is a supernumerary m^3 on both sides and the great enlargement in m^1 and especially in m^2 is very striking. In the lower jaw there is no extra tooth, but the molars are considerably larger than the normal size.

The next case is that of *Dasyurus maculatus*, having an extra

Fig. 4.



Dasyurus maculatus.

A. Right upper jaw of a normal specimen. B and C. Upper and lower jaws of an abnormal specimen having an extra molar in each lower jaw and in the left upper jaw. In correlation with this change the sixth upper back-tooth (m^5) has been increased in size. (The abnormal specimen was of less than normal size.) From specimens in the British Museum.

molar in the left upper and both lower jaws. In this case, owing to the great difference which normally exists both in shape and size between the last tooth and the last but one, some obscurity is introduced by the changes associated with the presence of an extra tooth, and it would be difficult to determine the nature of the upper teeth if this phenomenon of Variation were unrecognized. The structures are shown in fig. 4, A being the right upper jaw of a normal specimen, while B and C are the jaws of the abnormal form (Brit. Mus. 983 *b*). The normal specimen is unfortunately much larger

[1] This drawing was kindly made for me by Mr. J. J. Lister.

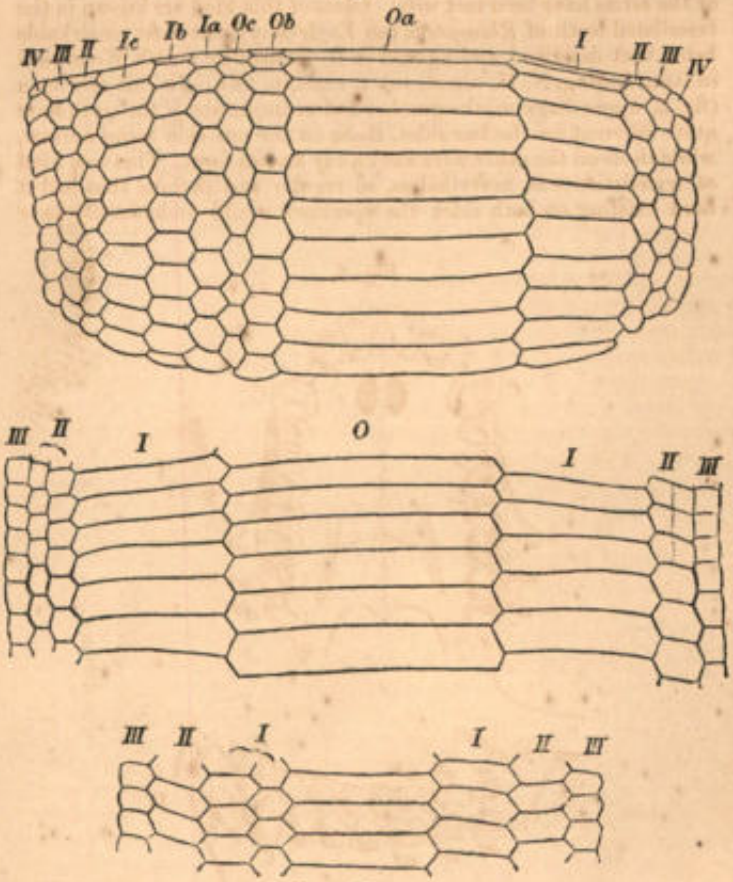
than the other, which Mr. Thomas tells me is abnormally small for the species. In the upper jaw of a normal skull there are two small premolars (p^1 and p^3 of Thomas) and behind these four molars. The molars increase in size from the first to the third, which is by far the largest. Behind the third is the fourth molar, which is much thinner than the others. On comparing the abnormal skull with the normal one it is seen, firstly, that on the left side there are seven teeth behind the canine, while on the right side there are only six such teeth, as usual. On the right side, however, the last molar has not the thin flattened form of the last molar of a normal skull, but is a fair-sized thick tooth. In each lower jaw there are seven back-teeth instead of six. In making a more detailed comparison, the first five teeth on each side are clearly alike, while from its form the seventh on the left side might be thought to represent the normal sixth, and this is the view originally proposed by Mr. Thomas in his 'Catalogue of Marsupialia,' p. 265, *note*. The difficulty in this view is that it offers no suggestion as to the nature of the sixth tooth on the right side. In the light, however, of what has been observed in other cases of extra molars, it seems likely that on the right side m^4 has been raised from a small tooth to one of fair size, while on the left side the process has gone further, m^4 being still larger and another tooth having been formed behind it. Mr. Thomas, to whom I am greatly indebted for having first shown me this specimen, allows me to say that he is prepared to accept the view here suggested.

This phenomenon, of the enlargement of the terminal member of a series when it becomes the penultimate, is not by any means confined to teeth, for the same is true in the case of ribs, digits, &c., and it is possibly a regular property of the Variation of Series of Multiple Parts which are so graduated that the terminal member is the smallest. This fact will be found of great importance in any attempt to conceive the physical process of the formation of Multiple Parts, and, pending a full discussion of this and kindred processes, it may be remarked that such a fact strikingly brings out the truth that the whole Series of Multiple Parts is bound together into one common whole, and that the addition of a member to the series may be correlated with a change in the series itself, and may occur in such a way that the general configuration of the whole series is preserved. In this case the new member of the series seems, as it were, to have been reckoned for before the division of the series into parts. This is, of course, only one way in which numerical Variation may take place; for, as was described in the previous section, additions to the series may be formed by the division of single members of the series, and in this case the configuration and proportions of the rest of the series remain normal. Examples of these two distinct methods of numerical Variation occur among Series of Multiple Parts of many kinds (digits, vertebræ, &c.).

Re-constitution of Parts of the Series.

Some curious instances of what is almost a remodelling of parts

Fig. 5.



Upper Diagram.

Teeth of *Rhinoptera javanica*, specimen having asymmetrical dentition (after Smith Woodward). The arrangement on the right side of the figure is normal. The lettering shows Mr. Woodward's suggestion as to the correspondence of the parts.

Middle Diagram.

Rhinoptera sp. inc. From a Hunterian specimen in the Museum of the College of Surgeons. On the left side there are three rows of small lateral teeth, while on the right side two of these rows are represented by one row, which in places shows an indication of division.

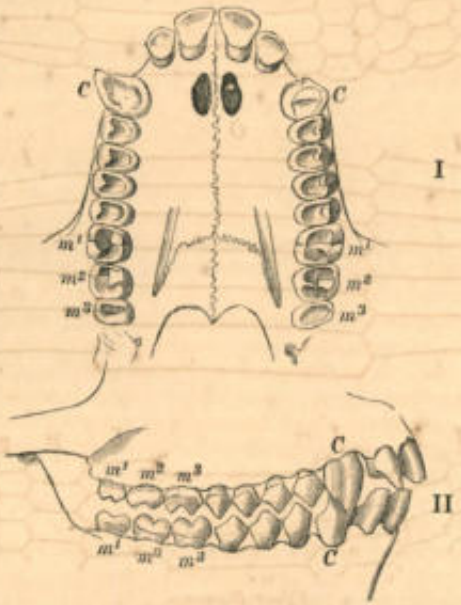
Lower Diagram.

Rhinoptera javanica, in which the row of teeth marked I. is on the other side represented by two rows. (After Owen, 'Odontography,' pl. xxv. fig. 2. From a specimen in Coll. Surg. Mus.)

Note.—That in these two cases, though the general proportions are maintained, the lines of division between the lateral plates on the abnormal side are not in their normal morphological positions relatively to the median plates, the interspaces on the one side corresponding to the teeth on the other.

of the series have been met with. Cases of this kind are known in the tessellated teeth of *Rhinoptera* (an Eagle-Ray), the most remarkable being that described and figured in *R. jussieui* by Smith Woodward in Ann. & Mag. N. H. ser. 6, vol. i, 1888, p. 281. In this specimen (fig. 5, upper diagram) the number and arrangement of the teeth were quite different on the two sides, those on the one side being normal, while those on the other were unlike any known form. This new kind of tessellation was, nevertheless, so regular and definite that had it been existing on both sides the specimen would undoubtedly have

Fig. 6.



Ateles marginatus, having four premolars on each side in the upper jaw instead of three. The lower jaw is normal, and the lower canine consequently bites behind the upper. (Brit. Mus. 1214 *b*.)

been made the type of a new species. There is, indeed, in the British Museum a unique pair of jaws in both of which a very similar tessellation occurs in a nearly symmetrical manner, and though this specimen has been described as *R. polyodon*, it is by no means unlikely that it is actually a "sport" of this kind derived from the usual formula of *Rhinoptera*.

One case in Mammals may be mentioned. This is a specimen of *Ateles marginatus* (Brit. Mus. 1214 *b*) having four premolars in each upper jaw instead of three (fig. 6). The lower jaw is normal. There is nothing in this specimen to indicate

that any one of these teeth should be considered supernumerary more than any other; and in the absence of such evidence it would, as I think, be best to regard the four premolars in this specimen as collectively representing the three premolars of the normal. For just as a stick may be broken into three pieces or into four, so would it seem to be with Multiple Parts. The epithelium which normally gives off three enamel-germs has here given off four such germs, and I believe that it is as impossible to analyze the four teeth and apportion them out among the three teeth as it would be to homologize the sides of an equilateral triangle with the sides of a square of the same peripheral measurement, or to homologize the segments of a 4-rayed *Sarsia*[1] with segments of its 6-rayed "sport." To make such an attempt would be to disregard the plain and obvious indications of the true nature of the phenomenon, and any theory of Homology which recognizes this class of problem as profitable or legitimate is, I believe, founded upon a wrong conception of the physical process of Division.

For, after all, it is with a process of physiological Division that we have here to do, and the Division which results in the formation of a series of Multiple Parts is probably a manifestation of the same physical process as the Division of a cell or the segmentation of an ovum. Whoever will discover by what physical process an ovum segments will give us the key to the problem of the segmentation of tissues into Series of Multiple Parts; and though we are far enough from having any such knowledge, we should at least recognize that this is the problem to be dealt with, and any working hypothesis of the nature of Homology should be, at all events, in harmony with what is known of the processes of Division and should be founded upon them. Now the ordinary conception of the relationship of Homology as defined above, though it has been a useful instrument as a basis of nomenclature and so forth, is nevertheless inconsistent with the facts of Division and is founded on assumptions which are not justified, suggesting a view of the physics of Division which is wrong.

In order to appreciate this, let the reader consider, for example, the case of *Ommatophoca rossii* given above. Judged by the ordinary rules of morphological criticism, this specimen shows one or both of two things:—

(1) The first premolar of *Ommatophoca may* in itself represent *two* premolars of an ancestor.

Or (2) In the descendants of *Ommatophoca* the single first premolar *may* be represented by two distinct and several premolars.

[1] *Sarsia* is the Medusa of a Gymnoblastic Hydroid (*Syncoryne*). The normal form has 4 radial canals, 4 ocelli, and 4 tentacles. Three specimens having six of each of these parts are recorded, two (American) by L. Agassiz, Mem. Amer. Acad. Sci. iv. 248, pl. v. fig. 5, and one (British) by Romanes, Journ. Linn. Soc. xii. p. 527. All of these were radially symmetrical.

One or both of these propositions may be true. If the division of the other three first premolars were as complete as that of the left p^1 there would be no indication of their origin. But if it is possible for a premolar to represent or to be represented by two premolars, without any visible indication of its double nature, may not the same be true of the premolars of other forms? May it not be true of teeth generally? And if it is true, how are the homologies of teeth to be determined? Nevertheless teeth are almost preeminently amenable to this kind of treatment. They have been studied with immense care. The facts which they present, and on which their homologies are to be determined, are remarkably compact, and of all Series of Multiple Parts they offer the best chance. But examined in the light of a knowledge of the facts of Variation, that process is found to be capable of occurring in a way which precludes the possibility of carrying out an analysis of the relation between the parts and suggests that such relationship need not necessarily exist at all. This subject cannot now be discussed further; but if any one wishes to realize the difficulties suggested by the Variations of which instances have been given, let him read some good discussion of dental homologies, as, for example, Thomas's excellent paper [1], with these cases in his mind, and as he reads let him ask himself what margin is left for the occurrence of phenomena like this. Such schemes as that alluded to, though they have done a most useful work, and though they are ingenious, logical, and orderly, are orderly because they are made without regard to the ways of Variation, which is arbitrary and capricious and follows no order that we have yet devised.

An illustration will perhaps help to make clear the point at issue. The received view of homology supposes that a varying form is derived from the normal much as a man might make a wax model of the variety from a wax model of the type, by small additions to, and subtractions from, the several parts. This may, to our imaginations, seem, perhaps, the readiest way by which to make the varying form if we were asked to do it; but the natural process differs in one great essential from this. For in nature the body of the varying form has never *been* the body of its parent and is not formed by a plastic operation from it; but in each case the body of the offspring is made again from the beginning, just as if the wax model had gone back into the melting-pot before the new model was begun.

The present system of Homology must probably be retained as a basis of notation, imperfect though it is and though it is founded on a misconception of essential facts. It is likely that many will be disposed to doubt the reality of this misconception, and I can only ask that they should suspend judgment until the whole evidence can be produced. In the meantime this summary of facts and conclusions is put forward, together with a few "Prerogative Instances," in the hope that some one may be thereby attracted to a most powerful and fascinating method of zoological research.

[1] Phil. Trans. 1887, vol. clxxviii. B, p. 443.

February 16, 1892.

Osbert Salvin, Esq., F.R.S., Vice-President, in the Chair.

Mr. W. T. Blanford exhibited two heads (one mounted) and a skin of the Yarkand Stag. The specimens had been lent for exhibition by Major C. S. Cumberland, who shot the animals in the woods on



Skull and horns of Yarkand Stag (from specimen in Nat. Hist. Mus.)[1].

the Yarkand or Tarim river in 1890, as described by him in 'Land and Water' (vol. li. p. 318, March 14th, and p. 446, April 11th, 1891).

Mr. Blanford made the following remarks:—

The Stag of Eastern Turkestan was first brought to notice by

[1] The head here figured is in the British Natural History Museum, and was presented by Mr. A. O. Hume. The skull measures in basal length 14 inches, in breadth across the orbits 6·75; the two horns are 35 and 34 inches long respectively, measured along the beam and round curves, and the girth of the right horn, just above the burr, is 6·75 inches.

some of the officers who accompanied the Mission under Sir D. Forsyth sent by the Government of India to Yárkand and Káshgar in 1873; and by Colonel Prejvalski, who found this Deer common around the Lower Tarim and Lobnor in 1876, and noticed it (Pet. Mitth., Erg. Heft, No. 53, p. 9) as *Cervus maral*. In the 'Mammalia' of the Scientific Results of the Second Yarkand Mission, p. 92, this animal is mentioned, and a photograph of its horns obtained by Mr. R. Shaw noticed. From the photograph it was surmised that the horns resembled those of *C. affinis*.

Several fine heads have since been obtained by Mr. A. O. Hume from Yarkand; of these three are now in the British Museum. All are very similar: they have 5 tines on each horn, as is generally the case in *C. cashmirianus* and *C. affinis*, but differ greatly from the last named in the curve of the beam, and somewhat from *C. cashmirianus*, to which, however, they appear very closely allied. At the same time the horns of the Tarim Stag appear always distinguishable as spreading less and by the terminal tine never being curved inwards to anything like the extent that it is in *C. cashmirianus*. There is very little resemblance to *C. maral*, in which the crown appears to consist of more than two tines.

C. maral, *C. cashmirianus*, and some other Deer may be ultimately classed as subspecies of *C. elaphus*. The Yarkand Stag is apparently another subspecies, distinguished by its unusually straight horns. As a distinctive name is useful for these races, each of which appears to occupy a small isolated area, the name *C. yarkandensis* may be applied to the Yarkand and Tarim Deer as a subspecific name, it being understood that the form is not regarded as specifically distinct from *C. cashmirianus*.

The skin of the body is unusually pale in colour, with a well marked caudal disk.

Mr. Sclater exhibited and made remarks on some "Spinning or Japanese Mice," as a particoloured breed of *Mus musculus* or one of its allies, now commonly kept in captivity, is usually called. The curious habit of spinning round and round after their tails like a kitten was highly developed in this breed and continually exercised. It was very difficult to imagine a reason how this habit originated, and why it was so readily inherited.

Mr. Sclater exhibited a series of mounted heads of Antelopes belonging to Capt. H. G. C. Swayne, R.E., and made the following remarks:—

My communication upon Capt. Swayne's Antelopes to the last meeting having been rather hurried owing to stress of time, I thought it might interest the Society to examine Capt. Swayne's private collection of heads, which have been beautifully mounted for him by Messrs. Rowland Ward & Co. of Piccadilly, and kindly sent here for exhibition.

They belong, as will be seen, to the eight following species:—

(1) *Bubalis swaynei.*
(2) *Neotragus saltianus.*
(3) *Gazella sœmmerringi.*
(4) *Gazella spekii.*
(5) *Lithocranius walleri.*
(6) *Oryx beisa.*
(7) *Strepsiceros kudu.*
(8) *Strepsiceros imberbis.*

Amongst these, I am specially pleased to be able to draw attention to a beautifully prepared head of Swayne's Hartebeest (*Bubalis swaynei*), the new Antelope of which I pointed out the characters at the last meeting. It will be observed that this mounted head fully confirms the points of difference between Swayne's Antelope and the allied species (*B. tora*) on the North, and Coke's Hartebeest (*B. cokii*) on the South. From both these species, without reference to the form of the horns, of which I spoke on the former occasion, the new species is at once distinguished by the dark chestnut colour of the whole head and neck, which is relieved by the black face below the eyes and the light isabelline of the nose and lips. The ears also are of an isabelline tint, with the hairs edging the interior rim nearly white.

This, I may remark, is the fourth new species of Antelope that we have lately received from Somaliland, and it is even possible that the Water-buck (*Cobus*) met with, but not obtained, by Mr. James's party in the interior, as well as the small Antelope called "Beira" spoken of by Capt. Swayne, may turn out to be novelties also.

Mr. Sclater gave the following list of the known Antelopes of Northern Somali-land and their native names:—

List of the Somaliland Antelopes.

1. Swayne's Hartebeest.	*Bubalis swaynei.*	"Sig."
2. Salt's Antelope.	*Neotragus saltianus.*	"Sagaro."
3. Klipspringer.	*Oreotragus saltator.*	"Alikhud."
4. Water-buck.	*Cobus* sp. inc.	
5. Sœmmerring's Gazelle.	*Gazella sœmmerringi.*	"Aiwal."
6. Pelzeln's Gazelle.	—— *pelzelni.*	"Dehro."
7. Speke's Gazelle.	—— *spekii.*	do ?
8. Clarke's Gazelle.	*Ammodorcas clarkii.*	"Debo Tag."
9. Waller's Gazelle.	*Lithocranius walleri.*	"Gerenook."
10. Beisa Antelope.	*Oryx beisa.*	"Baet."
11. Greater Koodoo.	*Strepsiceros kudu.*	"Goriali Gôdir."
12. Lesser Koodoo.	—— *imberbis.*	"Arreh Gôdir."

Mr. A. Smith Woodward exhibited and made remarks on specimens of the supposed jaws and teeth of *Bothriolepis* from the Upper Devonian Formation of Canada.

Mr. F. E. Beddard read a paper entitled "Contributions to the Anatomy of the Anthropoid Apes."

This contained a description of the external characters, brain, and muscles of the Bald-headed Chimpanzee "Sally," and the reputed Lesser Orang "George," lately living in the Society's gardens.

The Bald-headed Chimpanzee, *Troglodytes calvus*, was established as a second species of Chimpanzee by M. Du Chaillu. The Natural

History Museum possessed skins and skeletons of this Anthropoid which were obtained from M. Du Chaillu ; a comparison of these with the skin and skeleton of "Sally" showed that the Chimpanzee which lived for so many years (from 1883 to 1891) in the Society's Gardens was undoubtedly referable to Du Chaillu's *Troglodytes calvus*. The late Dr. Gray had refused to admit the validity of this species ; but the present paper afforded additional reasons for accepting *Troglodytes calvus* as a distinct form of Chimpanzee, not synonymous with the *T. tschego* of Duvernoy.

The animal was unfortunately so diseased that the viscera could not be satisfactorily studied ; the bones, too, exhibited pathological appearances, so that the supposed differences in the skulls of *T. calvus* and *T. niger* must probably be liberally discounted. The animal had acquired the permanent incisors and bicuspids of the upper jaw ; the first molar being the only one of the molar series which was in place. The canines were a long way from their definitive position, and protruded through the bone. In the lower jaw the only representatives of the milk-dentition which had not been replaced were the canines. The condition of the teeth, were their possessor a human being, would suggest the age to have been between ten and eleven years : this was in all probability the age of the Chimpanzee.

The muscular anatomy did not, as might be expected, show many differences from the common Chimpanzee, *T. niger*.

At present it was impossible to state how far even these slight differences might be individual. Although so many anatomists—Brühl, Bischoff, Humphrey, Macalister, Sutton, Chapman, Vrolik, Gratiolet, and Alix, &c.—had recorded their dissections of *T. niger*, the normal muscular structure of even that species was not yet beyond dispute. And as the present paper contained the only account yet published of the myology of *T. calvus*, the facts stated must be taken for what they were worth.

In the following table the principal differences between *Troglodytes calvus* and *Troglodytes niger* were shown (according to Sutton's account of the myology of the latter) :—

	T. calvus.	*T. niger.*
Pect. minor	Insertion : coracoid.	Insertion : capsule of shoulder-joint.
Biceps cruris	Ischial head present.	Ischial head absent.
Soleus	from head of fibula only.	from upper third of posterior surface of fibula only.
Flex. prof. digit......	attached by a vinculum to flex. long. digit.	No such vinculum (?)[1].
Flex. long. digit......	supplies digits II., IV., V.	supplies digits II., V.
Lumbricales	three.	four.
Flex. long. poll.	well developed, supplies index and pollex.	absent or feebly developed, supplies only pollex.
Ext. min. digit.	absent.	present.

[1] This vinculum, however, is stated by Macalister to occur. Sutton does not say it is absent ; he does not refer to it.

In the brain the chief differences from *T. niger* were: the greater depth in proportion to the length; the Sylvian fissure was much more upright than in the common Chimpanzee, and therefore approached the Gorilla and the other Anthropoids; the common Chimpanzee came nearest to man in the direction of this fissure. The middle lobe of the cerebellum was overlapped posteriorly, and nearly concealed, by the two lateral lobes.

The Orang "George" was believed on its arrival to be an adult example of the Lesser Orang, *Simia morio*, originally described by Sir R. Owen. It proved to be a much younger specimen than had been supposed. All the milk-teeth were present; and, although they were unusually worn, none had been replaced by the permanent teeth. The shape of the head was, however, rather different from that of the typical *Simia satyrus*, being distinctly longer and not so markedly brachycephalic.

The external characters, particularly the hands and feet, were described and illustrated, and a full account was given of the muscular anatomy of the limbs.

This paper will be published entire in the Society's 'Transactions.'

The following papers were read:—

1. On a Collection of Lepidoptera from Sandakan, N.E. Borneo. By Arthur G. Butler, F.L.S., F.Z.S., &c.

[Received January 8, 1892.]

(Plate VI.)

The Lepidoptera here enumerated were obtained by Mr. W. B. Pryer and presented by him to the National Collection; many of them have suffered considerably from damp, but, fortunately, the examples of the finest of the new species are in excellent condition.

RHOPALOCERA.

This part of the collection is of little value, and the specimens are much damaged; it, however, contains examples of an interesting *Elymnias*. The following is a list of the species:—*Calliplea mazares*, Moore, *Salpinx kadu*, Eschscholtz, *Elymnias* (probably the male of *E. penanga*, Westw., black above, with the interno-basal half and a belt across the apical area of the primaries slaty lilacine), *Eurytela castelnaui* ♀, Felder, *Neptis thamala*, Moore, *Rahinda sandaka*, n. sp.[1], *Athyma nefte*, Cram., *Euthalia dunya*, Hew., *Lebadea padaka*, Moore, *Amathusia phidippus*, Linn., *Hypolimnas*

[1] Exactly like *R. peraka*, excepting that the submarginal band of the primaries is single instead of treble—a distinction which is believed to be constant.



W.Purkiss lith. ad nat.

West, Newman & imp.

Lepidoptera from Sandakan.

wallaceana ♂, Butl., *Narathura pryeri*, n. sp.[1], *N. achelous* ♀ var., Hew., *Papilio prexaspes*, Feld., *P. evemon*, Bdv., *P. telephus*, Feld., *P. bathycles*, Zinck., *P. arycles*, Boisd., *P. agamemnon*, Linn., *Astictopterus sindu*, Feld.

HETEROCERA.

Amongst these are several beautiful new insects, as well as others which are by no means abundant in collections. No *Sphingidæ* are represented, but there is a lovely new *Zygænoid Arctiid*.

Chalcosiidæ.

Milleria ficta.

Cyclosia ficta, Walker, Journ. Linn. Soc. vi. p. 97 (1862).

Milleria pontioides, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. vii. p. 35 (1881).

Walker's description of this species is so bad that without examining the type it would be quite impossible to guess at its identity with *M. pontioides*.

Callamesia striata.

Amesia striata, Druce, Ann. & Mag. Nat. Hist. ser. 6, vol. vii. p. 142 (1891).

This species appears to be allied to *C. submaculans* of Walker (Journ. Linn. Soc. iii. p. 185, 1860). I have to thank Mr. Druce for identifying it for me as his species.

Chalcosia indistincta.

Chalcosia indistincta, Swinhoe, *in litt.*

One imperfect female.

Arctiidæ.

Mydrothauma, n. gen.

Nearest to *Eupyra*, the primaries a little narrower, the subcostal branches emitted regularly from the cell instead of branching off from the main nervure; the second and third median branches wider apart at their origins; the secondaries with strongly arched costal margins; three instead of two median branches; palpi extremely short and porrected, instead of very long and almost erect; tibial spurs also very short; abdomen much broader, flattened and tufted at the sides. From *Mydrodoxa*, to which it is also allied, it differs in its considerably narrower primaries with sinuous instead of arched inner margin; in the important point of

[1] Differs from *N. amphimuta*, to which it is allied and which it nearly resembles on the under surface, in its much inferior size and in the deep glistening ultramarine (rather than violet) blue colouring of the upper surface; the female, which is in the B.M. from Sarawak, has a much more restricted blue area, especially on the secondaries: expanse of wings, ♂ 43 millim., ♀ 40 millim.

the absence of an accessory cell, in the non-furcate subcostal branches, in the very important point of the absence of a costal vein to the secondaries, the simple instead of forked subcostal vein, the presence of a radial vein, which in *Mydrodoxa* is absent, and the more slender legs with better defined tibial spurs. Altogether, in spite of a similarity in the palpi of *Mydrodoxa* and *Mydrothauma*, the latter is decidedly more nearly allied to *Eupyra*. Type *M. ada*.

MYDROTHAUMA ADA, n. sp. (Plate VI. fig. 1.)

♂. Nearest to *M. semperi* (*Mydrodoxa semperi*, Druce, P. Z. S. 1885, p. 519, pl. xxxii. fig. 1), which is a true *Mydrothauma*, but far more beautiful; primaries above velvety greenish black, with three metallic violet spots forming an arched stripe across the base; a narrow band of gold with diffused greenish edges across the basal third, its inferior extremity not quite reaching the inner margin; the disk almost wholly occupied by two large unequal golden spots or patches with diffused greenish edges: secondaries intense sericeous black; the costal area greyish; a minute steel-blue spot at the end of the cell; a trifid subcuneiform hyaline patch divided by the second and third median branches: head and collar vivid carmine; thorax velvety black, the meso- and metathorax clothed at the sides with deep smoky brown hair: abdomen blackish brown, almost black, with velvety black lateral tufts; each segment marked with lateral metallic violet-blue dashes: wings below very like the under surface of *M. semperi*, excepting that they are blacker, the discocellular veinlets are defined by metallic blue instead of green spots, and the gold and green on the external area is much more extended; body below black, the legs and sides of venter spotted with metallic blue spots. Expanse of wings 48 millim.

A single example only of this charming novelty was captured by Mrs. Pryer, to whom (at her husband's request) I have dedicated it.

PHISSAMA VACILLANS.

Amphissa vacillans, Walker, Lep. Het. iii. p. 685. n. 1 (1855).

LITHOSIIDÆ.

CABARDA BIZONOIDES.

Lyclene bizonoides, Walker, Journ. Linn. Soc. vi. p. 111 (1862).

C. molliculana=*C. sequens* is perhaps only a variety of this species.

KATHA, sp. inc.

The single example is not perfect and therefore I hink it better not to describe it; it is like a small example of *K. intermixta*, Walk., from Southern India, but the face is greyer.

NYCTEMERIDÆ.

LEPTOSOMA INTEGRUM.

Nyctemera integra, Walker, Lep. Het. Suppl. v. p. 1879 (1866).

Originally described from a Philippine example.

LEPTOSOMA REGULARE.

Leptosoma regularis, Snellen, Veth's Midden-Sumatra, Lep. p. 34 (1880).

The specimen in the present collection differs from the typical form in the abbreviation of the outer marginal border of the secondaries on the upper surface.

LIPARIDÆ.

ADLULLIA GUTTULATA.

Euproctis guttulata, Snellen, Tijd. voor Ent. xxix. p. 36. n. 3, pl. 1. fig. 3 (1886).

One female.

Described from a Sumatran example.

ADLULLIA, n. sp., Swinhoe, *in litt.*

A slightly damaged female.

The generic term *Adlullia* of Walker takes precedence of *Chærotricha*, Felder, as in general use. Mr. Kirby, however, holds that the type of *Chærotricha* is synonymous with *Gogane*.

LIMACODIDÆ.

SCOPELODES VENOSA.

Scopelodes venosa, Walker, Lep. Het. v. p. 1105. n. 3 (1855).

A male example.

The female only was previously known to us from Silhet and "E. India"; the male now sent is very like that sex of *S. aurogrisea*, but the abdomen is more decidedly banded with black; the abdominal half only of the secondaries is ochreous and the primaries below are more distinctly veined with whitish.

The following appears to me to be a new genus of *Nycteolidæ*; the male, from Borneo, has been for some years in the Museum collection.

NYCTEOLIDÆ.

SIGLOPHORA, n. gen.

Allied to *Chandica*, primaries with nearly straight costa, slightly arched external margin and more strongly arched inner margin; a deep longitudinal groove behind the costal vein on the under surface; subcostal with four ordinary branches, the two last emitted from a long footstalk; the fifth branch emitted from the end of the cell close to the upper radial, the lower radial emitted near the third median and therefore looking like a fourth median branch: secondaries rather short, deeply excised in the male on the radial interspaces, merely angulated in the female; costal vein united to the subcostal

close to the base, separating from it at about the middle of the discoidal cell and running thence to apex; subcostal emitting two branches from the anterior angle of the cell; discocellular weak, inarched; radial emitted at the inferior angle of the cell; second and third median branches emitted from a long footstalk near to the radial: body robust, similar to that of *Chandica*; palpi long, thick, and compressed; antennæ, long, thick, simple; legs rather thick, the middle tibiæ armed with two unequal spurs, the inner ones very long; posterior tibiæ with four spurs. Type *S. bella*.

Siglophora bella, n. sp. (Plate VI. fig. 2.)

Basal three-sevenths of primaries bright lemon-yellow, ornamented by little irregular undulated lines and rings of blackish brown and bounded externally by a dark imperfect line; a costal patch beyond this area of the same colour and crossed by dark brown irregular lines; remainder of wing vinous brown in the male, rust-red in the female, varied by a few inconspicuous darker spots; a deeply dentated submarginal line of yellow—indistinct in the male, but sharply defined and partly bounded internally by black spots in the female; fringe vinous, sericeous, spotted with grey: secondaries with the basal half (♂) to third (♀) sericeous semitransparent white, tinted externally with yellow and bounded by a badly defined reddish band; remainder of wing vinous grey; fringe with a pale basal line: thorax bright yellow, varied with rust-red markings: abdomen bright rust-red, with a yellow spot in the centre of the basal segment, in the male specimen before me the sides and margins of the segments are pearly whitish (possibly owing to abrasion) and the anal tuft is blackish; on the under surface the defined markings have all disappeared; the yellow portions of the wings are softened down and the remaining area is grey, a reddish band separating the yellow from the grey areas: body below pearly white; palpi and fore tibiæ yellowish, banded with vinous grey. Expanse of wings, ♂ 24, ♀ 23 millim.

♂, Borneo, 1879 (coll. B.M.). ♀, Sandakan.

Notodontidæ.

Celeia, sp. inc.

A much broken example of a fine and apparently new species of this genus.

Careidæ.

Carea, n. sp.

Fragments of an unnamed species, shortly to be described by Col. Swinhoe, were in the collection.

Drepanulidæ.

Drapetodes nummularia.

Drapetodes nummularia, Snellen, Tijd. voor Ent. xxxii. n. 11, pl. 1. figs. 4, 4 *a* (1889).

A single female example.

AGNIDRA CARNEA, n. sp. (Plate VI. fig. 3.)

♂. Sericeous pale brownish flesh-colour, sparsely irrorated with blackish atoms, which are most abundant on the outer half of the secondaries: primaries crossed by two very indistinct oblique darker lines—the first before the middle, irregular, almost }-shaped, the second regular, discal, more oblique, elbowed below apex; a submarginal series of rosy spots on the veins: secondaries with two whitish stigmata on the discocellulars; under surface rosy flesh-coloured, veins ochraceous; wings sprinkled with black atoms; primaries crossed by an oblique grey discal stripe, which is vaguely continued by the black atoms across the secondaries; fore tibiæ scarlet. Expanse of wings 35 millim.

Although the apices of the primaries are broken the specimen of this very distinct species in the collection is sufficiently perfect for description.

BOMBYCIDÆ.

ERNOLATIA SIGNATA.

Ernolatia signata, Walker, Journ. Linn. Soc. vi. p. 131.

One female.

A discoloured male in the Museum from Java is named "*Ocinara lida*," Moore.

CARADRINIDÆ.

PRODENIA LITTORALIS.

Hadena littoralis, Boisduval, Faune Ent. de Madag. p. 91. n. 2, pl. 13. fig. 8.

CALLOPISTRIIDÆ.

I have waded laboriously through Walker's long paper on the Lepidoptera of Sarawak in the 'Journal of the Linnean Society' without being able to identify the three following species with certainty; the first, however, is probably his *Eutelia*? *consentanea*, and therefore I so name it, although it is not a *Eutelia* but belongs to a new genus allied to *Hyperdasys*.

PACHYDASYS, n. gen.

Primaries with straight costa, rectangular apex, and obtusely angulated outer margin; palpi broad, obliquely ascending, compressed, terminal joint short; antennæ of male subserrate, fasciculated: all the femora and tibiæ and the tarsi of the hind legs very broadly fringed and clothed with coarse hair-scales.

PACHYDASYS CONSENTANEA. (Plate VI. fig. 5.)

♀. *Eutelia*? *consentanea*, Walker, Journ. Linn. Soc. vii. p. 68. n. 313 (1864).

One male example.

PLATYDASYS, n. gen.

Allied to the preceding genus and to *Cotanda*; the wings of the same form as in *Dissolophus*; the antennæ most like those of *Cotanda* but thicker, the femora and tibiæ of all the legs and the tarsi of the middle and hind pairs very densely clothed with coarse hair-scales. Type *P. pryeri*.

PLATYDASYS PRYERI, n. sp. (Plate VI. fig. 6.)

Sepia-brown with faint roseate reflections; the primaries with black and white lines and spots almost exactly as in the European *Methorasa latreillei*; but the reniform spot is larger and more indented in front, and the pink hastate spot immediately beyond the sinuous black-edged white discal line and situated upon the upper radial vein is much less prominent, so that it is scarcely distinguishable from the remaining portion of the pale stripe bounding the external edge of the discal line. Expanse of wings 34 millim.

♂, Sarawak; ♀, Labuan. In coll. B.M.

A fragment of the female was obtained by Mr. Pryer in Sandakan. This species should be among the insects described by Walker; but, if so, the description is not good enough to render its identification possible.

PŒCILOGRAMMA, n. gen.

Nearest to *Gnamptocera*, but in the pied character of its markings very dissimilar, superficially, from any of the allied genera; antennæ normal in character, with short sparse ciliations; palpi broad, compressed, curved obliquely upwards, with short terminal joint; collar and tegulæ ample; metathorax with prominent central crest; basal segment of abdomen probably tufted; legs long, the front tibiæ broad, the external edge being densely fringed with coarse scales; femora of middle pair of legs flattened and grooved, the tibiæ densely clothed with hair and with two long terminal spurs; posterior legs almost naked, the tibiæ with the usual spurs. Type *P. picata*.

PŒCILOGRAMMA PICATUM, n. sp. (Plate VI. fig. 4.)

Primaries above sepia-brown, spotted and streaked with black, the internal area whity brown; base white, marked with two black spots, an oblique bisinuated white stripe from the base of the costa to an oblique white band across the basal two-fifths of the wing, the latter band is traversed by a black line and is angulated at its costal extremity; an oblique white streak from the apex, interrupted by the reniform spot, which is white, oval, and encloses two unequal black spots, and the postmedian stripe, which is white, internally edged with black, zigzag and very irregular, a slightly sinuous white submarginal stripe, connected on the second median interspace by a white spot, with a marginal series of internally white-edged black dashes; fringe whitish, spotted with grey: secondaries grey, with diffused darker external border: head and collar blackish, partly

white-edged; mesothorax buff, speckled with black; tegulæ and metathorax white, spotted and speckled with black; abdomen whitish with grey dorsal spots: primaries below smoky grey, with dull white inner margin; costa partly whitish; an indistinct transverse dark postmedian stripe and a subapical pure white spot: secondaries whitish irrorated with grey scales; a black crescent at end of cell followed by an arched discal grey stripe and a diffused grey external belt which tapers towards anal angle; body below whitish, palpi brownish, fore and middle tibiæ white barred with blackish. Expanse of wings 33 millim.

A single male example, with slightly damaged abdomen, but otherwise in good condition.

Homopteridæ.

Homoptera cruegeri.

Homoptera cruegeri, Butler, Trans. Ent. Soc. 1886, p. 411. n. 51.

Evidently a very wide-ranging species.

Catephiidæ.

Melipotis cyllaria.

Phalæna (Noctua) cyllaria, Cramer, Pap. Exot. iii. pl. 251. figs. C, D (1779).

This species, which varies greatly in the coloration of the primaries (like the other species of *Melipotis*), is identical with *M. cyllota* and *M. signivitta*. *Achæa purpureilinea*, Walk., is probably the same species.

Ophideridæ.

Ophideres fullonica.

Phalæna-Noctua fullonica, Linn. Syst. Nat. p. 812. n. 16.

Ophideres aurantia.

Ophideres aurantia, Moore, Proc. Zool. Soc. 1877, p. 607.

Phyllodidæ.

Potamophora manlia.

Phalæna-Noctua manlia, Cramer, Pap. Exot. i. p. 144, pl. 92. fig. A (1779).

The variability of this species is well known; one of Mr. Pryer's specimens is very pretty, the reniform spot and a stripe connecting it with the inner margin being bright ochreous: we have one similar example from Darjiling.

Lygniodes maurus, Staud.

An imperfect example of a fine species allied to *L. endoleuca*, but with the fringes and the abdominal area of the secondaries bright ochreous. Mr. Druce has received examples of this species from Dr. Staudinger with a name above given, but I am not certain that it has been published.

DYSGONIIDÆ.

LAGOPTERA HONESTA.

Thyas honesta, Hübner, Samml. exot. Schmett. ii., Lep. iv., Noct. iii. figs. 1, 2.

LAGOPTERA MAGICA.

Corycia magica, Hübner, Samml. exot. Schmett. Zutr. figs. 535, 536.

OPHIODES DISJUNGENS.

Othiodes (sic) *disjungens*, Walker, Lep. Het. xiv. p. 1360 (1857).

PINDARA ILLIBATA.

Noctua illibata, Fabricius, Syst. Ent. p. 592. n. 8 (1775).

OPHISMA INVERSA.

Ophisma inversa, Walker, Lep. Het. xiv. p. 1384. n. 34 (1857).

ACHÆA FASCICULIPES.

Achæa fasciculipes, Walker, Lep. Het. xiv. p. 1400. n. 20 (1857).

SERRODES CAMPANA.

Serrodes campana, Guenée, Noct. iii. p. 252. n. 1673 (1852).
An unusually lilacine example.

DYSGONIA FULVOTÆNIA.

Ophiusa fulvotænia, Guenée, Noct. iii. p. 272. n. 1710 (1852).

AMPHIGONIIDÆ.

AMPHIGONIA COMPRIMENS.

Amphigonia comprimens, Walker, Lep. Het. xv. p. 1540. n. 5 (1858).

THERMESIIDÆ.

PLATYJA UMMINEA.

♀. *Phalæna-Noctua umminea*, Cramer, Pap. Exot. iii. pl. 267. fig. F (1782).
Ginæa removens, Walker, Lep. Het. xv. p. 1638. n. 1 (1858).
♂. *Sympis subunita*, Guenée, Noct. iii. p. 344. n. 1810 (1852).
Cotuza drepanoides, Walker, l. c. p. 1552. n. 1 (1858).
Both varieties of this species were obtained by Mr. Pryer.

CAPNODES MACULICOSTA.

Capnodes? maculicosta, Walker, Lep. Het. xv. p. 1608. n. 19 (1858).

Herminiidæ.

Amblygoes oileusalis.

Herminia oileusalis, Walker, Lep. Het. xvi. p. 116. n. 38.
Madopa ? quadristrigata, Snellen, Tijd. voor Ent. 1877, p. 73, pl. 5. fig. 7.

Pyrales.

Stericta divitalis.

Glossina divitalis, Guenée, Delt. et Pyral. p. 124. n. 20.

Arthroschista hilaralis.

Margaronia hilaralis, Walker, Lep. Het. xviii. p. 532. n. 33 (1859).

Sylepta iopasalis.

Botys iopasalis, Walker, Lep. Het. xviii. p. 652. n. 182 (1859).

Mesanchyla illectalis.

Desmia ? illectalis, Walker, Lep. Het. xix. p. 931 (1859).

Talanga sexpunctalis.

Oligostigma sexpunctalis, Moore, Proc. Zool. Soc. 1877, p. 616, pl. 60. fig. 12.

Dichocrocis pandamalis.

Botys pandamalis, Walker, Lep. Het. xix. p. 999 (1859).

Siculodidæ.

Durdara ovifera, n. sp. (Plate VI. fig. 7.)

Nearest to *D. fenestrina*, but differing from all the named forms of the genus in its grey coloration above and in having an oblique oval hyaline spot near the base of the first median interspace of the primaries; the outer half of the fringe of the secondaries is white; the primaries below are almost wholly glaucous grey, with white internal border, and in the secondaries the costa and veins are greyish; the palpi are even longer than in *D. plagifera*, and are whitish internally and along their inferior margins. Expanse of wings 28 millim.

Mr. Meyrick says (Trans. Ent. Soc. 1887, p. 185) that "*Microsca plagifera* is a variety of *Striglina myrtæa*, Drury (=*fenestrina*, Feld., and *fenestrata*, Gn.), with the spot (which varies very much and is sometimes absent) unusually large. With every wish not to admit too many species, I cannot conceive that Mr. Meyrick is correct in this assertion; for, however much a spot on the wing may vary in size and shape, it appears highly improbable that the palpi would follow suit, and assuredly there is little resemblance between the palpi of *D. fenestrina* and *D. plagifera* (which I described as a *Microsca*). Our example of *D. fenestrina* is a female, and so far as can be judged from the type of *D. plagifera*, in which the frenulum

on one side is concealed and on the other broken, the latter is of the same sex; it has the last joint of the palpi much more slender and of nearly twice the length of that of *D. fenestrina*.

When it is proved beyond question, by careful breeding, that dissimilar forms are varieties of one and the same species, the sooner they are put together the better; but this guesswork, especially when concealed under the guise of an authoritative declaration, is a positive hindrance to the acquirement of accurate knowledge. In many cases where Mr. Meyrick has stated his conviction that a long series of described forms belong to one variable species, he has been subsequently obliged to alter his opinion; surely he cannot claim that his first action advanced science, since he must know of a truth that it only retarded it.

DURDARA ROBUSTA.

Durdara robusta, Warren, *in litt.*

The type of Mr. Warren's unpublished description is from Sarawak; it is just possible that Walker may have described it as an *Anisodes* or a *Capnodes* in his Supplement, or in one of the papers published in the Linnean Journal; but I cannot venture to attempt its identification.

PHARAMBARA VINOSA, n. sp. (Plate VI. fig. 8.)

Pale vinous-brown; wings reticulated with darker brown: primaries crossed by six imperfect darker bands, the outer edges of which, and the inner edge of the third one, are defined by blackish lines; the fourth and fifth lines are inarched towards the costa; the sixth, which is submarginal, is abbreviated and cuts off the apical half of the external border; on the secondaries there are about three black-edged, ill-defined, abbreviated bands from the costa, the central one is acutely elbowed and bounded on each side near the centre of the wing by a hyaline, subquadrate, white spot; on the under surface all the markings are more sharply defined, and on the primaries is a subcostal, basal, shining, pearly tuft covering the base of the frenulum. Expanse of wings 26 millim.

A single male example.

The species does not appear to be very closely allied to any named form.

URAPTERYGIDÆ.

SYNGONORTHUS, n. gen.

Allied to *Gonorthus*: of the same form and with similar neuration; but the male antennæ much shorter and with very short fine ciliations instead of being strongly pectinated.

SYNGONORTHUS SUBPUNCTATUS, n. sp. (Plate VI. fig. 9.)

Pale creamy straminecous, slightly sericeous; the wings irrorated with greyish argillaceous; the primaries crossed by two nearly parallel, straight, transverse stripes of the same colour; outer margin and fringe forming a third stripe rather more ferruginous in tint;

costal margin narrowly ochraceous, speckled with blackish: secondaries with only a discocellular spot to represent the inner stripe of the primaries, but with a well-defined subangulated outer stripe from outer fourth of costa to inner margin, close to anal angle; marginal stripe blacker than on the primaries: head and collar rufous-brownish: wings below without irrorations, but crossed by a straight discal series of blackish spots on the veins; primaries tinted with pink, with a transverse blackish dash on the discocellulars; pectus whitish. Expanse of wings 38 millim.

This very distinct species is unfortunately only represented by one imperfect specimen; it is, however, so unlike anything else that I have seen or of which I can find a description, that I have no hesitation in naming it.

Boarmiidæ.

Elphos hymenaria, var.

Elphos hymenaria, Guenée, Phal. i. p. 285. n. 446, pl. 16. fig. 4 (1857).

The single female obtained by Mr. Pryer has lost the white patch upon the secondaries.

Terpnidia nelearia.

Hypochroma nelearia, Guenée, Phal. i. p. 279. n. 444 (1857).

Hypochroma netunaria?

Hypochroma netunaria, Guenée, Phal. i. p. 279. n. 445 (1857).

The two examples, both females, seem to agree fairly well with the description of this species.

Hypochroma vitticosta.

Hypochroma vitticosta, Walker, Lep. Het. xxi. p. 438. n. 25 (1860).

A male example in good condition.

I have to thank Col. Swinhoe for the identification of this species; he tells me that the type from Sarawak is somewhat faded.

Ascotis selenaria.

Geometra selenaria, Schiffermüller, Wien. Verz. p. 101; Hübner, Geom. pl. 31. fig. 163.

A damaged female only was obtained.

Zerenidæ.

Panæthia georgiata.

Panæthia georgiata, Guenée, Phal. ii. p. 196. n. 1243.

Naxa textilis.

Naxa textilis, Walker, Lep. Het. vii. p. 1743 (1856).

EUSCHEMIDÆ.

EUSCHEMA DOUBLEDAYI.

Hazis doubledayi, Snellen, Tijd. voor Ent. xxvii. pp. lxxxii and 96–98 (1884).

IDÆIDÆ.

CHRYSOCRASPEDA VINOSA.

Chrysocraspeda vinosa, Warren, *in litt.*

A beautiful little bright yellow species, maculated and banded with plum-colour; it is to be hoped that a description of it will soon be published.

A much-worn example, apparently of a true *Idæa*, new to the Museum collection, was also obtained by Mr. Pryer.

MESOSTROPHE OVISIGNATA.

Anisodes ovisignata, Moore, Lep. Ceylon, iii. p. 444 (1884–7).

The specimen from Sandakan agrees perfectly well with the Ceylonese type.

CABERIDÆ.

MARESIA ? UNDIFASCIATA, n. sp. (Plate VI. fig. 10.)

Basal area of wings white, speckled with black and transversely striated with pearl-grey; remainder of wings pearl-grey, striated with white and crossed to near costa by white-edged, zigzag, dark brown stripes, three on the primaries and two on the secondaries, also by a submarginal stripe, slightly waved on the primaries, but distinctly zigzag on the secondaries, the third and sixth angles filled in so as to form blackish, more or less triangular spots; a slender, slightly zigzag, black marginal line; fringe, excepting along the abdominal margin of the secondaries, very short: head and collar blackish; thorax white, speckled with black; abdomen wanting: under surface pale pearl-grey; the disk of the wings crossed by two subparallel darker grey bands, enclosing a white belt; the outer band angulated on the primaries; legs silvery whitish. Expanse of wings 33 millim.

I have been unable to find any description or figure of this lovely little moth; judging by the descriptions alone, it would seem to be allied to *Acidalia destituta* and *Maresia binotata*, described by Walker from specimens coming from Sula and in Mr. Saunders's collection.

MACARIIDÆ.

PLUTODES CYCLARIA.

Plutodes cyclaria, Guenée, Phal. ii. p. 118. n. 1111, pl. 20. fig. 3.

TRYGODES DIVISARIA.

Macaria divisaria, Walker, Cat. Lep. Het. xxiv. p. 107 (1861).

Micronidæ.

Acropteris leptaliata.

Micronia leptaliata, Guenée, Phal. ii. p. 28. n. 935.

Pseudomicronia cœlata.

Pseudomicronia cœlata, Moore, Descr. Lep. Atk. p. 257 (1887).

Eumeleidæ.

Eumelea ludovicata.

Eumelea ludovicata, Guenée, Phal. i. p. 393. n. 629 (1857).

Geometridæ.

Ornithospila submonstrans.

Geometra submonstrans, Walker, Lep. Het. xxii. p. 526. n. 36 (1861).

Ornithospila cincta.

Geometra cincta, Walker, Lep. Het. xxii. p. 527. n. 38 (1861).

This species is of the same size and general colour as the preceding, but differs in the nearly straight instead of distinctly dentate-sinuate dark green lines across the wings and in the uniformly vinous-coloured fringes.

Comibæna megaspilaria.

Phorodesma megaspilaria, Guenée, Phal. i. p. 371. n. 593.

Zamarada, n. sp.

One much shattered example of an apparently new species; its condition unfits it for description.

Hyblæidæ.

The position of this family is somewhat doubtful; the aspect of the species forcibly reminds one of the Tortrices, but the neuration does not altogether correspond with that of the *Tortricidæ*; at the same time the *Hyblæidæ* do not appear to be true Noctuites.

Hyblæa constellata.

Hyblæa constellata, Guenée, Noct. ii. p. 391. n. 1251.

EXPLANATION OF PLATE VI.

Fig. 1. *Mydrothauma ada*, p. 122.
2. *Siglophora bella*, ♀, p. 124.
3. *Agnidra carnea*, p. 125.
4. *Pœcilogramma picata*, p. 126.
5. *Pachydasys consentanea*, p. 125.
6. *Platydasys pryeri*, p. 126.
7. *Durdara ovifera*, p. 129.
8. *Pharambara vinosa*, p. 130.
9. *Syngonorthus subpunctatus*, p. 130.
10. *Maresia? undifasciata*, p. 132.

2. Third Account of the Fishes obtained by Surgeon-Major A. S. G. Jayakar at Muscat, East Coast of Arabia[1]. By G. A. Boulenger.

[Received January 19, 1892.]

Two further collections received from Mr. Jayakar in 1891 enable me to supplement the list of Muscat Fishes with the names of seventeen species, of which one (*Histiopterus typus*) belongs to a genus previously unknown from the Indian Ocean.

TELEOSTEI.

Acanthopterygii.

Percidæ.

1. Serranus hoevenii, Blkr.

2. Histiopterus typus, Schleg.

This fish is on record from Japan only; but a fine specimen from Duke-of-York Island is preserved in the British Museum. The genus *Histiopterus* is an important addition to the fauna of the Indian Ocean, and it seems surprising that so striking a form should have hitherto escaped notice on the coasts of India and Ceylon, where it will no doubt be eventually found.

Sparidæ.

3. Box lineatus, sp. n.

D. $\frac{13}{14}$. A. $\frac{3}{14}$. L. lat. 70. L. tr. $\frac{5}{13}$.

Length of head a little more than one fourth of the total (without caudal); diameter of the eye a little greater than the length of the snout, two sevenths the length of the head. Pectoral three fourths the length of the head. Depth of the body thrice and one third in the total length (without caudal). Caudal deeply forked. Upper half of body greyish olive, lower half yellow; four rather indistinct dark lines along each side of the body, the uppermost running along the lateral line; a black spot in the upper axillar portion of the pectoral.

Total length 250 millim.

A single specimen.

This species is very nearly related to the Atlantic and Mediterranean *Box vulgaris*, from which it differs in the deeper body, the somewhat larger scales, and the slightly different number of rays. The fin-formula and the axillar spot differentiate it from Cuvier and Valenciennes's *B. salpoides*, stated to be from the Indian Ocean.

4. Pimelepterus fuscus, C. & V.

[1] *Cf.* P. Z. S. 1889, pp. 236–246.

SCIÆNIDÆ.

5. SCIÆNA SINA, C. & V.

SCOMBRIDÆ.

6. THYNNUS ALBACORA, Lowe.

Thynnus macropterus, Schleg.

Several large Tunnies sent by Mr. Jayakar belong to this species, being undistinguishable from Atlantic specimens. In my first report I recorded the true Tunny, *T. thynnus*, from Muscat. And if I am right in not separating the Pacific *T. macropterus* from the Albacore, it must be admitted that both the true Tunny and the Albacore roam over the Atlantic, Indian, and Pacific Oceans.

In the Indian Ocean *T. thynnus* must be by far the rarer of the two species, since it was not on record until discovered at Muscat by Mr. Jayakar.

CARANGIDÆ.

7. CARANX ROTTLERI, Bl.

8. CARANX LIOGLOSSUS, Gthr.

A specimen 29 inches long. It differs from the much smaller specimens described by Bleeker as *Lioglossus carangoides* in the total absence of teeth, the still greater projection of the lower jaw, and the very small extent of the scaleless portion of the breast. The differences are, however, ascribable to age; and I have not the slightest hesitation in referring this large example to the species described by Bleeker, of which a type specimen is now in the British Museum.

9. LACTARIUS DELICATULUS, C. & V.

PHYSOSTOMI.

CYPRINIDÆ.

10. DISCOGNATHUS LAMTA, Ham. Buch.

This well-known Indian freshwater fish has been previously recorded from Aden, in Arabia. It is also found in Abyssinia.

MURÆNIDÆ.

11. MURÆNA AFRA, Bl.

CHONDROPTERYGII.

CARCHARIIDÆ.

12. CARCHARIAS ACUTUS, Rüpp.

13. CARCHARIAS ELLIOTI, Day.

This Shark is very closely allied to *C. murrayi*, Gthr.; but differs

in having the upper teeth narrower and more oblique, and the snout longer, the distance between the mouth and the end of the snout being equal to the width of the mouth. Fig. 2 on pl. 189 of Day's 'Fishes of India' refers to *C. acutidens*, whilst fig. 1 represents *C. ellioti*.

14. Carcharias lamia, Risso.

Rhinobatidæ.

15. Rhynchobatus ancylostomus, Bl. Schn.

Trygonidæ.

16. Trygon sephen, Forsk.

17. Tæniura melanospila, Blkr.

3. Descriptions of Three new Species of Earthworms. By W. Blaxland Benham, D.Sc. (Lond.), Aldrichian Demonstrator in Anatomy in the University of Oxford[1].

[Received February 1, 1892.]

(Plates VII. & VIII.)

In July of last year (1891) I received from Professor Jeffrey Bell three bottles containing Earthworms which had been presented to the National Collection. With the permission of Dr. Günther, I was allowed to make an examination of these specimens, and to treat them in any way necessary for their identification.

I wish to express my thanks to Dr. Günther for this privilege, and to record my appreciation of Prof. Bell's kindness in allowing me to examine many Earthworms which from time to time have come into his hands for identification.

The contents of the bottles were as follows:—

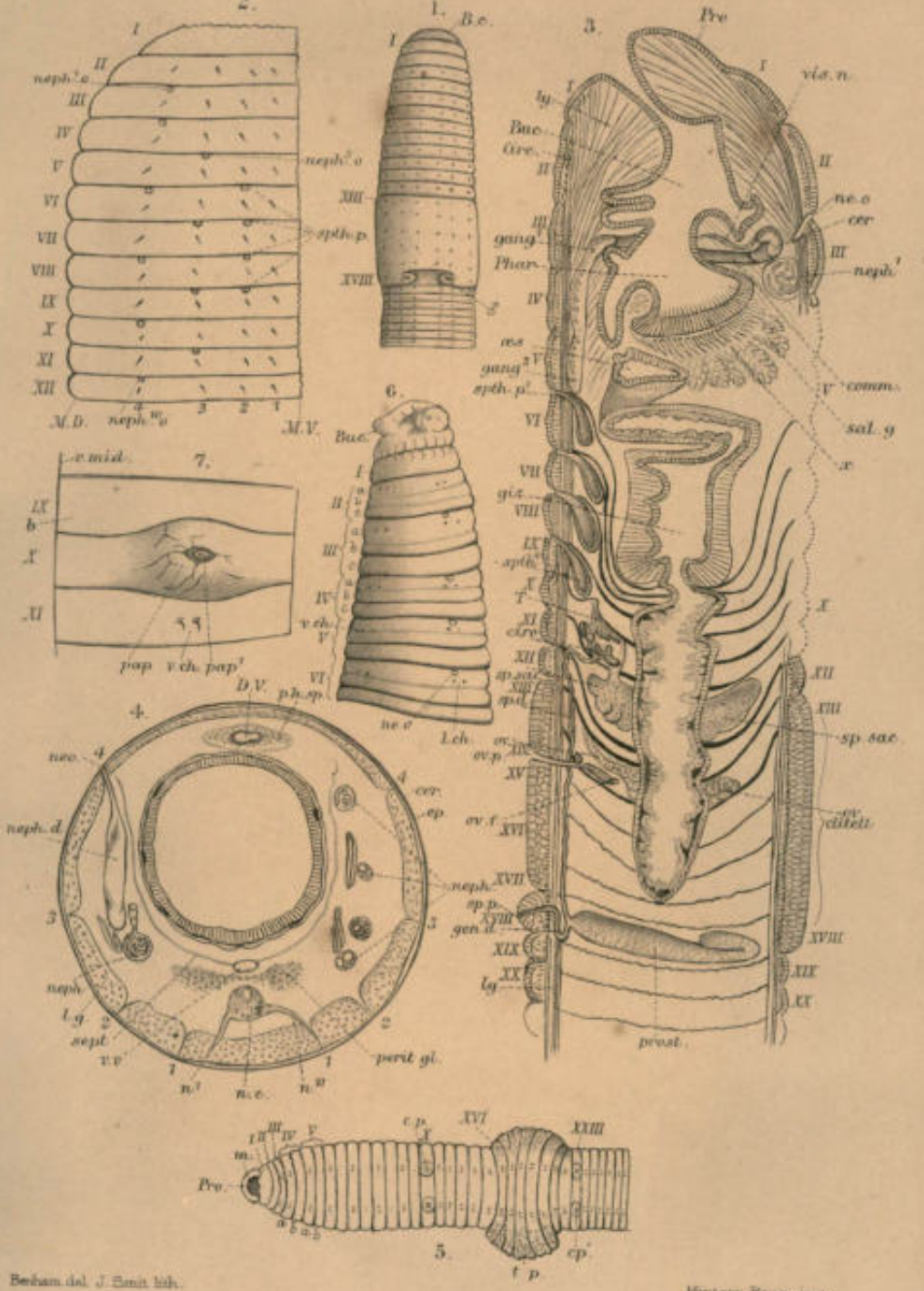
A. Three small worms [*Plutellus perrieri*, n. sp.] collected at Masset, Queen Charlotte's Island, British Columbia. Presented by the Rev. T. H. Keen.

B. A single specimen [*Microchæta papillata*, n. sp.] from Port Natal. Collected and presented by H. A. Spencer, Esq.

C. A single specimen [*Microchæta belli*, n. sp.] from East London, Cape Colony. Collected and presented by H. A. Spencer, Esq.

A. In the bottle from Queen Charlotte's Island were three worms, two mature and one apparently immature; the latter I cut into a series of transverse sections after the examination of one of the mature forms, under the impression that it belonged to the same

[1] Communicated by Frank E. Beddard, M.A. Oxon., Prosector to the Society.



NEW SPECIES OF EARTHWORMS.



Bentham. del. J. Smit. lith.

Mintern Bros. imp.

NEW SPECIES OF EARTHWORMS.

species as the other two, but I find that it is an Enchytræid, the anatomy of which, however, I have not yet worked over.

Of the two other specimens one remains entire, and was returned to the British Museum, the drawing of the external surface (Plate VII. fig. 1) being taken from it; the second was partially cut into sections—after being opened and examined—the anterior twenty somites being cut sagittally, the posterior portion transversely.

The chief characters of the worm may be summed up as follows:—

(1) The eight *chætæ* are isolated, though they are not all equidistant.
(2) The *clitellum* is complete, and occupies somites xiii. to xviii.
(3) The *male pores* are on somite xviii.
(4) The *nephridiopores* alternate in position, one series being in line with the chætæ "3," the other with the chætæ "4."

There are (5) one pair of *testes* in somite x.; (6) one pair of *sperm-sacs* in somite xi.; and (7) four pairs of *spermathecæ*, without diverticula, in somites vi., vii., viii., and ix.

(8) The cylindrical *prostate* lies in somite xviii.
(9) The *gizzard* occupies somite v.; there are no definite œsophageal diverticula.

The Earthworm which appears to agree most clearly with this diagnosis is *Plutellus heteroporus*[1] from Pennsylvania; but this worm, according to Perrier's description, presents two very striking anomalies, which do not occur in the present instance: (*a*) the nephridia are entirely confined to one somite, *i. e.* the funnel does not perforate the septum; (*b*) the "ovary" is placed anteriorly to the testes.

But these two peculiarities are anomalous, not amongst Earthworms only but amongst all the *Oligochæta*; the post-septal position of the nephridiostome is indeed totally at variance with the arrangement met with throughout the whole group of *Chætopoda*; hence, we must look with very great suspicion on these supposed characters, and indeed Perrier himself, in writing of the presumed "ovary" in the tenth somite, recognizes its abnormal position and expresses himself, not only with great caution, but also with a good deal of doubt—"Mais nous devons dire qu'à cet égard notre conviction est loin d'être aussi complète qu'en ce qui concerne les testicules."

Most zoologists working on this group have thrown doubts on the accuracy of these supposed facts, and this without impugning the carefulness of M. Perrier, for he had two specimens only, and these, having lain in spirit for 50 years and more, were in a very bad condition of preservation; moreover, his statements were drawn from observations on the dissected specimens, which are not so likely to be correct as those obtained from examination of serial sections.

We must then remove these two characteristics from the diagnosis of the genus *Plutellus*, and thereby we bring the worm into accord with what has become regarded as the normal condition of things.

I believe the worm which forms the subject of this communication

[1] Ed. Perrier, Arch. de Zool. Expér. ii. 1873.

belongs to Perrier's genus, and name it after that zoologist. I shall reserve certain histological points for later consideration.

PLUTELLUS PERRIERI, n. sp.

It has a length of 2 inches (50 mm.) and a comparatively great diameter—namely a little more than $\frac{1}{6}$ inch (4 mm.); the length of the clitellum is 4 mm., and the distance from its anterior margin to the tip of the prostomium is 7 mm.[1] There are 126 somites in the specimen which remains uninjured; they are all well marked and are only obscurely annulated. The two extremities of the worm are rounded, obtuse, and not noticeably attenuated, and at the posterior extremity the body is slightly dilated.

The *prostomium* is distinct and completely dovetailed into the buccal somite, as it is in *P. heteroporus*.

The *clitellum*, when the worm is fully developed, extends all round the somites xiii. to xviii., with the exception of the median ventral region of the last somite and a short portion of the first somite.

The intersegmental grooves are entirely obliterated and the anterior and posterior boundaries are very sharply defined. In the specimen dissected, where the clitellum was not so fully developed, the ventral surface of the somites was less glandular and the grooves less obliterated than in the entire specimen, and a pair of papillæ exist on somite xviii. between the chætæ "1" and "2." In the fully matured form, the glandular modification of this somite extends ventrally so as to become continuous with these papillæ, which are then no longer evident.

[In *P. heteroporus* the clitellum is also complete, occupying somites xiv. to xvii., but overlapping the anterior part of somite xviii.]

The *chætæ*, eight in number, are isolated; the ventralmost—constituting the series of chætæ "1"—on each side is close to the middle line; if the space between "1" and "2" be taken as the unit, represented by *S*, the space between the ventral chætæ of the two sides is 2*S*, that between the second and third is $1\frac{1}{2}S$, that between "3" and "4" is 2*S*, and the dorsal area, between the dorsalmost chætæ of the two sides, is 5*S*; the chætæ "4" lie dorsally (Plate VII. figs. 2 and 4). Posteriorly the space "1–2" is slightly greater than it is anteriorly; and anteriorly to the clitellum, space 1–1 is less than it is posteriorly.

[In *P. heteroporus* the chætæ are equidistant, but posteriorly the dorsal and ventral spaces are a little greater than the lateral spaces, and spaces 1–2 and 3–4 are a little less than anteriorly.]

The chætæ themselves are of the usual lumbricid form, without ornamentations; there are no modified, copulatory chætæ of any sort.

The *nephridiopores* are not visible externally in my specimens, which are very well preserved, and the segments probably a good deal closer together than in life; but I find from my longitudinal sections that they have the following arrangement (Plate VII. figs. 2 & 4):—The first pore lies on the anterior margin of somite iii., and,

[1] These figures for *P. heteroporus* are 15 cm. as length of body, 6 mm. as length of clitellum, and 4 mm. as its distance from the extremity of the body.

like the pore of the next somite, is in line with the chætæ "4"; the pores in somites v., vii., ix., xi., xiii., xv., &c. are in line with chætæ "3"; those of the even-numbered somites are in line with chætæ "4"; but in the case of somites vi., viii., x., xii., I did not actually *see* the pores, as the dorsal body-wall in this region of the body had been injured in dissecting the worm, but there is no pore in either of these somites in line with either of the other chætæ.

[In *P. heteroporus*, the nephridiopores of somites iii., iv., v., vi. are in line with the third chætæ, those of vii., ix., xi., &c. with the fourth chætæ, and those of viii., x., xii., &c. with the second chætæ, with some divergence from regularity in certain somites.]

The *male pores* are on somite xviii., just between the first and second chætæ; but in the immature specimen, as I have mentioned, there is a pair of papillæ in this position, which carry the pores; the papillæ in the fully developed individual being continuous with the rest of the glandular modification of the clitellum.

With regard to *P. heteroporus*, Perrier states (p. 255) "il nous semble que les orifices mâles étaient accompagnés chacun d'une papille en avant et en arrière," but owing to the state of preservation of the worm he was uncertain on the point. The figure (Plate VII. fig. 1) which accompanies the present paper might suggest these papillæ, but the slight pit represented between somites xvii. and xviii. is not the male pore, which lies on the slight papilla *on* somite xviii.

I was unable to see the pores in somite x. which Perrier regarded as those of his "oviducts"; they, in fact, do not exist in the present worm. With regard to these pores, his figures are not in agreement with one another.

The spermathecal pores (which are in line with chætæ "2," at the anterior margin of somites vi. to ix.) and oviducal pores (on somite xiv.) are not visible in surface view.

There appear to be no dorsal pores; this is one of the few points in which my specimen differs from *P. heteroporus*.

Internal Anatomy.

The *septa* bounding posteriorly each of the somites v. to xi. are considerably pouched centrally, so that the organs in these somites are carried backwards in such a way that they appear to occupy a more posterior position than they actually have; the septa behind the somites viii. to xii. are slightly stronger than the others (Plate VII. fig. 3).

The *nephridia* conform to the usual type; the coiled tube presenting the three regions which I have described[1] in those of *Lumbricus* and which appear to be pretty generally present in "meganephric" Earthworms.

The muscular region or "bladder" is very large, and differs in size in the two series of nephridia. The funnel has the normal structure and position—*i. e.* it is præseptal.

The *genital organs* have the following arrangement, as determined

[1] "The Nephridium of *Lumbricus*," Quart. Journ. Micr. Sci. xxxii. p. 294.

by dissection, controlled by examination of a series of longitudinal sections.

A single pair of testes lies in somite x. enclosed with the ciliated rosettes in a special sac, continuous below the gut from side to side, and with the sperm-sacs in the following somite; of the latter there is but one pair in the specimen examined—which, it must be remembered, may not have been *quite* mature; they do not extend into either of the neighbouring somites, but are entirely contained in somite xi. (Plate VII. fig. 3, *sp. sac*).

[In *P. heteroporus*, Perrier places the "testicules," *i. e.* sperm-sacs, in somite xii.]

The sperm-ducts were traceable to somite xviii., in which lies a pair of prostates (*Prost.*, fig. 3). Each prostate is cylindrical, and curved upwards, so that the free end, which is slightly recurved, lies above the gut, the ventral end is continued as a narrow muscular duct (*gen. d.*) along the body-wall to the external pore; this "genital" or penial duct receives the sperm-duct immediately after its origin from the glandular portion of the organ.

The prostates are entirely confined to their somite, and their histological structure agrees with that of *Perichæta* and other worms.

[In *P. heteroporus* the gland is several times bent, as in *Acanthodrilus*, and is wider ventrally, where the penial duct originates.]

A pair of ovaries lies in somite xiii. (Plate VII. fig. 3, *ov.*), and the oviducts have the usual position. The gonad is fairly large, and in section is seen to occupy the greater part of the cavity of the somite, extending upwards and outwards on each side.

I may again remark that I find no structures in somite x. which would answer to Perrier's "ovaries"; indeed, he himself felt uncertain as to the correctness of his interpretation of these grape-like glands, and suggested that they might be an anterior pair of "testicules" (sperm-sacs). He remarks, however, that their structure differs from that of the sperm-sacs in somite xii. and states (on p. 259): "Ce sont des grosses granulations réfringentes, groupées de manière à constituer des sphères, au centre desquelles nous avons vu souvent *une apparence* de vésicule transparente et des taches germinatives," but adds his doubt on the matter of interpretation which I have quoted above; there is, indeed, nothing in his description which leads me to believe that these structures are ovaries, and when he mentions that a large funnel, like that of the sperm-duct, lies below this organ—*i. e.* in the position in which I find the ciliated rosettes—I think we may conclude that these organs, whatever they may be, are *not* ovaries.

It is possible, indeed, that they are masses of young stages in the development of spermatozoa, which have become free in this somite, or a portion of the sperm-sac, which after rupture of the septa might come to lie here, or again cysts of *Monocystis*.

As to the organs which he described as "testicules" in somite xii., there is little doubt but that he was dealing with the sperm-sacs, for he found "spermatiques filaments" attached to central

spheres, and younger stages in the development of spermatozoa, though their position in this somite is rather difficult to explain, except on the idea that the septa, here delicate, may have become ruptured or displaced in dissection. But Perrier was a very careful dissector, and he had had great experience in the dissection of Earthworms, so that it is scarcely justifiable to suggest a mistake in the matter.

In *P. perrieri* there are four pairs of spermathecæ lying in somites vi. to ix.; each is an ovoid sac, without any distinct neck or duct and without a diverticulum (Plate VII. fig. 3, *spth.*). Each sac opens at the anterior margin of its somite—practically intersegmentally—in a line with the second chætæ.

[In *P. heteroporus* there are five pairs, the additional pair being in somite v.; each sac has a diverticulum.]

I may add that in the genus *Perichæta* we find species with and species without diverticula to the spermathecæ.

In the *alimentary tract* the position of the gizzard is to be noted; it lies, as seen in sections, entirely in somite v., though its hinder extremity is carried back to the level of somite ix. (Plate VII. fig. 3, *giz.*).

The following region of the gut, as far back as somite xvi., has very vascular walls, which are considerably folded (Plate VII. fig. 3). But there are no definite "pouches" or diverticula, though the general structure recalls that of calciferous glands; and I find in the hinder somites crystalline bodies, resembling those of carbonate of lime present in the glands of *Lumbricus*, but there is no effervescence on the application of acetic acid. This vascular region of the gut is not so extensive as it appears on paper, for the cavities of somites vi., vii., viii. are exceedingly short, the septa being almost in contact centrally.

The thin-walled intestine commences in somite xvii. or xviii. and is very wide, occupying a considerable extent of the body-cavity; there is no typhlosole (Plate VII. fig. 4).

[In *P. heteroporus* the gizzard is in somite vii.; there are three pairs of reniform diverticula, with short ducts, in somites x., xi., xii.]

B. Microchæta papillata, n. sp.

We are acquainted with only two species[1] of this genus, which was instituted by Beddard[2] for a worm originally described by Rapp under the name of "*Lumbricus microchæta*," collected in Cape Colony. Mr. Beddard named the species *M. rappi*, and it received a description at my hands[3] almost simultaneously with that published by him. I described the second species, from Natal, under the name of *M. beddardi*[4]. In a recent paper[5] I have pointed

[1] After the MS. of this paper had left my hands, I received from Dr. D. Rosa a copy of his memoir, "Die exotischen Terricolen des k. k. Naturhistorischen Hofmuseums," published in the 'Annalen d. k.-k. Nat. Hofmuseums,' Wien, 1891, Bd. vi. Heft. 3 & 4. Herein he describes a third species, *M. benhami*.

[2] Trans. Zool. Soc. xii. 1886, p. 63.

[3] Q. J. M. Sc. vol. xxvi. p. 267.

[4] *Ibid.* xxvii. p. 77.

[5] "An Attempt to Classify Earthworms," *ibid.* xxxi. p. 215.

out that the numbering of the somites, as it stands in my description, requires some alteration, and Beddard[1] has likewise made certain corrections in regard to the interpretation of certain organs, which have become necessary from the advance in our knowledge of the anatomy of the group[2]. I here give a figure (Plate VIII. fig. 8) of the anterior end of *M. beddardi*, in illustration of my remarks on the alteration of numbering of this somite.

Microchæta papillata has a length of 10 inches and a breadth of half an inch; it is thus smaller than either of the two previously known species. As to its colour, I am unable to speak, for, as is so generally the case, it has evidently been considerably changed by the spirit.

The *prostomium* (Plate VII. fig. 5) is, as in *M. beddardi*, broad and marked by longitudinal grooves, which extend into the first somite (*cf.* Plate VII. fig. 6, representing *M. belli*); this somite is similarly grooved on the ventral surface. The following somites are bi- or tri-annulated, but the grooves between the annuli are in some cases almost as marked as those between the somites, so much so, indeed, that in fixing the position of the various external characters I at first reckoned the annuli as somites. The first three somites are not annulated; the fourth to the ninth inclusive are bi-annulated (*a*, *b*), the grooves between the annuli being very deep; posteriorly the somites are not so noticeably annulated. This same well-marked annulation of the somites exists, as I have pointed out and figured, in *M. rappi*.

The *chætæ*, however, serve to define the somites, and, as in the other two species, are in four couples per somite, the individuals of a couple being close together; the outer couple is quite lateral in position, being about midway between the dorsal and ventral median lines; whilst the inner couples are latero-ventral. The interspace between the outer and inner couples is about equal to the space between the two inner couples. The chætæ themselves are very small, and in the anterior somites, indeed, I had to make use of Zeiss's B, as a hand-lens, in order to see them; they commence in somite iii. It might be suggested that the first somite is biannulate, but in *M. belli* (Plate VII. fig. 6) the chætæ occur in the second somite, which is in other respects similar to the second ring of the present species. The four species exhibit an interesting series of stages in "cephalization." In *M. belli* the first and second somites are distinct, the chætæ being present on the latter. In *M. beddardi* these somites are not distinctly marked off from one another (Plate VIII. fig. 8), and the apparent first somite carries chætæ in its hinder part; in *M. papillata*, though the somites are distinct, the chætæ are absent on the second: in *M. rappi* the two somites are with difficulty distinguishable from one another; the first annulus

[1] "The Classification and Distribution of Earthworms," Proc. Roy. Phys. Soc. Edinb. x. pp. 242, 243.

[2] Rosa points out this necessary correction in the paper just referred to, on p. 384.

probably is somite i., and the next two annuli belong to somite ii. (see pl. xv. fig. 1 of my paper, *loc. cit.*).

The chætæ of both the new species differ from those of the previous species in the presence of an "ornamentation," similar to that of the chætæ in *Rhinodrilus*[1], and consisting of longitudinal rows of obliquely transverse ridges[2].

The *clitellum* is evidently not fully developed, but the intersegmental grooves on the dorsal surface of somites xix. to xxviii. are partially obliterated (this area includes the 26th to 35th annuli). Along each side of the body there is a very pronounced latero-ventral ridge extending across somites xvi. to xx., the body being here flattened, though probably the appearance, as represented in the figure (Plate VII. fig. 5, *t.p.*), is less marked during life. This ridge is glandular and appears to correspond with the structures known as the "tubercula pubertatis" in *Lumbricus*, *Allolobophora*, *Rhinodrilus*, &c.

By teasing up the body-wall, and by the examination of sections, I find the clitellar cells to occur over a much wider area than that represented by the above numbers, viz. as far forwards as somite x., so that we may, I think, conclude that the clitellum, when fully developed, covers the somites x. to xxx. This agrees closely with the extent of the same organ in *M. rappi* as described by Beddard; in the specimen examined by myself it occupied somites xiv. to xxvi.[3] In *M. beddardi* the clitellum is less extensive, covering somites xi. to xxiii.; but in neither of these species did I find the limits well defined.

Although I did not observe, when I was engaged upon the previous species, anything like *tubercula pubertatis*, yet I figured for *M. rappi*[4] the ventral edges of the clitellum as being well marked and thickened; a re-examination, too, of specimens of *M. beddardi* reveals, though in a very indistinct manner, owing to their very poor condition, a band along each side of the clitellum, which is no doubt of the same nature.

The *nephridiopores* are, as in the other two species, very distinct even along the clitellum; they are placed in front of the outer chætæ, *i. e.* along the sides of the body, the first nephridiopore occurring in somite iii. There are no dorsal pores, nor could I detect any of the generative apertures. But on either side of each of the somites x. and xxiii., that is on the somites which carry the 8th and 21st nephridiopores respectively, occupying the position of the inner chætæ, is a rounded papilla (Plate VII. fig. 5, *cp.*, *cp'.*), slightly pitted

[1] Perrier, "Lomb. terr.," Nouv. Arch. d. Muséum, 1872, pl. i. fig. 11; Horst, Notes from Leyden Museum, 1887, pl. i. fig. 7.

[2] Mr. Beddard has recently described, in the 'Annals & Mag. Nat. Hist.' Feb. 1892, ornamented chætæ in *Anteus*, *Geoscolex*, and *Pontoscolex*, Schmarda (*Urochæta*, Perrier).

[3] As I have remarked in my "Attempt to Classify Earthworms," we must increase the numbers given in my description of *M. rappi* by *one*, as the apparent first somite is in all probability somite i. and ii., the chætæ of somite ii. having disappeared.

[4] *Loc. cit.* pl. xv. fig. 1.

at the tip; and projecting from this pit is a smaller whitish papilla provided at its apex with a minute pore (Plate VII. fig. 7).

I expected, at first sight, that the hinder pair of the papillæ would be in connection with the sperm-ducts, but no such relation exists. Each of the four papillæ is represented internally by a rounded or kidney-shaped swelling (Plate VIII. fig. 9), from the centre of which (or from the hilum as the case may be) there passes to the body-wall a bundle of fibres (*m*). These are muscle-fibres and surround a "chætophore" or sac containing the chætæ, which replace the ordinary ventral chætæ, from which they differ only in their greater length.

The papilla itself has the following structure (which is closely similar to that of the next species, of which a figure is appended (Plate VIII. figs. 10, 11): the pore at the apex of the inner papilla (*pap.*) leads into a sac lined by columnar cells (*ep.*) forming a definite epithelium; the lumen of the sac extends in an irregular way for some distance all round the aperture, and its epithelium is, at places, considerably folded. Outside the epithelium are numerous bundles of muscle-fibres (*mus.*), some radially arranged, some circularly, and some longitudinally (as seen in a transverse section of the body-wall passing through the papilla). These fibres can be traced into the muscular layers of the body-wall, from which they are evidently derived by its invagination. Outside the muscular coat—though not separated from it by any marked line such as the figure suggests—is a thick coat of clitellar cells arranged in groups (fig. 11, *gl.*). Blood-vessels ramify between the groups and amongst the muscle-bundles. Surrounding the whole is a layer of flattened cœlomic epithelial cells (*co.ep.*), which dips down between the groups of clitellar cells. The muscle-fibres are found only near the aperture in that part of the organ which forms the external papilla; in the remainder of the gland the clitellar cells abut immediately upon the epithelial cells.

There is a remarkable resemblance in structure between this organ —which is evidently copulatory in function and capable of slight eversion—and the prostates (or atria) of *Perichæta*, *Acanthodrilus*, *Trigaster*, &c.; the epithelium, however, is more definitely marked off from the gland-cells than in these, and recalls, rather, the prostates of *Pontodrilus*; or if we compare the structure of the organ near its pore with the atrium of *Moniligaster* we shall see a still greater resemblance, except that in the latter genus there is, according to Beddard's description[1], no membranous cœlomic epithelium, for the "clitellar cells" represent this layer.

Amongst the families *Rhinodrilidæ*, *Geoscolecidæ*, and *Lumbricidæ*, a "prostate" is not usually recognized as being present, but in several genera there is a more or less conspicuous swelling of the body-wall, which is perforated by the sperm-duct in its passage to the exterior. In *Geoscolex*, *Brachydrilus*, *Criodrilus*, and *Callidrilus* such structures exist; of the histology of these, however,

[1] Q. J. M. Sc. xxix. pp. 119 &c. pl. xii. fig. 11.

records are scanty. In *Criodrilus* I mention [1], briefly, the "hemispherical gland, which may be called a prostate," and which "consists of cells similar to those forming the epidermis of the clitellum and quite continuous with them; the gland appears to be formed only by a hemispherical thickening of the epidermis over this area." Rosa [2] refers to this organ as "atrium." In the case of *Callidrilus*, Michaelsen [3] states that this "doubtful prostate" consists of small granular cells, with indistinct boundaries, the nuclei sometimes being scarcely recognizable; in the same place he describes—though very briefly—structures of the same nature as those in *Micr. papillata* as occurring in *Kynotus madagascariensis*; to which I shall refer later on in this paper.

The nature of the organ in *Geoscolex* is unknown. But *Microchæta* (and probably *Kynotus*) differs from the rest in that this gland is entirely independent of the sperm-duct; whereas in prostatiferous worms (that is, those of the families *Cryptodrilidæ*, *Perichætidæ*, *Acanthodrilidæ*, *Eudrilidæ*, &c.) this gland is always in connection with the sperm-duct, or in its immediate neighbourhood; moreover, it is tubular in general character and is apparently a more efficient organ of copulation than in these other cases.

We are in ignorance of the real function of the prostate or of the "genital duct" in these prostatiferous worms; but there is, probably, a protrusion of the muscular duct during copulation, and an insertion thereof into the spermatheca, as there is undoubtedly in such forms as the *Tubificidæ*: but in the case of *Microchæta* such a penial function is impossible, for there is no sac into which such a papilla could be inserted; it probably, however, serves as a *sucker*. The small papilla in the terminal pit of the larger one, the muscular arrangements, and the folded cavity suggest such a sucking-organ; and, no doubt, the copulating chætæ serve to aid this apparatus in holding on to another worm [4].

It is not necessary to think that this sucking-apparatus in *Microchæta* is the forerunner of the prostates with their protrusible duct, though it is quite possible that this latter organ may have arisen from some such apparatus as is present in *Brachydrilus*, *Geoscolex*, &c., where the "sucker" is perforated by the sperm-duct. During copulation in *Lumbricus*, &c., the ventral surface of the clitellum itself, bounded by the tubercula pubertatis, very probably acts as a sucker; here in *Microchæta* a more specialized apparatus, on

[1] "Studies in Earthworms, III.," Q. J. M. Sc. xxvii. p. 568.

[2] "Sul *Criodrilus lacuum*," Mem. d. R. Accad. d. Sci. d. Torino, ser. 2, tom. xxxviii.

[3] "Terricolen d. Berliner Zool. Samml.," Arch. f. Naturgesch. 1891.

[4] Rosa describes (Ann. d. k. k. Natur. Hofmus. 1891) certain glandular bodies in *M. beskasi* (in somites xi. to xxviii.) which appear to have a somewhat similar structure; but he mentions no external papillæ: he compares them with the "pyriform glands" of *Urobenus* and *Urochæta*, and suggests, as I have done, their possible connection with the prostates of other worms; and his species forms an interesting link between the arrangement in *Urobenus* and *M. papillata*, though the structures in *M. beskasi* do not appear to have any copulatory functions.

definite spots, has taken the place of, or is developed in addition to, this clitellar sucking arrangement.

It is very generally believed that in *Lumbricus herculeus*, Savigny (*L. terrestris*, auct.), a mucous band is developed around the bodies of the two worms during the process of copulation: but, from my own repeated observations of the act in *Lumbricus*, I can state, as some of the older authors have stated, that such a band does not exist. There is such a band in *Allolobophora fœtida* and no doubt in other species, but in *Lumbricus* the two worms are joined together, and that pretty firmly, by the action of the *tubercula pubertatis*, and no doubt by a certain amount of sucking-action, exerted by the ventral region, not only of the clitellum, but also of all that part of the body lying between that and the fifteenth somite, which is converted into a groove by the action of a band of muscles passing from one side to the other—the arched muscles [1].

In worms, such as *Perichæta* and *Acanthodrilus*, &c., where the clitellum is "complete" or nearly so, and where no *tubercula pubertatis* exist, there is no evidence of any power of converting the ventral surface of the body into an adhesive apparatus: and it is in these forms that a (probably) protrusible penis—or muscular duct of the prostate—exists. This organ has either (1) actually replaced the adhesive arrangement such as exists in *Lumbricus*, in which case the sucking-papillæ, independent of the sperm-duct in *Microchæta* and the (probably) similar apparatus around the male pore in *Geoscolex*, *Brachydrilus*, *Criodrilus*, may represent stages in the process; or (2) the two modes of copulation may have arisen independently.

The Internal Anatomy.

In the arrangement of its internal organs *M. papillata* agrees closely with that of the previous species.

The *nephridia*, though smaller, present the characteristic tuft of coiled tubules at the end of a fairly large bladder; the "fine tube" [2] presents the same peculiar branching and anastomoses that I have described for *M. rappi* [3].

The dorsal *blood-vessel* is doubled in the somites v., vi., vii., viii., and ix., and in the last somite is dilated to form a double heart-like organ; in each case the two vessels unite at each end of the somite to form a single tube perforating the septa; in *M. rappi* this doubling occurs in the same somites, but in *M. beddardi* it is limited to somites vii., viii., and ix.

Large moniliform "lateral hearts" exist in the present species in somites ix., x., xi., and smaller ones in somites vii. and viii., as in *M. rappi*.

With regard to the *alimentary tract*, the chief features to be noted are (*a*) the gizzard, which appears to occupy somite vi., and (*b*) the œsophageal diverticula or calciferous glands; of these there is but

[1] Cerfontaine, "Rech. sur le Syst. cutané et sur le Syst. musculaire du Lomb. terr.," Arch. de Biologie, x. 1890, pl. xii. fig. 26, p. 407.

[2] "The Nephridium of *Lumbricus*," Q. J. M. Sc. xxxii.

[3] Q. J. M. Sc. xxvi. pl. xvi. fig. 21, and pl. xvi. *bis* fig. 31.

one pair in somite ix.—one somite anterior to that of *M. rappi*. In *M. beddardi*, however, the gland is partly in somite ix. and partly in somite x., occupying, as it were, an intermediate position between that of the other two species.

The *genital organs*.—There are apparently three pairs of sperm-sacs, but in reality only *two* pairs are present, each sac being constricted into a larger anterior portion, and a small posterior and more ventrally situated lobe. The two larger sacs (Plate VIII. fig. 13, *A*, *B*) lie in somites x. and xi.; the posterior lobes, constricted by the septa, lie in somites xi. and xii. (*C*, *D*). There are no median sacs.

The two pairs of *testes* and of ciliated rosettes, which lie in somites x. and xi., are enclosed in the larger portions of the sacs.

In *M. rappi* there is the same kind of subdivision of the sperm-sacs, the anterior lobe, however, of each being the smaller and containing the testes; they occupy (according to the amended numbering of the somites) the same position as in the present species.

The two sperm-ducts of one side unite in somite xii., but I was unable to trace them onwards; they have no connection with either of the copulatory apparatus mentioned above.

The *spermathecæ* have the same arrangement as in the other species; that is, a row of ten or twelve very small oval sacs on the anterior margin of each side of somites xiii. and xiv.

In *M. rappi* there are fewer in each row, but four rows on each side, and some of them are curved. Similar spermathecæ exist in *Brachydrilus*[1] and in *Kynotus*.

C. MICROCHÆTA BELLI, n. sp.

This species agrees in its anatomy very closely with *M. beddardi*, I name it after my friend Prof. Jeffrey Bell, who has enabled me to examine and study a large number of Earthworms presented to the National Collection[2].

Its length is 8 inches and its diameter is $\frac{3}{4}$ inch.

It had apparently been allowed to become dry at some period before it reached me, as the worm is much shrivelled, and a dark brown, hardened, plate-like structure occupies the dorsal surface of somites xiii. to xxi. and part of the next somite; this "saddle" extends laterally as far as the nephridiopores, or line of the outer chætæ. This brown area appears to represent the clitellum. Along the lateral boundary of part of the clitellum is a broadish band, having a glandular appearance, crossing the somites xv., xvi., xvii., xviii., and part of xix. This recalls the *tubercula pubertatis* of the *Lumbricidæ*, and a similar structure is already known in *Rhinodrilus* and *Hormogaster*, and Horst speaks of something of the sort in *Glyphidrilus*[3]. On the ventral surface these segments, though dis-

[1] Benham, "An Attempt to Classify Earthworms," Q. J. M. Sc. xxxi. p. 256, fig. 28.

[2] The specimens of *M. papillata* and *M. belli* are now in the collection of the British Museum.

[3] In *M. benhami*, Rosa, *loc. cit.* also describes *tubercula pubertatis*.

tinctly marked off from the clitellum, are more sharply separated from one another than is the case elsewhere in the body. The histological structure of the tubercula is represented in Plate VIII. fig. 14.

On each side of somite xiii., between the outer and inner couples of chætæ, and rather nearer to the former, is a copulatory papilla, similar to those I have described above for *M. papillata*.

The nephridiopores and the oviducal pores have the usual positions; I could not detect any other apertures.

The chætæ have the same arrangement and markings as in *M. papillata*; they are longer than in that species and commence on the second somite.

The annuli of the anterior somites are extremely well marked by deep grooves (Plate VII. fig. 6). The first somite is simple; the second is triannulated; the third is biannulated; somites iv. to ix. (inclusive) are triannulated, the third annulus in each case being very distinctly marked off; the tenth is biannulated; the following ones are bi- or triannulated, though the annuli are not so distinctly separated.

Of the internal organs, one or two features are worthy of note. Three septa are stronger than the others; the first lies between somites iv. and v., the second strong one lies in the *middle* of the somite viii., the third in the *middle* of somite ix.

The œsophageal glands are nipped by the septum between somites ix. and x., as in *M. beddardi*. There is only one pair of ciliated rosettes (and probably, therefore, of testes) in somite x. and one pair of sperm-sacs in the same somite.

In *M. beddardi*, also, there is but a single pair of each of these organs—the testes in somite x., the sperm-sacs in somite xi.

I traced the sperm-duct as far as somite xvi., where it enters the muscles of the body-wall. But I have been unable to determine the position of the external aperture; for I did not wish to injure the single specimen.

In *M. rappi* the spermducal pore lies in somite xx.; but I was unable to find the pore in *M. beddardi*, where, however, it has probably the same position[1].

The *spermathecæ* are eight in number, arranged in couples on the anterior margin of each side of somites xii. and xiii.; they are larger than in *M. papillata*, though of the same shape. In number and position they agree with the condition in *M. beddardi*.

The four species of *Microchæta* can thus be arranged in two groups:—

I. *M. rappi* and *M. papillata* have two pairs of testes, and very numerous spermathecæ arranged in rows of several in a row; the œsophageal glands lie wholly in one somite; the dorsal vessel is doubled in each of the somites v. to ix.

II. *M. beddardi* and *M. belli* have but one pair of testes; have eight spermathecæ arranged in couples; the œsophageal glands are

[1] In *M. benhami* this pore is between somites xx. and xxi.

indented by a septum, so as to lie partially in two somites; the dorsal vessel is doubled in three somites only.

Remarks on the genus Kynotus, *Michaelsen.*

Dr. Michaelsen has recently described two species of this new genus which present certain anatomical features that are so unusual as to deserve a reconsideration.

Kynotus madagascariensis[1] and *K. longus*[2] both come from Madagascar.

The description of them is very incomplete, both as regards external and internal anatomy, owing to the bad condition of the specimens. These were not mature, and no clitellum was present.

The *chætæ are absent in the anterior part of the body* in the first twenty-six "segments" (Mich.), so that the correct interpretation of these external markings is a matter of considerable uncertainty; nor does the position of the nephridiopores aid us in determining the value of these surface-markings, as the author does not state where these pores commence; they are in line with the inner (ventral) couples of chætæ in those segments where these are present; in the anterior twenty-six "segments," however, they are *on alternate rings*. The grooves separating the rings are stated to be well marked, and in *K. longus* each "segment" is biannulated.

Thus, from external characters, there is nothing to guide us to a correct enumeration of the true *somites*.

Internally, the septa are, in most worms, of use, to some extent at least, for the determination of somites, and the position of the spermsacs and ovaries is so generally constant that these organs are frequently of considerable help in confirming any otherwise doubtful determination of somites.

But according to Michaelsen's view of the anatomy of these two worms, the first septum lies between "segments" 7 and 8; and the ninth septum between "segments" 23 and 24; so that *two "segments"* (instead of a single one as is usually the case) *occur between every two successive septa*. Behind the ninth septum, however, the condition of things usual in *Oligochæta* obtains. But although there are two "segments," yet there is *only one pair of nephridia*.

Michaelsen gives no information as to the condition of the vascular or nervous system, which might have aided us in solving the difficulty as to the value of his "segments."

When I read his description of these worms I was reminded of my own difficulty in determining the value of the external rings and the limits of the somites in *Microchæta rappi*, and this difficulty still further impressed itself on me when I examined the specimens of the two new species of the genus described in the present paper; at first I reckoned as somites the markings which I have above termed "annuli."

Now, when we consider the very abnormal condition of things

[1] Michaelsen, Arch. f. Naturgesch. 1891.
[2] Michaelsen, Jahrb. d. Hamburg. wiss. Anstalt, ix. 1891.

presented by the position and arrangement of the internal organs, which I have just mentioned, in *Kynotus*, and, still further, the position of the few genital organs described by Michaelsen, I am inclined to put a different interpretation on his "segments," and hence a different enumeration of "somites."

In *K. madagascariensis* the only genital organs observed are the *spermathecæ*; these are in a condition similar to that of *Microchæta*; they are in rows of 22, 26, and 25 small sacs along the anterior margins of the "segments" 23, 24, and 25 respectively; the rows extending nearly all round the body.

In *K. longus* there are four rows of eight spermathecæ—one row on each side of the anterior margin of the "segments" 25 and 26. In this species he observed the *sperm-sacs*, of which there appears to be a pair in front of each of the *septa* vi. and vii. ["Ein Paar umfangreicher Säcke, vor den Dissepimenten vi. und vii., deutete ich als Samensäcke"].

Now, if it be borne in mind that between the septa v. and vi. there are, according to Michaelsen's mode of reckoning, two "segments," namely the 16th and 17th, and between the septa vi. and vii. likewise two "segments," the 18th and 19th, we get the sperm-sacs occupying a very abnormal condition indeed; for in what Earthworm, of all the many genera, do we find the sperm-sacs originating as far backwards as the 16th "somite"?[1] They usually occur in any somite from the eighth to the twelfth, and where there are two pairs they nearly always originate in somites x. and xi., or in somites xi. and xii.

I believe this apparently abnormally posterior position of the genital organs and the other peculiarities of *Kynotus* can be explained by interpreting the external rings, *not as "segments" but as annuli*; then between every two consecutive septa in the anterior part of the body we shall have not two "segments" but two annuli, that is one *somite*, and we shall find that matters work out more in accordance with what we find in other Earthworms.

Granting that the gizzard lies in somite vi., which is a very usual position for the organ in the family *Rhinodrilidæ* (amongst which Michaelsen places the worm), as well as in other families, the first septum lies, not between "segments" 7 and 8, but behind *somite* vi., the second behind *somite* vii., and so on; this brings the sperm-sacs into *somites* xi. and xii. (where they *do* occur in *Micr. rappi*, in *Rhinodrilus*, *Hormogaster*, and perhaps in *Brachydrilus*), and the spermathecæ are then in *somites* xv. and xvi. in *K. longus*, and in *somites* xiv., xv., and xvi. in *K. madagascariensis*; and this position agrees with that of the sacs in *Mic. rappi*.

Again, the nephridia will be *one* to each somite. Michaelsen remarks on the variation in the position of the pores in the anterior region of the worm, where they lie in some "segments" just behind the septa, in others in the middle of the "segments"; he sees only one explanation of this, that the nephridia were originally one

[1] The condition of the sacs in *Geoscolex*, *Urochæta*, and *Diachæta* is quite different; they may *extend* into these somites, but *originate* in a more normal position.

pair to each "segment" and that has disappeared. It seems to me that we can just as readily explain the apparent anomaly of the nephridiopores being in the *middle* of the space between two septa by a reference to other genera in which the areas of attachment of septa have shifted from their original position, as I have mentioned in *M. belli*. Rosa notes it in *Hormogaster*[1] and Beddard has referred to a similar partial shift of the septa in *Libyodrilus*[2].

With regard to the papillæ which exist on the 25th annulus ("segment" of Michaelsen) in *K. madagascariensis* and on the 26th in *K. longus*, the suggested modification of enumeration brings each to *somite* xvi. Michaelsen refers to them as carrying the apertures of the sperm-ducts; but as he saw no sperm-duct it is quite as probable that they are independent copulatory structures, similar to those I have described in the two species of *Microchæta*. The interpretation which he gave to them, however, is quite natural, and I myself, till I cut sections through them, presumed that they were the indications of the spermducal pores, and we, as I have mentioned, know of no other instance (except certain papillæ in *Perichæta*, sp., whose structure is unknown) of such organs independent of the sperm-ducts.

According to my view, then, the genus *Kynotus* is not so aberrant as Michaelsen believes. The genus is a near ally of *Microchæta*, if, indeed, it be not identical with it, the link between it and *M. rappi* (the "type" of the genus) being provided by the new species described in the present paper; and were it not for the very close agreement between these species and the two earlier known species of *Microchæta* (especially in regard to calciferous gland, "hearts," doubling of dorsal vessel, extent of clitellum, position of nephridiopore), I should have referred them to Michaelsen's genus.

EXPLANATION OF PLATES VII. & VIII.

Figures 1 to 4 illustrate the anatomy of *Plutellus perrieri*.

Fig. 1. View of the ventral surface of the anterior end of the worm, showing the arrangement of the chætæ (the dorsalmost on each side not being visible), the male pores (♂), the extent of the clitellum. *Bc.*, protruded buccal cavity.

2. Diagrammatic view of a portion of the body-wall, extending from the mid-ventral line (*M.V.*) to mid-dorsal line (*M.D.*). The chætæ (1, 2, 3, 4) have the true relative spacing; *nep&o.*, nephridiopores; *apth.p.*, spermathecal pores.

3. Semidiagrammatic view of a sagittal section through the first twenty segments: parts represented as cut through are drawn from the actual section; organs lying beyond these cut surfaces are put in from other sections. The dotted lines on the dorsal surface indicate the boundaries of somites—in the actual sections they are not present. The septa are represented black, in order that their course may be the more readily followed.

Buc., buccal cavity; *cer.*, brain; *ci.ro.*, ciliated rosette; *circ.*, circular muscles of the body-wall; *Comm.*, the peripharyngeal nerve commissure; *gang'.*, the subpharyngeal or first ventral ganglion; *gen.d.*, the "genital duct"; *giz.*, gizzard; *lg.*, longitudinal muscles of the

[1] "Sulla strutt. d. *Hormogaster redii*," Mem. d. R. Accad. d. Sci. d. Torino, ser. 2, vol. xxxix.

[2] "On the Structure of an Earthworm allied to *Nemertodrilus*," Q. J. M. Sc. xxxii. p. 546.

body-wall; *lg'*., their distribution to the wall of the buccal cavity; *ne.o*., the aperture of the first nephridium; *neph'*., the first nephridium; *ov*., ovary; *ov.f*., oviducal funnel; *ov.p*., oviducal pore; *œs*., œsophagus; *Phar*., pharynx; *pro*., prostomium; *prost*., prostate; *sal.g*., salivary glands; *sp.d*., sperm-duct; *sp.p*., male pore; *sp.sac*, sperm-sac; *spth*., spermatheca; *spth.p*., spermathecal pore; *T*., testis; *vis.n*., visceral nerve, from brain to wall of buccal cavity and pharynx; *x*, ciliated cells on roof of pharynx.

Fig. 4. Transverse section through *Plutellus*. 1, 2, 3, 4, the positions occupied by the four chætæ on each side; *ep*., epidermis, represented as a black line; *cer*., circular muscles of body-wall; *lg*., longitudinal muscles, which form a thinner layer dorsally than ventrally; *D.v*., dorsal vessel lying partially surrounded by a "perihæmal cavity" (*p.h.sp*.); *N.C*., nerve-cord; *n'*., ventral nerve; *n''*., ventro-lateral nerve; *neph*., portions of the loops of a nephridium; *neph.d*., nephridial duct, opening at *ne.o*.; *perit.gl*., a "peritoneal gland"; *sept*., septum; *v.v*., ventral vessel.

5. Ventral surface of *Microchæta papillata* (nat. size). *c.p*., *c.p'*., the copulatory papillæ (suckers) on somites x. and xxiii.; *m*., mouth; *Pro*., prostomium; *t.p*., ridge at each side of clitellar region, probably representing tubercula pubertatis. The roman numerals indicate the somites, some of which are biannulated (*a*, *b*).

6. Side view of *M. belli*, in order to show the deeply marked annulation of the somites. *a*, *b*, *c*, the three annuli into which the surface of the somite is divided. The roman numerals indicate the somites. *Buc*., the protruded buccal cavity; *ne.o*., nephridiopore; *l.ch*., the outer couple of chætæ; *v.ch*., the inner couple of chætæ.

7. The copulatory papilla of somite x. of *M. papillata*. *Pap*., the papilla; *pap'*., the small papilla in the apical cup, showing the pore of the internal organ as a small dot; *V.ch*., the ventral chætæ of somite xi.; *v.mid*., the ventral midline.

8. Side view of anterior end of *M. beddardi*, in order to show the fusion of somites i. and ii., referred to in the text. *prost*., prostomium; *ne.o'*., first nephridiopore.

9. The "sucker" or internal organ, corresponding to the external papilla of somite xxiii. of *M. papillata*. *s.s'*., the septa of the segment; *m*., the muscle of the chætophore.

10. A somewhat diagrammatic view of a transverse section of the "sucking-organ" (combined from a series of sections).
Ch., the chætæ surrounded by the apparatus; *circ*., circular muscles of the body-wall, continued over the "sucker"; *cl*., clitellum; *co.ep*., cœlomic epithelium covering the organ; *ep*., the epithelium lining the "sucker"; *gl*. the gland-cells of the organ; *lg*., longitudinal muscles of the body-wall; *m.ch*., the muscles of the chætophore; *mus*., the muscles surrounding the "sucker"; *pap*., the external papilla; *pap'*., the smaller papilla contained in the apical cup of the larger; *pore*, the pore of the apparatus.

11. A portion of the wall of the sucker of *M. papillata*; only a small portion is filled in in detail. *co.ep*., the cœlomic epithelium, dipping down between the groups of gland-cells (*gl*.); *b.v*., blood-vessels; *ep*., epithelium of the organ; *mus*., muscles in various directions in the wall; *ner*., nerves cut across.

12. The tip of an ordinary chæta of *M. belli*.

13. The sperm-sacs of *M. papillata*. *A*, *B*, the chief sacs; *C*, *D*, the smaller posterior lobes of these. *A*, *B* have been opened on the right side, showing the contained ciliated rosettes (*c.r*.) and testes (*t*.): *cal*., calciferous gland; *giz*., gizzard; *sep*., the strong septa.

14. A transverse section of the tuberculum pubertatis of *M. belli* (only a portion is filled in with detail). *ep*., epidermis of clitellum; *circ*., circular muscles of the body-wall, between the fibres of which the gland-cells of the tuberculum pass inwards; *lg*., longitudinal muscles; *b.v*., blood-vessels.





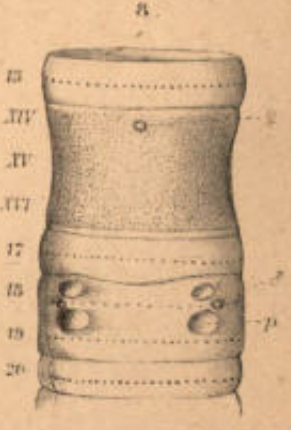






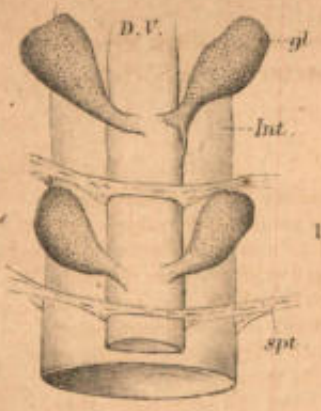






F. V. B. del. J. Smit, lith. Mintern Bros. imp.

SPECIES OF PERICHÆTA.



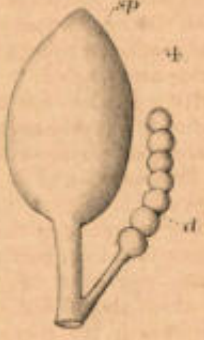
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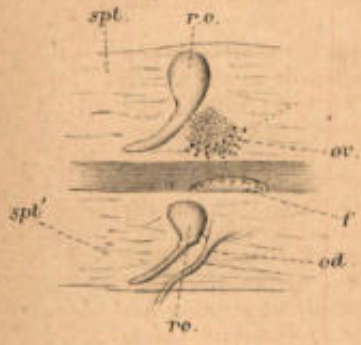


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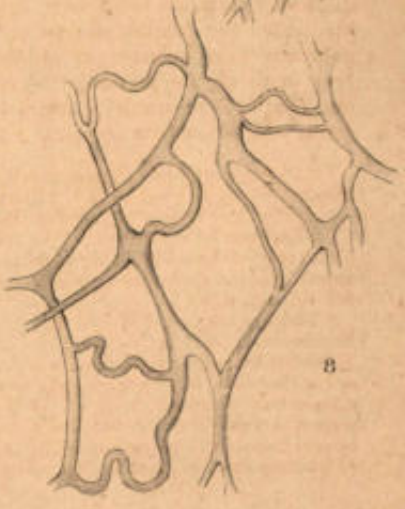
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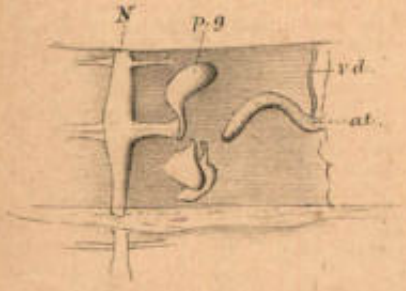


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F.E.B. del. J. Smit. lith. Mintern Bros. imp.

ANATOMY OF PERICHÆTA.

4. On some Species of the Genus *Perichæta* (*sensu stricto*).

By Frank E. Beddard, M.A., Prosector to the Society.

[Received February 5, 1892.]

(Plates IX. & X.)

I have already communicated to this Society [1] some observations upon the family Perichætidæ and upon the generic types which may be recognized in it. In the present paper I propose to describe some species of *Perichæta* (*s. s.*). I regard those Perichætidæ as referable to the genus *Perichæta* in the strict sense in which the setæ are disposed in a perfectly continuous circle round each segment, being generally (? always) disposed along a distinct ridge in the middle of the segment; this gives to the species of the genus a very different feel from either *Megascolex* or *Perionyx*, since the setæ necessarily project more and thus produce a roughening of the skin, very perceptible when the worms are handled.

My experience of living Earthworms of the genus *Megascolex* is limited to the examination of a specimen (as yet unidentified) from the Seychelles. These worms are far more lethargic in demeanour than the extremely active *Perichætæ*, and it is quite possible that this difference may be general.

Another distinguishing character of the genus is the presence of a pair of cæca [2] projecting forwards from the intestine in the xxvith segment. The gizzard, moreover, lies in segments viii.–x. and the septa are wanting which should divide those segments. No true *Perichæta* is known in which the spermatheca have more than a single diverticulum apiece [3]. The clitellum never consists (with one exception, *P. feæ*) of more than three segments (xiv.-xvi.), and the oviducal pore is generally, if not always, single and median [4].

Most naturalists who have described species of *Perichæta* have mentioned the number of setæ on the segments; but a segment has generally been selected at random, and frequently no mention has been made of the particular segment chosen. Prof. Bourne points out that it is desirable to count the setæ upon more than one segment, and he selects segments v., ix., & xxv.; he finds "that the

[1] "Observations upon an American Species of *Perichæta*, and upon some other Members of the Genus," P. Z. S. 1890, p. 52.

[2] I refer later on in this paper (p. 165) to one exception to this rule.

[3] The second "diverticulum," in the form of a pear-shaped pouch, which occurs in *Perichæta houlleti* does not belong to the same category as the true appendix of the spermatheca; this I have pointed out elsewhere [Q. J. Micr. Sci. vol. xxx. p. 462].

[4] Fletcher has described and figured an Earthworm ("Notes on Australian Earthworms: Part II."; Proc. Linn. Soc. N. S. W. ser. 2, vol. i. pl. 13. fig. 6 ♀, and p. 962), *Perichæta queenslandica*, which has the internal organization of a true *Perichæta*, but "interrupted" setæ and paired oviducal pores; *Perichæta daraleiensis*, described on p. 966 of the same memoir, appears to be in every respect a true *Perichæta*, but has also paired oviducal pores. This matter, however, requires looking into again, as Mr. Fletcher suggests a slight doubt as to whether the said apertures are really separate.

relation of these numbers to one another varies with other important characters rather than the actual numbers themselves."

Prof. A. G. Bourne[1] considers that in all true *Perichætæ* there are setæ between the male pores. So far as my own experience goes I agree with Prof. Bourne. The only possible exception that occurs to me is *Perichæta taprobanæ* described in the present paper (on p. 163). That species has setæ between the male pores, but differs from *Perichæta* in a few other points to which I direct attention. Another point which appears to me to be of importance is the size of the setæ upon the anterior as contrasted with the posterior segments; in all the species of *Perichæta* described in the present paper the setæ of the eight anterior segments are very much larger than those upon the segments which follow; there is an abrupt break at the end of segment viii.; up to this point the setæ get gradually larger upon successive segments. In *Perichæta taprobanæ*, which may perhaps be a distinct genus, there is no such marked difference between the segments in front of and those behind the eighth. Although there is a sudden diminution in size of the setæ there is not always a corresponding increase in their numbers, but there generally is an increase.

So much, then, for the generic distinctions of *Perichæta*.

As to the species there exists already some little confusion, and I am not prepared to guarantee absolutely the novelty of the species described in the present paper. When there were only a very few species of the genus known, their discrimination was a much easier matter than it is now; at the time that Perrier wrote his first descriptions of *Perichætæ* it was a nearly sufficient definition to state merely the number and position of the spermathecæ. There are therefore a good many points, now known to be of systematic importance, which are omitted or not clearly set forth in some of the papers which record new species of *Perichætæ*. So far as we know at present, the following are the principal external features which are of systematic importance:—

(1) Whether the ventral setæ are larger than the rest.
(2) The number of setæ upon the segments.
(3) Whether the clitellum includes the *whole* of segments xiv.–xvi.[2]
(4) Whether the setæ are present or absent from some or all of the clitellar segments; and if present whether they are modified (as, for instance, in *Perichæta houlleti*).
(5) The number and arrangement of the anterior and posterior genital papillæ.
(6) The position of the atrial pores upon the xviiith segment, *i. e.* whether they are more lateral or ventral.
(7) Colour and size (including number of segments).

I should like to take this opportunity of calling attention to the importance of illustrating these and other Earthworms by accurate

[1] "On *Megascolex cæruleus*, Templeton, &c.," Q. J. Micr. Sci. vol. xxxii.

[2] My attention was directed to the importance of this point by Prof. Bourne's paper upon *Megascolex cæruleus* (Q. J. Micr. Sci. vol. xxxii. p. 49).

coloured figures. The species of *Perichæta* generally (so far as my experience goes, *always*) show characteristic differences of colour which it is difficult to express in words so as to convey a sufficiently accurate idea. The characters, moreover, which separate the species of *Perichæta* are not always available; some species are separable by very well-marked characters, but others again hardly differ, except in the number and position of the genital papillæ with which are associated peculiar glands, and *in their colour*; immature specimens often want the papillæ, and, in the absence of coloured figures for reference, new species may be described which have no existence or important facts in distribution may be ignored. At present there are only two coloured figures of Perichætidæ extant on which any reliance can be placed: these are Bourne's figure of *Megascolex cæruleus* and my own of *Perichæta indica*[1]. Several coloured figures accompany Schmarda's descriptions of *Perichætæ* in his 'Neue wirbellose Thiere,' but these are not so useful as they would be if the descriptions were sufficiently full to render identification of the species possible[2].

The chief internal characters which show variations are the spermathecæ and the atria. The number and position of the spermathecæ, and perhaps the relative size of the spermatheca and its diverticulum, offer useful characters; but they are rather difficult to make use of, as the quantity of sperm in the diverticulum is responsible for considerable variations in its form, as I point out in the case of *Perichæta sinensis* (see p. 159). The atrium is sometimes furnished at its point of opening with a dilated sac, the presence or absence of which is very characteristic of a given species. The extent of the glandular part of the atrium is perhaps often a valid specific distinction, especially in such forms as *Perichæta taprobanæ*, where it is extraordinarily small. The intestinal cæca are also subject to some variation, which is, however, not common; in two species only are they absent, and in two others there are six pairs instead of the normal one pair. There seems also to be some variety in the position of the specially thickened intersegmental septa; but this character is one which is best appreciated in large species such as *Perichæta forbesi*, and is not always so clearly marked in the smaller forms.

Whether the receptacula ovorum really vary from one to two pairs is a matter which requires further investigation. At present I am almost inclined to think that the existence of the two pairs of these structures placed in segments xiii. and xiv. will prove to be characteristic, not of particular species, but of the genus itself.

? PERICHÆTA SUMATRANA, Horst.

Megascolex sumatrana, Horst, Notes Leyden Mus. vol. v. p. 189.
Perichæta sumatrana, Horst, Midden-Sumatra, Vermes, p. 5.

I have examined five or six specimens of this species, which has a

[1] Vaillant's figure of "*Megascolex diffringens*" may be *Perichæta indica*.
[2] Since the above was written I have received, through the great kindness of Prof. Claus, these worms for identification.

very conspicuous coloration, illustrated in Plate IX. (fig. 4). The specimens were all received alive from Kew Gardens; they were brought to Kew in Wardian cases from Barbados and from Hong Kong; it may be that the specimens from the two localities were accidentally mixed, but the fact that each box contained another and a distinct species in each case is against the supposition that there had been an accidental transference of specimens from one box to another. The occurrence of the same species of *Perichæta* in two such widely-separated regions of the World is interesting, but it is not the only instance seen in this genus; both *Perichæta indica* and *Perichæta houlleti* have been recorded from the tropics of both the New and the Old World.

The accompanying drawing (Plate IX. fig. 4) illustrates the coloration of the species, which varies somewhat in individuals, preserving, however, the same general plan. The body is markedly ringed as in our own *Allobophora fœtida*; there are alternate bands of olive-brown and pale brownish yellow; in the individual figured the darker bands are of a more distinctly green colour than in other specimens.

When treated with Perenyi's solution the green, both of the greener and browner individual, became very much brighter and more distinctly green, and was finally dissolved out when the worms were transferred to alcohol. This change of colour appears to be due to the acid in the Perenyi's fluid, as it was not produced by alcohol alone.

This species is extremely strong and active and it is most difficult to catch; the buccal cavity is protruded when the animal is moving, as in all other species of the genus that have been examined in the living condition. The length is 70 mm. by 4 mm. in breadth [1].

Number of segments 86.

The *clitellum* occupies the usual three segments, beginning and ending sharply. There are no setæ upon it.

The *oviducal pore* is single and median upon the xivth segment.

The *atrial pores* are not prominent; they are transversely elongated slits upon the xviiith segment.

There are *no genital papillæ*.

The *intestine* commences in segment xiv.; it has the usual pair of cæca.

There are, as in most species of *Perichæta*, especially thick tufts of nephridia on the septa in front of segment vii.

The ventral blood-vessel is not enclosed by the sperm-sacs.

The *spermathecæ* lie in segments vii. and viii.; each has a diverticulum bent upon itself three times.

The *atrium* has a large terminal sac.

I am not quite certain whether to identify this species with *Perichæta sumatrana* or whether to regard it as new. The diverticulum appears to be somewhat different in form, but this may perhaps be accounted for by the distribution of the spermatozoa in the pouch.

[1] Another specimen measured 3 inches and consisted of 93 segments.

PERICHÆTA DYERI, n. sp.

I obtained a single specimen of this *Perichæta* from Kew Gardens in August of last year; Mr. Crisp, one of the employés at the Royal Gardens, brought me the worm, which had been remarked for some days on account of its active habits; it had obviously come from some foreign country, but at that season so many plants in Wardian cases arrive from abroad that I found it impossible to ascertain its exact locality.

The colour of this species when alive (Plate IX. fig. 2) is a rich brown, darker posteriorly; the cuticle is markedly iridescent, the iridescence being probably more strongly marked on account of the dark background of pigment. During life it protruded, as other *Perichætæ* do, the whole of the buccal cavity during its movements; the clitellar region was also continually contracted: in preserved specimens this region of the body is, it should be observed, frequently much narrower than the rest; the older term of cingulum is thus particularly applicable, as the impression given is that of a belt tightly drawn round the middle of the worm. When placed in weak spirit, the worm threw out a quantity of turbid yellowish fluid.

After preservation the specimen measured 117 mm. and was composed of 72 segments. The circumference of the body in the region of the spermathecæ is 13 mm.

The *clitellum* occupies the three usual segments, but does not exactly coincide with the boundaries of those segments; it commences a little after the beginning of the xivth segment and terminates a little before the end of the xvith. There are no setæ upon the clitellum. The seta formula is

Segment I.	V.	XII.	XXV.[1]
27	27	39	45

The *oviducal pore* is single and occupies the usual position.

The *male pores* lie upon the xviiith segment within the line of setæ, which are, however, interrupted for a short distance on either side of each pore. On the same segment are two pairs of large sucker-like *papillæ*, which seem to have a concave surface. The anterior pair (Plate IX. fig. 8) lie in front, and to the inside, of the male pores; the other pair occupy a corresponding position behind the circle of setæ of the segment, and touch the border-line between the xviiith and xixth segments.

The *spermathecal pores* were not evident.

As to the internal anatomy. The alimentary tract is furnished with a *gizzard* occupying the usual position and number of segments. The paired *cæca* of the intestine arise between the xxvith and xxviith segments and reach forward as far as the xxvth.

From segment xxviii. backward are paired series of "*septal glands*"

[1] The segments selected for enumeration are not quite the same as those chosen by Prof. Bourne (Q. J. Micr. Sci. vol. xxxii. p. 53, footnote); but I find that the proportions and numbers are not altered by the segments which I give.

such as I have described in other species of *Perichæta*[1]. They appear, however (Plate X. fig. 1), to arise rather from the dorsal vessel than from the septum; each gland is somewhat pear-shaped, with a narrow stalk which approaches that of its fellow.

The *sperm-sacs* are in segments xi., xii.

The *atria* are very extensive; the glandular part occupies segments xvi.–xxi. inclusive; the muscular duct opens directly on to the exterior and is unprovided with a thin-walled sac.

The segments xvii., xviii., and xix. are masses of white glands which are no doubt connected with the papillæ already spoken of.

The *ovaries* (which are, as usual, attached to the front wall of segment xiii.) are very large and bunchy.

The *spermathecæ* are present to the number of four pairs, and lie in segments vi., vii., viii., and ix.; they open at the anterior boundary of these segments and are very dorsal in position, the external apertures being about 6 mm. from the nerve-cord. The pouch has the usual shape; the diverticulum is half again as long as the pouch.

The characters of the papillæ appear to distinguish this species from all other *Perichætæ* with four pairs of spermathecæ. It comes nearest to *P. modiglianii*.

The above description refers to a single specimen which I shall keep as the type of the species. Since the description was written I have received a large number of other examples, all living, from Trinidad and Jamaica, and from Lagos on the W. African coast; the specimens from Trinidad I owe to the kindness of Mr. Hart, Superintendent of the Botanical Gardens; the other specimens came from Kew. I kept a number of them alive for some weeks in the hope that they might possibly produce cocoons; unfortunately they died without producing any. One of these specimens (which I have also kept) is illustrated in the accompanying coloured drawing (Plate IX. fig. 2). The examination of a large number of individuals has shown that the characters of the genital papillæ as described above are not quite distinctive of the species. In a good many individuals the papillæ were precisely as I have described them, but in others there were only a single pair present, that pair lying behind the male pores. These individuals therefore bear a very close resemblance to *Perichæta sinensis*. If one had only alcoholic specimens to examine and were not allowed to dissect them, it would indeed be impossible to distinguish the species by any at all marked characters. The colour, however (*cf.* figs. 2 & 3, Plate IX.), is here quite distinctive of the species.

PERICHÆTA SINENSIS, n. sp.

Of this species of *Perichæta* I received a number of living specimens from Kew Gardens; they came from Foochow in China. A coloured drawing which I exhibit (Plate IX. fig. 3) was made by Mr. Smit from the living worm. I ought to mention, however, that that

[1] P. Z. S. *loc. cit.*

sketch does not show the prismatic colours, which were very evident. The hinder part of the body is extremely transparent and of a pale brown colour; the blood-vessels and the paired septal glands were quite clearly visible through the thin integument. The last dozen segments or so are yellow-coloured; beyond the clitellum, which is grey, is a patch of yellow due to the prostate.

The activity of this species is quite on a par with that of other Perichætes, and it possesses the same power of everting the buccal cavity that I have referred to in the case of *Perichæta indica*[1] and the other species described in the present paper. M. Vaillant has also figured the same protrusion of the buccal cavity in *Perichæta posthuma*. In *Perichæta sinensis* the length of the fully everted buccal cavity was quite equal to that of the first three segments of the body.

The length of the species is 126 mm., the circumference at the viiith segment 10 mm.

The individual with the above measurements had 104 segments.

The *clitellum*, as is occasionally the case, does not coincide exactly with the limits of the three segments (xiv.–xvi.) of which it is composed; it begins *after* the furrow separating segments xiii./xiv., and ends *before* the intersegmental groove xvi./xvii. I could discover no setæ upon it.

The *oviducal pore* is single and median upon segment xiv.

The *atrial pores* lie upon segment xviii.

Genital papillæ.—There are two large sucker-like papillæ of circular outline lying between segments xviii./xix.; each is placed a little to the inside of (and of course below) the atrial pore of its own side.

The *spermathecal orifices* were not visible.

As to the internal anatomy, this species shows the usual characters peculiar to the genus *Perichæta*.

There are a pair of *cæca* in the usual position.

There are four pairs of *spermathecæ* lying in segments vi., vii., viii., and ix. In several individuals which I dissected the proportions between the pouch and its single diverticulum, as well as the shape of the diverticulum, varied. The normal condition appears to be for the diverticulum to be quite as long as the pouch; like the pouch it consists of a distal sac where the spermatozoa are retained and a narrowed duct. The pouch itself contained no spermatozoa, only a quantity of material presenting the appearance shown in the accompanying drawing (Plate X. fig. 3); it is of a fluid consistency and contains minute granules as well as spherical bodies; the drawing, I should say, represents the contents of the pouch of a living worm. The diverticulum frequently shows a beaded appearance represented in fig. 4; in one case the upper end of the diverticulum was divided by constrictions into seven spherical chambers full of sperm; quite as often the diverticulum was tubular and of equal calibre throughout, except of course the proximal end, which is always narrower. My investigations upon the living worm, which I had

[1] P. Z. S. *loc. cit.*

hoped would be more thorough, were cut short by the drying up of the specimens; I had proposed to study the vascular system in detail, but my failure to do so is the less to be regretted since Prof. A. G. Bourne has recently published [1] an excellent account of the circulatory organs of the large *Megascolex cæruleus*, which would probably in any case have rendered a similar account of the circulatory organs of *Perichæta* unnecessary.

I may, however, call attention to figs. 7 & 8, which represent a portion of the capillary network upon the spermathecal diverticulum drawn from the living organ. It will be noticed that this network is of some vertical thickness; its branches lie in two planes, both of which are contained in the superficial layers of the pouch and do not penetrate between the cells of its lining epithelium.

The *atrium* is not furnished with a terminal sac.

A crowd of closely pressed white egg-shaped glands corresponds to each of the genital papillæ (Plate X. fig. 2).

The *setæ* of segments vi., vii., viii., ix. are longer and stouter than those upon the anterior and posterior segments; this is especially the case with the more laterally placed.

The seta formula is as follows:—

Segment I.	V.	XII.	XXV.
28	26	42	48

PERICHÆTA BERMUDENSIS, n. sp.

I received thirty or forty examples of this *Perichæta* preserved in spirit from the Bermudas; I am indebted for them to Surgeon-Major Windle.

The specimens were all of about the same size; the length of one specimen chosen at random is 120 mm., breadth 4 mm., number of segments 93. The colour (in alcohol) is a reddish brown dorsally, passing into a yellowish colour ventrally.

The *prostomium* extends back over about half of the peristomial segment.

The *setæ* are small on the first setigerous segment; they gradually increase in size on the next three, and then get small again; they are quite small on segment ix. They form complete circles.

The *clitellum* shows the unusual, though not unique (see description of *Perichæta dyeri*, p. 157), character of not *completely* occupying three segments. Instead of being developed over the entire circumference of segments xiv.–xvi., it only commences to be visible 1 mm. after the boundary-line of segments xiii./xiv. and terminates at about the same distance in front of the boundary-line between segments xvi./xvii. This gives the clitellum a peculiar and very characteristic appearance. As it occurred in all the specimens which I examined, I regard this reduction of the clitellum as a valid specific character.

The clitellum is not entirely unprovided with setæ; there is a

[1] "On *Megascolex cæruleus*, Templeton, from Ceylon, &c.," Q. J. Micr. Sci. vol. xxxii. p. 49.

single row present at the posterior boundary of the clitellar region, which belong therefore to segment xvi.; it is at this point that the thick clitellar epithelium ceases. The setæ do not form a continuous ring round that segment (the xvith); they are visible only upon the ventral surface and are developed for an equal distance on either side of the ventral median line; they extend for a distance of about one quarter of the entire circumference of the segment. The clitellar setæ are quite obvious without having recourse to a microscopical investigation of the integument, since the thick clitellar epithelium is much broken along the line of their emergence. The setæ themselves do not appear to present any differences in shape from those which are found in other parts of the body; they may perhaps be a trifle smaller, but there is no such differentiation as occurs, for example, in *Perichæta houlleti*. The most careful search failed to show any setæ on either of the two remaining segments of the clitellum: in one specimen I counted 20 setæ on segment xvi.; in another there seemed to be rather fewer, but there was no perceptible variation in the length of the line occupied by the setæ in different individuals.

I have been particular in calling attention to the characteristics of the clitellum, not only because the points to which I have directed attention are of specific importance, but also for the special reason that they serve to discriminate *Perichæta bermudensis* from *Perichæta aspergillum*. I was at first inclined to regard the species described in this paper under the name of *Perichæta bermudensis* as being identical with *Perichæta aspergillum*. The latter was first described by Perrier[1] as being "sans désignation d'origine." As I received a few years ago some Earthworms collected by Mr. Shipley in the Bermudas which seemed to be *P. aspergillum*, I considered that the present species was the same, as the individuals agreed, on a superficial inspection, with *Perichæta aspergillum*. However, in Perrier's description of *P. aspergillum* there are characters mentioned which appear to show that I am right in regarding *Perichæta bermudensis* as a distinct though closely allied form; in the figure[2] illustrating *Perichæta aspergillum* setæ are figured upon *all* the segments of the clitellum; but in the text the matter is left a little obscure. M. Perrier says (p. 120), "Je n'ai vu sur la ceinture que de faibles traces . . . . des ceintures de soies."

The great difference in size may possibly also be a valid specific difference; no doubt this character is one which has to be used with special caution in the case of Earthworms. There are other points, too, which I shall call attention to in referring to the characters offered by the male generative pores and the spermathecal pores.

The *dorsal pores* commence, as in *Perichæta aspergillum*, between segments x./xi.

The *oviducal pore* lies upon the middle ventral line of segment xiv.

[1] "Recherches pour servir à l'histoire des Lombriciens terrestres," Nouv. Arch. Mus. t. viii. p. 5.

[2] *Loc. cit.* pl. iv. fig. 71.

The *male pores* are upon segment xviii., comparatively near to the ventral median line; they are not, as is, for example, the case with *Perichæta affinis*, at the sides of their segment. The setæ of segment xviii. are present between the two pores, but they cease to be visible some little way from the pores on each side. The pores themselves lie in the direct line of the circle of setæ. Close to each of the apertures of the atria is a group of rounded orifices, which in one specimen showed the following arrangement:—There were four on one side and five upon the other, each group of pores lying in a circle below, and to the inside of, the atrial pores. The arrangement therefore, as well as the number of these pores, shows some differences from *Perichæta aspergillum*; I occasionally observed fewer than four pores, but never anything like so many as eleven, which Perrier states to be the number found in *Perichæta aspergillum*. When the cuticle is stripped off, these pores become very obvious and can be easily counted with a lens. Examined under the microscope they do not present the appearance of pores, but of solid papillæ covered by a reticulation; they are in fact, as I have already pointed out [1] for *Perichæta aspergillum* and other species of the genus, the openings of masses of unicellular glands.

I could not see the *spermathecal pores*, and there was no development of accessory papillæ corresponding to those which have just been described as occurring near the atrial pores. This is another point in which *Perichæta bermudensis* differs from *Perichæta aspergillum*, where such papillæ have been described and figured by Perrier.

The *gizzard* occupies segments viii.–x., the septa of those segments being absent; the remains of the septa are to be recognized in a series of ligamentous bands which attach the gizzard to the parietes; of these there are three pairs: two on each side are attached, close to each other, not to the gizzard itself, but to the septum which lies just in front of it; they pass obliquely backwards and outwards; behind these and nearly at the posterior extremity of the gizzard is another band on each side. The walls of the œsophagus behind the gizzard are much folded (internally) and very vascular in segments xii.–xiv., particularly in segment xiii.; this region no doubt represents the calciferous glands of other Earthworms, which do not here form distinct diverticula.

In segments v. and vi. are "*blood-glands*" which present a racemose appearance.

The *intestine* is provided with the usual pair of cæca.

The *sperm-sacs* are in segments xi. and xii.

The curved duct of the *atrium* opens directly on to the exterior, and not through a dilated terminal portion; it is surrounded by innumerable small white glands, which correspond to the pores which surround the external orifice of the atrium.

The *ovaries* are in segment xiii.

[1] "Contributions to the Anatomy of Earthworms, with Descriptions of some New Species," Q. J. Micr. Sci. vol. xxx. p. 461 *et seq.* pl. xxix. figs. 3, 4, 5.

There are two pairs of *receptacula ovorum* in segments xiii.[1] and xiv. respectively. Those of segment xiii. lie above the ovaries.

The three pairs of *spermathecæ* lie in segments vi., vii., and viii. The oval pouch of the spermatheca has a long narrow duct: the diverticulum has the same form but is much smaller; it is hardly as long as the duct of the main pouch.

PERICHÆTA TAPROBANÆ, n. sp.

The following description is based upon the examination of some half-dozen examples of a *Perichæta* from Ceylon. The specimens were collected a good many years ago by Prof. Moseley and were deposited by him in the Oxford University Museum. Mr. W. Hatchett Jackson was so good as to place them in my hands for identification and description. The worms were labelled "*Perichæta cingulata*," and I presume therefore that they agreed with Schmarda's coloured figure of that species[2]. As, however, Schmarda's description of the species is not by any means sufficient for identification, I do not think it safe, in the present state of our knowledge of this genus of Earthworms, to define any species by colour only.

M. Vaillant[3], to whom we are indebted for the first anatomical account of *Perichæta*, identified six Earthworms in the Paris Museum with *P. cingulata*, apparently basing this identification upon the shape of the setæ. The futility of such a character is shown by the fact that Perrier[4] was rightly able to distinguish several distinct species among the individuals which were all called "*Perichæta cingulata*" by Vaillant. The name "*cingulata*" was applied by Schmarda in the belief that the species was characterized by possessing a clitellum. It is not, however, on this ground that I think it desirable to drop the name *Perichæta cingulata* altogether. Vaillant's *Perichæta cingulata* according to Perrier[5] is practically indistinguishable from the *Perichæta posthuma* of the same author; and it is impossible to be certain that they are different from Perrier's *Perichæta affinis*—so at least Prof. Perrier thinks, and Dr. Horst[6] agrees with him. But I do not follow Perrier in retaining the name *Perichæta cingulata* for *Perichæta posthuma*, since there are really

[1] Fletcher ("Notes on Australian Earthworms, Part III.," Proc. Linn. Soc. N. S. W. ser. 2, vol. ii. p. 394) describes in *Perichæta canaliculata* "a pair of smooth white sacs" lying above the ovaries in segment xiii., which are doubtless the same structures. Two pairs of these bodies occur in several species of *Perichæta*.

[2] 'Neue wirbellose Thiere,' Bd. ii. p. 16, pl. xviii. fig. 162.

[3] "Note sur l'Anatomie de deux Espèces du Genre *Perichæta*, &c.," Ann. Sci. Nat. 5e sér. t. x. p. 225.

[4] *Loc. cit.*

[5] *Loc. cit.* p. 114.

[6] "Descriptions of Earthworms, V.," Notes Leyden Mus. vol. xii. p. 232. It should be remarked, however, that Vaillant neither figures nor describes setæ upon the clitellum; he remarks, indeed, "la ceinture seule en [des soies] est privée." They *are* present in *Perichæta affinis*, so that probably Dr. Horst's earlier (Midden-Sumatra, Vermes, p. 4) identification of *P. cingulata* (of Vaillant) with *Perichæta indica* was more correct.

no reasons either for believing or disbelieving that Vaillant's *Perichæta cingulata* is the same species as Schmarda's *Perichæta cingulata*.

In the specimens which I examined there is no trace of the natural colour left; the worms are a pale brownish grey—the clitellum a darker brown. As they do not agree with any *Perichæta* of which there is an adequate description, I give them the new name *Perichæta taprobanæ*.

There are only four species of *Perichæta* which agree with the present in possessing only a single pair of spermathecæ, so that it is more easily to be discriminated than species which possess the more typical number of three or four pairs. The species in question are *Perichæta sangirensis*, Mich.[1], *Perichæta ceylonica*, F. E. B.[2], *Perichæta quadragenaria*, E. P., and *Perichæta elongata*, E. P. *Perichæta taprobanæ* differs from the last two species in a number of points; it will be sufficient here to mention one point of difference only for each species. *Perichæta taprobanæ* differs from *Perichæta quadragenaria* in the size and form of the spermathecal appendix; from *Perichæta elongata* in the characters of the "prostate"; from *Perichæta sangirensis* in the absence of a dilated sac at the distal extremity of the atrium. *Perichæta ceylonica* is distinguished by having two pairs of atria.

Perichæta taprobanæ is a stout worm, measuring about 80–100 mm.; the largest specimen was 105 mm. in length; an individual measuring 84 millims. in length had a breadth of 6·5 mm. and was composed of about 114 segments.

The worm undoubtedly belongs to the restricted genus *Perichæta*, although, as will be seen presently, one of the distinctive characters of the genus is absent: the *setæ* form continuous rows and are numerous; on the first setigerous segment of one specimen I counted 52 setæ, on the fifth 81, on the twelfth segment of the same individual there were 74, on the twenty-fifth 67. The seta formula is therefore as follows:—

Segment I.	V.	XII.	XXV.
52	81	74	67

The setæ are present on *all* the clitellar segments and form complete circles. Their form is not different from that of the setæ elsewhere. Those upon the hinder segment of the body are nearly twice as long as those upon the anterior.

The *clitellum* is composed of the usual three segments, but is a little indistinct at both ends.

The *oviducal pore* is single and median; it lies in front of the circle of setæ of segment xiv.

The *atrial pores* are upon the xviiith segment and are sometimes very prominent—forming conical elevations—owing to a protrusion

[1] "Oligochaeten des naturhistorischen Museums in Hamburg, IV.," Jahrb. Hamburg. wiss. Anst. viii. p. 35.

[2] "Notes on some Earthworms from Ceylon and the Philippine Islands, &c.," Ann. & Mag. Nat. Hist., Feb. 1886.

of a part of the atrium; the setæ are interrupted for a short space on either side of each pore, which, however, lie directly in the line of the setæ. I counted seventeen setæ between the male pores.

I could find *no* genital or copulatory *papillæ* of any kind.

The *spermathecal pores* were very evident in all the specimens; they lie between segments vii./viii.

The *dorsal pores* commence between segments xii./xiii.

The anterior segments of the body are bi- or tri-annulate.

With regard to the internal anatomy of the species, I only direct attention to those points which are known to be of importance in the discrimination of species. The position of the *gizzard* is perfectly normal; it lies in segments viii.–x., and the septa between these segments have nearly entirely disappeared, being represented only by a few ligaments binding the gizzard to the parietes. The *intestine* is very remarkable on account of the fact that there are *no cæca*. I looked for these structures very carefully, and entirely failed to discover them; they are always (according to my experience) quite easy to find when present. I must therefore conclude that the present species is unique in the absence of cæca. Although there appears to be no Earthworm known on other grounds referable to the genus *Perichæta* (*s. s.*) which possesses no intestinal cæca, Mr. Fletcher[1] has described a *Megascolex* in which cæca are present. In *Perichæta queenslandica*, a worm with "interrupted circles of setæ," there are a pair of lateral cæca arising from the intestine in segment xxv. and directed anteriorly, as in all true *Perichætæ* with the exception of *Perichæta taprobanæ*[2]; these two species evidently render it impossible to define strictly the genera *Perichæta* and *Megascolex*, though as a matter of convenience those names may be, for the present at least, retained until more exceptions are made known. In other particulars the alimentary tract of this Earthworm does not diverge from the normal.

The *intersegmental septa* commence to be distinct after the fourth segment; the first four septa, viz. those bounding segments v.–vii., are rather thickened; as are also the first two septa which lie behind the gizzard, that is to say those which separate segments x./xi. and xi./xii. The thick septa in front of the gizzard are covered with very conspicuous nephridial tufts.

The *sperm-sacs* lie in segments x., xi., and xii.

The *atria* consist as usual of a thick muscular duct bent upon itself and of a glandular portion consisting of ramifying cæca; the latter is fairly compact except where it is cleft at its junction with the non-glandular part. The glandular part is much smaller than is usual in this genus, and is entirely limited to the xviiith segment. The muscular duct is unprovided with a dilated sac at its extremity.

There is only a single pair of *spermathecæ*, which lie in segment viii. They also are small; and, as the facts contained in this account are based upon the dissection of several examples, I may emphasize the

[1] "Notes on Australian Earthworms, Part II.," P. Linn. Soc. N. S. W. ser. 2, vol. i. p. 964.

[2] I am not certain as to *Perichæta ceylonica*.

smallness of the atria and the spermathecæ as a characteristic of the species. Each spermatheca consists of a globular portion communicating with the exterior by a narrow duct, to which is appended a small diverticulum consisting also of a swollen terminal portion and of a narrow duct.

PERICHÆTA MORRISI, n. sp.

I name this species, of which I obtained several living examples from Kew, after Mr. Morris, Assistant Director of the Royal Gardens. Three or four specimens were forwarded to me, of which only one was sexually mature; the following description is based upon that specimen.

The species comes from Penang.

The accompanying coloured sketch by Mr. Smit (Plate IX. fig. 1) represents the natural colours of the worm and shows its distinctness from *Perichæta sinensis*, with which species, however, it cannot be confounded, as will be seen in the course of the following description.

The worms during life protruded the buccal cavity, as apparently all species of *Perichæta* do.

The length of the specimen (after preservation in weak, followed strong, alcohol) is 52 mm.; the number of segments in the body is 93.

The *setæ*, as in other species, form continuous rows.

The *clitellum* begins abruptly with the commencement of segment xiv., but does not terminate exactly at the posterior boundary of segment xvi.; the glandular substance ends at the level of the setæ which are present on the last segment of the clitellum, as in *Perichæta bermudensis* (see p. 160); the setæ of this segment, as in the species with which I have compared *Perichæta morrisi* in this particular, are only present upon the ventral surface.

The *oviducal pore* occupies the usual position.

The *atrial pores* open on to the xviiith segment, and are not separated by a very wide interval: they are in the line of setæ, but the setæ cease for a short space on either side of each pore.

The *spermathecal pores* lie between segments v./vi. and vi./vii.

There are no *papillæ* in the neighbourhood of the male pores, although on a subsequent dissection of the worm I noticed some minute white glands in the xviiith segment. Papillæ, however, are present upon certain of the anterior segments in the neighbourhood of the spermathecal apertures.

Upon each of segments vii. and viii. is a single circular disk occupying the median ventral line of the segment and lying just in front of the circle of setæ belonging to the segment.

The *gizzard* lies in segments viii.–x., the mesenteries which should divide those segments being absent.

The usual pair of *cæca* are present.

The *œsophagus* in segments x.–xiv. is much thickened and of a whitish appearance. This region doubtless corresponds to the calciferous glands of other Earthworms, which do not appear to be developed as distinct pouches in the genus *Perichæta*.

The *atrium* is not furnished with a distal sac.

There are two pairs of *spermathecæ*, which lie in segments vi. and vii.; the appendix is a tube of uniform calibre and is very nearly as long as the pouch. In the case of one spermatheca, the appendix is twisted at its commencement round the stalk of the spermatheca.

PERICHÆTA BARBADENSIS, n. sp.

In June of the present year I received from Kew Gardens five living worms of the genus *Perichæta*, which were all of a reddish-brown colour with a grey clitellum; the iridescence of the cuticle was very marked, on account of the dark pigment in the body-wall; when the worms were killed in weak alcohol, a quantity of yellowish fluid was expelled from the dorsal pores.

In spite of the close similarity in colour between all five specimens, I believe that they are to be referred to two distinct species, of which one—that which I call *Perichæta barbadensis*—is somewhat protean, showing considerable variations, which I do not, however, regard, for reasons which will be stated presently, as being of specific value. I describe the second species subsequently (see p. 169).

Two of the specimens were of about the same size, measuring 4¼ inches in length (when preserved in strong alcohol, after having been killed in *weak* alcohol); the diameter in front of the clitellum is 4 mm. The length of the preclitellar somites is 18 mm.; the clitellum itself measures 4 mm. The number of segments is 78.

In this individual—which I call *a*—setæ were present upon the last segment of the clitellum (Plate IX. fig. 6); the clitellum itself in all three specimens is fully developed upon all the segments xiv.–xvi. and bears anteriorly the single median oviducal pore; the number of setæ upon the last segment of the clitellum is small, about half a dozen.

In the second individual (*b*) the number of setæ upon the last segment of the clitellum is greater than in *a*.

In the third individual (*c*) the number of setæ upon the last segment of the clitellum is about as great as in *b*, but in addition the first segment of the clitellum (*i. e.* no. xiv.) bears three, or possibly four, setæ on each side of the oviducal pore (Plate IX. fig. 7), which there lies within the circle of setæ of its segment, and not, as is usually the case in the genus *Perichæta*, in front of the setæ. It might be supposed that these three individuals represented merely three stages in the disappearance of the setæ belonging to the clitellar segments. In immature worms setæ are always present upon the clitellar segments. I am not aware that any exact observations have been made as to the time and manner of their disappearance in those species which have, when adult, a clitellum devoid of setæ. But in the present species the differences in the clitellar setæ coincide with differences in the genital papillæ and also with differences in the number of spermathecæ. But, as will be seen presently, it does not happen that the worm with the fewest setæ upon the clitellum has the most marked development of the genital papillæ. Hence I

should conclude that this species is one whose characters are not yet definitely fixed; it is evidently on the way to entirely losing the setæ upon the clitellum.

The genital *papillæ*, as has been already remarked, differ in the three individuals.

In *a* there is, in the first place, a median sucker-like papilla upon segment vii., just in front of the circle of setæ; and in the second place, a single median papilla occupying an exactly corresponding position upon segment xviii.

In *b* there is no anterior papilla or papillæ; on segment xviii. are two papillæ placed on the inner side of each atrial pore and lying below the circle of setæ; the innermost papilla on each side is below as well as to the inside of the outermost, which occupies a corresponding position with regard to the male pore.

In *c* the arrangement is by far the most complicated, and yet this individual is the one which has the most setæ upon the clitellum.

There are no anterior papillæ; on the eighteenth segment a small circular papilla lies above each atrial pore and another lies exactly below it, on the boundary-line between segments xviii./xix. In the middle of segment xviii. are two papillæ lying side by side and above the setæ of that segment. On the right-hand side of the body is another papilla, which lies just above one of these two. There are thus seven papillæ in all.

In all three individuals the *atrial pores* are lateral in position, being separated by the entire diameter of the body, which is here a trifle wider than either anteriorly or posteriorly.

With regard to the internal anatomy, all three specimens showed the following characters in common:—

The *gizzard* occupies the usual position, and there are a pair of intestinal *cæca*.

The *intestine* has a small typhlosole.

The *atria* have an extensively developed glandular portion, which extends from segments xvii.–xxi. in *b* and from xviii.–xxii. in *a*; it is rather smaller in *c*, but then the worm itself is smaller [1].

I found two pairs of *egg-sacs* attached to the posterior face of the septa dividing segments xii./xiii. and xiii./xiv.; they are pear-shaped with a long stalk, and not very wide at the widest end.

The position and number of the *spermathecæ* differ in the three individuals: in *a* there were two pairs somewhat unsymmetrically disposed; they open, however, in the intersegmental grooves v./vi. and vi./vii. In segment vi. lie a pair, of which one was very small and immature; the fully developed spermatheca consists of an oval pouch terminating in a narrow duct, from which arises a long cylindrical appendix. In segment vii. the spermatheca of the right side of the body had the same characters; on the left side the duct of the spermatheca, although opening in the normal position, is greatly elongated, traversing septum vii./viii. and expanding in the viiith segment into the large oval pouch. The diverticulum of this spermatheca lies in segment vi.

[1] It measures 84 mm. and consists of 64 segments.

In *b* there are three pairs of spermathecæ in segments vi., vii., and viii., which are in every respect perfectly normal.

In *c* there are two pairs lying in vi. and vii., but quite normal in structure.

It may be that I am wrong in associating all these individuals together under one specific name.

PERICHÆTA HESPERIDUM, n. sp.

Two individuals out of the five specimens just referred to, of which I have described three under the name of *Perichæta barbadensis*, presented certain differences; these differences would, if the specimens had come from a different locality, be undoubtedly considered of specific value. As it is, I am uncertain, considering their exceedingly close similarity in coloration, whether to regard all five individuals as belonging to one protean species, or whether to regard the two specimens described here as a distinct species. Since the differences which they show to the three described as *Perichæta barbadensis* are more marked than either of the three exhibit among themselves, I give them at least a provisional name.

The *external characters* are those of *Perichæta barbadensis*, excepting that there are *no setæ upon the clitellum* and that there are *no genital papillæ*. In describing the last species, I pointed out that there is a gradual reduction in the three specimens of the setæ upon the clitellum, which is accompanied by a reduction in the genital papillæ. In the two specimens which I describe here as *Perichæta hesperidum* this reduction in number has culminated in the total disappearance of both the clitellar setæ and the genital papillæ. If it were not for certain differences in the internal anatomy, to which I shall call attention later, these facts would rather show that there is no necessity for separating the forms specifically.

In the internal anatomy there are, however, differences. I should say, however, that I have only dissected one of the two individuals associated together here under the name of *Perichæta hesperidum*.

In that worm the *cæca* are remarkably small as compared with those of other species. The *intestine* is provided with a fairly well-marked typhlosole; it commences in the xvth segment.

There are two pairs of *spermathecæ*, which lie in segments vii. and viii. and open on the border-line between segments vii./viii. and viii./ix.; in the case of the anterior pair, the displacement of mesentery makes the apertures, when viewed from the inside of the body, look as if they were placed in the middle of segment vii.

The diverticulum is contorted.

I only found a single pair of *receptacula ovorum* in place of the two pairs of the last species; they are attached to the front wall of segment xiii. and lie above the ovaries; they are elongate and lie obliquely on the septum.

The *atrium* shows a difference of importance from the last species; this is the presence of a terminal sac. This sac is, however, so extremely small in the present species that it needs careful looking

for and might very easily escape attention; the muscular duct of the atrium becomes very narrow just before it opens into this sac.

PERICHÆTA MAURITIANA, n. sp.

In August of last year I received from Kew a number of living Earthworms which had been accidentally imported from *Mauritius*: they proved on examination to belong to two distinct species: one is a *Urochæta*, indistinguishable, so far as I can see, from *Urochæta corethrura*; the other is a *Perichæta* belonging apparently to a new species.

At present one species of *Perichæta* is known to occur in Mauritius; and a second, although described from Australia, is believed to be indigenous to Mauritius. The first is *Perichæta mauritii* of Kinberg, which cannot be satisfactorily identified; the second—*Perichæta peregrina*—has been lately described by Mr. Fletcher[1], and so cannot be confounded with *Perichæta mauritiana*, which comes much nearer to *Perichæta robusta* from the neighbouring Ile de France.

The colour of the living worms was reddish brown, with a pale greyish-brown clitellum. Their habits are those of other species of *Perichæta*.

The length of the largest specimen, after preservation with corrosive sublimate and alcohol, is 80 mm.

The number of segments is 85.

The *clitellum* occupies the usual segments; the last segment of which it is composed has a short row of setæ in the middle ventral line, as in *Perichæta bermudensis*.

The *oviducal pore* is single and median upon segment xiv.

The *atrial pores* are in the line of setæ of segment xviii.; the setæ are interrupted for a short distance on each side of both apertures.

The *genital papillæ* are restricted to the neighbourhood of the atrial pores. There are three on each side, lying below and to the inside of the atrial pores.

The *gizzard* lies in segments viii. and ix.; it apparently does not extend, as this organ so often does in other species of *Perichæta*, into segment x.

The usual pair of *cæca* are present, which originate from the intestine in segment xxvi. and extend forwards to the anterior boundary of segment xxv.

There are two pairs of *spermathecæ* in segments vii. and viii. The diverticulum is as long as, or perhaps rather longer than, the spermatheca itself. It consists of a slightly sinuous tube with a globular extremity.

There are two pairs of *receptacula ovorum* (Plate X. fig. 5), both of which have the form which seems to be so generally met with in this genus of Earthworms. The organ is oval, with a long tail directed towards the median ventral line. The receptacula ovorum are attached to the front wall of segments xiii. and xiv. The anterior pair lie above the ovaries.

[1] "Notes on Australian Earthworms, Part II.," Proc. Linn. Soc. N. S. W. ser. 2, vol. i. p. 969.

The *atrium* is not provided with a terminal sac; the glandular part of each atrium is very extensive, and reaches from segment xvii. to segment xxii.

Between the opening of the atrium and the nerve-cord on each side of the body are three small white oval glands (*p.g.*, fig. 6, Plate X.), which correspond to the papillæ visible on the exterior of the xviiith segment.

Note on a Perichæta *from Singapore.*

I received a single specimen of this *Perichæta* in a living condition from Kew Gardens; it had reached there in a Wardian case from Singapore.

Unfortunately I omitted to make any notes upon the worm while alive; a quantity of other material which came about the same time obliged me to preserve it at once for future study; the specimen was killed in Perenyi's solution and investigated by means of transverse sections. It is very possibly the same species as that which I have called *Perichæta morrisi*, and described in the present paper; but my notes upon its diagnostic characters are so far from being complete, that I do not venture to express an opinion as to the name which should be applied to it.

It measured 2½ inches when preserved.

The *clitellum* occupied the usual three segments, but I am not certain as to whether setæ were, or were not, present.

On the xviiith segment was a single median *papilla* placed between the two atrial pores.

I observed the *gizzard* to occupy the usual position and that *cæca* were present. There are two pairs of *spermathecæ* in segments vi. and vii.; these agree very closely with those of *Perichæta morrisi* in the proportions of the appendix to the spermatheca, but the extremity of the former was swollen, forming an oval sac. This is possibly merely due to the presence of more sperm in one case than in the other.

I desire to call special attention to the structure of the *atria*.

These organs have the usual form characteristic of the genus *Perichæta*.

Their minute structure, however, presents one character of some little interest, which has not yet been recorded in the genus. Transverse sections through the stout muscular duct by which the secretions of the glandular part of the atrium reach the exterior show that the muscular sheath encloses three separate ducts instead of only one, as is the case in all other species which have been as yet investigated microscopically. One of these tubes is large and is the main conduit of the secretion of the gland; the two other tubes are equal in size to each other, but very much smaller than the main tube.

The smaller tubes retain their distinctness from the larger tube until near the external orifice, though still remaining enclosed within the same muscular sheath. Just before the external aperture

they fuse with the larger tube, and all these open by a common orifice.

Traced in the reverse direction, one of the two smaller tubes was found to communicate with a separate lobe of the branched atrium. Whether this was or was not the case with the second of the two smaller tubes, I am not able to say.

These facts are of interest in relation to the structure of the terminal portion of the male efferent apparatus in *Perichæta ceylonensis*, a species which I described some years ago.

Perichæta ceylonensis differs from all other species of the genus in possessing *two* glandular bodies on each side in the xviiith segment. One of these is a lobed atrium like that of *Perichæta* in general, but with a straight instead of a curved muscular duct; the other is a tubular gland like the atria of *Acanthodrilus*. Unfortunately I have not been able to ascertain with which of these two glandular appendages the vasa deferentia communicate.

It seems to me that in this *Perichæta* there is a commencing separation of each atrium into two halves which culminates in *Perichæta ceylonensis*.

EXPLANATION OF THE PLATES.

Plate IX.

Fig. 1. *Perichæta morrisi*. Nat. size.
2. *Perichæta dyeri*. Nat. size.
3. *Perichæta sinensis*. Nat. size.
4. *Perichæta sumatrana* (?). Nat. size.
5. Genital segments of *Perichæta sinensis*. ♀, oviducal pore; ♂, atrial pore; *p*, genital papillæ. The segments are numbered, those of clitellum in roman numerals.
6, 7. Genital segments of *Perichæta barbadensis*, two varieties; letters as above.
8. Genital segments of *Perichæta dyeri*; letters as above.

Plate X.

Fig. 1. *Perichæta dyeri*, a portion of intestine and dorsal vessel showing septal glands. *D.V.*, dorsal vessel; *Int.*, intestine; *Spt.*, intersegmental septum; *gl.*, septal glands.
2. *Perichæta sinensis*, mulberry-shaped glands (*p.g.*) corresponding to papillæ.
3. *Perichæta sinensis*, a portion of contents of spermatheca in fresh condition.
4. *Perichæta sinensis*, a spermatheca drawn in the fresh condition. *sp.*, spermatheca; *d.*, diverticulum.
5. *Perichæta mauritiana*. *Spt.*, septum between segments xii./xiii.; *Spt.'*, septum between segments xiii./xiv.; *r.o.*, receptacula ovorum; *ov.*, ovary; *f.*, funnel of *od.*, oviduct.
6. *Perichæta mauritiana*. *N.*, nerve-cord; *v.d.*, vas deferens; *at.*, muscular part of atrium; *p.g.*, glands corresponding to papillæ.
7, 8. *Perichæta sinensis*, vascular plexus from spermathecal appendix.

5. On Specimens of *Haliaetus pelagicus* and *H. branickii* now living in the Zoological Gardens of Hamburg. By Heinrich Bolau, Ph. D., Director of the Hamburg Gardens, C.M.Z.S.

[Received February 6, 1892.]

On Dec. 12th, 1882, we received as a present from Capt. Häveker a very fine specimen of *Haliaetus pelagicus*, the Giant Sea-Eagle, which he had brought from the Amur River in Eastern Asia. This bird is still in our possession, and is, I believe, the first of the species that has ever been received alive in Europe. On Feb. 6th, 1887, a second specimen of a giant *Haliaetus* from Eastern Asia was presented by Capt. B. Dethlefsen, who had brought it from Corea. This bird was so much like the first one—except especially in the want of the white patch on the shoulders—that I long thought it a young of *Haliaetus pelagicus*. I expected it would get the white shoulder-patches after some time and turn out to be a true *H. pelagicus*; but year after year elapsed and no change took place.

Last summer, when Dr. R. Bowdler Sharpe visited our Gardens, I told him about our birds and communicated to that excellent ornithologist my observations about our Corean bird. A short time after, Dr. P. L. Sclater asked me about our two *Haliaeti* and directed my attention to the new species *Haliaetus branickii* of Taczanowski, described in his "Liste supplémentaire des Oiseaux recueillis en Corée par M. Jean Kalinowski" (P. Z. S. 1888, p. 451).

I compared my bird with the description given by Taczanowski, and was at once convinced that our Corean bird belongs to the new species.

I now send for exhibition exact figures of our two birds, carefully taken from life, and the following short descriptions of them.

The Corean Sea-Eagle (*Haliaetus branickii*) is of a deep dull slaty-black colour, which inclines to brown only in certain reflexions of light; the streaks of the feather-shafts on the neck are somewhat lighter. The upper and under tail-coverts, the shoulders, and the thighs are black, and only the tail is white. The bill is not very different from that of *Haliaetus pelagicus* except in colour. The bill and feet of *H. branickii* are less yellow than those of the other species.

The Giant Sea-Eagle (*H. pelagicus*) is decidedly brown-black; besides it is at once to be distinguished from *H. branickii* by its shoulder-patches, thighs, and upper and under tail-coverts being white, so much so that the whole hinder part of our beautiful bird is of a white colour.

The iris of *H. pelagicus* is pale yellow, that of *H. branickii* of the same colour, but many delicate streaks make it somewhat darker. In both species the margin of the upper eyelid is bare and yellow like the bill; but in *H. branickii* the bald streak is more distinct than that of *H. pelagicus*.

In the plumage of the lores our birds are not quite so different as would appear from Taczanowski's description above referred to; probably these differences vary according to age or sex. Both our birds have the lores delicately feathered, but the bristle-feathers of *H. branickii* are lighter than those of *H. pelagicus*.

H. pelagicus and *H. branickii* are the largest of all the Eagles. Both our birds live, together with many other Eagles and birds of prey, in a large cage of our Eagle-house. When at rest they are generally to be seen sitting close together: their cry is in correspondence with their giant size, much louder and more penetrating than that of all the other Eagles.

March 1, 1892.

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 1892:—

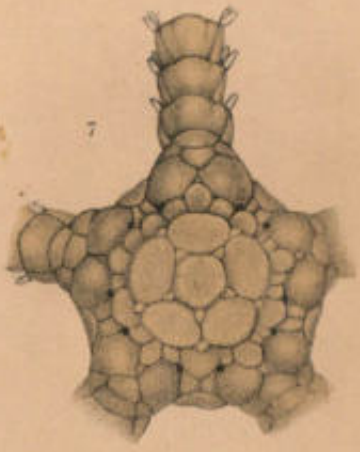
The total number of registered additions to the Society's Menagerie during the month of February was 84, of which 37 were by presentation, 7 by birth, 30 by purchase, 4 were received in exchange, and 6 on deposit. The total number of departures during the same period, by death and removals, was 75.

Amongst these special attention is called to the following:—

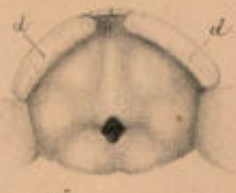
1. Two Short-winged Tyrants (*Machetornis rixosa*), purchased Feb. 15. These are the first examples of this bird that have reached us.

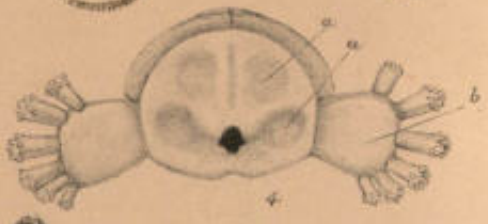
2. A female Beatrix Antelope (*Oryx beatrix*) from Arabia, presented by Lt.-Col. Talbot, Feb. 18. The pair of this Antelope presented by Col. Ross in 1890 being still alive, the receipt of another female makes a very acceptable addition to our series.

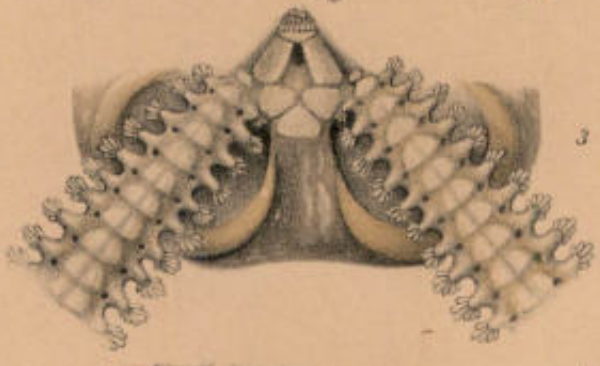
Mr. J. Graham Kerr gave a short account of the late Captain John Page's expedition up the Rio Pilcomayo, which he had accompanied as Naturalist upon the recommendation of the Council of this Society. Leaving England in the summer of 1889, Mr. Kerr spent some months studying the Zoology of the Pampas. In January of 1890 he left Buenos Aires in the steamship 'Bolivia,' which had been specially constructed for the expedition, and after several weeks spent on the Paraná, and a short preliminary trip up the Bermejo River, entered the Pilcomayo in March of 1890. Rapid progress was made for the first few days—the river being, although intensely tortuous, comparatively broad and unobstructed. The banks were here covered with thick and almost impenetrable forests, chiefly of small scrubby trees, and characterized by a great paucity of animal life. The most conspicuous mammals were:—the Carayá Monkey (*Mycetes caraya*), troops of which were to be seen in the trees by the river-side; the Mirikiná (*Nyctipithecus trivirgatus*), of which some half a dozen specimens were killed; the Tapir (*Tapirus americanus*), the tracks of which were to be seen in all directions;



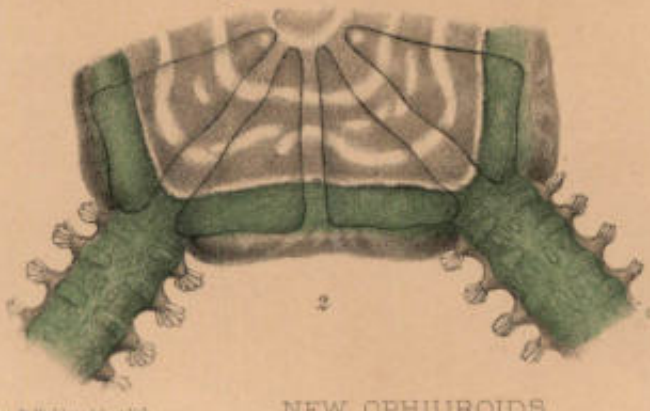


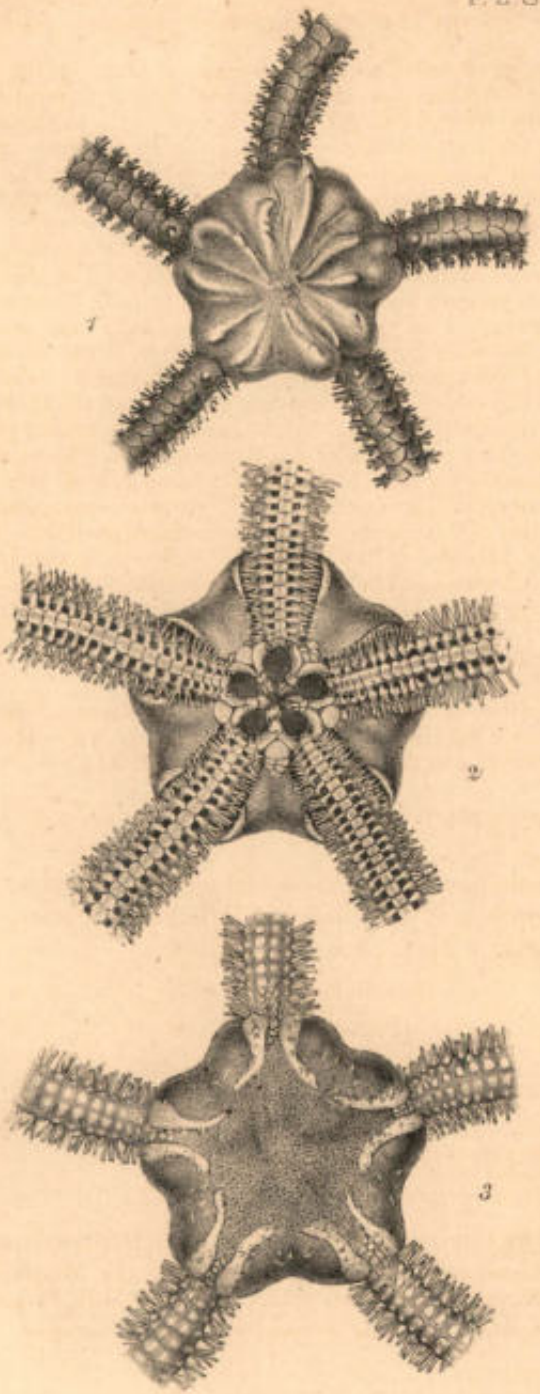












Bergen & Ripley del. et lith. Hanhart imp.

NEW OPHIUROIDS.

two species of Deer—*Cariacus paludosus*, frequenting the open marshy spots, and *Cariacus simplicicornis*, inhabiting the woods; and two Peccaries (*Dicotyles torquatus* and *D. labiatus*). Of Carnivora, the Jaguar was the most frequently seen; the Puma being equally abundant but less conspicuous, owing to its inhabiting the open campo. In the waters of the river near the mouth an Otter (*Lutra paranensis*) was abundant.

As the expedition proceeded farther up the Pilcomayo, the channel became narrower, and a great fall in the level of the water taking place, progress became much obstructed. Still, however, the 'Bolivia' struggled to get onward, but eventually came to a full stop about 300 miles from the mouth of the river, in the midst of a parched and salt-saturated country, consisting almost entirely of open campo, in which animal and vegetable life of all kinds was marked by extreme poverty and lack of variety. The greater part of the men here deserted, the leader and the doctor both died; and the remainder, numbering nine in all, after a detention of over four months, were ultimately rescued by a military search-party sent out by the Argentine Government. Mr. Kerr was compelled to leave the steamer 'Bolivia' in the Pilcomayo, and with it the greater part of his collections. The more portable portions—the bird-skins and the plants—were brought off on mule-back. The birds have been worked out, and an account of them has been published in the 'Ibis' for January 1892; while the Botanical collections are being investigated at Kew.

In illustration of his remarks, Mr. Kerr exhibited a series of 14 views taken from his own negatives, representing the progress of the expedition, and the life of the district traversed by it.

The following papers were read:—

1. A Contribution to the Classification of Ophiuroids, with Descriptions of some new and little-known Forms. By F. Jeffrey Bell, M.A., Sec. R.M.S.

[Received February 15, 1892.]

(Plates XI. & XII.)

1. The Calycinal Plates of a young Ophiuroid, p. 175.
2. The Classification of Ophiuroids, p. 176.
3. Account of *Ophioteresis elegans*, g. et sp. n., p. 178.
4. The Subdivisions of Ophiuroids, p. 179.
5. The Relation of *Ophioteresis* to Fossil Forms, p. 182
6. The Radial Shields of *Ophiomaza obscura*, p. 182.
7. *Ophiobyrsa hystricis*, p. 183.

1. The Calycinal Plates of a young Ophiurid.

Among the valuable collections recently made by Messrs. J. J. Walker, R.N., and P. W. Bassett-Smith, R.N., of H.M.S. 'Penguin'[1],

[1] Forwarded to the British Museum through the Hydrographer.

on the north-west coast of Australia, are a number of young Echinoderms; in many cases it is not possible to assign them a definite specific place, but to the morphologist they will offer charms less patent to the systematist.

Among them there is an Ophiurid which is remarkable for the large size of what are now generally regarded as the plates of the calycinal area, and which my lamented friend P. Herbert Carpenter in his valuable essay [1] called respectively centro-dorsal, under-basals, and radials. These plates are so well marked that it is quite impossible for the most sceptical to regard them as anything else than the components of a vestigial calyx, and I think their relations to the rest of the organism are perhaps better shown in the drawing given herewith than in any previously published figure of an Ophiurid (Plate XI. figs. 6, 7).

It is certain that the specimen is the young of a species of *Pectinura* or of some form closely allied to that genus.

2. Classification of Ophiuroids.

Since the year 1867, when Dr. Ljungman [2] published his still valuable classification, no serious attempt has been made to classify the Ophiuroidea, and it is possible that some doubts remain as to the relations of the genera that compose that class; the question whether the simple-armed *Ophioderma* or the much-branched *Astrophyton* has the more archaic characters is one which systematists have neither asked nor answered. The majority of naturalists would probably confess that their impression was that the many-branched forms had succeeded those with simple arms.

At any rate all are agreed that there are two equivalent orders or groups—the Ophiuræ and the Euryalæ of Johannes Müller, the Ophiuridæ and Astrophytidæ of Theodore Lyman; if these two groups are really sharply separated from one another, it will follow that we must look upon one as derived from the other and now separated from it by the disappearance of the connecting-links, or we must suppose that they had long ago a common ancestor and have since been evolved along distinct lines; the latter is the view adopted by Prof. Haeckel in his 'Generelle Morphologie.'

Mr. Lyman, though retaining the bifid division of the class, recognizes the resemblance of some of the Ophiuridæ to the Astrophytidæ, for his "group III." is called "Astrophyton-like Ophiurans." One striking point in which *Sigsbeia* and *Hemieuryale*, for example, two members of the group, resemble *Astrophyton* is the power of rolling their arms. And the function has a corresponding similarity of structure. In most brittle-stars the "several ossicles of the arm have a certain power of movement on one another, but this is limited by the development of processes and pits analogous to the zygosphenes and zygantra of the Ophidian vertebræ. In such

[1] Quart. Journ. Micr. Sci. xxiv. (1884) pp. 1–23.
[2] Öfv. Vet.-Akad. Förhandl. xxiii. (1867) p. 303.

Ophiuroids, however, as are, like *Astroschema*, capable of twisting or twining their arms round a straight Gorgonian, the saddle-shaped faces are well developed, but the limiting pits and processes are absent" [1]. The former plan of structure may be spoken of as zygospondyline and the latter as streptospondyline; there can be no doubt that the latter is the simpler, and there is much evidence to support the view that this simplicity is archaic and not secondarily acquired. For example, no Astrophytid, all of which exhibit the streptospondyline type, has the investiture of the central arm-ossicles differentiated into upper, lower, and side arm-plates; the madreporites are inconstant in number and position, and pedicellariæ, never known among Ophiurida, may be present.

If the possession of streptospondyline ossicles is an archaic character in the Astrophytidæ, it is so also in the Ophiuridæ. Have any of them other archaic characters? *Ophioscolex* has no upper arm-plates; *Neoplax* has a single, incomplete, upper arm-plate; species of *Ophiomyxa* have or have not arm-plates, which, when present, may be in two pieces; the tentacle-scales, which are so characteristic of most Ophiurids, are wanting from *Ophiomyxa* and *Ophiobyrsa*, are small and single in *Neoplax*, small and narrow in *Ophiochondrus*; the teeth and teeth-papillæ of *Ophiobyrsa* are spiniform; and the teeth-papillæ are wanting in *Ophiomyxa*, *Ophiochondrus*, *Sigsbeia*, and *Hemieuryale*.

Such a combination of characters points to the forms just mentioned as the simpler of the class; they might have led to the vegetatively multiplying Gorgon's-head or to the more highly differentiated *Ophiothrix*.

Before coming to any definite opinion, let us consider the value of the evidence of the calycinal plates. But little is known of the development of any streptospondyline Ophiurid; indeed, all that we do know is, I think, contained in one passage in Mr. Lyman's 'Challenger' Report. There we read of the young *Gorgonocephalus* (p. 252): "Above there is in the centre a group of six or seven primary plates, each encircled by a superimposed line of grains." Later on, the "disk-plates" become obliterated. Mr. Lyman's observations show that there is no regularity of the plates, which, as he calls them primary, we may suppose to be the representatives of the calycinal plates of recent Echinoderm Morphology.

But, after all, this is what may well be expected; now that we are, as I hope, delivered from the theory of the pelmatozoic [2] origin of the Echinoderms, we may go a step further and recognize, as the Cystidea teach us to do, that the calyx did not appear at once with all the diagrammatic regularity that it has retained during the manifold changes in name that its parts have suffered.

It is, then, among those Cystid-like forms in which a definite pentamerous arrangement was not permanently established [3] that we must seek for the ancestor of the Ophiurid. At present, palæonto-

[1] Bell, Comp. Anat. & Physiology, p. 316.
[2] See Ann. & Mag. N. H. viii. (1891) pp. 206 *et seq.*
[3] *Cf.* Bather, Quart. Journ. Geol. Soc. 1889, p. 166.

logists have no form known to them which gives any certain indication of Ophiurid affinities.

The considerations which I have urged will perhaps induce the student to regard the streptospondyline type as earlier than the zygospondyline. I have now to show how that type is modified.

Mr. Lyman has shown how the "Astrophyton-like Ophiurans" make an attempt to acquire the saddle-shaped ossicle of the Astrophytidæ; we have among the several genera various modifications of the type which is seen at its simplest in *Ophioteresis*.

3. Account of Ophioteresis elegans.

Among the specimens collected by Dr. Coppinger, of H.M.S. 'Alert,' while in the waters of the Western Indian Ocean, were some examples of a remarkable Ophiurid, the explanation of the structure of which was quite unattainable at the time when I was engaged in preparing a portion of the Report published by order of the Trustees of the British Museum, under the editorship of Dr. Günther, F.R.S.

Description of the General Appearance of a Specimen.

This form is particularly elegant in appearance, owing to the green colour of the upper surface of the arms and the margins of the disk, and the ornamentation by light, wavy, meandering lines of the central portion of the disk with its dark background. Below, the colour is pale yellow, except in the interradial portions of the disk, which are dark, and marked by white wavy lines. The contour of the disk, which is of moderate size in proportion to the arms, is more or less distinctly pentagonal; the regularity of the disk is, no doubt, due to the large size of the radial shields. These, however, are not apparent from the outer surface, for, like all the rest of the animal, they are enclosed in a thick softish skin. The oval slits are provided with teeth and tooth-papillæ, but there are no mouth-papillæ. The arms twist and coil on themselves; at their sides the spines form mere papilliform projections, owing to the fact that their bases are encased in the thick investing skin; on the middle line of their lower surface there is a distinct groove.

Anatomical Details.

Since the publication of Mr. Lyman's 'Challenger' Report, in which so many valuable figures were given of the characters of the ossicles of which the arms of various species of Ophiuroids are made up, every student of the group turns first to an examination of these parts of the skeleton.

Those of *Ophioteresis* are particularly interesting from the extremely generalized condition which they present. As will be seen from the drawings (figs. 4 and 5, Plate XI.), the recesses on the adoral side of the ossicle are excessively shallow, and, in correspondence with that, the articulating elevations on the aboral side are very slight and inconspicuous. But, at the same time, it is to be noted that

the saddle-shaped face of the Astrophytid ossicle is not seen here; we have merely a generalized Ophiurid ossicle, without knobs or pits.

The most remarkable character of this Ophiurid (see Plate XI. figs. 3 and 4) is the complete absence of a ventral plate; no other existing brittle-star is known to want this plate. The upper plates are definitely double, and the side-plates, instead of lying flat against the side of the central ossicles, are wider than long and stand out from the sides of the arm. The radial shields are very large and extend almost to the centre of the disk; they have the form of right-angled triangles, the hypothenuses of which face, but do not touch, one another; there are no other plates on the surface of the disk.

It is necessary to form a new genus for this form, which may be called *Ophioteresis*[1].

Definition of the Genus and Species.

Ophioteresis is a streptospondyline Ophiurid in which the covering-plates of the arms are double above, wanting below, and wedge-shaped at the sides; the radial shields are well developed, and there are ordinary teeth and teeth-papillæ.

Ophioteresis elegans has the disk more or less distinctly pentagonal, of moderate size; arm-spines five. Elegantly coloured, the upper surface of the arms and the margins of the disk green, the central portion of the disk dark, with an irregular pattern of meandering white lines; interradial portions of lower surface of disk dark, with white lines; the rest of the lower surface yellow.

Hab. Seychelles, 4–12 fms. In coll. B. M.

From this simple form differentiation would seem to have preceded along two lines; there has been an increase in complexity of articulation, associated with the fixation of certain ossicles and spines, or there has been vegetative repetition and branching with a more primitive inconstancy and irregularity of anatomical characters.

Around the primitive stock some forms—those which Mr. Lyman calls the "Astrophyton-like Ophiurans"—have remained, such as *Ophioscolex*, *Ophiobyrsa*, *Neoplax*, and *Ophioteresis*.

4. The Subdivisions of Ophiuroids.

It will perhaps be found convenient to give distinctive names to the three groups; for brevity's sake I add here the definition of Ophiuroids which I ventured to publish last September[2].

The Ophiuroidea are caliculate, actinogonidial, eleutherozoic, azygopodous Echinoderms, in which there is no distinct ambulacral groove. The "arms" are sharply marked off from the disk, are very rarely more than five in number, and are sometimes elaborately branched. The digestive system, which is aproctous, and the generative are confined to the area of the disk, as is also the specialized respiratory apparatus, which takes the form of deep clefts.

The Streptophiuræ are Ophiurids in which the ambulacral

[1] Τήρησις, alertness.

[2] *T. c.* p. 214.

ossicles articulate with one another by means of a more or less simple ball-and-socket joint; the covering plates are more or less regularly developed as superior, inferior, and two lateral, the last of which bear spines.

The Astrophiuræ (*s.* Cladophiuræ) are Ophiurids in which the ambulacral ossicles articulate with one another by means of hour-glass-shaped surfaces, and are covered by granular deposits in the thick integument; the arms may be simple or branched repeatedly.

The Zygophiuræ are Ophiurids in which the movement of the ossicles on one another is limited by the development of lateral processes and pits; superior, inferior, and lateral spine-bearing plates are always developed as a covering for the arms, which are always simple, and incapable of coiling round straight rods.

The Streptophiuræ.

The following facts justify the vagueness of the definition offered.

α. *Upper arm-plates*: absent in *Ophiomyxa vivipara*, double in *O. pentagona*, of several pieces in *O. flaccida*; double in *Ophioteresis*; in *Hemieuryale* a mosaic of small plates; single but incomplete in *Neoplax*.

β. *Under arm-plate*: absent from *Ophioteresis*, alone among existing Ophiuræ.

γ. *Tentacle-scales*: absent from *Ophiomyxa*, *Neoplax*, and *Ophiobyrsa*.

δ. *Tooth-papillæ*: absent from *Sigsbeia*, *Hemieuryale*, *Ophiochondrus*, and *Ophiomyxa*.

ε. *Radial shields* are small and short in *Ophiobyrsa*, small and irregular in *Ophiomyxa*, rather large in *Ophioteresis*, large in *Hemieuryale*, and very large in *Sigsbeia*; on the other hand, they are absent from *Neoplax*.

The order in which the genera just mentioned should stand to one another is a question which cannot be discussed now, nor can that of the relation, clearly enough marked in many points, between the Streptophiuræ and the lowest of the Zygophiuræ: the "articulating peg" in *Ophioscolex* is described as minute; it, *Ophiambix*, *Ophiosciasma**, *Ophiogeron**, *Ophiohelus**, and *Ophiotholia* have no upper arm-plates, while in *Ophiomyces* they are, if present, minute; in the three genera marked with an asterisk the arm-ossicles retain the embryonic character of being nearly divided into two.

In addition to the genera placed under the "Astrophyton-like Ophiurans" of Mr. Lyman—*Ophiobyrsa*, *Ophiomyxa*, *Ophiochondrus*, *Hemieuryale*, and *Sigsbeia*—to which, of course, must be added *Neoplax*, I would place in the Streptophiuræ the genera *Ophiomyces*, *Ophiotholia*, *Ophiohelus*, *Ophiosciasma*, *Ophiambix*, and *Ophioscolex*.

Mr. Lyman says of *Ophioblenna*, which he places next to *Ophioscolex*, "Of its skeleton I am quite ignorant." I applied, therefore, to Dr. Lütken, who has charge of the only known specimens, and he

most kindly informs me the arm-ossicles remind him most of those of *Ophiothrix* and *Ophiacantha*.

The Streptophiuræ may be thus arranged:—

A. No under arm-plates ..... 1. *Ophioteresis.*
B. Under arm-plates imperfect.. 2. *Ophiosciasma.*
C. Under arm-plates moderate or well developed.
  α. No upper arm-plates.
    I. No radial shield .. 3. *Neoplax.*
      4. *Ophiohelus.*
      5. *Ophiotholia* (?).
    II. Radial shields present.
      6. *Ophioscolex.*
      7. *Ophiambix.*
      8. *Ophiogeron.*
      9. *Ophiobyrsa.*
      10. *Ophiomyxa* (pars).
  β. Upper arm-plates minute or formed of scattered plates.
      11. *Ophiomyxa* (pars).
      12. *Ophiomyces.*
      13. *Ophiochondrus.*
      14. *Hemieuryale.*
      15. *Sigsbeia.*

It will be gathered that I regard the simple-armed Astrophiuræ as the more archaic, and I propose, therefore, an arrangement of the genera which is altogether different from that of Mr. Lyman:—

A. Arms simple.
  i. Disk large ..... 1. *Astrotoma.*
    2. *Astronyx.*
    3. *Astrochele.*
  ii. Disk moderate (about one-tenth of the length of the arms) ..... 4. *Astrogomphus.*
    5. *Astroporpa.*
  iii. Disk small, even very small.
    6. *Ophiocreas.*
    7. *Astroschema.*
    8. *Astroceras.*
B. Arms branch a few times near their free ends.
    9. *Trichaster.*
    10. *Astroclon.*
    11. *Astrocnida.*
C. Arms branch much and from near their base.
    12. *Euryale.*
    13. *Gorgonocephalus.*
    14. *Astrophyton.*

These three groups (A, B, and C) correspond to the subfamilies of Ljungman—Astronycinæ, Trichasterinæ, and Gorgonocephalinæ; and the fact that it should be so, notwithstanding the multiplication almost by three of the genera of Astrophiuræ since 1866, is another

proof, if more were needed, of the acumen of the distinguished naturalist who proposed them.

For the Zygophiurans assistance in classification will be gained from Ljungman's well-known work [1], and the families may be disposed thus :—

- *α*. No dental papillæ
  - I. Arm-incisures on the disk.
    - 1. *Ophiodermatidæ*.
    - 2. *Ophiolepedidæ*.
  - II. Arms inserted on ventral surface of disk.
    - 3. *Amphiuridæ*.
- *β*. Dental papillæ.
  - I. Oral papillæ present.
    - 4. *Ophiocomidæ*.
  - II. No oral papillæ.
    - 5. *Ophiothricidæ*.

5. The Relation of Ophioteresis to Fossil Forms.

Zittel places in the suborder Euryaleæ (= Cladophiuræ) the genera *Onychaster* and *Eucladia*, of which he says (Handb. d. Pal. p. 444) that they are "die einzigen fossilen Formen, welche mit einiger Sicherheit zu den Euryaliden gestellt werden können." But *Eucladia*, as described by Dr. Woodward (Geol. Mag. 1869, p. 241), has the madreporite on the abactinal surface, whereas all Ophiuroids have that plate actinal in position. As I purpose to confine myself for the present to the Ophiuroids, I need not discuss what is the exact systematic position of *Eucladia*, beyond urging that it should be recognized as a form which cannot be placed in the group Ophiuroidea, as now recognized.

Onychaster has the granular investment which is now found only in Astrophiuroids, but the articular surface of the arm-ossicles appears to be rather on the Streptospondyline than the Astrophiuroid (hour-glass-shaped) type.

Tæniaster (Billings, Geol. Surv. Canada, Canadian Organic Remains, dec. iii. p. 80) and *Protaster* (Forbes, Mem. Geol. Surv. U. K., dec. i. pl. iv.) are examples of a group of which the most salient known fact is the absence of ventral arm-plates. I have no information as to the character of the faces of their arm-ossicles; but, as the arms of both are flexible, I have no doubt that their proper place is with the Streptophiuræ.

6. The Radial Shields of Ophiomaza obscura.

In his description of this species Herr Ljungman (*op. cit.* p. 333) says, "in dorso scutis radialibus maximis gibboso-carinatis." So far as I can discover, this species has not been seen by any subsequent student of the group, and no figure of this very interesting species has been published.

Its discovery by Mr. Bassett-Smith off the N.W. coast of Australia (Bassett-Smith Bank, 9 fathoms) extends its geographical range, as the type was taken off Singapore. The figure which is now given

[1] *Op. cit.*

(Plate XII. fig. 1) shows very well the definite carination of the radial shields; the term carination has been and is applied to keels varying so much in depth that it is difficult to gauge how slight or how great it may be in any particular case. Herr Ljungman says "Brachia longitudine diametrum disci ter haud æquantia," but in the specimen before me the proportions are nearly 5 to 1; I cannot suppose that this difference is of specific value.

7. Ophiobyrsa hystricis.

The largest Streptophiurid found within the British area is the species so named by Mr. Lyman. Readers of Sir Wyville Thomson's 'Depths of the Sea' will remember that (on p. 123) there is a brief account of "a very large Ophiurid with thick arms, upwards of three decimetres long, and a large soft disk resembling that of *Ophiomyxa*, to which genus it seems to be allied. The specimens which have been hitherto procured are scarcely sufficiently perfect to allow of its being thoroughly worked out." There is not complete concordance between these measurements and that of Mr. Lyman, who gives the length of the arm as 187 mm.; as the diameter of the disc is 20 mm., the total spread would be very nearly four decimetres.

Among the specimens collected by the Rev. W. Spotswood Green during the dredging-expedition of the 'Flying Fox' off the S.W. coast of Ireland was one example of this species; it is a good deal broken and was, most unfortunately, dried. The figure, however, now given of it (Plate XII. fig. 2) will give a good idea of its general appearance. The diameter of the disk is 35 mm., and the arms must have been at least 310 mm. long. As Thomson states that the specimens he obtained were in a bad condition, it is not improbable that he did not preserve his largest but merely noticed its size.

Mr. Green dredged this example in 315 fathoms: the 'Porcupine' found specimens in 345 fathoms.

EXPLANATION OF THE PLATES.

Plate XI.

Fig. 1. *Ophioteresis elegans*, nat. size.
2. Disk and arms from above, to show the large radial shields, × 8.
3. The same from below, × 8.
4. Aboral surface of arm-ossicle, to show the double dorsal plates, the simplicity of the articular cavities (*a*), the absence of a covering plate to the ventral surface of the ossicle, the form and position of the side arm-plates (*l*), and the position of the spines. × 24.
5. Adoral surface of arm-ossicle, to show the double dorsal plates (*d*) and the simple articulating convexities.
6. General view of a young *Protasura*, to show the preponderating size of the calycinal plates, × 2.
7. Disk of the same × 8, to show the form and character of the calycinal plates.

Plate XII.

Fig. 1. *Ophiomaza obscura*, upper surface of disk, to show the carinated radial shields, × 2.
2. *Ophiobyrsa hystricis*, from below, nat. size.
3. The same from above, nat. size.

2. Description of an Abnormal Earthworm possessing Seven Pairs of Ovaries. By M. F. Woodward, Demonstrator of Zoology, Royal College of Science, London[1].

[Received February 29, 1892.]

(Plate XIII.)

Abnormalities affecting the genitalia of the Earthworm are of unfrequent occurrence, and, when such variations occur, they, as a rule, only affect accessory structures like the spermathecæ and seminal vesicles, not essential ones such as the genital glands.

One or two cases have, however, been put upon record in which the genital glands were themselves affected, although these variations were but slight ones. One case is described by Benham[2], in which the ovary of the right side was situated on the 12th somite; this might at first sight appear to be a simple shifting forward of the ovary, especially as the oviduct and the posterior termination of the vas deferens of that side are also displaced on to the segment in front of that on which they are normally situated. But when compared with the specimen which I now propose to describe it would appear more probable that the right ovary of Benham's specimen does not correspond with the normal one, but is rather a fresh structure altogether. Bergh[3] has also described three abnormal specimens, viz. two *L. turgidus* and one *L. purpureus*, which are of great interest in having undergone an actual reduplication of the ovaries, being possessed of an additional pair on segment 14, the normal ovaries being present as usual on segment 13.

The above-cited cases are, as far as I can ascertain, the only recorded cases of variations in the position and number of the ovaries in *Lumbricus*.

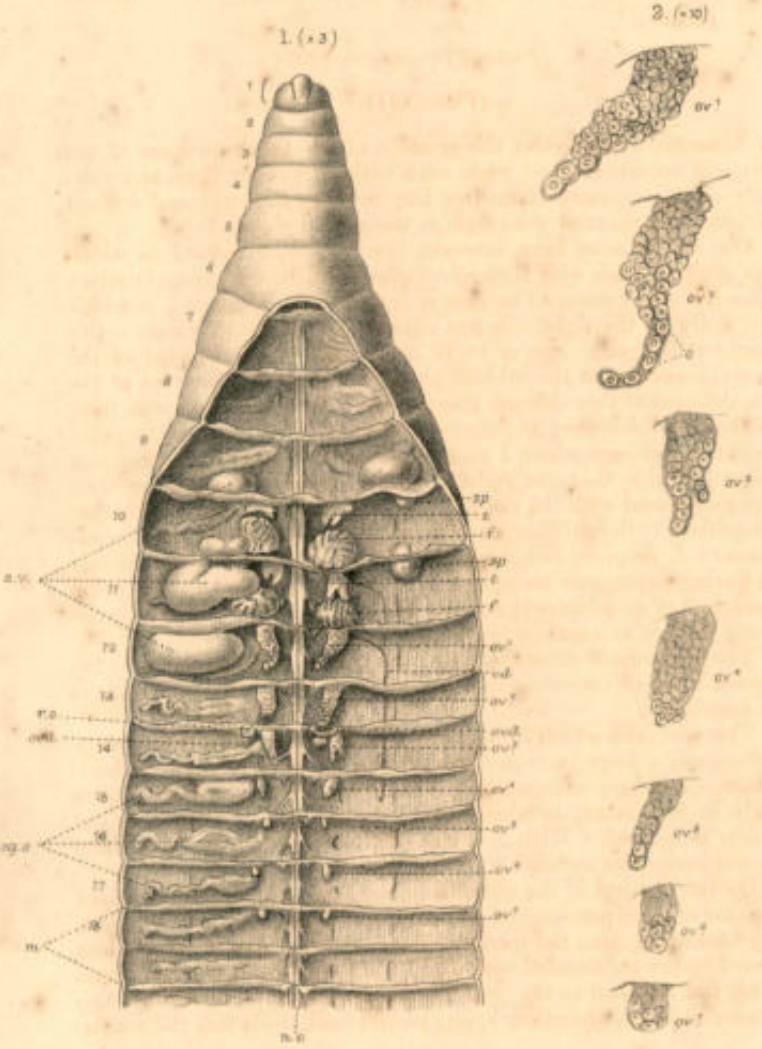
The specimen which forms the subject of the present communication was a large, well-developed common Earthworm (*Allolobophora*, sp. inc.), possessing a well-marked clitellum; it was killed early in November, in which month the genitalia are generally but poorly developed. With the exception of the ovaries the genital organs were quite normal.

On the removal of the alimentary canal one immediately noticed a number of small pear-shaped bodies (Plate XIII. fig. 1, *ov.*$^{1-7}$) projecting backwards from the mesenteries of the segments 11–17. These paired bodies are situated one on either side of the longitudinal nerve-cord, and attached to the posterior face of the mesenteries by their expanded bases, while their apices project back freely into the cavities

[1] Communicated by Prof. G. B. Howes.

[2] "Note on a couple of Abnormalities," Ann. & Mag. Nat. Hist. 6th series, vol. vii. (1891) p. 256.

[3] "Ueb. d. Bau u. d. Entwicklg. d. Geschlechtsorg. d. Regenwurmer," Zeitschr. für wiss. Zool. 1886, vol. xliv. p. 303.



M.F.Woodward del.
M.P.Parkes lith.

West, Newman, imp.

Earthworm with supernumerary ovaries.

of the somites. The anterior pair (fig. 1, *ov.*[1]) was borne upon the mesentery separating the 11th and 12th somites, and immediately dorsal to the coiled portion of the vas deferens which emerges from the latter segment. This pair is slightly the largest.

The 2nd pair (*ov.*[2]) is situated on the 13th somite, and has all the typical relations of the ovaries as found in the normal worm; facing them, and piercing the mesentery 13/14, we find a small pair of oviducts (*ovd.*) with well developed receptacula ovorum (*r.o.*). Side by side with the latter structures, on the 14th somite, is a 3rd pair (*ov.*[3]) of these conical white bodies, slightly smaller than those in front, but resembling them in position and structure. On the 15th somite is situated the 4th pair (*ov.*[4]), the members being smaller, of unequal size, and no longer exhibiting the free tapering apex so characteristic of the anterior ones. The 5th, 6th, and 7th pairs of these bodies (*ov.*[5], *ov.*[6], and *ov.*[7]) lie respectively on the 16th, 17th, and 18th somites, and show a marked decrease in size; they are relatively rounder and less regularly developed, the members of each pair being often unequal in size; further, those on the 17th somite are slightly larger than the corresponding ones on the 16th.

A rough examination with a hand-lens while the worm was still fresh showed that the free ends of these structures were composed of a number of large rounded cells, which at once suggested ova, especially as the pair of these bodies on the 13th somite possessed all the relations of the typical ovaries of the normal worm.

The specimen was subsequently clarified in glycerine, and subjected to a microscopic examination, which entirely confirmed the last observation. Each of these bodies consisted of a number of rounded cells, smaller at the broad end, and becoming larger and rounder at the free end, the tapering apex being composed of a single row of these large cells (Plate XIII., *ov.*[1]–*ov.*[5], *o.*), in each of which can be seen a large round nucleus and one or two nucleoli.

A comparison with the ovaries of a typical worm shows that the anterior pairs of these structures can in no way be distinguished from them, either in structure, position on their segments, or in shape. The four posterior pairs (fig. 2, *ov.*[4]–*ov.*[7]), however, rather resemble the ovaries of a very young or immature worm, being rounder and smaller, composed of smaller cells, and only showing one or two large round cells so characteristic of the adult ovary, while they are entirely destitute of that very characteristic free filamentous termination composed of ripe ova.

From the consideration of the above description, together with a comparison of the figures given, there can be no doubt that each pair of these 7 cell-masses is the serial homologue of the single pair of ovaries of the normal Earthworm; so that this interesting specimen, instead of possessing only a single pair situated on the 13th somite, is rich in the possession of seven pairs of ovaries, situated respectively on segments 12 to 18 inclusive.

The condition and shape of the three anterior pairs suggests that they have already been functional in the discharge of ova into the body-cavity; while the four posterior pairs are in a more rudimentary

condition, and possibly have not thus far been functional, although the large size of the cells in some of them does not preclude the possibility of their future maturity.

With regard to the oviducts, although the specimen was most carefully dissected and thoroughly examined, only one pair of these ducts was to be seen, and that in the position of the typical single pair of the normal worm: that is, related to the mesentery between the 13th and 14th somites, opening into the body-cavity of the former and on to the exterior on the latter. And neither externally nor internally could any trace of accessory oviducts be discovered.

It is interesting to note in Bergh's [1] description of the presence of additional ovaries that he, being unable to discover additional oviducts, concluded that the ova from the supernumerary ovaries must necessarily be lost.

This might probably be the case with some of the ova, but if many were shed into the body-cavity (as would happen supposing all these ovaries to be functional), it seems possible that some would find their way through the circum-neural arcade, which puts the various subdivisions of the body-cavity into communication with one another, and through which the perivisceral fluid circulates; and, if so, there would seem to be no difficulty in their finding their way into the 13th somite, and then out through the oviducts.

Beddard [2] has recently shown reason to believe that "in *Acanthodrilus* the genital funnels and a portion at least of the ducts are formed out of nephridia," and though not definitely proved for *Lumbricus*, it is probable that they are there formed by a modification of the same process. In view of this it seems strange that an animal so rich in ovaries, and with so much material in the way of segmental organs out of which to fashion oviducts, should have only developed a single pair.

Passing from *Lumbricus* to the allied genera, it is not so rare to find the animal normally possessing two pairs of these glands. Beddard has described a number of such forms. Thus, *Perionyx* [3] has normally two pairs of ovaries, and is further interesting from the fact that these structures vary in position from the 9th to the 16th segment. *Phreoryctes* [4 & 5] and *Urochæta* [6] possess two pairs of ovaries, situated respectively on segments 12 and 13. Also in *Eudrilus* [7], *Acanthodrilus* [8], and *Phreodrilus* [9] Beddard finds strong evidence for the belief that they also possess an additional pair of ovaries.

[1] *Loc. cit.* p. 308, footnote.

[2] "On the Homology between the Genital Ducts and Nephridia in the Oligochæta," P. R. S. Lond. 1890, p. 452.

[3] "On a new and little-known Earthworm, with an account of the variations of *Perionyx excavatus*," P. Z. S. 1886, p. 308.

[4] "Affinities of *Phreoryctes*," T. R. S. Ed. vol. xxxv. p. 629.

[5] "Reproductive Organs of *Phreoryctes*," Ann. & Mag. Nat. Hist. ser. 6, i. p. 389 (1888).

[6] "Certain Points in the Structure of *Urochæta*," Q. J. M. S. n. s. vol. xxix. p. 235.

[7] "On the Anatomy of Earthworms," Q. J. M. S. n. s. vol. xxx. p. 421.

[8] "On *Phreodrilus*," T. R. S. Ed. vol. xxxvi. (1890) p. 287.

Eisen[1] in *Eclipidrilus* has described three pairs of ovaries situated on segments 9, 10, and 11; this statement is challenged by Vejdovky[2], who maintains that the Oligochæta possess only a single pair of ovaries which are never found on the segments behind the oviducts (see fig. 1, *ov.*–*ov.*'). In like manner the last-named authority would throw doubt on Lankester's[3] description of the two pairs of ovaries present in *Chætogaster*.

Among the other genera of the Oligochæta, so far as I am aware, only one pair of ovaries is developed; this in the Lumbricomorpha is usually situated on the 13th somite. But, as has been just pointed out, at least eight genera may possess more than one pair, and, further, in many forms the ovaries are developed on segments other than the 13th.

The following table shows the variation in the position of the ovaries in those forms that possess two or more pairs of ovaries:—

Somites.....	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
Acanthodrilus	...	...	...	...	×	×?				
Eclipidrilus	×	×	×							
Eudrilus.....	...	...	...	...	×	×				
Lumbricus terrestris (*?herculeus*) (normal)	...	...	...	...	×					
L. herculeus (Benham) ..	...	...	...	×	×					
L. purpureus and *L. tumidus* (Bergh)	...	...	...	...	×	×				
Allolobophora, sp.? (abnormal)	...	...	...	×	×	×	×	×	×	×
Perionyx (two pairs varying from 9–16).	←							→		
Phreodrilus	...	...	×	×						
Phreoryctes	...	...	...	×	×					
Urochæta	...	...	...	×	×					

From this table it will be seen that within the limits of the Lumbricomorpha the ovaries are found to vary in position from the 9th to the 18th somite, the maximum number thus far known to be developed being seven pairs.

In front of these we find in my specimen the two typical pairs of testes developed on segments 10 and 11. As these are without doubt the serial homologues of the ovaries, the genital glands in this worm extend from the 10th to the 18th somites.

The genital glands are developed from and under cover of the peritoneal epithelium, on the posterior face of the mesenteries of the genital somites. And when we consider that the mesenteries, from which the germinal epithelium arises, are present for each segment of the body, and, further, that in most of its organs the worm exhibits a marked metamerism, it at once suggests itself that in those forms

[1] "Eclipidrilidæ and their Anatomy," Nov. Act. R. Soc. Sci. Upsala, vol. xi. (1881).

[2] Syst. d. Oligochaeten, p. 144: Prague, 1884.

[3] "The Sexual Form of *Chætogaster*," Q. J. M. S. n. s. vol. ix. (1869) p. 272.

or individuals possessed of more than one pair of ovaries we have indications of a metameric reduplication of those organs similar to that of the testes in the Hirudinea.

A metamerically repetitional disposition of the ovaries is very rare among worms generally; in fact, it is only met with in the Platyhelminthes, the Cestoda and the Nemerteans both exhibiting it. Setting aside the Cestoda as highly specialized, we find that the only worms exhibiting the metameric reduplication of the ovaries are certain of the Planarians.

Beddard has shown in *Eudrilus*[1] that the condition of the oviducts and their accessory structures, to quote his words, "suggests a comparison with the corresponding organs in the Planarians, from which group I am disposed (following Lang) to derive the Annelids."

The facts which I have herein described and tabulated appear to me to justify a belief in the potentially reproductive nature of the individual somites of the Chætopod body, and to support Beddard's suggestion above alluded to.

EXPLANATION OF PLATE XIII.

Fig. 1. Abnormal Earthworm (*Allolobophora*, sp. inc.), dissected to show the genitalia, × 3. The segmental organs and two posterior seminal vesicles removed from the right side.

1–18, the somites; *sg.o*, the segmental organs; *m*, the mesenteries; *n.c*, the nerve commissures; *s.v*, the seminal vesicles; *sp*, the spermathecæ; *t*, the testes; *f*, seminal funnels; *v.d*, the vas deferens; *ov.*^{1}–*ov.*^{7}, the ovaries; *ovd*, the oviducts; *r.o*, the receptacula ovorum.

2. Enlarged drawings of the ovaries from the right side, × 10; drawn with a camera lucida.

o., nearly ripe ova; *ov.*^{1}–*ov.*^{7}, the seven ovaries.

3. On Stridulation in certain Lepidoptera, and on the Distortion of the Hind Wings in the Males of certain *Ommatophorinæ*. By G. F. Hampson, B.A. Oxon. &c.

[Received February 1, 1892.]

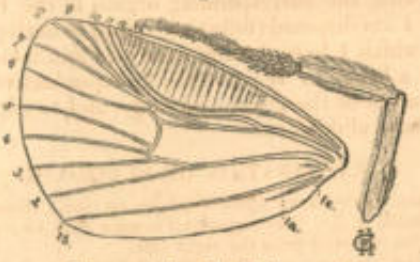
When working at the Indian Moths of the family *Agaristidæ*, my attention was drawn by Mr. E. Y. Watson, of the Madras Staff Corps, to the powers of stridulation possessed by the males of *Ægocera tripartita*, Kirby, of which he had brought home a long series from Burma. This Moth flies at dusk, and the males produce a loud clicking sound audible at some distance off—click-click-click at intervals of about a second. This led me to investigate the subject in this species and in the only other Lepidoptera known to produce the same sound—certain Butterflies of the genus *Ageronia* and other allied genera from Brazil.

The males of *Æ. tripartita* (fig. 1, p. 189) obviously differ from those of all the other species of the genus in the possession of a large patch of hyaline membrane denuded of scales beneath the costa of the fore wing, and this at once suggests itself as being connected

[1] "The Anatomy of Earthworms," Q. J. M. S. n. s. vol. xxx. p. 455.

with the sound produced. When examined with a lens, it is seen that the wing-membrane is dilated so as to produce a large concavity on the underside, the membrane being thrown into deep transverse ridges, strongest immediately below the costa; and when the wing is cleared of scales it is seen that the costal and subcostal nervures have all been distorted and curved downward, so as to give increased space to the dilated and ridged membrane. The question then arose as to the organ that could be used in combination with this structure to produce the sound. I found that the fore tarsi, instead of being

Fig. 1.



Ægocera tripartita, Kirby. ♂.
Fore leg and fore wing.

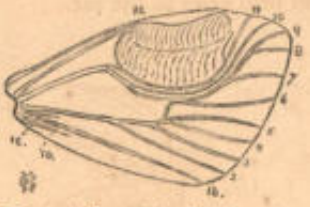
simply clothed with scales, or with the paired series of spines along the under surface that are present in many Lepidoptera to give greater power of attachment when settled, had these spines immensely developed all over the upper surface of the tarsi, and that if held extended, instead of folded against the under surface of the body, the usual method of carrying the legs in Lepidoptera during flight, the spined upper surface of the tarsi would be exactly coincident with the ridged under surface of the wing-membrane, so that each stroke of the wings in flight would cause the ridges to pass sharply over the spines and be quite adequate, I think, to produce the clicking sound. The hind tarsi have the ordinary paired spines on the under surface, and I suggest that the fore tarsi can be used to produce the sound, the dilated wing-membrane between the ridges acting as a sounding-board, for which reason it is denuded of scales on both surfaces. The use of the stridulation would be for sexual attraction.

In the closely allied genus *Hecatesia*, from Australia (fig. 2, p. 190), the males have a similar but slightly modified structure; the costal edge of the fore wing is slightly folded over on the under surface of the wing, and beneath this, and further from the base of the wing than in *Ægocera*, is a still broader and more dilated area of hyaline wing-membrane; this is longitudinally grooved and thrown into very strong waved ridges on each side of the groove, and in correlation with the different position of the ridged wing-membrane we find that it is the mid tarsi that have the spines strongly developed over the

upper surface, and I suggest that the longitudinal fold acts as a channel for the tarsus, the ridges on each side striking against the spines. Mr. E. Meyrick informs me that this insect makes a loud buzzing sound during flight, and the first time he heard it he thought a "humble-bee" was buzzing round his hat; he tells me that the insect during flight swings rapidly up and down in the air, and he thought the vibration of the air on the membrane might account for the sound.

The only other Lepidoptera known to make a similar clicking

Fig. 2.



Hecatesia fenestrata, Boisd. ♂.
Fore wing.

sound are some of the species of *Ageronia*, e. g. *A. feronia*, *fornax*, *amphinome*, and *arethusa*, as was first discovered by Darwin during the voyage of the 'Beagle,' and confirmed by Wallace, and again by Fritz Müller, who says that he also observed it in *Eunica margarita* and a small brown butterfly which he could not capture.

Darwin says that when a pair of *Ageronia feronia* were chasing each other they produced a clicking sound similar to that produced by a toothed wheel passing under a spring catch, and that the noise was produced at short intervals and was audible at twenty yards' distance. Wallace says the noise was never produced by a single specimen, but only when a pair were chasing each other, and he imagined it was in some way produced by the contact of the two insects; but Bigg-Wither noted that the butterfly settled head downwards with its wings outspread, and that if approached it raised its wings sharply once or twice, producing a whip-like sound, and that it also made the same sound while on the wing.

Ed. Doubleday examined the butterfly, and found a small membranous sac between the costal and subcostal nervures of the fore wing, with a structure along the subcostal nervure like an Archimedean screw; he very properly disclaimed this structure being necessarily connected with the sound, and, as Scudder pointed out, these are merely the swollen base of the subcostal nervure found in so many *Nymphalinæ* and the tracheal vessel in the nervure.

Swinton says that the sound is produced by the costal nervure of the hind wing, which is ridged like a file, being received into and rubbing against a small depression of the fore wing; but, as Scudder

again pointed out, this was a structure common to all nervures, and the ribbing of the nervures is always strongest near the base of the wings.

Scudder himself suggests that the sound is produced by the small erect scales on the superficies of the two wings that overlap rubbing against each other; but this is obviously inadequate to produce a clicking sound audible twenty yards off, and it is of universal occurrence that in the parts of wings that overlap the scales are short and differently formed, so as to decrease the friction; though the rubbing of the wings one against another might be sufficient to account for the slight rustling or hissing sound made by many of the *Vanessidæ* when held close to the ear.

Fig. 3.



Ageronia arethusa, Cram. ♂.

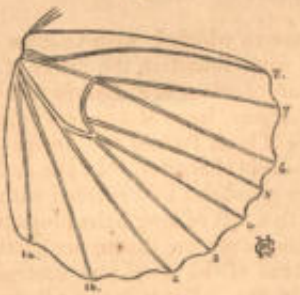
Base of fore wing and part of thorax.

a, pyriform membranous sac attached to fore wing; *b*, chitinous hooks of sac; *c*, chitinous hooks of thorax.

On detaching and clearing a fore wing of *Ageronia arethusa* (fig. 3), I found there was a small pyriform membranous sac attached to the base of the inner margin of the fore wing, open anteriorly, and with a pair of curved chitinous hooks with spatulate extremities lying freely in front of it. It was obvious that this could not come into contact with any of the nervures of the hind wing, and that no structure attached to the hind wing could act on it; and as there seemed to be a projection on the thorax in the immediate neighbourhood, I cleared and denuded of scales a half insect with the wings still attached to the thorax, and could then see under a low power of the microscope that there was a pair of strong chitinous hooks attached to the thorax, and that when the fore wing was moved up and down the spatulate ends of the chitinous hooks attached to the wing played against these, being released when the wing reached a certain angle, and I suggest that this is the cause of the clicking sound, the hooks acting as a tuning-fork and the membranous sac as a sounding-board.

In this case the structure exists in both sexes, and we must conclude that there is a mutual wish to attract, and that perhaps it is also used as a means of inspiring fear, in accordance with Bigg-Wither's

Fig. 4.



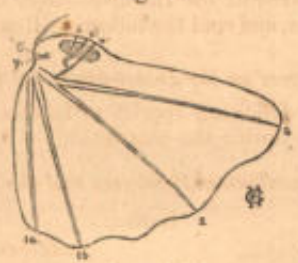
Patula and *Argiva*. ♀.
Hind wing.

Fig. 5.



Patula macrops. ♂.
Hind wing.

Fig. 6.



Argiva hieroglyphica. ♂.
Hind wing.

experience. I found the structure to be present in *Ageronia feronia* and *arethusa*.

The other structure to which I wish to draw attention is the distortion of the hind wing found in the males of certain *Noctuina* of the subfamily *Ommatophorinæ*, e. g. *Patula macrops* and the various species of the genus *Argiva*, large Moths very common all through the East. In the females of both *Patula* and *Argiva* (fig. 4) the neuration is of the ordinary *Noctuid* character. In the males of *Patula* (fig. 5) there is a very large glandular fold covered with long, silky, closely matted hairs, and with a tuft of long hairs projecting from it, attached to the costa and folded over on the upper surface of the wing, and one notices that instead of the usual nine emarginations of the outer margin there are only five. But it is not till the wing is denuded of scales that we see the nature of the change that has taken place; when this is done, we see that instead of vein 8 going to the apex of the wing it is vein 4 that does so, that the functional apex is really the middle of the outer margin, and that the whole costal half of the wing has been transformed into the glandular fold, carrying the nervures with it, perhaps for purposes of nutrition.

In the males of *Argiva* (fig. 6) we find that this has gone one step further; the fold and glandular patch are very small, but it is vein 3 that goes to the apex and there are only four emarginations of the outer margin, the other veins being represented by small aborted detached fragments near the base.

The glandular fold is almost certainly a scent-organ, and I suggest that *Argiva* once possessed an even larger one than *Patula*, and that this fold, becoming detrimental or useless to it, either from hindering flight or some other cause, has been aborted, carrying the neuration with it.

March 15, 1892.

Prof. Flower, C.B., LL.D., F.R.S., President, 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 1891.

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.
Cricula trifenestra.

American.

Samia cecropia.
Telea polyphemus.
—— *promethea.*
Hypochera io.
Actias luna.

Diurnal Lepidoptera.

European.

Papilio podalirius.
—— *machaon.*
—— *alexanor.*
*—— *maackii.*
**Sericinus telamon.*
Thais polyxena.
*—— *cerisyi*, var. *deyrollei.*
**Doritis apollinus.*
Parnassius apollo.
Anthocharis cardamines.
*—— *eupheno.*
Lycæna iolas.
—— *corydon.*
Vanessa levana.
—— *polychlorus.*
—— *urticæ.*
—— *io.*
Argynnis aglaia.
Melitæa cinxia.
Melanargia galathea.

American.

Papilio ajax.
—— *asterias.*
Papilio cresphontes.
Limenitis disippus.

Nocturnal Lepidoptera.

Smerinthus ocellatus.
—— *tiliæ.*
—— *populi.*
Sphinx ligustri.
Deilephila euphorbiæ.
—— *galii.*
*—— *nicæa.*
*—— *alecto.*
Saturnia pyri.
—— *carpini.*
Gonomita postica.
Eacles regalis.
—— *imperialis.*
* *Anisota stigma.*
* *Tricæna maxima.*

Of the insects which I have the honour to place before the Meeting this evening the following are exhibited for the first time, viz.:—*Papilio maackii* and *Sericinus telamon* from Eastern Siberia; *Thais cerisyi*, var. *deyrollei*, and *Doritis apollinus* from Syria; *Anthocharis eupheno* and *Deilephila nicæa* from the South of France; *Deilephila alecto* from Syria; *Anisota stigma* from N. America; and *Tricæna maxima* from India.

The specimens of *Deilephila nicæa* and *Deilephila alecto* were reared from pupæ deposited in the Insect-house by the Hon. Walter Rothschild, F.Z.S. The specimen of *Tricæna maxima* is the only one that emerged from several pupæ kindly sent by Mr. J. G. Gammie, of Monghoo, Kurseong, near Darjeeling, through Mr. W. L. Sclater, F.Z.S. With these pupæ many other pupæ and cocoons were sent, but I am sorry to say nearly all emerged *en route*. Amongst those that arrived in good condition were some cocoons of *Cricula trifenestrata*, from which moths emerged in due course.

* Exhibited for the first time.



J. Smit del. et lith.

Mintern Bros. imp.

ORYX CALLOTIS.

Pairings took place, and for the first time I succeeded in rearing the larvæ and obtaining a second brood of this species. The larvæ were very handsome and were reared upon whitethorn. I also succeeded in rearing the larvæ of *Eacles imperialis*, and the pupæ (3) in the Insect-house are alive and healthy. I had also the larvæ of *Eacles regalis*, but these I did not succeed in rearing.

Owing to the cold and wet summer of last year collecting was very difficult, and many species which I have generally easily obtained are absent from this list in consequence.

Mr. Sclater exhibited a flat skin of the Wild Ass of Somali-land (*Equus asinus somalicus*), taken from a specimen shot by Mr. J. D. Inverarity, about fifty miles from Berbera, about eighteen months ago, and made the following remarks :—

"Mr. Inverarity has kindly sent me the skin of the Wild Ass of Somali-land (*Equus asinus somalicus*), which I now exhibit. It will be observed that the present specimen differs from that previously described and figured (P. Z. S. 1884, p. 542, pl. 50) in having slight shoulder-stripes, as well as a dorsal stripe. The shoulder-stripe on the off side is the more distinct of the two. The general colour of the skin is also not of so deep a grey tint. All the four feet are banded as in the former specimen."

Mr. Henry Seebohm exhibited four examples (two males and two females) of *Picus richardsi* from the island of Tsu-sima in the Straits of Corea, and pointed out that one of them had more white at the tips of the primaries than has yet been found in examples from Corea. As this is the only alleged difference between *P. richardsi* and *P. kalinowskii*, the latter name, being the most recent, must be henceforth regarded as a synonym of the former.

Mr. Oldfield Thomas exhibited a mounted head of the East-African Antelope hitherto referred to *Oryx beisa*, Rüpp., but which he considered to represent a new species.

The specimen described was from the neighbourhood of Mount Kilimanjaro, and had been generously presented to the National Museum by Messrs. Rowland Ward and Co., of Piccadilly.

The species was proposed to be called

ORYX CALLOTIS, sp. n. (Plate XIV.)

Size of *O. beisa*; horns as in that species, but very slightly curved backwards. Ears long, their tips sharply pointed, and ornamented with a prominent black tuft, the hairs of which are from two to three inches in length. Ground-colour of face between the black markings rich fawn, as dark as the sides of the neck, except just round the muzzle, where the colour is white. Arrangement of markings much as in *O. beisa*, except that the black line passing through the eye runs further down under the throat and in some specimens,

as for example in the type, unites below the ramus of the mandible into that running down from the ear, those of both sides uniting again on the throat. Throat apparently without a tuft.

Oryx beisa and *O. gazella*, the only two species at all allied to *O. callotis*, both have their ears broadly rounded and quite short-haired at the tips, and both have the ground-colour of the face white, characters which readily separate both of these from the species now described. On the whole *O. callotis* is more nearly allied to *O. beisa*, *O. gazella* being distinguished from both of them by its throat-tuft, its larger and more widely expanded horns, and the different characters of its face-markings.

The type specimen has horns 23½ and 22 inches in length, but the horns are frequently much larger. Sir John Willoughby [1] says, "The horns of a female measure from thirty to thirty-two inches; those of the male are thicker, but a few inches shorter."

Mr. Thomas expressed the hope that complete specimens of this handsome inhabitant of the Imperial British East African Company's territory would soon be obtained for the National Collection.

The following papers were read :—

1. On the Orthoptera of the Island of St. Vincent, West Indies. By C. Brunner v. Wattenwyl and Professor J. Redtenbacher [2].

[Received February 17, 1892.]

(Plates XV.–XVII.)

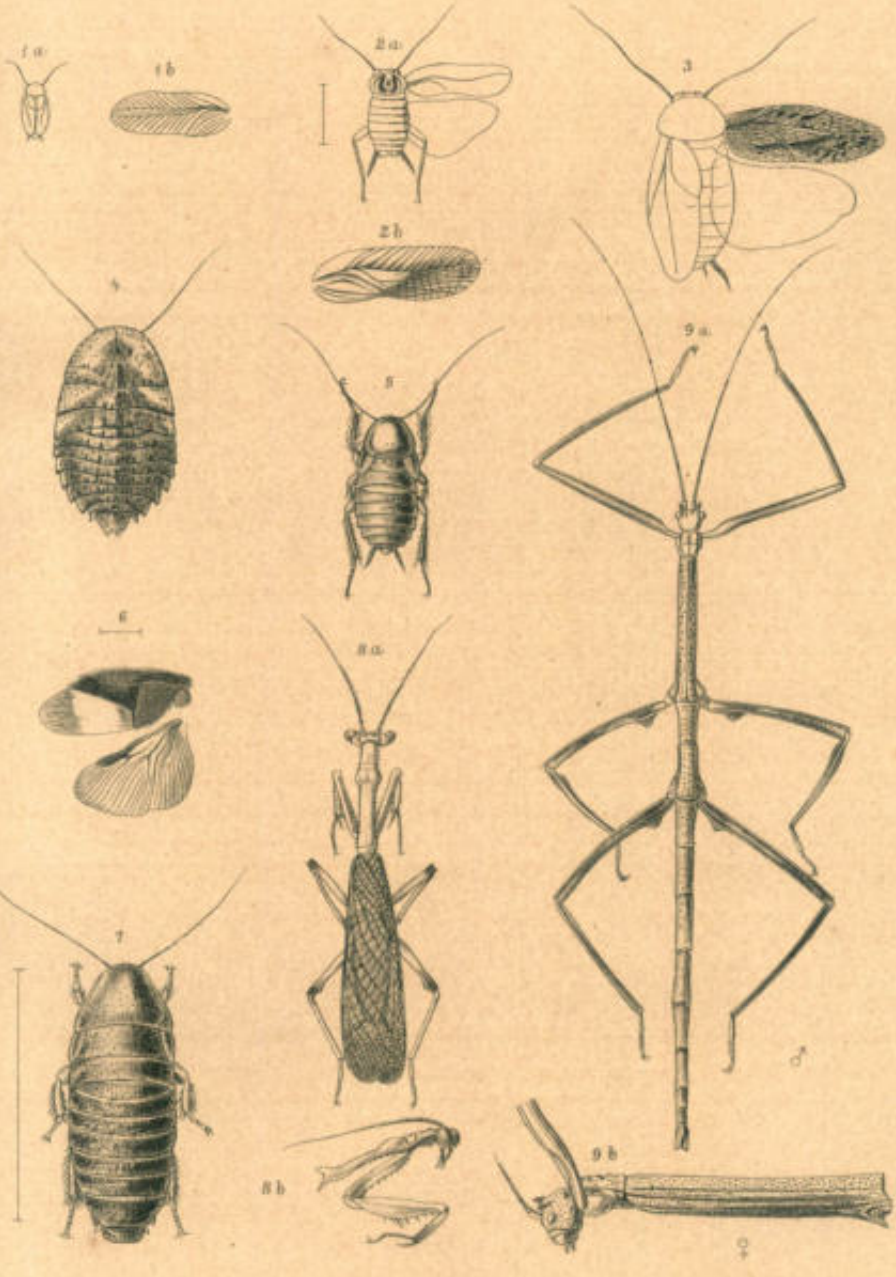
At the request of the joint Committee appointed by the British Association and by the Royal Society to investigate the Fauna and Flora of the West Indian Islands, Herr Hofrath Carl Brunner von Wattenwyl has been so good as to undertake the examination of the Orthoptera obtained in the Island of St. Vincent by Mr. H. H. Smith, the naturalist sent thither by Mr. F. D. Godman, F.R.S., to assist the operations of the Committee.

Herr Brunner obtained the help of Prof. J. Redtenbacher, and the present memoir gives the result of their study of the material submitted to them.

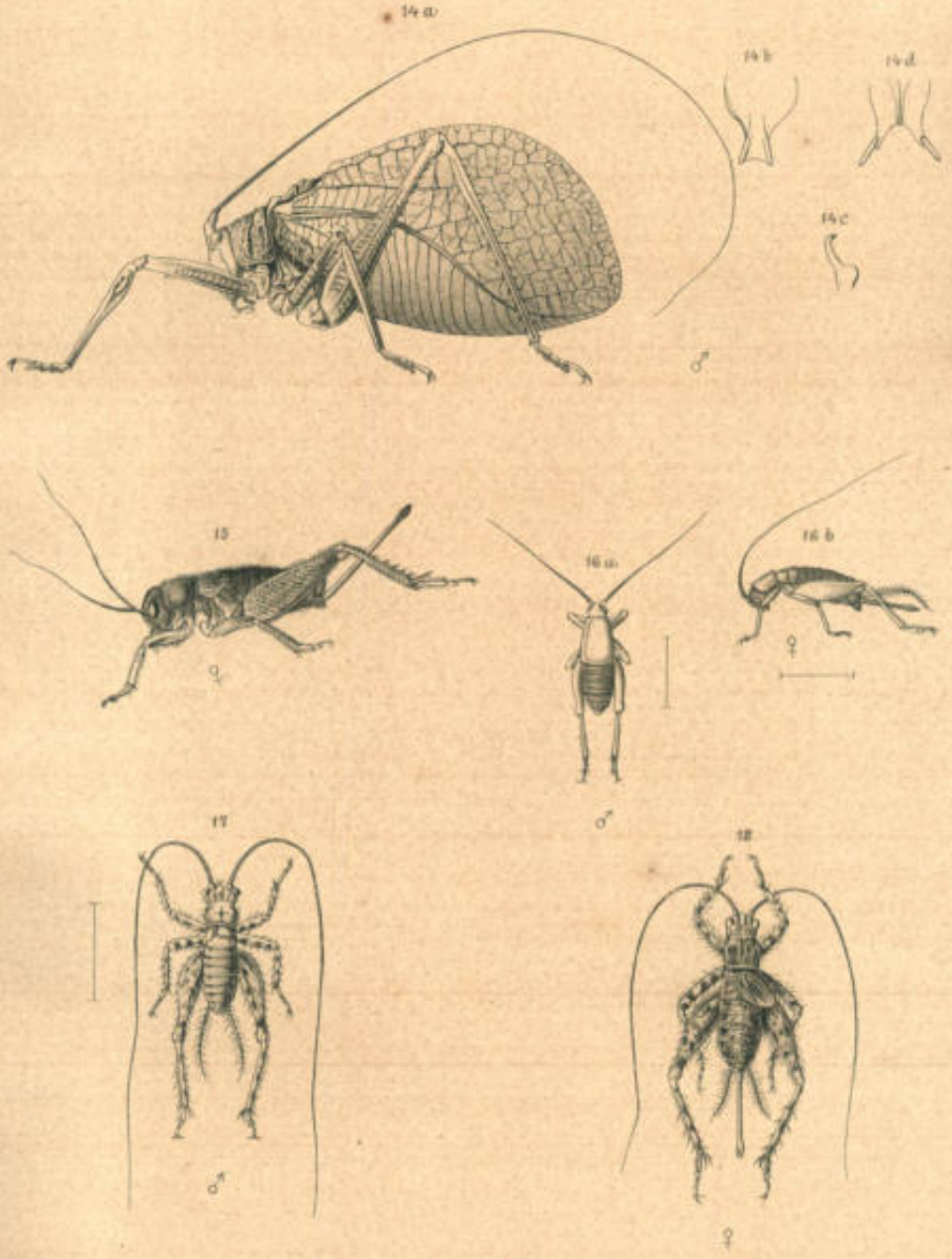
Herr Brunner, when sending to me the MS. of this paper, requested me to write an introductory notice in our own language; I have complied with his wish with the greater pleasure as giving me an opportunity on behalf of the Committee of publicly thanking him, as well as Prof. Redtenbacher, for the careful study they have made of these insects. I have also been able to supplement

[1] 'East Africa and its Big Game,' p. 288 (1889).

[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.]



ORTHOPTERA OF ST VINCENT.



ORTHOPTERA OF ST. VINCENT.

the information given in Latin by Herr Brunner, as to localities at which the species have been observed, by some memoranda communicated to me by the collector, Mr. H. H. Smith, to which his initials are appended.

The collection numbers in all 62 species, of which 19 appear to be peculiar to the island, 17 of these being here for the first time named and described.

All the great divisions of the Orthoptera are represented, and in what may roughly be called the usual proportions, except in one respect, viz. the paucity of *Acridiodea*.

The island appears to be favourable for the existence of Orthoptera, and, as it contains a variety of conditions, the number of species must be looked on as small compared with what would be found in a similarly varied area of equal extent in Central or Tropical America. What the true difference in this respect may be—whether the comparative poverty of St. Vincent is great or small—I cannot say, as I am not aware that the Orthoptera of any one district of Equatorial or of Central America have been anything like completely worked up.

Except in the two points I have just alluded to I do not perceive any points of peculiarity in the Orthopterous fauna of St. Vincent. The proportion of apterous to winged species seems to be about as usual, and the number of cosmopolitan or very widely distributed species is but small.

I have drawn up a table in order to display the distribution of the species outside of the island. From this it will be gathered that 29 of the 62 occur in other of the W. Indian Islands, 34 have been found also in South or Central America, 6 exist in N. America, and 3 have a wide distribution. Of the 26 species found in other W. Indian Islands (not including the cosmopolitan forms) the majority occur in Cuba, no less than 20 of the 26 being already known to be found there.

There is nothing to indicate that these Orthoptera have been distributed by other means than those that occur in the case of continental regions; and Messrs. Brunner and Redtenbacher make no remarks that would lead us to suppose that they are modified or varietal forms: the species that are known from elsewhere are not alluded to as varieties, and the forms that are described as peculiar are apparently distinguished by characters of normal specific value.

In reference to the comparative poverty of the island in species, it might be suggested (by those who take it for granted that the fauna of the island is an entirely derived one) that this poverty is due to the fact that not all the species that could find subsistence in the island have been able to make their way thither. But it appears at least equally probable that the poverty may be due to the restricted range that the small area of the island affords to its inhabitants.

The paucity of *Acridiodea* I see no way of comprehending with any certainty; but as this division is not only the most numerous in species elsewhere, but is also the one in which activity is as a

rule greatest, it may be that the restricted range is in their case specially unfavourable. The genus *Schistocerca* includes two of the six species of St.-Vincent *Acridiodea*; and this genus is remarkable as comprising one of the few migratory locusts that at times devastate regions of the Old World; the genus is, however, specially an American one and it is supposed that the *S. peregrina*, Ol.—the migratory locust I am speaking of—is an American insect that made its way to Africa. It is worthy of note that it is not this *Schistocerca* with great powers of flight and self-distribution that is found in St. Vincent, but two other species, one of which has a wide distribution in the Antilles and in the continental lands adjacent, while the other has been hitherto only found in Cuba, Haiti, and Jamaica, so that both are endemic species of the region in which St. Vincent is situated.

The Orthopterous fauna of St. Vincent appears to point out that it is not powers of locomotion that have established certain species in the island and excluded others, for the earwigs, which are remarkable from their very feeble powers of flight, are proportionally better represented in the fauna than the *Acridiodea*, whose powers of locomotion are notoriously great. Of the nineteen species appearing at present peculiar to the island eleven are apterous, and only eight winged species. It must not, however, be taken for granted that these nineteen species will ultimately prove to be absolutely limited to the island of St. Vincent. We may indeed feel pretty sure that some of them will be found in the neighbouring islands, and until these have been explored it would be premature to attach much importance to the fact that the majority of the species peculiar to the island are incapable of flight. It should also be remarked in reference to these nineteen species that most of them appear to be extremely rare, indeed in the case of seven of them only a single specimen of each has been obtained.

The most remarkable of these Orthoptera is *Diapherodes gigas*, the female of which is a gigantic apterous insect, 7 or 8 inches in length. Another of the most interesting of the Orthoptera of the island is the *Cyrtophyllus crepitans*; this is one of the singing Locustidæ, allied to the N. American "Katydids," and is provided with a powerful musical apparatus. The most abundant Orthopteron appears to be *Orphula punctata*; this is a comparatively small insect, extremely similar to the *Stenobothri* that are so numerous in our European fields and commons; it has, however, no stridulating organ. The common earwig of the island appears to be *Anisolabis janeirensis*.

(D. S.)

List of the Orthoptera of St. Vincent, with Indications of their Distribution outside the Island.

	Other Antilles.	S. America & Centr. America.	N. America.	More general.	Remarks.
Dermaptera.					
1. Labia arcuata, *Scud.*	0	+	0	0	
2. —— rotundata, *Scud.*	0	+	0	0	
3. —— brunnea, *Scud.*	+	0	0	0	
4. —— pulchella, *Serv.*	0	0	+	0	Niagara.
5. Anisolabis janeirensis, *Dohrn*	0	+	0	0	Apterous.
6. —— maritima, *Bon.*	+	+	+	+	Apterous; introduced by commerce?
Blattodea.					
7. Anaptycta (n. gen.) bipunctulata (n. sp.).	0	0	0	0	Three specimens obtained.
8. Phyllodromia adspersicollis, *Stål.*	+	+	0	0	
9. —— delicatula, *Guér.*	+	0	0	0	Cuba.
10. Pseudophyllodromia semivitrea (n. sp.).	0	0	0	0	One example only.
11. Epilampra brevis (n. sp.)	0	+	0	0	Cayenne.
12. Homalopteryx laminata (n. sp.).	0	0	0	0	Apterous; rare.
13. Stilopyga antillarum (n. sp.).	0	0	0	0	Apterous; one example only.
14. Panchlora viridis, *Burm.* (?)	+	+			
15. Leucophæa surinamensis, *L.*	+	+	+	+	Cosmopolitan.
16. —— maderæ, *Fabr.*	+	+	+	+	Cosmopolitan.
17. Holocompsa collaris, *Burm.*	+	+	0	0	
18. Parasphæria nigra (n. sp.)	0	0	0	0	Apterous; rare.
Mantodea.					
19. Musonia surinama, *Sauss.*?	0	+	0	0	One example.
20. Parastagmatoptera lobipes, n. sp.	0	0	0	0	One example.
Phasmodea.					
21. Phanocles curvipes, n. sp.	0	0	0	0	Apterous; rare.
22. Bacteria cyphus, *Westw.*	0	0	0	0	Apterous; rare.
23. —— linearis, *Drury*	+	0	0	0	Antigua.
24. Diapherodes gigas, *Drury*	+	0	0	0	Guadeloupe.
Acridiodea.					
25. Orphula punctata, *de Geer*	0	+	0	0	Very common.
26. Tettix quadriundulatus, n. sp.	0	0	0	0	♀almost apterous.
27. Vilerna æneo-oculata, *de Geer*	0	+	0	0	
28. Caletes (n. g.) apterus, n. sp.	0	0	0	0	Apterous; scarce.
29. Schistocerca pallens, *Thunb.*	+	0	0	0	One example.
30. —— columbina, *Thunb.*	+	+	0	0	

TABLE (*continued*).

	Other Antilles.	S. America & Centr. America.	N. America.	More general.	Remarks.
LOCUSTODEA.					
31. Anaulacomera laticauda, *Brun.*	0	+	0	0	
32. Microcentrum pallidum, *Brun.*	+	+	0	0	
33. Stilpnochlora marginella, *Serv.*	+	+	0	0	
34. Bliastes superbus, n. sp.	0	0	0	0	Winged.
35. —— striolatus, n. sp.	0	0	0	0	Winged.
36. Cyrtophyllus crepitans, n. sp.	0	0	0	0	Winged.
37. Copiophora brevicornis, *Redt.*	0	+	0	0	
38. Conocephalus guttatus, *Serv.*	+	+	0	0	
39. —— muticus, *Redt.*	+	0	0	0	Cuba.
40. —— maxillosus, *Fabr.*	+	+	0	0	
41. —— infuscatus, *Scud.*	+	+	0	0	
42. —— frater, *Redt.*	+	+	0	0	
43. —— heteropus, *Bol.*	0	+	0	0	
44. —— macropterus, *Redt.*	+	+	0	0	
45. —— punctipes, *Redt.*	0	0	0	0	
46. —— surinamensis, *Redt.*	0	+	0	0	
47. Xiphidium saltator, *Sauss.*	+	+	0	0	
48. —— propinquum, *Redt.*	0	+	0	0	
49. Pherterus cubensis, *de Haan*	+	+	0	0	
GRYLLODEA.					
50. Gryllotalpa hexadactyla, *Perty*	0	+	0	0	
51. Scapteriscus didactylus, *Latr.*	+	+	0	0	
52. Tridactylus minutus, *Scud.*	0	0	+	0	Maritime.
53. Anurogryllus muticus, *de Geer*	+	+	0	0	
54. Gryllus assimilis, *Fabr.*	+	+	+		
55. Gryllodes rufipes, n. sp.	0	0	0	0	Apterous; unique.
56. Ectatoderus antillarum, n. sp.	0	0	0	0	Apterous.
57. Larandus marmoratus, n. sp.	0	0	0	0	Apterous; unique.
58. Endacustes dispar, n. sp.	0	0	0	0	Apterous; unique.
59. Cyrtoxiphus vittatus, *Bol.*	+	0	0	0	Cuba.
60. —— gundlachi, *Sauss.*	+	+	0	0	
61. Orocharis gryllodes, *Pall.*	+	+	+	0	Cuba.
62. Metrypus luridus, *Sauss.*	+	0	0	0	

I. Ordo DERMAPTERA.

(Auctore A. DE BORMANS.)

Genus LABIA, Leach.

1. L. ARCUATA, Scudder.

Labia arcuata, Scudd. 1879, A Century of Orthoptera, p. 36; Proceed. of the Boston Soc. of Nat. Hist. vols. xii.–xx.

Patria: St. Vincent, leeward side.—Specimina compluria, collecta sub ligno putrido, stercore, etc. mensibus Januar. et April. in Rich-

mond Valley, 1200′.—Occurrit etiam in Brasilia (*Scudd.*), Columbia et Peru (*coll. Brunner*).

Also at Châteaubelais, Lot 14 Estate. Kingstown old Botanic garden.—*H. H. S.*

2. L. ROTUNDATA, Scudder.

Labia rotundata, Scudd. ibidem, p. 42.

Patria: St. Vincent, leeward side, prope Kingstown et Richmond Valley 1200′.—Specimina compluria, collecta sub lignis, mensibus Januario et Octobri.—Occurrit etiam in Mexico (*Scudd., coll. Brunner*).

Also at Baronallie; found on several occasions near the sea.—*H. H. S.*

3. L. BRUNNEA, Scudder.

Labia brunnea, Scudd. ibidem, p. 43.

Patria: St. Vincent, windward side.—Specimina compluria.—Occurrit etiam in Cuba (*Scudd., coll. Brunner*).

Found in the forest on the W. slope of the Soufrière at an elevation of 1500 ft., also on Lot 14 Estate.—*H. H. S.*

4. L. PULCHELLA, Serville.

Forficula pulchella, Serv. 1839, Hist. nat. des Ins. Orthoptères, p. 42.

Patria: St. Vincent, prope Richmond Valley (1100′) et Bow-wood Valley (800′).—Specimina compluria, collecta sub lignis, mensibus Decembri, Januario, et Octobri.—Occurrit etiam in America septentrionali, Niagara (*Serv.*).

Genus ANISOLABIS, Fieber.

1. A. JANEIRENSIS, Dohrn.

Forcinella janeirensis, Dohrn, 1864, Monogr. d. Dermaptteren, Stettin. ent. Zeit. p. 285.

Patria: St. Vincent, leeward side, prope Richmond Valley (1200′), Bow-wood, prope Kingstown.—Specimina numerosa, collecta sub lignis et frondibus, in fruticibus, mensibus Januario et Octobri.—Occurrit etiam in Brasilia, Rio de Janeiro (*Dohrn; coll. Brunner*), St. Catharina (*coll. Brunner*).

This is the most abundant earwig in the islands, and was very frequently met with.—*H. H. S.*

2. A. MARITIMA, Bonelli.

Forficula maritima, Bon., Gené, 1862, Monograph. Forfic. p. 9.

Patria: St. Vincent, prope Bow-wood Valley (800′).—Specimina duo juvenilia, collecta in silvis sub lignis putridis mense Octobri.—Species cosmopolitica, indigena in confinibus Mediterraneis; occurrit etiam in Japan, Haïti, Cayenne, Columbia, Buenos Aires, New Orleans (*coll. Brunner*).

II. Ordo ORTHOPTERA GENUINA.

1. Familia BLATTODEA.

(Auctore C. BRUNNER v. WATTENWYL.)

Tribus ECTOBIIDÆ.

Genus ANAPTYCTA, Brunner (gen. nov.).

(ἀνά = retro ; πτυκτός = plicatus.)

Caput magnum. Oculi remoti. Pronotum suborbiculare, postice subtruncatum, latere deflexum. Elytra abdomen vix superantia, venis distinctis, vena radiali ramos parallelos in marginem anticum, vena ulnari ramos parallelos in marginem posticum elytri, emittentibus. Alæ in modum generis Anaplectæ *plicatæ. Femora subtus inermia.*

Differt a genere *Anaplecta*, Burm.: elytrorum vena ulnari ramos pectinatos in marginem posticum emittente, femoribus subtus inermibus.

1. A. BIPUNCTULATA, Brunner (n. sp.). (Plate XV. fig. 1.)

Parva, colore pallide testaceo. Pronotum disco punctis duobus ferrugineis, vix perspicuis, ornatum. Pedes pallidi. Sexus?

Long.	corp.	7	millim.
„	elytr.	6	„
„	pronot.	2	„
Lat.	„	2·5	„

Patria: St. Vincent, leeward side.—Specimina tria.

Two specimens were beaten from branches, at an elevation of 1000 ft., in the forest above Châteaubelais in September. The third has no locality.—*H. H. S.*

Tribus PHYLLODROMIIDÆ.

Genus PHYLLODROMIA, Serv.

1. P. ADSPERSICOLLIS, Stål.

Phyllodromia adspersicollis, Stål, 1861, Freg. Eugenies Resa, Zool. v. p. 308.

Patria: St. Vincent, windward side.—Specimina præsentia compluria differunt colore nitido-ferrugineo.—Occurrit etiam in Cuba, Guantanamo (*Bolivar*), Brasilia (*Stål*), Mexico (*coll. Brunner*).

Lot 14 Estate: Châteaubelais.—*H. H. S.*

2. P. DELICATULA, Guérin.

Phyllodromia delicatula, Guérin, Sagra, Hist. de Cuba, 1856, p. 346.

Patria: St. Vincent, windward et leeward side.—Specimina compluria.—Occurrit etiam in Cubâ (*Guérin*).

Lot 14 Estate: Châteaubelais.—*H. H. S.*

Genus Pseudophyllodromia, Brunner.

Hoc genus in unam speciem Philippinicam instructum, multas species Americanas comprehendit, quarum singulas de Saussure *descripsit* (Miss. scientif. au Mexique, p. 42).

1. P. semivitrea, Brunner (n. sp.). (Plate XV. fig. 2.)

Caput testaceum, vitta fusca inter oculos signatum. Antennæ nigræ. Pronotum valde transversum, marginibus lateralibus late hyalino-testaceis, disco flavo, vittis duabus longitudinalibus nigris, lyrato-curvatis, necnon vitta breviore media. Elytra hyalino-testacea, venis fuscis, pone medium macula obliqua fusca ornata. Alæ hyalinæ, levissime infumatæ, venis fuscis, vena ulnari ramos duos in apicem alæ emittente. Pedes pallide testacei, fusco-marginati. Abdomen fuscum. Cerci fusci. Lamina supra-analis ♀ transversa, leviter rotundata. Lamina subgenitalis ♀ rotundato-emarginata. ♀.

Long.	corp.	7	millim.
„	elytror.	8	„
„	pronot.	1·9	„
Lat.	„	2·8	„

Patria: St. Vincent, windward side.—Specimen unicum.
Found near Lot 14 Estate in April.—*H. H. S.*

Tribus Epilampridæ.

Genus Epilampra, Burm.

1. E. brevis, Brunner (n. sp.). (Plate XV. fig. 3.)

Statura minore, colore testaceo. Caput magnum. Antennæ testaceæ. Oculi valde remoti. Vertex infuscatus. Frons pallida. Pronotum caput liberans, totum læve, minutissime fusco-conspersum, latere deflexo. Elytra in ♂ apicem abdominis parum superantia, in ♀ hoc æquantia, minute fusco-conspersa, punctis impressis nullis. Alæ hyalinæ, venis pallide testaceis, margine antico testaceo-afflato. Pedes testacei, levissime fusco-marginati. Abdomen fuscum. Lamina supra-analis ♂ levissime rotundato-emarginata. Lamina supra-analis ♀ plicata, sed vix emarginata. Lamina subgenitalis ♂ utrinque stylo instructa. ♂ ♀.

		♂		♀	
Long.	corp.	20	millim.	23·5	millim.
„	pronot.	5	„	7	„
Lat.	„	7·5	„	8·7	„
Long.	elytr.	17	„	19	„

Patria: St. Vincent, windward side.—Specimina compluria.—Occurrit etiam in Cayenne (*coll. Brunner*).
Lot 14 Estate in April.—*H. H. S.*

Genus Homalopteryx, Brunner.

1. H. laminata, Brunner (n. sp.). (Plate XV. fig. 4.)

Fusco-testacea. Aptera, plana. Pronotum oblongo-semiorbiculare, caput valde superans, supra caput leviter cucullatum, rugulis et granulis rugosum, margine postico, cum segmentis ceteris omnibus, rugulis regularibus obsito, meso- et metasternum latere in dentem productum. Pedes breves. Segmenta abdominis dorsalia latere in dentem producta. Cerci minimi, pallidi, apice ipso nigri. Lamina supra-analis ♀ triangulariter producta, apice triangulariter emarginata. Lamina subgenitalis ♀ rotundato-producta. ♀.

Larva ♂ non differt a feminis, exceptis meso- et metanoto lobatis, qua de causa certe imagines alatæ sunt.

Long. corp. ♀	.....	26	millim.
„ pronot.	.....	7·8	„
Lat. „	.....	12·8	„

Patria: St. Vincent, windward side.—Specimina nonnulla, feminæ adultæ, mares imperfecti.—Hæc species *Homalopterygi capucinæ*, Br. (Nouv. Syst. des Blattaires, p. 196), affinis est. Feminæ hujus speciei ignotæ.

Lot 14 Estate; Châteaubelais; also in the Forest at an elevation of 2000 ft. in decaying leaves.—*H. H. S.*

Tribus Periplanetidæ.

Genus Stylopyga, Fischer de W.

1. S. antillarum, Brunner (n. sp.). (Plate XV. fig. 5.)

Parva, oblongo-rectangularis (abdomine haud dilatato) picea, nitida. Caput globosum, excepto labro, atrum. Oculi magis inter se remoti quam scrobes antennarum. Pronotum parabolicum, levissimum. Elytra lobiformia, lateralia, mesonotum haud superantia. Metanotum cum segmentis abdominis marginibus lateralibus levissime reflexis. Pedes graciles. Metatarsus posticus ceteris articulis unitis longior. Pulvilli minutissimi. Cerci nigri. Lamina supra-analis ♀ transversa, angustissima, rotundata. ♀.

Long. corp.	.....	16	millim.
„ elytr.	.....	2·5	„
„ pronot.	.....	4·6	„
Lat. „	.....	6·5	„

Patria: St. Vincent, W. I.—Specimen unicum.—Differt a *St. orientali*, L., statura oblongo-rectangulari, elytris mesonotum haud superantibus, lamina supra-anali ♀ transversa.

Leeward, in the Forest under rotting leaves on the banks of a stream at an elevation of 500 ft.—*H. H. S.*

Tribus Panchloridæ.

Genus Panchlora, Burm.

Species totæ virides hujus generis difficillime distinguuntur. Diagnoses in opere 'Nouv. Syst. des Blattaires' non sufficiunt: præcipue species *exoleta*, Klug, *viridis*, Burm., et *nivea*, L., confunduntur.

1. P. viridis, Burm. (?).

Panchlora viridis, Burm. 1839, Handbuch, ii. p. 506; Brunner, l. c. p. 273.

Patria: St. Vincent, leeward side (300').—Specimina compluria, collecta vespere mense Januario.—Occurrit etiam in Cuba et America meridionali (*coll. Brunner*).

Golden grove, flew to light on Jan. 29th; also at Baronallie and Châteaubelais.—*H. H. S.*

Genus Leucophæa, Brunner.

1. L. surinamensis, L.

Blatta surinamensis, L. 1766, Syst. Nat. p. 687.
Panchlora surinamensis, Brunner, Nouv. Syst. d. Blatt. p. 278.

Patria: St. Vincent, windward side.—Specimina duo.—Species cosmopolitana.

Lot 14 Estate.—*H. H. S.*

2. L. maderæ, Fabr.

Blatta maderæ, Fabricius, 1792, Ent. Syst. ii. p. 6.
Panchlora maderæ, Brunner, Nouv. Syst. d. Blatt. p. 282.

Patria: St. Vincent.—Species cosmopolitana, cognita ex Cuba, Brasilia, insulis Canariensibus, insula Madera, Senegal, Java et insulis Philippinicis.—Specimen unicum.

Lot 14 Estate in May.—*H. H. S.*

Tribus Corydiidæ.

Genus Holocompsa, Burm.

1. H. collaris, Burm. (Plate XV. fig. 6.[1])

Corydia collaris, Burmeister, 1839, Handb. ii. p. 492.
Holocompsa collaris, Brunner, Nouv. Syst. d. Blatt. p. 347.

Patria: St. Vincent, windward side.—Specimen unicum.—Occurrit etiam in Cuba (*Guérin*), Brasilia (*coll. Brunner*).

Lot 14 Estate in April.—*H. H. S.*

[1] Imago, quoad alas, in opere 'Nouv. Syst. des Blattaires,' tab. x. fig. 50, falsa est.

Tribus Perisphæriidæ.

Genus Parasphæria, Brunner.

1. P. nigra, Brunner (n. sp.) (Plate XV. fig. 7.)

Picea, raro punctata. Uterque sexus elytris lobiformibus, lateralibus, corpori concoloribus, margine externo limbato. Pedes rufo-fusci. Tarsi breves. Metatarsus ceteris articulis unitis triplo brevior. Pulvilli articulorum omnium per totam longitudinem extensi. ♂ ♀.

Larvæ marginem versus pallidiores, pedibus fusco-testaceis.

	♂		♀	
Long. corp.	22	millim.	33	millim.
„ pronot.	7·5	„	8·5	„
Lat. „	10	„	12	„
Long. elytr.	3·5	„	4·5	„

Patria: St. Vincent, windward side, leeward side.—Specimina nonnulla.—Hæc species differt ab omnibus congenericis utroque sexu subaptero necnon tarsis brevioribus.

Lot 14 Estate; also on the W. slope of the Soufrière volcano at an elevation of 1500 ft. under rotting fruit in September.—*H. H. S.*

2. Familia Mantodea.
(Auctore J. Redtenbacher.)

Tribus Mantidæ.

Genus Musonia, Stål.

1. M. surinama, Saussure (?).

Thespis surinama, Sauss. 1871, Mém. Mex. 2, 1, p. 129.
Musonia surinama, Stål, 1877, Syst. Mantod. p. 66.

Patria: St. Vincent, windward side.—Specimen unicum, imperfectum, propterea difficiliter determinandum.—Hæc species occurrit in Surinam et Venezuela (*Stål*).

Lot 14 Estate in September.—*H. H. S.*

Tribus Vatidæ, Stål.

Genus Parastagmatoptera, Sauss.

1. P. lobipes, Redt. (n. sp.). (Plate XV. fig. 8.)

Viridi-flavescens. Oculi rotundati. Prothorax gracilis, supra coxas anticas valde ampliatus, margine laterali nigro-denticulato. Elytra hyalina, elongata, reticulo beryllino, campo antico basi dilatato, viridi, opaco, coriaceo. Alæ vitreæ, margine antico virescente. Antennæ ♂ *valde serratæ. Coxæ anticæ validiores, apice superne valde dilatato intusque macula lata nigra ornatæ. Femora antica valida, intus spinis alternatim nigris et pallidis (apice tantum fuscis) instructa. Femora quatuor postica apice*

cum basi tibiarum infuscata, ante apicem subtus lobo distincto infuscato instructa. ♂.

Long. corpor.	38	millim.
„ pronot.	14·3	„
„ elytror.	29·8	„
„ fem. ant.	10·5	„
„ fem. post.	10·5	„

Patria: St. Vincent, south end.—Specimen unicum, collectum in fruticibus mense Septembri.

Hæc species maxime affinis *Parastagmatopteræ flavoguttatæ* (Serv. Hist. Nat. d. Ins. Orth. p. 183, et Saussure, Mém. Mex. iv. p. 84), quæ occurrit in Brasilia, Republica Argentina (*Sauss.*) et Venezuela (*Serv.*). Differt: prothorace supra coxas valde ampliato, femoribus 4 posticis ad apices infuscatis, singulo subtus lobo distincto instructo.

3. Familia PHASMODEA.

Genus PHANOCLES, Stål.

1. P. CURVIPES, Redt. (n. sp.). (Plate XV. fig. 9.)

Fusco-griseus vel grisco-cinereus. Antennæ longæ, interdum dilute et remote fusco-annulatæ. Articulus primus antennarum haud ampliatus, marginibus parallelis, oculis sesquilongior. Dorsum capitis bicornutum, cornu apice compresso, inæqualiter bidentato. Corpus totum albido-granulosum, granulis, præsertim in ♂, *minutis. Elytra alæque nulla. Segmentum medianum metanoto longius. Mesonotum leviter carinatum. Abdominis segmenta 3 et 4 postice in medio tuberculo depresso, in* ♂ *obsoleto, instructa. Segmentum dorsale 6 in utroque sexu duobus sequentibus, simul sumptis, longius. Segmentum ultimum* ♂ *gracile. Femora 4 postica cum tibiis distincte curvata, sæpe dilute et late fusco-fasciata. Femora et tibiæ carinis omnibus subtiliter et confertim spinulosis. Femora 4 postica subtus prope basin in* ♂ *valde lobiformiter, in* ♀ *multo minus laminato-dilatata. Metatarsus superne compressus, haud lobatus, articulis reliquis simul sumptis subæqualis. Cerci* ♂ *breves, acuminati, teretes.* ♂ ♀.

	♂		♀	
Long. corp.	83–84	millim.	160	millim.
„ pronot.	3·4	„	5·8	„
„ mesonot.	18	„	34	„
„ metanot.	5·7	„	10	„
„ seg. med.	7·3	„	14·6	„
„ fem. ant.	22·7	„	39	„
„ fem. post.	21·5	„	36·3	„

Patria: St. Vincent, windward side, leeward side prope Cumberland (500′).—Specimina nonnulla, collecta in silvis aridis mense Septembri.

Hæc species valde similis est *Bacteriæ bicorni*, Stoll (Spectr. etc.

pl. xv. fig. 57); ab ea autem differt metatarso superne haud lobato, cornubus capitis ad apices compressis et inæqualiter bidentatis.

The male was met with on Lot 14 Estate in September.—*H. H. S.*

Genus Bacteria, Latreille.

1. B. cyphus, Westw.

Bacteria cyphus, Westwood, Cat. of Orth. Ins. in the Collect. of the Brit. Mus. i. Phasmidæ, p. 24, 1859, pl. vii. fig. 7.

Patria: St. Vincent, windward side.—Specimina duo.

Lot 14 Estate and Châteaubelais.—*H. H. S.*

2. B. linearis, Drury (?).

Mantis linearis, Drury, Exot. Ent. i. pl. 50.

Bacteria linearis, Burmeister, Handb. ii. 567; Westwood, l. c. p. 24.

Patria: St. Vincent, windward side.—Specimina numerosiora.

Diagnoses in operibus citatis (Burmeister, Westwood, etc.), valde breves, non sufficiunt ad determinandam speciem. Fortasse specimina præsentia ad *Bacteriam gracilem*, Burm. (Handb. ii. p. 567), referenda sunt.

Genus Diapherodes, Gray.

1. D. gigas, Drury.

Diapherodes gigas, Drury, Exot. Ent. ii. pl. 50; Westwood, Catal. of Orth. Ins. i. Phasmidæ, p. 84.

Mantis angulata, Fabricius, Ent. Syst. ii. p. 13.

Patria: St. Vincent, windward side, leeward side (1200').—Specimina compluria, collecta in arboribus altis mensibus Januario, Maio, Octobri, et Novembri.—Occurrit etiam in insula Guadeloupe.

4. Familia Acridiodea.

Tribus Tryxalidæ.

Genus Orphula, Stål.

1. O. punctata, de Geer.

Orphula punctata, Stål, 1873, Recens. Orthopt. i. p. 106.

Acrydium punctatum, de Geer, 1773, Mém. iii. p. 503, pl. 42. fig. 12.

Patria: St. Vincent, windward side.—Specimina numerosa.—Occurrit etiam in Mexico, Costarica, Guatemala, Nicaragua, Columbia, Venezuela, Surinam, Brasilia et Peru (*coll. Brunner*).

Abundant about Lot 14 Estate and Châteaubelais.—*H. H. S.*

Tribus Tettigidæ.

Genus Tettix, Charpentier.

1. T. quadriundulatus, Redt. (n. sp.). (Plate XVI. fig. 10.)

Fuscus vel fusco-griseus, interdum pallido-conspersus, ubique minutissime granulatus. Vertex oculo latior, in medio carinatus, ante

oculos parum productus, apice breviter tridentatus. Costa frontalis ante oculos valde (a latere visa) rotundato-producta, carinis approximatis, subparallelis. Pronotum antice truncatum, postice haud subulatum sed acuminatum, apicem femorum posticorum haud attingens, superne in medio interdum utrinque macula nigra transversa ornatum. Carina media pronoti compressa, retrorsum sensim humilior, imprimis in ♀ valde quadri-undulata. Anguli humerales carinati, obtusi. Elytra ovata. Alæ in ♀ valde abbreviatæ, in ♂ nonnihil longiores. Femora antica carinis haud undulata, intermedia superne subtusque undulata, postica haud undulata. Tibiæ omnes fusco-annulatæ. Tarsi basi et apice fusci; metatarsus posticus articulis reliquis unitis nonnihil longior, pulvillo tertio quam pulvillis 1 et 2 simul sumptis brevior. ♂ ♀.

	♂		♀	
Long. corpor.	4–5	millim.	6·4	millim.
„ pronot.	4–5	„	6	„
„ fem. post.	3·6	„	4	„

Patria: St. Vincent.—Specimina numerosa.

Valde affinis *Tettigi femorato*, Scudder (Trans. Amer. Ent. Soc. 1869, p. 305; Bolivar, Essai sur les Acrid. d. la trib. d. Tettigidæ, 1887, p. 90); ab eo differt præcipue carina media pronoti quadri-undulata.

Found at Châteaubelais, also at the south end of the island on rocky ground near the sea, under decaying leaves.—*H. H. S.*

Tribus Acridiidæ.

Genus Vilerna, Stål.

1. V. æneo-oculata, de Geer.

Acrydium æneo-oculatum, de Geer, Mém. iii. p. 502, pl. 42. fig. 11 (1773).

Acrydium sanguinipes, Serville, Hist. nat. Ins. Orthopt. p. 670 (1839).

Patria: St. Vincent, windward side.—Specimina numerosa.—Occurrit etiam in Surinam (*Stål, coll. Brunner*).

Apparently common on Lot 14 Estate and at Châteaubelais.—*H. H. S.*

Genus Caletes, Redt. (nov. gen.).

(καλήτης = strumosus.)

Costa frontalis supra ocellum valde producta, carinis subparallelis, infra ocellum medium sensim evanescentibus. Fastigium verticis cum occipite fere in eodem plano jacens, antice sulco transverso nullo. Ocellus medius a scrobibus antennarum distincte remotus. Carinæ laterales frontis subparallelæ, distinctæ, completæ. Pronotum totum cum capite rugosum, margine antico et postico truncato, tuberculis elevatis obsito, in medio valde carinatum, sulcis transversis tribus completis, carinam mediam insecantibus; carina media prope marginem posticum compresso-elevata. Carinæ laterales subdistinctæ, irregulares, inter sulcos duos

posticos extrorsum curvatæ; angulus anticus loborum lateralium in tuberculum productus, margine inferiore subrecto obliquo. Meso- et metanotum cum abdominis segmentis omnibus rugosa, pilosa, superne carina media longitudinali, margine postico granulis vel tuberculis elevatis instructa. Elytra et alæ nulla. Prosternum protuberantia conica, erecta, longa. Lobi mesosternales parum (♀) vel haud (♂) transversi, intervallo iis parum angustiore. Lobi metasternales distincte distantes, intervallo quam in mesosterno angustiore (præcipue in ♂). Pedes pilosi. Femora postica superne remote serrulata, lobis apicalibus rotundatis. Tibiæ posticæ superne teretes, utrinque spinis 6, intervallis æqualibus, apice superne spinis apicalibus nullis. Cerci ♂ breves, acuminati, recti. Valvulæ superiores ovipositoris extus crenulatæ. ♂, ♀.

Hoc genus, valde affine *Vilernæ*, Stål (Rec. Orth. i. 1873, pp. 38 et 71), differt pronoto in medio strumoso, elytris alisque nullis.

1. C. APTERUS, Redt. (n. sp.). (Plate XVI. fig. 11, *a*, *b*.)

Olivaceus, dilute obscure marmoratus, lateribus plerumque obscurioribus. Venter cum pectore viridi- vel ferrugineo-testaceus. Tuberculi elevati thoracis et abdominis fusci. Femora postica extus dilute, intus distincte fusco-bifasciata, carinis omnibus remote nigro-serrulatis. Tibiæ posticæ sordide flavescentes, annulo subbasali sulfureo, spinis flavis vel sulfureis, apice fusco-nigris. Tarsi ferruginei. ♂ ♀.

	♂		♀	
Long. corpor.	27	millim.	37–38	millim.
,, pronot.	5·2	,,	6·5	,,
,, fem. post.	15·5	,,	19·8	,,

Patria: St. Vincent, windward side, Bow-wood prope Kingstown (1000′).—Specimina nonnulla, partim imperfecta, collecta prope marginem silvarum.

Found on Lot 14 Estate on three occasions in April and May.—*H. H. S.*

Genus SCHISTOCERCA, Stål.

1. S. PALLENS, Thunberg.

Gryllus pallens, Thunbg. Mém. Ac. Pétersb. v. p. 237 (1815); Mém. Ac. Pétersb. ix. p. 422 (1824).

Schistocerca pallens, Stål, Rec. Orthopt. i. p. 66 (1873).

Patria: St. Vincent, windward side.—Specimen unicum.—Occurrit etiam in Cuba, Haïti, Jamaica (*coll. Brunner*).

Lot 14 Estate in April.—*H. H. S.*

2. S. COLUMBINA, Thunberg.

Gryllus columbinus, Thunberg, Mém. Ac. Pétersb. ix. p. 425 (1824).

Schistocerca columbina, Stål, Rec. Orthopt. i. p. 67 (1873).

Patria: St. Vincent, windward side.—Specimina compluria.—

Occurrit etiam in Mexico, Costarica, Nicaragua, Panama, Guatemala, Venezuela, Columbia, Surinam, Trinidad, Martinique, Brasilia, Peru (*coll. Brunner*), insula St. Bartholomæi (*Stål*).

Lot 14 Estate in April.—*H. H. S.*

5. Familia LOCUSTODEA.

Tribus PHANEROPTERIDÆ.

Genus ANAULACOMERA, Stål.

1. A. LATICAUDA, Brunner.

Anaulacomera laticauda, Br. Monogr. d. Phaneropt. 1878, p. 292.

Patria: St. Vincent, windward side.—Specimina compluria.—Occurrit etiam in Mexico et Columbia (*Brunner*).

Lot 14 Estate and Châteaubelais.—*H. H. S.*

Genus MICROCENTRUM, Scudder.

1. M. PALLIDUM, Brunner.

Microcentrum pallidum, Br. Monogr. d. Phaneropt. 1878, p. 337.

Locusta laurifolia, Stoll, Représ. des Spectres, etc. pl. vi. *a*. fig. 21 et pl. xvii. *b*. fig. 62.

Phylloptera laurifolia, Serville, Rev. méthod. p. 142; Orth. p. 404; Burmeister, Handb. ii. p. 693.

Patria; St. Vincent, windward side, leeward side.—Specimina compluria, collecta mense Julio.—Occurrit etiam in insulis Cuba et Martinique, necnon in Columbia (*Brunner*).

Lot 14 Estate in April and May.—*H. H. S.*

Genus STILPNOCHLORA, Stål.

1. S. MARGINELLA, Serville.

Phylloptera marginella, Serv., 1839, Hist. Nat. d. Ins. Orthopt. p. 405.

Phylloptera thoracica, Burmeister, 1839, Handb. ii. p. 693.

Stilpnochlora marginella, Brunner, 1878, Monogr. d. Phaneropt. p. 358.

Patria: St. Vincent.—Specimina duo.—Occurrit etiam in Mexico, Panama, Columbia, Venezuela, Surinam, Brasilia, Peru, in insula Cuba (*coll. Brunner*).

Tribus PSEUDOPHYLLIDÆ.

Genus BLIASTES, Stål.

1. B. SUPERBUS, Redt. (n. sp.). (Plate XVI. fig. 12.)

Ferrugineo-castaneus. Antennæ longissimæ, articulis binis primis nigris. Frons dense rugosa, nigra vel fusco-ferruginea, utrinque carina laterali elevata instructa, superne utrinque ruga infraoculari, cum illa parallela. Occiput cum vertice sæpe fusco-nigrum. Clypeus cum labro flavo-ferrugineus;

mandibulæ apice fusco-castaneo. Pronotum dense rugoso-granulosum, in latere ruguloso-punctatum, dorso sæpe obscuriore, margine postico nonnihil producto, rotundato-truncato. Elytra femora postica valde superantia, apice rotundato, fusco-nigra, nitida, reticulo in area antica pallide testaceo, minus conferto, in area postica densiore flavo-ferrugineo, area anali plus minusve infuscata. Alæ latæ, fusco-griseæ. Pedes ferrugineo-castanei vel rufi; femora antica intus spinis 4, intermedia extus spinis 4–5 instructa; femora postica valida, extus spinis 9, omnibus apicibus nigris armata. Lobi geniculares femorum 4 anteriorum intus tantum brevi-spinosi, femorum posticorum inermes, rotundati. Tibiæ anticæ superne planæ, carinis lateralibus haud dentatis. Venter flavo-ferrugineus. Cerci ♂ crassi, incurvi, granulosi et pilosi, apice obtusi et mucrone instructi. Lamina subgenitalis ♂ elongata, apice triangulariter excisa, stylis longis instructa. Lamina subgenitalis ♀ triangularis, apice incisa. Ovipositor basi latus, apicem versus sensim angustatus, nonnihil incurvus et infuscatus. ♂ ♀.

	♂	♀
Long. corpor.	53 millim.	54 millim.
„ pronot.	11·8 „	11 „
„ elytror.	49 „	51·3 „
„ fem. post.	28·3 „	30 „
„ ovipos.	—	26·5 „

Patria: St. Vincent, windward side.—Specimina nonnulla.
Hæc species ab omnibus congenericis differt colore capitis et pronoti. Lot 14 Estate in April.—*H. H. S.*

2. B. STRIOLATUS, Redt. (n. sp.). (Plate XVI. fig. 13, *a*, *b*, *c*.)

Testaceus, pilosus. Antennarum articulus primus utrinque fusco- vel nigro-punctatus. Fastigium verticis superne infuscatum. Frons utrinque carina laterali obtusa, in medio maculis duabus nigris necnon in margine scrobum antennarum utrinque punctis 2 nigris ornata, superne supra basin mandibularum macula nigra parva necnon striga majore infraoculari utrinque signata. Labium parte inferiore fusco-nigra. Mandibulæ apice infuscato. Pronotum postice parum productum, rotundato-truncatum, dense rugoso-granulosum, margine antico et postico in medio nigro-maculatis, dorso vittis et lituris compluribus nigris ornato. Elytra femora postica valde superantia, apice rotundato, fusco-grisea, reticulo pallido, denso; tympano in ♂ infuscato. Alæ griseæ. Femora omnia extus, antica etiam utrinque, transverse nigro-striolata, 4 antica antice spinis 4, postica extus spinis 8, apicibus nigris, armata. Lobi geniculares femorum 4 anticorum intus, femorum posticorum utrinque spina apicali brevi, adpressa instructi. Segmentum anale ♂ valde convexum, subglobosum, postice longitudinaliter carinatum, carina subtus fissa, in lobos duos parallelos, rotundatos divisa.

Cerci ♂ fere toti absconditi, apice obtuso. Lamina subgenitalis ♂ elongata, apice emarginata, stylis longis instructa. Lamina subgenitalis ♀ trigonalis, apice triangulariter excisa. Ovipositor latus, margine superiore subrecto, inferiore incurvo, dimidia parte apicali superne subtusque castanea. ♂ ♀.

	♂	♀
Long. corpor.	42 millim.	42 millim.
„ pronot.	10·2 „	11·6 „
„ elytror.	41·5 „	49·3 „
„ fem. post. . .	23·8 „	29·6 „
„ ovipos.	—	23 „

Patria: St. Vincent, windward side, usque ad 1500′.—Specimina numerosiora.—Frequenter occurrit in silvis et locis umbrosis, die in foliis latis crispis.

Hæc species valde distincta est femoribus omnibus extus transverse nigro-striolatis.

Near the sea-level to 1500 feet. The species is pretty common in forest and shady places, secreting itself during the day in large curled leaves. Colours do not change much in drying.—*H. H. S.*

Genus Cyrtophyllus, Burm.

1. C. crepitans, Redt. (n. sp.). (Plate XVII. fig. 14, *a*, *b*, *c*.)

Statura robusta. Flavo-viridis. Pronotum in parte posteriore carinis lateralibus distinctis. Elytra latissima, valde convexa, margine antico albido, basi interdum purpureo-maculato, margine postico valde rotundato, semicirculum formante; vena radialis fere tota cum vena subcostali unita, valde flexuosa, postice ramos 4 obliquos, parallelos emittens. Campus anticus elytrorum latus, venis parallelis regularibus numerosis; campus posticus venis transversis regulariter dispositis. Speculum ♂ ovoideum, campus analis in ♂ brevis, parum longior quam latior, in ♀ duplo longior quam latior. Alæ hyalinæ. Femora antica intus spinis 6, extus 1 instructa, femora intermedia extus spinis 6, postica extus circiter 11 armata. Lobi geniculares omnes breviter spinosi. Segmentum anale ♂ apice in lobum productum, apice ipso dilatatum et truncato-emarginatum. Cerci ♂ simplices, cylindrici, obtusi, et apice hamo instructi. Lamina subgenitalis ♂ longitudinaliter cristata, apice profunde excisa, stylis longis et supra eorum basin dente parvo apicali instructa. Lamina subgenitalis ♀ apice profunde rotundato-excisa. Ovipositor longus, sensim acuminatus et incurvus, apice ferrugineo vel olivaceo. ♂ ♀.

	♂	♀
Long. corpor.	40–42 millim.	40–42 millim.
„ pronot.	8·6 „	9·3 „
„ elytror.	43 „	46·8 „
„ fem. post. . .	27 „	32·5 „
„ ovipos.	— „	24 „
Latit. elytror.	26·5 „	24 „

Patria: St. Vincent, windward side.—Specimina compluria.

Hæc species differt ab congenericis (*Cyrt. perspicillatus*, Burm., et *C. concavus*, Harr.) elytris latissimis, valde convexis, forma genitalium, etc.; habitu similis est generi *Coryco*, Sauss. (*cf.* Krauss, "Beitrag z. Kenntniss westafrikanischer Orthopt.," Spengel's Zool. Jahrb. v. p. 344).

Lot 14 Estate in April.—*H. H. S.*

Tribus Conocephalidæ.

Genus Copiophora, Serville.

1. C. brevicornis, Redt.

Copiophora brevicornis, Redtenbacher, Monogr. d. Conoceph., Verhandl. zool.-bot. Ges. Wien, 1891, p. 343 (29).

Patria: St. Vincent, windward side.—Specimen unicum, haud adultum. Occurrit etiam in Peru (*Redt.*).

Lot 14 Estate in April.—*H. H. S.*

Genus Conocephalus, Thunberg.

1. C. guttatus, Serv.

Conocephalus guttatus, Serville, Hist. Nat. Ins. Orth. p. 518 (1839); Redtenbacher, Monogr. d. Conoceph. p. 392 (78).

Patria: St. Vincent, Golden Grove estate, leeward side (300′).—Specimina nonnulla, collecta mense Decembri.—Occurrit etiam in Mexico, America centrali, Columbia, Venezuela, et in insulis Cuba et Jamaica (*Redt.*).

Lot 14 Estate in April; also at Golden Grove.—*H. H. S.*

2. C. muticus, Redt.

Conocephalus muticus, Redtenbacher, 1891, Monogr. d. Conoceph. p. 393 (79).

Patria: St. Vincent.—Specimen unicum.—Occurrit etiam in insula Cuba (*Redt.*).

3. C. maxillosus, Fabr.

Locusta maxillosa, Fabricius, 1794, Ent. Syst. ii. p. 37.

Conocephalus maxillosus, Serville, 1839, Hist. Nat. Ins. Orth. p. 520; Redtenbacher, Monogr. Conoceph. p. 396 (82).

Patria: St. Vincent, windward side; Union Island.—Specimina compluria.—Occurrit etiam in insulis Cuba et Domingo, in Guyana, Brasilia, Bolivia (*Redt.*).

Lot 14 Estate in April; Châteaubelais in September.—*H. H. S.*

4. C. infuscatus, Scudder.

Conocephalus infuscatus, Scudder, 1875, Entom. Notes v. p. 19; Redtenbacher, Monogr. Conoc. p. 398 (84).

Patria: St. Vincent, windward side.—Specimina compluria.—

Occurrit etiam in Cuba, Panama, Venezuela, Guyana, Brasilia et Peru (*Redt.*).

Lot 14 Estate in April; Châteaubelais in September.—*H. H. S.*

5. C. FRATER, Redt.

Conocephalus frater, Redtenbacher, Monogr. Conoc. 1891, p. 399 (85).

Patria: St. Vincent.—Specimen unicum.—Occurrit etiam in Cuba, Trinidad, Brasilia (*Redt.*).

6. C. HETEROPUS, Bolivar.

Conocephalus heteropus, Boliv. 1881, Notas entomol. v. p. 50; 1884, Artr. Viaje al Pacif. p. 94; Redtenbacher, Monogr. Conoc. p. 400 (86).

Patria: St. Vincent.—Specimen unicum.—Occurrit etiam in Brasilia, Peru, Chili (*Redt.*).

Châteaubelais in July.—*H. H. S.*

7. C. MACROPTERUS, Redt.

Conocephalus macropterus, Redtenbacher, 1891, Monogr. Conoc. p. 402 (88).

Patria: St. Vincent.—Specimen unicum.—Occurrit etiam in Mexico, Martinique, Cuba, Brasilia, Peru, Republica Argentina (*Redt.*).

Châteaubelais in July.—*H. H. S.*

8. C. PUNCTIPES, Redt.

Conocephalus punctipes, Redtenbacher, 1891, Monogr. Conoc. p. 422 (108).

Patria: St. Vincent, leeward side (500').—Specimina nonnulla, collecta mense Augusto.

Châteaubelais in September; Lot 14 Estate.—*H. H. S.*

9. C. SURINAMENSIS, Redt.

Conocephalus surinamensis, Redtenbacher, Monogr. Conoc. p. 423 (109).

Patria: St. Vincent.—Specimina duo.—Occurrit in India occidentali, Guyana (*Redt.*).

Châteaubelais in September; Lot 14 Estate.—*H. H. S.*

Genus XIPHIDIUM, Serville.

1. X. SALTATOR, Sauss.

Xiphidium saltator, Saussure, Orth. nova Amer. i. p. 12 (1859); Redtenbacher, 1891, Monogr. Conoc. p. 507 (193).

Patria: St. Vincent, leeward side (500').—Specimina duo, collecta mense Augusto.—Occurrit etiam in Cuba, Panama, Columbia, Venezuela, Guyana, Brasilia, Uruguay (*Redt.*).

2. X. PROPINQUUM, Redt.

Xiphidium propinquum, Redtenbacher, 1891, Monogr. d. Conoc. p. 523 (209).

Patria: St. Vincent, windward side.—Specimina nonnulla.—Occurrit etiam in Guatemala, Venezuela (*Redt.*).

Tribus STENOPELMATIDÆ.

Genus PHERTERUS, Brunner.

1. P. CUBENSIS, de Haan.

Rhaphidophorus cubensis, de Haan, 1842, Bijdragen tot de kennis der Orthoptera, p. 218.

Pherterus cubensis, Brunner, Monogr. d. Stenopelm. et Gryllacr. p. 282 (38).

Patria: St. Vincent, Richmond valley (1200–1800′).—Specimina duo, collecta in silvis densis et humidis sub lignis et fruticibus, mensibus Decembri et Januario.—Occurrit etiam in insulis Cuba, Haïti, et in Brasilia (*Brunner*).

6. Familia GRYLLODEA.

Tribus GRYLLOTALPIDÆ.

Genus GRYLLOTALPA, Latr.

1. G. HEXADACTYLA, Perty.

Gryllotalpa hexadactyla, Perty, 1830, Delect. Anim. Art. p. 119, pl. xxiii. fig. 9; Saussure, Miss. scient. au Mexique, p. 344.

Patria: St. Vincent, leeward side (500′).—Specimen unicum, collectum vespere mense Augusto.—Occurrit etiam in Mexico, Brasilia (*Sauss.*).

Genus SCAPTERISCUS, Scudder.

1. S. DIDACTYLUS, Latreille.

Gryllotalpa didactyla, Latr. Hist. Crust. et Ins. xii. p. 122 (1802).
Scapteriscus didactylus, Sauss. Miss. scient. au Mexique, p. 338.

Patria: St. Vincent, windward side, leeward side, Golden Grove estate (300′).—Specimina compluria, collecta vespere mense Januario.—Occurrit etiam in Haïti, Portorico, Panama, Costarica, Surinam, Brasilia, Peru, Uruguay, et Republica Argentina (*coll. Brunner*).

Genus TRIDACTYLUS, Oliv.

1. T. MINUTUS, Scudder.

Tridactylus minutus, Scudd., Bost. Journ of Nat. Hist. vii. p. 425 (1862); Sauss. Miss. scient. au Mexique, p. 353.

Patria: St. Vincent, windward side.—Specimina compluria, collecta in litore maritimo.—Occurrit etiam in Texas (*coll. Brunner*), Illinois (*Sauss.*).

Tribus Gryllidæ.

Genus Anurogryllus, Sauss.

1. A. muticus, de Geer.

Gryllus muticus, de Geer, 1773, Mém. Ins. iii. p. 520, pl. 43. fig. 2.

Anurogryllus muticus, Sauss. Mélang. Orthopt. v. p. 452.

Patria: St. Vincent, windward side, leeward side (500'–1000'). —Specimina nonnulla, collecta vespere in silvis mensibus Januario et Augusto.—Occurrit etiam in Haïti, Mexico, Panama, Venezuela, Surinam, Brasilia (*coll. Brunner, Sauss.*).

Genus Gryllus, Linn.

1. G. assimilis, Fabr. (var. cubensis, Sauss.).

Gryllus assimilis, Fabr. S. E. 280, 3 (1775); E. S. ii. p. 29, 4; Saussure, Miss. Scient. au Mexique, p. 396; id. Mélang. Orth. v. p. 318.

Patria: St. Vincent.—Specimen unicum.—Occurrit etiam in Cuba, Martinique, Brasilia, Columbia, Mexico, et in provinciis meridionalibus Civitatum Unitarum (*coll. Brunner, Sauss.*).

Genus Gryllodes, Sauss.

1. G. rufipes, Redt. (n. sp.). (Plate XVII. fig. 15.)

Statura majore. Fusco-niger. Caput nigro-nitidum, glabrum, unicolor, exceptis ocellis flavis (fascia supra-antennali testacea nulla). Pronotum teres, fusco-nigrum, pilosum; lobi laterales margine inferiore rotundato, retrorsum nonnihil ascendente; dorsum pronoti margine antico et macula discoidali cruciformi obscure rubris. Elytra ♀ lobiformia, metanotum parum superantia, dorso distincte (1 mm.) *remota, castanea, basi pallidiora, ovata, fere circularia, venis longitudinalibus parallelis instructa. Abdomen fusco-nigrum, pilosum, subtus pallidius. Femora omnia cum tibiis tarsisque rufo-ferruginea. Femora postica extus indistincte et oblique obscure striata. Tibiæ anticæ intus tympano nullo, extus tympano angusto, elliptico. Tibiæ posticæ superne utrinque 5-spinosæ. Metatarsus posticus articulis duobus sequentibus unitis longior. Ovipositor femoribus posticis subæquilongus, apice utrinque bispinosus.* ♀.

Long. corpor.	22·5	millim.
„ pronot.	4·5	„
„ elytror.	4·2	„
„ fem. post.	13·3	„
„ oviposit.	14	„

Patria: St. Vincent, Richmond valley (1200').—Specimen unicum, collectum sub virgultis in silvis humidis mense Januario.—Hæc species, valde affinis *Gr. guyannensi* et *la-platæ*, Sauss. (Mél. Orthopt. v. pp. 383 et 384), faciliter distinguenda est capite unicolore, statura majore, pedibus ferrugineis.

Tribus Myrmecophilidæ.

Genus Ectatoderus, Guérin.

1. E. antillarum, Redt. (n. sp.). (Plate XVII. fig. 16, *a*, *b*.)

Corpus totum albido-squamosum. Caput cum pectore superne ferrugineum, subtus testaceum. Protuberantia facialis per sulcum longitudinalem minutissimum, subobsoletum divisa. Articulus ultimus palporum maxillarium brevis, conicus, apice oblique truncatus. Pronotum in ♂ valde productum, basin abdominis necnon elytra tota obtegens, postice rotundatum, in ♀ breve, parum longius quam latius, margine postico truncato. Pedes omnes testacei. Femora postica tibiis cum metatarso unitis æquilonga. Tibiæ posticæ fusco-serrulatæ; metatarsus posticus elongatus, superne serrulatus. Abdomen totum fusco-nigrum, segmentis omnibus apice plus minusve pallide ferrugineo-marginatis. Lamina subgenitalis ♂ lata, rotundata. Cerci ♀ ovipositorem distincte superantes; hic rectus, femoribus posticis subæquilongus, castaneus, apice incrassato, acuminato. ♂ ♀.

	♂	♀
Long. corpor.	9 millim.	9·5 millim.
„ pronot.	4 „	2·5 „
„ elytror.	? „	? „
„ fem. post.	5·6 „	6 „
„ oviposit.	— „	5·9 „

Patria: St. Vincent, windward side.—Specimina tria (unum imperfectum).

Valde affinis *Ect. varicolori* (Sauss. Mél. Orth. v. p. 475), distinguitur colore capitis, pronoto breviore.

Tribus Œcanthidæ.

Genus Larandus, Walker.

1. L. marmoratus, Redt. (n. sp.). (Plate XVII. fig. 17.)

Testaceus, ubique fusco-marmoratus, nigro-pilosus. Antennæ longissimæ, fuscæ, leviter pallide annulatæ. Frons angusta; fastigium frontis articulo primo antennarum angustius. Ocelli in triangulum elongatum, acutum dispositi; ocellus medius in fossula leviter impressa situs. Pronotum superne impressione cruciformi, parum profunda; lobi laterales subtus rotundati, margine inferiore valde obliquo. Elytrum sinistrum squamiforme, minimum, ovatum, dextrum (an fortuiter?) nullum. Pedes omnes fusco-annulati. Femora postica valida, haud inflata, tibiis longiora. Femora antica gracilia. Tibiæ anticæ tympano utrinque nullo. Tibiæ posticæ superne 4:4 spinosæ, inter spinas (exceptis duabus ultimis) distincte serrulatæ. Calcaria extus 3, intermedius longus, inferior et supernus breves. Metatarsus posticus articulo tertio multo longior, subtus haud carinatus, superne utrinque 5-spinulosus. ♂.

Long. corpor.	12·5	millim.
,, pronot.	3	,,
,, elytror.	0·8	,,
,, fem. post.	9·8	,,

Patria: St. Vincent.—Specimen unicum.

Valde affinis videtur *L. rogenhoferi*, Sauss. (Mél. Orthopt. vi. p. 550), differt colore pallidiore, fusco-marmorato, tibiis posticis 4:4 spinosis, statura minore, etc.

Genus ENDACUSTES, Brunner.

1. E. DISPAR, Redt. (n. sp.). (Plate XVII. fig. 18.)

Fulvo-testaceus, fusco-marmoratus et irroratus. Antennæ pallide et remote annulatæ. Frons nigra, fascia intermedia longitudinali, deorsum latiore, usque ad labrum extensa, necnon utrinque fascia infraoculari angusta flavis. Frontis rostrum articulo primo antennarum angustius. Ocelli flavi, in triangulum acutum dispositi. Pronotum sulco subtili longitudinali instructum, in medio nonnihil excavatum. Elytrum sinistrum (an fortuiter?) nullum; elytrum dextrum fere circulare, campo antico (laterali) ante apicem nonnihil emarginato, venis tribus percurrentibus, necnon inter venam primam et secundam vena abbreviata instructo; campo postico (dorsali) venis parallelis 6 subæque distantibus. Alæ nullæ. Corpus totum nigro-pilosum. Pedes minus elongati; fusco-annulati. Tibiæ posticæ femoribus posticis nonnihil breviores, superne serrulatæ, dimidia parte apicali utrinque spinis 4 æqualibus fuscis, apice pallidis. Calcaria extus tria, intermedio longiore, intus duo longa, æqualia. Tarsi 4 antici testacei, articulo primo basi flavo, dehinc fusco, postici unicolores, ferruginei; metatarsus posticus superne extus spinulis 4, intus 3 instructus. Ovipositor femoribus posticis æquilongus, gracilis, valvulis apice lanceolato, in spinam producto. Cerci? ♀.

Long. corpor.	20·5	millim.
,, pronot.	5·1	,,
,, elytror.	5·5	,,
,, fem. post.	14·8	,,
,, tib.	12·4	,,
,, oviposit.	15	,,

Patria: St. Vincent, Richmond valley, 1200′.—Specimen unicum, collectum in silvis humidis sub virgultis mense Januario.

Hæc species valde affinis videtur *End. irrorato*, Sauss. (Mél. Orthopt. p. 576), multo magis autem speciei in collectione Brunner v. Wattenwyl (in Madagascar collectæ), quæ etiam dextro tantum elytro instructa est; ab ambabus tamen speciebus differt calcaribus duobus tantum in latere interno tibiarum posticarum insertis.

Tribus Trigonidiidæ.

Genus Cyrtoxiphus, Brunner.

1. C. vittatus, Bolivar.

Cyrtoxyphus vittatus, Bol. Orth. de l'Ile de Cuba, p. 44 (1888).

Patria: St. Vincent, windward side, 1500′.—Specimina compluria.—Occurrit etiam in insula Cuba (*Bolie.*).

2. C. gundlachi, Saussure.

Cyrtoxypha gundlachi, Sauss. Miss. scient. au Mexique, p. 373, pl. vii. fig. 2.

Cyrtoxyphus gundlachi, Sauss. Mélang. Orthopt. vi. p. 620.

Patria: St. Vincent, 1500′.—Specimen unicum, collectum in silva mense Augusto.—Occurrit etiam in Cuba, Brasilia (*Sauss.*).

Tribus Eneopteridæ.

Genus Orocharis, Uhl.

1. O. gryllodes, Pallas.

Gryllus gryllodes, Pall. Spicileg. Zoolog. 1772, p. 16, pl. iii. fig. 10.

Orocharis gryllodes, Saussure, Miss. scient. au Mexique, p. 495; Mél. Orthopt. vi. p. 755.

Patria: St. Vincent, windward side, prope Richmond River, 800′.—Specimina nonnulla, capta in silvis sub lapidibus mense Novembri.—Occurrit etiam in Texas, Mexico, insula San Domingo, etc. (*coll. Brunner, Saussure*).

Genus Metrypus, Brunner.

1. M. luridus, Saussure.

Metrypa lurida, Sauss. Miss. scient. au Mexique, p. 513.

Metrypus luridus, Sauss. Mélang. Orthopt. vi. p. 813.

Patria: St. Vincent, windward side.—Specimina duo (unum imperfectum).—Occurrit etiam in Cuba (*Sauss.*).

EXPLANATION OF THE PLATES.

Plate XV.

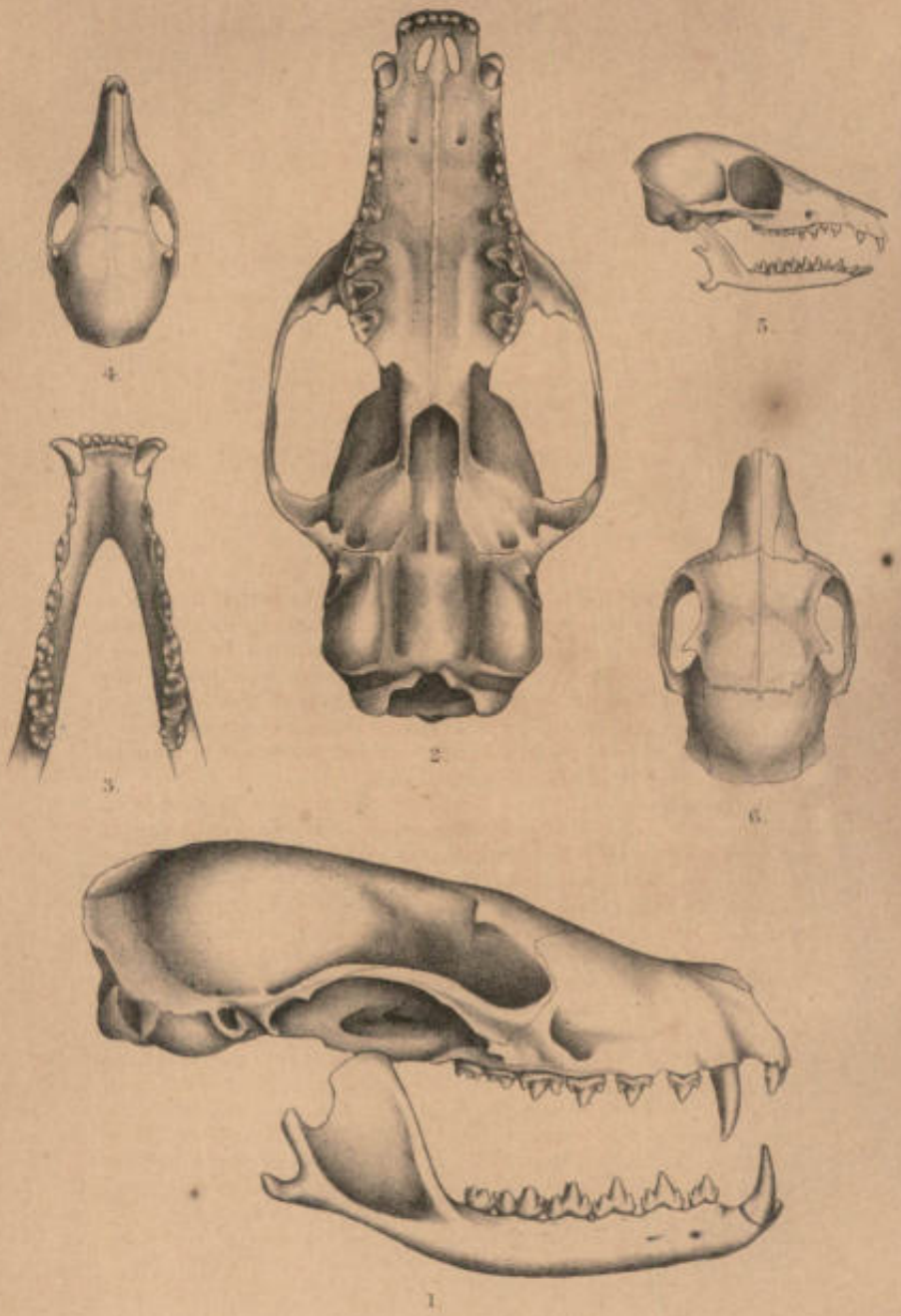
Fig. 1 *a*. *Anaptycta bipunctulata*, p. 202.
b. —— ——; elytrum sinistrum (magnitudine aucta).
2 *a*. *Pseudophyllodromia semivitrea*, p. 203. ♀ (magnitudine aucta).
b. —— ——; elytrum dextrum (magnitudine aucta).
3. *Epilampra brevis*, p. 203. ♂.
4. *Homaloptery x laminata*, p. 204. ♀.
5. *Stylopyga antillarum*, p. 204. ♀.
6. *Holocompsa collaris*, p. 205; elytrum et ala sinistra (magnitudine aucta).
7. *Paraspheria nigra*, p. 206. ♀.
8 *a*. *Parastagmatoptera lobipes*, p. 206. ♂.
b. —— ——; caput cum pronoto necnon pedibus anticis a latere visum.
9 *a*. *Phanocles curvipes*, p. 207. ♂.
b. —— ——; caput cum pronoto ♀ a latere visum.



J. Smit del. et lith.

HEMIGALE HOSEI.

Mintern Bros. imp.



M. H. Fisher del. et lith.

Mintern Bros. imp.

SKULLS OF BORNEAN MAMMALS.

PLATE XVI.

Fig. 10. *Tettix quadriundulatus*, p. 208. ♀ (magnitudine aucta).
11 *a*. *Caletes apterus*, p. 210. ♀.
b. —— ——; a supero visus.
12. *Blastes superbus*, p. 211. ♀.
13 *a*. —— *striolatus*, p. 212. ♀.
b. —— ——; abdomen ♂ a latere visum.
c. —— ——; abdomen ♂ a supero visum.

PLATE XVII.

Fig. 14 *a*. *Cyrtophyllus crepitans*, p. 213. ♂.
b. —— ——; segmentum anale ♂ a supero visum.
c. —— ——; cercus sinister ♂.
d. —— ——; lamina subgenitalis ♂ ab infero visa.
15. *Gryllodes rufipes*, p. 217. ♀.
16 *a*. *Ectatoderus antillarum*, p. 218. ♂.
b. —— ——. ♀.
17. *Lavandus marmoratus*, p. 218. ♂ (magnitudine aucta).
18. *Endecustes dispar*, p. 219. ♀.

2. On some Mammals from Mount Dulit, North Borneo.

By OLDFIELD THOMAS.

[Received February 20, 1892.]

(Plates XVIII. & XIX.).

In 1889 I had the honour of presenting to the Society a paper on the Mammals of Mount Kina Balu, the highest mountain in Northern Borneo, and one previously quite unexplored zoologically. Thanks to the energy of Mr. Charles Hose, a gentleman who has already distinguished himself by his discoveries in the district of Baram, N.E. Sarawak, I am enabled now to give an account of some Mammals collected on Mount Dulit, a mountain about 9000 feet in altitude, standing at the head of the Baram River.

In the autumn of last year Mr. Hose made a successful expedition up Mount Dulit, collecting a large number of specimens at altitudes of from 2000 to 5000 feet, and thereby affording us a very good idea of the fauna of the mountain.

On the whole, judging from the present collection, it may be said that the Mammal-fauna of Dulit is very much the same as that of Kina Balu, there being no instance of a representative but different species [1], while two of the peculiar Kina Balu species reappear here on Dulit. In all probability, therefore, we may look upon Mr. Hose's valuable collection as supplementary to that of Mr. Whitehead, and may expect that in time most of the members of both the collections will be found to occur on both the mountains. This is the more likely as the collections were made at very different seasons of the year, when different forms of animal life would be *en évidence*. Thus Mr. Hose's collection is especially rich in *Tupaiæ*, of which two are new, while Mr. Whitehead's was equally rich in Rats, Mice, and

[1] In the case of the birds, however, *Calyptomena hosei*, Sharpe, represents *C. whiteheadi*, Sharpe, and *Harpactes dulitensis*, Grant, represents *H. oreskios*, the latter occurring in Malacca, Sumatra, and Java as well as on Mt. Kina Balu.

Shrews, and this difference between the two collections, while increasing the number of species, decreases the value of any comparisons of the two mountain-faunas.

The Dulit Mammals amount to 14, of which four are new, the Kina Balu to 21, and, 5 being common to both, the two mountains together contain, so far as is yet known, a total of 30 species. Of these the large proportion of 9 are peculiar to these mountains, but this proportion will probably be reduced as our knowledge of the mammals inhabiting the low countries near the mountains is extended. As a contribution towards this knowledge, a nominal list of the mammals collected by Messrs. Hose and A. H. Everett near the mouth of the Baram River is appended below. By this it will be seen that there is a far greater essential difference between the Dulit and Baram faunas than there is between those of Dulit and Kina Balu.

Mr. Hose is to be congratulated on the interest and value attaching to this mountain-collection, and especially on his discovery of the new *Hemigale*, a species very distinct from its only ally, and belonging to an Order, the Carnivora, in which novelties are now excessively rare.

1. Hemigale hosei, Thos.[1] (Plate XVIII.)

a. ♂. 4000 feet. 30/9/91. *Type*.

Size and proportions very much those of *H. hardwickei*, although the skull seems to be rather more lightly built. General colour above uniform dark smoky brown or black, the bases of the body-hairs whitish. Sides of muzzle at the roots of the whiskers white, the corresponding place in *H. hardwickei* being black; cheek below eye and a patch above and behind it grizzled brownish white. Ears thinly haired, pure white on their inner aspect; edges in marked contrast to the black crown. Chin white; chest, belly, and inner sides of limbs proximally smoky yellowish grey. Rest of limbs and whole of tail black.

Skull (Plate XIX. figs. 1–3) rather slenderer and lighter than that of specimens of *H. hardwickei* of similar age and sex. Muzzle rather more parallel-sided, not tapering so much anteriorly. Infra-orbital foramina comparatively large.

Teeth very much more delicate than those of the allied species. Canines long and slender. P^1 long antero-posteriorly, double-rooted, with accessory cusps, like p^3, and like the p^3 of *H. hardwickei*, in which p^3 is simple and single-rooted. Other teeth above similar in shape to those of *H. hardwickei*, although markedly smaller, and with their inner lobes especially reduced. M^2, however, is as large as in *H. hardwickei*, m^1 and m^2 being approximately equal. Similarly below the teeth are smaller and narrower, but p^1 and m^2 are less so in proportion.

Dimensions (approximate, from skin):—

Head and body 540 millim.; tail 320; hind foot 78.

Skull: basal length 89; greatest breadth 45·3; interorbital

[1] Preliminary diagnoses of the new species have been given, Ann. Mag. N. H. (6) ix. pp. 250–253.

breadth 18·8; tip to tip of postorbital processes 22·5; intertemporal breadth 14·3; palate, length 54, breadth at posterior corner of p^4 25; length of palatine foramina 5·2; greatest diameter of infraorbital foramina 5·9.

Teeth: combined breadth of upper incisors 11·2; antero-posterior length of p^1 4·6, p^2 4·9, p^3 5·7, p^4 6·1, m^1 4·8, m^2 4·3; greatest transverse diameter of p^4 6·6, of m^1 5·5.

This striking species is certainly the chief prize of the collection, as new Carnivores are very rare, and so distinct a new species has not been described for many years.

That *H. hosei* is not simply a melanism of *H. hardwickei* is proved by the white patches on the muzzle, the white ears, whitish underside, and also by the differences in the size of the teeth.

Some animal similar to this, and possibly of the same species, was seen by Mr. Whitehead on Mount Kina Balu, and it is certainly very unlikely that an animal of this sort should be confined to one mountain. We may therefore expect that other specimens of it will turn up as the mountain-systems of N. Borneo are more thoroughly explored.

2. Herpestes semitorquatus, Gray.

a. 2000 feet. 23/9/91.

The Museum possesses a specimen of this rare Mungoose from Baram, besides the type, of which the exact locality in Borneo was not recorded.

3. Rhinolophus luctus, Temm.

a. ♀. 4000 feet. 29/9/91.

As remarked by Dr. Dobson, this Bat is a regular highland species, and seems to occur on all the higher mountains of the Oriental region.

4. Tupaia tana, Raff.

a. 4000 feet. 10/91.

5. Tupaia montana, Thos.[1]

a. ♂. 5000 feet. 14/10/91. *Type*.
b. ♀. 3000 feet. 25/9/91.
c. Immature ♂. 4000 feet. 10/91.

Size much as in Malaccan specimens of *T. ferruginea* (Bornean ones are rather larger), but the tail shorter in proportion. General colour above dusky olive, with a strong rufous suffusion; head clearer olive. Back, in fully adult specimens, with a deep black median line running from the withers to the rump, but broadening out and becoming less sharply defined in its posterior half. Under surface greyish orange, the hairs grey at their bases, broadly washed terminally with rich olive-yellow. Tail concolorous with the body, not greyer, as it is so markedly in *T. ferruginea*; grizzled black and shining ferrugineous above; below the central short-haired part is

[1] *L. c.* p. 252.

grey, then laterally there is a broad band on each side of rich olive-yellow, and the tips are grizzled yellow and black.

Skull and teeth apparently not definitely distinguishable from those of *T. ferruginea*. Zygomatic vacuity large, widely open, about 5 × 2 millim. in the type.

Dimensions:—Head and body (*c.*) 200 millim.; tail (*c.*) 140 (the *extreme* tip of the tail in the type is apparently wanting; the tail-length in *b* and *c* is 127 and 153 respectively); hind foot 41.

Skull: basal length (*c.*) 45·5; greatest breadth 27; anterior rim of orbit to nasal tip 22·5; interorbital breadth 15; palate, length 27·8, breadth outside $\underline{m}^2$ 16·4, inside $\underline{m}^2$ 9·7; diastema between $\underline{i}^2$ and $\underline{c}$ 4·5, between $\underline{c}$ and $\underline{p}^3$ 1·1; front of $\underline{i}^1$ to back of $\underline{m}^3$ 27.

T. montana is most nearly allied to *T. ferruginea*, Raff., and *T. picta*, Thos.[1] It is distinguished from both by the colour of its tail, the former having this member dull annulated grey, and the latter brilliant rufous; it has also a shorter tail than either. From the former again it is separated by developing in old age a median dorsal black line, and from the latter, in which the line is present at all ages, by its less sharp definition, and also the greater uniformity of the general dorsal coloration.

6. Tupaia minor, Günth.

a. ♂. 4500 feet. 9/10/91.
b. ♀. 4000 feet. 10/10/91.

These specimens precisely agree with Dr. Günther's types, and equally differ from the typical *T. javanica* in their smaller size and pure white bellies.

7. Tupaia melanura, Thos.[2]

a. ♀. 5000 feet. 10/91. *Type*.

Size very small, less than in *T. minor*. Fur very soft, close, and velvety. General colour dark olivaceous grey, finely sprinkled with yellow, a slight suffusion of dark rufous on the rump and base of tail. Face rather clearer olive; a short orange-coloured stripe above and below the eye, but not passing backwards towards the ear. No pale shoulder-stripe present. Belly-hairs grey basally, washed terminally, from chin to anus, with bright orange. Outer sides of limbs like back, inner sides like belly; upper surfaces of hands and feet nearly black. Tail furred and coloured like body for about its basal inch and a half above and half inch below, but beyond that it differs from that of all other species by being quite cylindrical and short-haired, the hairs being closely adpressed and not forming a terminal pencil; in colour the short-haired part is deep jet-black throughout.

Skull (Plate XIX. figs. 4 and 5) delicate, smooth, and evenly rounded. Zygomatic foramen reduced to a minute oval opening, which will scarcely admit the point of a needle. Palate without vacuities.

Teeth. $\underline{I}^2$ nearly as long as $\underline{i}^1$; double-rooted. Canine and $\underline{p}^2$ also

[1] Described Ann. Mag. N. H. (6) ix. p. 251.
[2] *L. c.* p. 252.

both double-rooted. Lower teeth as in *T. minor* except that $\underline{c}$ is smaller and $\underline{p^3}$ and $\underline{p^4}$ larger in proportion, so that the tooth-row appears as a whole to be more uniform.

Dimensions (approximate, from skin):—

Head and body 125 millim.; tail 136; hind foot 29·7.

Skull: basal length 30; greatest length 36, greatest breadth 17·7; nasal length 13; interorbital breadth 10; intertemporal breadth 14; palate, length 18·2, breadth outside m^2 9·6, inside m^2 5·4; diastema between i^2 and c 2·0, between c and p^2 0·4. Vertical length of $\underline{i^1}$ 2·1, of i^2 1·7, of $\underline{c}$ 1·5. Front of i^1 to back of m^3 17·7.

This beautiful little species is the most interesting of the *Tupaiæ* obtained, as it forms a connecting-link with the two species belonging to the genus *Dendrogale*. That genus was founded by Dr. Gray and recognized by Dr. Anderson in his recent review of the *Tupaiidæ* mainly on account of its cylindrical tail, black-and-white banded cheeks, and the absence of the usual shoulder-stripe. Now *T. melanura* on the one hand has a tail even slenderer and more cylindrical than *D. murina* and *D. frenata*, and has no shoulder-stripe, while on the other its face-markings are quite as in *Tupaia*. One character, however, distinguishes *Dendrogale*, or at least *D. frenata*, from all the *Tupaiæ*, namely the extremely small size of the claws, both fore and hind; and so far as this character is concerned *T. melanura* is a true *Tupaia*, as it has claws quite as large in proportion as the other species. For the present therefore I consider it to be a *Tupaia*, and leave the validity of "*Dendrogale*" as an open question to be settled when further, and especially spirit-, specimens are obtained.

8. Sciurus bicolor ephippium, Temm.

a. ♀. 4000 feet. 10/91.

9. Sciurus prevostii, Desm.

a, *b*. ♂ ♀. 5000 feet. 10/91.

Both these specimens are of the grey-backed form of this species, like specimens *a*–*c* of the Kina Balu collection.

10. Sciurus notatus, Bodd.

a. ♂. 3500 feet. 20/9/91.

This specimen, like the Kina Balu examples of the species, is of the blue-bellied type, and Mr. Hose remarks that he obtained 13 skins, all like this one, during the same month.

11. Sciurus brookei, Thos.[1]

a. ♂. 3800 feet. 25/9/91.

b. ♀. 5000 feet. 10/91. *Type*.

About the size of *Sciurus lokriah*, Hodgs., or rather smaller; decidedly larger than *S. tenuis*, Horsf. General colour above plain olive-grey, grizzled with yellow, but not so finely as in *S. tenuis*. Sides of body and outer and upper surfaces of limbs like the back,

[1] *L. c.* p. 253.

without the rufous suffusion characteristic of *S. tenuis*. Cheeks, anal region, and basal inch of tail below brilliant rufous. Chest and belly greyish white, the hairs grey basally, and dirty white terminally. Tail-hairs broadly annulated with black and pale yellow.

Skull (Plate XIX. fig. 6) with an elongated tapering muzzle, disproportionately large for the size of the animal, although not nearly so long as in *S. rufigenis*, *everetti*, &c. Premolars $\frac{2}{1}$.

Dimensions of the type, an adult female in skin :—

Head and body 205 millim.; tail, without hairs, 144; hind foot 37.

Skull: basal length (*c.*) 37; bregma to nasal tip 32; greatest breadth 25·6; nasals, length 13·2, combined breadth 7; interorbital breadth 15; diastema 10·6; palate, length 22, breadth outside m^3 10·2, inside m^1 6; front of p^4 to back of m^3 7·4.

This Squirrel belongs to a group of Oriental species characterized by their dull grizzled olive-grey colour, unstriped sides, and annulated black and yellowish tails. For ornamentation some of the species have rufous patches on the head, shoulders, hips, or tail, but some are quite without them, and in all they vary very much in their development. To this group belong *S. chinensis*, Gr., *S. lokriah*, Hodgs., *S. lokrioides*, Hodgs., *S. tenuis*, Horsf., *S. lowii*, Thos., *S. philippinensis*, Waterh., and others. From all of these *S. brookei* is readily distinguished by its bright rufous cheeks and base of tail, and by its size, in which respect it considerably exceeds *S. tenuis* and *S. lowii*, and falls short of all the rest. *S. modestus*, Müll. & Schl., I agree with Dr. Jentink [1] in considering synonymous with *S. tenuis*, as not only is Malacca the first-mentioned locality for it, but the figures both of animal and skull are identical with typical Malaccan and Singapore specimens.

Of other Bornean species *S. jentinki*, Thos., is smaller and much more yellow above, while *S. everetti*, Thos., has a much more elongated muzzle, and neither of them has the rufous markings of *S. brookei*.

I have taken the liberty of naming this species in honour of His Highness the Rajah of Sarawak, in whose service Mr. Hose is, and by whose active encouragement he has been enabled to do so much valuable zoological work in that interesting territory.

This species must be very common on Mt. Dulit, as Mr. Hose states that he obtained 20 specimens of it while he was there.

12. Sciurus melanotis, Müll. & Schl.

a. ♂. 2000 feet. 10/91.

13. Sciurus whiteheadi, Thos.

a. ♂. 4000 feet. 10/91.

This beautiful little species, described and figured in my paper on the Kina Balu mammals, has only been previously recorded from that mountain.

[1] Notes Leyd. Mus. v. p. 125 (1883).



1. AMAURODICHLA BOCAGII. 2. TURDINUS MOLONEYANUS.

14. Cervulus muntjac, Zimm.

a. ♀. 4000 feet. 10/91.

The following is a list (inserted for comparison) of the mammals obtained during the past few years by Messrs. Hose and Everett at Baram, N.E. Sarawak, that district forming the lowland country between Mt. Dulit and the sea :—

Hylobates leuciscus, *Schr.*
—— müllerí, *Mart.*
Semnopithecus cristatus, *Raff.*
—— chrysomelas, *Müll. & Schl.*
—— hosei, *Thos.*
—— rubicundus, *Müll. & Schl.*

Felis bengalensis, *Kerr* (F. minuta, *Temm.*).
—— planiceps, *Vig. & Horsf.*
—— badia, *Gray.*
Hemigale hardwickei, *Gray.*
Herpestes brachyurus, *Waterh.*
—— semitorquatus, *Gray.*

Tupaia ferruginea, *Raff.*
—— picta, *Thos.*
—— dorsalis, *Schl.*

Cynopterus spadiceus, *Thos.*
Rhinolophus luctus, *Temm.*
Hipposiderus cervinus, *Gould.*

Sciuropterus pulverulentus, *Günth.*
—— horsfieldi, *Waterh.*[1]
—— lepidus, *Horsf.*
Rheithrosciurus macrotis, *Gray.*
Sciurus prevostii, *Desm.*
—— tenuis, *Horsf.*
—— lowii, *Thos.*[2]
Mus, sp. inc. (allied to *M. coxingi*, Swinh.).
Trichys guentheri, *Thos.*

Sus barbatus, *Müll. & Schl.*
Tragulus napu, *F. Cuv.*
Cervulus muntjac, *Zimm.*

EXPLANATION OF THE PLATES.

Plate XVIII.

Hemigale hosei.

Plate XIX.

Figs. 1–3. Skull of *Hemigale hosei*.
4, 5. Skull of *Tupaia melanura*.
6. Skull of *Sciurus brookei*.

3. Descriptions of some new Species of Timeliine Birds from West Africa. By R. Bowdler Sharpe, LL.D., F.L.S., &c.

[Received February 27, 1892.]

(Plate XX.)

My old friend Prof. Barboza du Bocage has recently sent me for comparison a very interesting bird, which he has received from his correspondent Senhor Francisco Newton, who is well known to Ornithologists as the discoverer of several new and remarkable forms of

[1] I much regret to have to state that the *Sciuropterus* described by me (P. Z. S. 1886, p. 74) as *S. davisoni* proves on re-examination, with larger series, to be referable to *S. horsfieldi*, whether that in its turn is or is not the same as *S. sagitta*, Linn.

[2] Ann. Mag. N. H. (6) ix. p. 253 (1892).

birds in the island of St. Thomas. This new species has a brown style of coloration which is characteristic of many Timeliine birds, but it seems to find its nearest ally in a Malayan genus *Crateroscelis* of Malacca and Borneo. It differs, however, from that genus in certain evident characters, which may be diagnosed as follows:—

AMAUROCICHLA, gen. nov.

Similar to *Crateroscelis*, but distinguished by the shape of the wing, the first primary being nearly as long as the second. Additional characters are:—The bill is as long as the head, and rictal bristles are absent, while the tail-feathers are somewhat acuminate. The type is:—

AMAUROCICHLA BOCAGII, sp. nov. (Plate XX. fig. 1.)

Adult. General colour above uniform chocolate-brown, the wings and tail a little darker than the back; lores and sides of face dark brown like back, the ear-coverts slightly rufescent, like the sides of the neck; cheeks and throat whitish, with a slightly indicated malar line of rufous; lower throat and rest of under surface of the body rufous; the abdomen isabelline; under wing-coverts isabelline; quills sepia-brown below. Total length 5 inches, culmen 0·8, wing 2·55, tail 1·55, tarsus 0·95.

Hab. San Miguel, west coast of St. Thomas, West Africa.

While describing this interesting species I may add the diagnosis of another Timeliine bird recently acquired by the British Museum, which also seems to be undescribed, and for which I propose the following name:—

TURDINUS MOLONEYANUS, sp. nov. (Plate XX. fig. 2.)

Adult. General colour rufous brown, inclining to chestnut on the lower back, rump, and upper tail-coverts, as well as on the wings; primaries dusky, externally light rufous; tail-feathers light rufous brown, externally shaded with chestnut; crown of head slightly more dusky than the back; an indistinct line of ashy grey above the eye, and the feathers below the latter ashy; ear-coverts brown; throat and under surface of body tawny rufous, more rufous on the fore neck, chest, and sides of body, the latter inclining somewhat to reddish brown; thighs like the abdomen; under tail-coverts light chestnut; axillaries and under wing-coverts tawny rufous; quills dusky below, rufescent along the inner web. Total length 6·6 inches, culmen 0·85, wing 2·7, tail 2·5, tarsus 1·0.

Hab. Gold Coast.

The typical specimen was presented to the British Museum by Sir Alfred Moloney, who procured it during the time that he was Governor of the Colony.

4. On the Classification of Birds. By Hans Gadow, M.A., Ph.D., F.Z.S., Strickland Curator and Lecturer on Advanced Morphology of Vertebrata in the University of Cambridge.

[Received March 12, 1892.]

By undertaking, in 1884, the continuation of the part 'Aves' of Bronn's 'Klassen und Ordnungen des Thier-Reichs,' I became pledged not only to a descriptive account of the anatomical structure of birds, but also to a systematic treatment of this Class with its Orders.

The anatomical portion has been written with the view of abstracting therefrom a classification. In the meantime (after Huxley, Garrod, Forbes, Sclater, and Reichenow's systems) have appeared several other classifications: one each by Prof. Newton, Dr. Elliott Coues, Dr. Stejneger, Prof. Fuerbringer, Dr. R. B. Sharpe, and two or three by Mr. Seebohm. Some of these systems or classifications give no reasoning, and seem to be based upon either experience in ornithological matters or upon inclination—in other words, upon personal convictions. Fuerbringer's volumes of ponderous size have ushered in a new epoch of scientific ornithology. No praise can be high enough for this work, and no blame can be greater than that it is too long and far too cautiously expressed. For instance, the introduction of "intermediate" groups (be they suborders or gentes) cannot be accepted in a system which, if it is to be a working one, must appear in a fixed form. In several important points I do not agree with my friend; moreover, I was naturally anxious to see what my own resources would enable me to find out. This is my apology for the new classification which I propose in the following pages.

The author of a new classification ought to state the reasons which have led him to the separation and grouping together of the birds known to him. This means not simply to enumerate the characters which he has employed, but also to say why and how he has used them. Of course there are characters and characters. Some are probably of little value, and others are equivalent to half a dozen of them. Some are sure to break down unexpectedly somewhere, others run through many families and even orders; but the former characters are not necessarily bad and the latter are not necessarily good. The objection has frequently been made that we have no criterion to determine the value of characters in any given group, and that therefore any classification based upon any number of characters however large (but always arbitrary, since composed of non-equivalent units) must necessarily be artificial and therefore be probably a failure. This is quite true if we take all these characters, treat them as all alike, and by a simple process of plus or minus, *i. e.* present or absent, large or small, 1, 2, 3, 4, &c., produce a "Key," but certainly not a natural classification.

To avoid this evil, we have to *sift* or *weigh* the same characters every time anew and in different ways, whenever we inquire into the

degree of affinity between two or more species, genera, families, or larger groups of creatures.

This I have tried to do in a manner hitherto not applied to birds; it may have been done by others, but they have not published any account of this process. Certainly it has not been applied throughout the whole Class of Birds.

I have selected about forty characters from various organic systems (see Appendix, p. 254), preferring such characters which either can be expressed by a formula or by some other short symbol, or which, during the working out of the anatomical portion of Bronn's 'Aves,' have revealed themselves as of taxonomic value, and of which I have learnt to understand the correlation, determining causes, and range of modification. Other characters, perhaps too complicated, too variable, or last, but not least, too imperfectly known in many birds, are left out or reserved for occasional employment.

Of my 40 characters about half occur also in Fuerbringer's table, which contains 51 characters. A number of skeletal characters I have adopted from Mr. Lydekker's 'Catalogue of Fossil Birds,' after having convinced myself, from a study of that excellent book, of their taxonomic value. Certain others referring to the formation of the rhamphotheca, the structure and distribution of the down in the young and in the adult, the syringeal muscles, the intestinal convolutions, and the nares, have not hitherto been employed in the Class of Birds.

Groups of birds, arranged in *bona fide* families, sometimes only genera of doubtful affinity, were compared with each other—each family with every other family or group—and the number of characters in which they agree was noted down in a tabular form. Presumably families which agree in all the 40 characters would be identical, but this has never happened. There are none which differ in less than about 6, and none which agree in less than 10 points. The latter may be due to their all being birds. It is not easy to imagine two birds which would differ in all the 40 characters.

In another table all the families were arranged in lines according to their numerical coincidences, and attempts were made to arrange and to combine these lines of supposed affinities in tree-like branches [1]. These attempts are often successful [2], often disappointing [3].

[1] Many calculations are obviously unnecessary: for instance, the comparison of Geese with Parrots or Passeres; Steganopodes with Swifts, Rollers, Trogons, &c.

[2] For instance, Pteroclidæ agree with Limicolæ and with Columbæ in about 29 points, with Alcæ and with Gallidæ in 24, with Ralli in 21, with Lari only in 18.—Again, Lari agree with Alcæ and with Limicolæ in 33 or 34; Limicolæ agree with Alcæ, Lari, and Ralli each in 33, with Pterocles and Columbæ in 30 or 31, with Gallidæ in 26. Combination of these lines shows that Lari and Pterocles are widely divergent from each other, while they each separately agree closely with the Limicolæ; in other words, Lari and Pterocles are specialized in two different directions as terminal divergent branches of one common Limicoline stock.

[3] The more generalized, or rather the less specialized, two given groups are, the more characters they will probably have in common, and similar false affinities will appear the more likely the greater the diversity of organic modifi-

Of course this merely mathematical principle is scientifically faulty, because the characters are decidedly not all equivalent. It may happen that a great numerical agreement between two families rests upon unimportant characters only, and a small number of coincidences may be due to fundamentally valuable structures, and in either case the true affinities would be obscured. This it was necessary to inquire into. But at any rate I obtained many hints from this simple mode of calculation, indicating the direction which further inquiry should take.

The *Psittaci* may serve as an example of my mode of sifting characters.

According to the numerical agreement of the 40 characters employed generally, we have the following table :—

Psittaci agree with Coccyges in 31 points, with Pici in about 29, with Coraciidæ 25, Falconidæ 25, Striges 22, Bucerotidæ 22, Gallidæ 21, against 19 points of difference.

A previous line of investigation had revealed the fact that the Coccyges and Gallidæ are intimately connected with each other through *Opisthocomus*. This knowledge obviated further inquiry as to the affinity between Psittaci and Gallidæ.

I. *Comparison of Psittaci with Falconidæ.*

Psittaci and Falconidæ agree.	*Psittaci and Falconidæ differ.*
Nidicolous = Cuculi.	Toes = Cuculi (not *Pandion*).
Woolly nestlings.	10 remiges = Cuculidæ.
Distribution of nestling downs.	No vomer = Musophagidæ.
Distribution of adult downs.	Mandible = Musoph.
Cervical apteria = Cuculi.	+ Ectepicondylar process = Cuc.
Dorsal apteria = Coccyges.	+ Tibial intercondylar tubercle = Cuc.
Ventral apteria = Musophagidæ.	Hypotarsus complex = Cuc.
Aftershaft = Musoph.	Flexor tendons = Cuc.
Tufted oil-gland = Musoph.	Garrod's formula = Cuc.
Aquinto-cubital.	Large procoracoid process = Cuc.
Desmognathous = Cuculi.	Thoracal hæmapophyses = Cuc.
No basipteryg. proc. = Cuculi.	Food = Musoph.
Holorhinal = Cuculi.	Cæca none = Musoph.
Nares impervim = Cuculi.	Syrinx specialized.
Shallow temporal fossa.	
Number of cervical vertebræ = Cuculi.	14 negative points.
No spina interna = Cuculi.	
Spina externa = Cuculi.	
Posterior sternal margin = Cuculi.	
Coracoids = Cuculi.	
Furcula = Cuculi.	
Humero-coracoid groove = Cuculi.	
Cervical hæmapophyses = Cuculi.	
2 carotids = Cuculi.	
Tongue.	
Intestinal convolutions.	
26 positive points.	

cations within the various members of such groups, as, *e. g.*, Tubinares and Accipitres, Limicolæ and Passeres. These are traps which it is not always easy to avoid.

Of the 26 positive points not less than 19 are common to Falconidæ, Psittaci, and Coccyges. In the remaining 7 points Psittaci and Falconidæ agree together against Coccyges, namely nestlings, downs of young and adult, fifth cubital, temporal fossa, fleshy tongue, convolutions of intestines. Most of these characters seem important, especially the woolly nestlings, considering that Psittaci breed in holes, and agree in the convolutions in spite of the totally different food.

On the other hand, the sifting of the 14 negative characters shows that in 13 of them the Parrots agree with Cuculidæ or with Musophagidæ, or with both, and differ along with the Coccyges from the Falconidæ. The syrinx is an absolute specialization. Fuerbringer remarks that powder-downs, ceroma, and beak speak for Falconidæ against Coccyges. Again, Psittaci and Falconidæ differ greatly in the formation of the furcula, in nearly the whole of the muscular system, and in the bones of the wings and legs.

Conclusion.—The Psittaci are much more nearly allied to the Coccyges than to the Falconidæ, and of the Coccyges the Musophagidæ are nearer than the Cuculidæ because of the vegetable food, ventral pterylosis, presence of aftershaft, tufted oil-gland, absence of vomer, truncated mandible, and absence of cæca.

II. *Comparison of Psittaci, Coraciidæ, and Coccyges*, based by Fuerbringer chiefly upon the pterylosis, anterior lateral process of the sternum, procoracoid process, clavicular connexion, hypotarsus, shortness of metatarsus, many muscles of the shoulder and thigh. He observes, however, that the greater number of characters is against this relationship. The comparison made by me is given in the Table now before us (see p. 233).

III. *Comparison of Psittaci and Striges.* 22 characters agree, 18 differ; the latter are:—

Toes. . . Striges more primitive, although ectamphibolic.
Downs of adult in Striges only upon apteria.
Ventral pterylæ.
10 primaries. Striges with 11, *i. e.* more primitive.
Aftershaft large.
Tufted oil-gland.
Desmognathous. Striges more primitive.
Vomer. Striges more primitive.
Basipterygoid processes. Striges more primitive.
Temporal fossa.
Coracoids overlapping in Striges.

Table.

Comparison of Psittaci, Coraciidæ, and Coccyges.

Psittaci = *Coraciidæ* = *Coccyges*.	*Psittaci* = *Coraciidæ* and differing from *Coccyges*.	*Psittaci* = *Coccyges* and differing from *Coraciidæ*.	*Psittaci* differing from *Coraciidæ* and *Coccyges*.
Nidicolous. Cervical apteria. Primaries. Desmognathous. No basypteryg. proc. Holorhinal. Nares impervious. Mandible truncated. 14 cervical vertebræ. Cervical hæmapophyses. Thoracal hæmapophyses. Spina externa. Spina interna. Posterior sternal margin. Coracoids. Procoracoid process. Furcula. Humero-coracoidal groove. Tibial intercondylar tubercle. Hypotarsus. 2 carotids. Food. 22	Dorsal-spinal apterium. Frequent absence of bony tibial bridge. 2	Toes. Ventral apteria. Aftershaft large (Musoph.). Oil-gland (Musoph.). Vomer. Ectepicondylar process. Toe flexors. Cæca absent (Musoph.). 8	Downy nestlings. Downs of adult. Aquinto-cubital. Shallow temporal fossa. Tongue. Cæca. Intestinal convolutions [1]. 7

[1] The convolutions of the Psittaci are peculiar; the telogyrous tendency of the loops resembles that of Falconidæ, but this is also indicated in several Cuculidæ, while on the whole the convolutions of the Psittaci combine a mixture of Coraciine and Cuculine characters. *Cf.* Bronn, Aves, p. 708.

Intercondylar tubercle.
Hypotarsus. Striges raptorial type.
Thigh-muscles. Striges very specialized.
Syrinx. Striges more primitive, Cuculiform.
Intestinal convolutions.
Food. } Parrots specialized.
Cæca. }

These differences are important enough, not only on account of their number but also on account of their value, to remove Psittaci and Striges far from each other. Striges are perhaps on the whole more primitive, but both groups have been specialized in two different directions. Some of the agreements (*e. g.* absence of a bony tibial bridge, the sternal configuration) are most likely referable to the numerous organic links which connect the Coraciiformes and Cuculiformes with each other.

IV. *Comparison of Psittaci with Pici.* Curiously enough these two groups have many characters in common, namely 29 against 11. The differences are:—

1. Woolly nestlings, although both breed in holes.
2. Presence of downs in adult.
3. Dorsal pterylosis.
4. Large aftershaft (intermediate are, however, *Capito* and *Indicator*).
5. Aquinto-cubital.
6. No vomer.
7. Flexor tendons of toes.
8. Procoracoid process.
9. Cervical hæmapophyses.
10. Syrinx.
11. Intestinal convolutions.

Of these differences Nos. 1, 2, 6, 7, 8, 10, and 11 are of great importance.

Of the 29 positive characters or resemblances the form of the spina externa sterni alone is remarkable, otherwise nothing which cannot be explained equally well by the affinity of the Psittaci to the Coccyges or to the Coraciiformes, of which latter order, moreover, the Pici are an offshoot. The resemblances between the Pici and Psittaci have therefore chiefly to be looked upon as convergent analogies.

Final Conclusion.—The sifting of all these characters shows an undoubtedly close affinity between the Psittaci and Coraciidæ, but less intimate than with the Coccyges. The latter are, however, closely

related to the Coraciidæ, and are (as indicated by the *Opisthocomus*-Gallidæ connexion) the lowest of the three groups of Psittaci, Coraciidæ, and Coccyges. Cuculidæ, as well as Coraciidæ, are zoophagous, chiefly insectivorous. The Striges, as a lateral branch of the lower Coraciine stock, explain the considerable number of characters which connect the Striges with the Coccyges, 28 against 12, and with the Psittaci, 22 against 18. In our hypothetical tree the Psittaci would combine with the Coccyges into one bigger branch—Cuculiformes; the Psittacine twig to stand between that of the Musophagidæ and looking towards the branch of the Striges, which again come out of the bigger branch of the Coraciiformes. This big branch and that of the Cuculiformes would ultimately combine into a still bigger branch; below this bifurcation would come off *Opisthocomus* and lower still that of the Gallidæ. Thus the Psittaci permit us a glimpse at a large part of the Avine tree, namely at that big branch which downwards points towards the Galliformes and towards the Gallo-Ralline and Rallo-Limicoline region of the tree, while the same branch upwards ends not only in all the so-called Picariæ but also in the Pico-Passeres.

The laborious process exemplified in these comparisons was applied to all the families and was not without results, because certain families were gradually found to assume a central position towards which a number of others gravitated. Thus, for instance, the Coraciidæ had to be compared with not less than 10 other families; the Gallidæ with 8, &c. Notoriously difficult forms, as, for instance, Trogons and Colies, naturally caused more trouble than others, since the number of comparisons had to be increased.

The result of all this is the following classification. In the mode of denomination of the various smaller and larger combinations I have followed Fuerbringer's plan. I am sorry that my classification does not bear greater resemblance to his, but nobody who has really studied Fuerbringer's work will fail to perceive that I stand on my friend's shoulders, or rather on his two fundamental volumes in addition to my own work.

The *subfamilies*, which have been mentioned whenever desirable, end in *inæ*. The *families* end in *idæ*.

The Families are combined into Suborders, indicated by substantival names. The Suborders are combined into Orders, ending in *formes*, with a Latin substantive stem. The Orders could, if necessary, be combined into Phyla, ending in *morphæ*, with a Greek substantive stem; these would correspond with Fuerbringer's Orders, while my Orders are equivalent to his Suborders.

The whole of the Class Aves has been divided into 2 Subclasses, to which the names of Archornithes and Neornithes have been given, the equivalent names of Saururæ and Ornithuræ being objectionable, because there is no difference in the skeletal part of the tail of *Archæopteryx* and that of the Ratitæ, Crypturi, and Hesperornithidæ. The Neornithes are separated into the two Divisions of Ratitæ and

Carinatæ. These names are likewise open to objection, but they have become household terms and they serve a practical purpose.

Many attempts have been made to *brigade* together two and two of my orders into combinations intermediate in value between Orders and Phyla—for instance, Tubinariformes and Ardeiformes, Charadriformes and Columbiformes—but ultimately these attempts have been abandoned as of little practical value. They are, however, conducive to the construction of the much searched for phylogenetic tree, but the very existence of such a single Avine tree is a problematic idea.

Under the heading of each group, be it subfamily, order, or subclass, is mentioned a variable number of characters. The sum total of these constitutes more than a diagnosis. The single characters themselves are not necessarily all those which have led to the establishment of the group in question, but the sum total of the characters mentioned has been thus arranged, first that it applies to all the members of the group, secondly that it does not occur again in those of any other group.

Class AVES.

Oviparous, warm-blooded, amniotic Vertebrates which have their anterior extremities transformed into wings. Metacarpus and fingers carrying feathers or quills. With an intertarsal joint. Not more than four toes, of which the first is the hallux.

I. Subclass ARCHORNITHES.

First, second, and third metacarpals and fingers separate. First finger with 2, second and third each with 3 phalanges. Each finger with a claw.

Upper jaw with conical teeth.

Skeleton of posterior extremities typically avine. Feet four-toed. Hallux posterior.

Vertebræ amphicœlous. Caudal vertebræ numerous, about 21, not terminating in a pygostyle.

About 24 rectrices, attached in pairs to about 12 caudal vertebræ.

Ribs without uncinate processes.

Wings with 6 or 7 well-developed primaries, attached to metacarpal III. and digits III. and II.; 10 cubital quills.

Extinct. Jurassic. Terrestrial—aerial.

1. ARCHÆOPTERYGIFORMES.

I. Archæopteryges. 1. *Archæopterygidæ.*

II. Subclass NEORNITHES.

Metacarpals fused with each other. Second finger the longest, third finger reduced. Caudal vertebræ apparently not more than 13 in number.

1st Division. NEORNITHES RATITÆ.

Nidifugous. Omnivorous. Terrestrial.
Rhamphotheca compound. Nares impervious. Holorhinal.
Vertebræ heterocœlous.
Basipterygoid processes functional. Proximal articulating head of quadrate single.
Sternum without keel and without spina interna. Spina externa small or absent. Coracoid fused with scapula; both bones forming a very obtuse angle.
With incisura ischiadica; only in adult *Rhea* and *Dromæus* the distal end of the ischium fusing with the ilium and forming a foramen ischiadicum.
Wings reduced; flightless. Terminal caudal vertebræ not coalesced into a pygostyle.
Hypotarsus simple. Flexors of type II. or IV.
Adult without pterylæ. Oil-gland absent.
Cæca functional.

1. STRUTHIONES.

Ethiopian.
Maxillo-palatines articulating with the vomer, which touches neither palatines nor pterygoids.
Third and fourth toes only developed, terminal phalanges shortened, with stunted nails.
Procoracoid large. No clavicles. Tibia without bony bridge.
Aftershaft absent.
Cæca and rectum enormous. (*Unique.*)

2. RHEÆ.

Neotropical.
Maxillo-palatines large, fenestrated, not touching the vomer.
Palatines short, articulating with the vomer.
Hallux absent. Front toes with claws, middle phalanges shortened.
Procoracoid process large. No clavicles. Tibia without bony bridge.
Aftershaft absent.
Cæca large.
Syrinx tracheo-bronchial, with one pair of syringeal muscles. (*Unique among Ratitæ.*)

3. CASUARII.

Australasian.
Maxillo-palatines large, fused with vomer and premaxilla.
Vomer long, articulating with palatines and pterygoids.
Hallux absent. Front toes with claws, middle phalanges shortened.
Procoracoid process small. Clavicles rudimentary. Tibia without bony bridge.
Aftershaft very large. Cæca small, functional.

4. APTERYGES.

New Zealand.
Maxillo-palatines as in *Casuarii*, but vomer fused with palatines and pterygoids.
All the four toes well developed, with claws.
Procoracoid process rudimentary. No clavicles. Tibia with bony bridge over extensor tendons.
Aftershaft absent. Cæca large.

5. DINORNITHES.

New Zealand.
Palate as in *Casuarii*. Hallux variable.
Whole shoulder-girdle and wing fragmentary.
Procoracoid process rudimentary. Tibia with bony extensor bridge.
Aftershaft very large.

6. ÆPYORNITHES.

Madagascar.
Hallux present. Tibia without bony extensor bridge.

2nd Division. **NEORNITHES CARINATÆ.**

This division comprises all those Neornithes to which the sum of characters descriptive of the Ratitæ does not apply.

As a rule the Carinatæ are described as birds possessed of a carina sterni; an acrocoracoid process; separate scapulæ and coracoids, which form an acute or a right angle; complete furcula; ischiadic foramen; single-headed quadrate; a vomer which is not fused with the neighbouring bones of the palate.

The existence of such forms as *Crypturi*, *Didus*, *Ocydromus*, *Stringops*, *Hesperornis*, &c., does not permit the employment of these characters to differentiate the Carinatæ from the Ratitæ. These are reasons sufficient to contest the validity of these two divisions, which are, however, retained more for the sake of convenience than on the ground of demonstrable facts.

7. COLYMBIFORMES.

Cosmopolitan. Aquatic. Nidifugous. Zoophagous.
Schizognathous. No basipterygoid process. Nares pervious.

Rhamphotheca simple. Supraorbital glands present.
Neck without apteria. Aftershaft present. Oil-gland tufted.
No ectepicondylar process. Aquinto-cubital.
Legs short. Hallux small, front toes webbed or lobated.
High patellar + epicnemial process. (*Unique.*)
Intestinal convolutions orthocœlous, type II.
Cæca functional.

I. COLYMBI.

14 or 15 cervical vertebræ.
11 primaries.
Hypotarsus enclosing one triangular space.
Front toes webbed.

II. PODICIPEDES.

17 to 21 cervical vertebræ.
12 primaries.
Hypotarsus complex.
Front toes lobated.

8. SPHENISCIFORMES.

Antarctic. Marine. Nidicolous. Zoophagous.
Schizognathous. No basipterygoid processes.
Rhamphotheca compound. Nares impervious.
Large supraorbital glands. Oil-gland tufted.
Pterylosis without apteria. Aftershaft present.
Remiges and rectrices rudimentary, numerous.
Wings transformed into paddles. (*Unique.*)
Metatarsals short, incompletely fused. (*Unique.*)
Hypotarsus simple. Flexors of type II.
Coraco-humeral groove shallow.
No ectepicondylar process.
Procoracoid process rudimentary.
Cæca functional.

I. SPHENISCI.

9. PROCELLARIIFORMES.

Cosmopolitan. Marine. Nidicolous. Zoophagous.
Nestlings downy. Downs complex.
Oil-gland tufted. Aquinto-cubital.
Neck with lateral apteria.
Schizognathous.
Rhamphotheca compound. Large supraorbital glands.
Nares impervious, tubular.
Hallux small or rudimentary. Front toes webbed.
Hypotarsus complex, or with several grooves.
Coraco-humeral groove shallow. Ectepicondylar process large.

Tracheo-bronchial muscles attached to 7th or 5th bronchial rings.
Tongue mostly rudimentary.

I. TUBINARES.

10. ARDEIFORMES.

Cosmopolitan. Aquatic.
Young passing through a downy stage.
Oil-gland tufted. Aquinto-cubital. Humero-coracoid deep. No ectepicondylar process.
Desmognathous. No basipterygoid process.

I. STEGANOPODES.

Cosmopolitan. Aquatic. Nidicolous. Piscivorous.
Rhamphotheca compound. Nares impervious.
No supraorbital glands. Angulare truncated.
Neck without apteria.
Legs short; all the four toes webbed together. (*Unique.*)
Hypotarsus complex. Flexors type of II.
Orthocœlous, type II. Tongue rudimentary.

1. *Phaetontidæ.*

15 cervical vertebræ.
Procoracoid process large.
Garrod's symbol AXY+.

2. *Phalacrocoracidæ.* (including Sulinæ, Plotinæ, Phalacrocoracinæ.)

18–20 cervical vertebræ.
Garrod's symbol AX+.

3. *Pelecanidæ.*

17 cervical vertebræ.
Procoracoid process small
Garrod's symbol A —.

4. *Fregatidæ.*

15 cervical vertebræ.
Procoracoid process small.
Garrod's symbol A+.

II. HERODII.

Cosmopolitan. Waders. Nidicolous. Zoophagous.
Bill long, pointed, laterally compressed, with simple rhamphotheca. Nares pervious.
No supraorbital glands.
Neck long, with long apteria. Downs of adults only upon the apteria. (*Unique* among Ardeiformes.)

Legs long; four toes, not webbed.
Hypotarsus complex. Flexors of type I. or VII.
Orthocœlous, type II. Cæca rudimentary.
Tracheo-bronchial muscles attached to second bronchial rings.

1. *Ardeidæ.*

19 or 20 cervical vertebræ.
Several pairs of powder-down patches.
11 primaries.—Cosmopolitan.

2. *Scopidæ.*

16 cervical vertebræ.
No powder-down patches.
10 primaries.—Ethiopian.

III. PELARGI.

Cosmopolitan. Waders.
Neck long, without apteria. Nares pervious.
Rhamphotheca simple.
Legs long. Hypotarsus simple.
Intestinal type IV., telogyrous.

1. *Ciconiidæ.*

Zoophagous. Nidicolous.
17 cervical vertebræ.
Hallux long, toes not webbed. Flexors of type I.
Tongue rudimentary.
Cæca rudimentary.
Syrinx without tracheo-bronchial muscles.

2. *Phœnicopteridæ.*

Tropical. Nidifugous.
18 or 19 cervical vertebræ.
Hallux small, front toes webbed. Flexors of type IV.
Tongue large and thick.
Cæca functional.
Syrinx with tracheo-bronchial muscles.

11. FALCONIFORMES.

Cosmopolitan. Nidicolous. Zoophagous.
Desmognathous.
Bill raptorial. Rhamphotheca simple, with ceroma.
Aquinto-cubital.
Feet raptorial. Hypotarsus simple.
Intestinal convolutions of type IV., telogyrous. Cæca rudimentary.
Coraco-humeral groove indistinct.

I. Cathartæ.

Neotropical.
Oil-gland nude. Neck without apteria.
Nares pervious.
Aftershaft absent.
Basipterygoid processes articulating with middle of pterygoids.
Procoracoid rudimentary.
Sternum with two pairs of notches.
Hypotarsus with two shallow grooves.
Flexors of type V.
Syrinx without muscles.

II. Accipitres.

Cosmopolitan.
Oil-gland tufted. Nares impervious.
Neck with lateral apteria.
Procoracoid process large.
Sternum with one pair of notches or fenestræ.
Flexors of type III.
Syrinx with tracheo-bronchial muscles.

1. *Vulturidæ*.

15 cervical vertebræ.
No basipterygoid processes.
Aftershaft present.
Coracoids present.

2. *Gypogeranidæ*.

15 cervical vertebræ.
Basipterygoid processes present.
Aftershaft present.
Coracoids separate.

3. *Pandionidæ*.

14 or 15 cervical vertebræ.
Basipterygoid processes absent.
Aftershaft absent.
Coracoids overlapping.

4. *Falconidæ*.

14 cervical vertebræ.
Basipterygoid processes absent.
Aftershaft present.
Coracoids separate.

12. ANSERIFORMES.

Cosmopolitan. Aquatic. Nidifugous.
Young downy.
Neck long, without apteria.

Aftershaft rudimentary.
Oil-gland tufted. Aquinto-cubital.
Rhamphotheca with ceroma; bill with lamellæ. Nares pervious.
Desmognathous. With basipterygoid processes.
Angulare of mandible long and recurved.
Coraco-humeral groove indistinct.
No ectepicondylar process.
Two pairs of pectoro-tracheal muscles. (*Unique.*)
Intestinal convolutions of type III.
Cæca functional.
Penis large, spiral. (*Unique* among Carinatæ.)

I. PALAMEDEÆ.

Neotropical.
Basipterygoid articulation on middle of pterygoids.
Hypotarsus simple.
Ribs without uncinate processes. (*Unique.*)

II. ANSERES.

Basipterygoid processes articulating with the palatine end of the pterygoids.
Hypotarsus complex.
Ribs with uncinate processes.

13. CRYPTURIFORMES.

Neotropical. Nidifugous. Phytophagous.
Schizognathous. Vomer fused with bones of palate. (*Unique.*)
Basipterygoid processes present.
Rhamphotheca compound. Nares impervious. Holorhinal.
Sternum with very slender and long mesosternum and simple posterior lateral processes. Procoracoid process rudimentary.
With incisura ischiadica.
Hypotarsus simple.
Flexors of type II.
Neck with lateral apteria.
Aftershaft rudimentary.
Oil-gland tufted. Quinto-cubital.
10 primaries.
Plagiocœlous, type V. Cæca large. Crop globular.

I. CRYPTURI.

14. GALLIFORMES.

Cosmopolitan. Phytophagous.
Schizognathous. Nares impervious. Rhamphotheca simple.

Furcula with hypocleidium.
Plagiocœlous, type V. Cæca large. Crop globular.
10 primaries.

I. Turnices.

14 or 15 cervical vertebræ.
Schizorhinal.
Sternum with long and simple posterior lateral processes.
Procoracoid process large.
No spina externa sterni.
Coracoids separate.
Hypotarsus complex. Hallux very small or absent.
Flexors of type IV.
Neck with lateral apteria.
Oil-gland tufted.
Quinto-cubital.

II. Galli.

16 or more cervical vertebræ.
Holorhinal.
Coracoids touching each other.
Flexors of type I. Hallux large.
Neck without lateral apteria.

1. *Gallidæ*.

16 cervical vertebræ. Nidifugous.
Spina communis sterni.
Sternum with long posterior lateral processes and with oblique processes.
Hypotarsus complex.

2. *Opisthocomidæ*.

18 or 19 cervical vertebræ. Nidicolous.
Spina externa only present.
Sternum with small notches or fenestra only; no oblique process.
Oil-gland tufted.

15. GRUIFORMES [1].

Cosmopolitan. Aquatic or paludic.
Angulare mandibulæ truncated. Rhamphotheca simple.

[1] Owing to the existence of such peculiarly specialized forms as *Eurypyga*, *Rhinochetus*, *Podica*, *Dicholophus*, and *Otis* (all of which are most intimately related to the bulk of the Grues and Ralli), it is not possible to admit some important characters into the diagnosis of the Gruiformes. They all are absolutely *nidifugous* with the exception of *Eurypyga* and *Heliornis* (the young of *Rhinochetus* are unknown). They are typically *schizognathous*, except *Rhinochetus* and *Dicholophus*. They have a *tufted oil-gland* except *Rhinochetus*, *Eurypyga*, *Dicholophus*, and *Otis*. They have lateral *cervical apteria* except *Eurypyga*, *Dicholophus*, and *Otis*. Their *feet* are those of Waders, except the tridactyle cursorial *Otis*. *Rhinochetus* alone has impervious *nares*.

No basipterygoid processes.
No ectepicondylar process.
Flexors of type I. or IV.
Peri-orthocœlous, type I.

I. EURYPYGÆ.

Neotropical.
With powder-down patches. (*Unique* among Gruiformes.)
Oil-gland nude. Schizorhinal.

1. *Eurypygidæ*.

Aquinto-cubital. No lateral cervical apteria.
Schizognathous. Nares pervious.
18 cervical vertebræ.
Sternum with one pair of notches.
Nidicolous.

2. *Rhinochetidæ*.

New Caledonia.
Quinto-cubital. Lateral cervical apteria.
Desmognathous. Nares impervious.
16 cervical vertebræ.
Sternum solid.
Hypotarsus with high ridges.

3. *Mesitidæ*.

Madagascar.
Cubital. Lateral cervical apteria.
Schizognathous. Nares pervious.
Sternum with long simple posterior lateral processes. Clavicles rudimentary.
17 cervical vertebræ.
Spina interna alone developed. (*Unique* among Gruiformes.)

II. RALLI.

Aquinto-cubital. With lateral cervical apteria.
Oil-gland tufted.
Schizognathous. Holorhinal.
14 or 15 cervical vertebræ.
Sternum with long simple posterior lateral processes.
Hypotarsus without canals but with high ridges.

III. GRUES.

With lateral cervical apteria.
Oil-gland nude.
Schizognathous.
17 to 20 cervical vertebræ.
Sternum solid.
Hypotarsus complex.

IV. Dicholophi.

Neotropical.
No cervical apteria.
Oil-gland nude.
Schizognathous. Holorhinal.
14 or 15 cervical vertebræ.
Sternum with two posterior notches.
Hypotarsus simple.

V. Otides.

No cervical apteria. Downs of adults only on apteria. (*Unique* among Gruiformes.)
Schizognathous. Holorhinal.
Sternum with four posterior notches.
Hypotarsus complex. Hallux absent; feet *cursorial*.

16. CHARADRIIFORMES.

Cosmopolitan. Nidifugous.
Downs of adult on pterylæ and on apteria.
With lateral cervical apteria. Aftershaft present. 11 primaries.
Oil-gland tufted. Aquinto-cubital.
Schizognathous. Nares pervious.
Rhamphotheca simple.
15 cervical vertebræ (except *Œdicnemus* and *Parridæ*).
Coraco-humeral groove distinct.
Furcula with hypocleidium.
Peri-orthocœlous, with mesogyrous tendency; type I.
Flexors of type I. or IV.

I. Limicolæ.

Downs of young very simple, brush-like.
Hypotarsus with canals.
Front toes webbed.
Supraorbital glands variable.

1. *Chionididæ*.

Antarctic.
Schizorhinal. No basipterygoid processes.
Vomer broad. Rhamphotheca complex. (*Unique* among Charadriiformes.)

2. *Charadriidæ*.

Cosmopolitan.
Schizorhinal. With basipterygoid processes.

a. *Charadriinæ*.
b. *Scolopacinæ*.

3. *Glareolidæ*.

Afro-Indo-Australian.
Schizorhinal (except *Pluvianus*). No basipterygoid processes.
(*Glareola, Pluvianus, Cursorius, Dromas.*)

4. *Thinocoridæ* (incl. *Attagis*).

Neotropical.
Schizo- inclining to holorhinal.
No basipterygoid processes.
With a globular crop. (*Unique* among Charadriiformes.)
Phytophagous.

5. *Œdicnemidæ*.

Cosmopolitan.
Holorhinal. No basipterygoid processes.
16 cervical vertebræ.
No hallux.

6. *Parridæ*.

Tropical.
Schizorhinal. With basipterygoid processes.
Hallux long.
16 cervical vertebræ.

II. GAVIÆ.

Downs of young more complex, approaching typical downs.
Front toes webbed. Aquatic. Zoophagous.
Supraorbital glands always large. Schizorhinal.
Hypotarsus with two grooves.

1. *Alcidæ*.

Sternum with two notches. Coracoids separate.
No ectepicondylar process. Procoracoid process small.
Periarctic.

2. *Laridæ*.

Sternum with four notches. Coracoids touching each other. With ectepicondylar process.
Procoracoid process large.
Cosmopolitan.

17. COLUMBIFORMES.

Cosmopolitan. Phytophagous.
Adult downs scarce and restricted to the apteria.
No lateral cervical apteria. 11 remiges.
Aftershaft rudimentary or absent.
Oil-gland nude or absent. Aquinto-cubital.

Schizognathous. Schizorhinal. Nares impervious.
Rhamphotheca simple.
Hypotarsus with one canal. Procoracoid process large.
Flexors of type I. or IV. Crop globular.

I. Pterocles.

African and Asiatic. Nidifugous.
Flexors of type IV. Hallux rudimentary.
Syringeal muscles broncho-tracheal.
Sterno-tracheal muscles separate.
Cæca large.
15 or 16 cervical vertebræ.

II. Columbæ.

Cosmopolitan. Nidicolous.
No downs in adults.
Flexors of type I. Hallux functional.
Syringeal muscles tracheal only.
Both sterno-tracheal muscles united asymmetrically.
Cæca not functional.
14 or 15 cervical vertebræ.

1. *Didida.*

Wings and furcula reduced.
Flightless.

2. *Columbidæ.*

Wings and furcula fully developed.

18. CUCULIFORMES.

Cosmopolitan. Nidicolous.
Neck with lateral apteria. 10 primaries.
Desmognathous. No basipterygoid processes.
Holorhinal. Nares impervious. Rhamphotheca simple.
Sternum with small notches or fenestræ.
Procoracoid process large.
13, 14, or 15 cervical vertebræ.
Humerus with ectepicondylar process.
Feet zygodactylous, scansorial.
Flexors of type I. Hypotarsus complex.
Intestinal convolutions of type IV. or V., with telogyrous tendencies.

I. Coccyges.

Nestlings naked.
Downs of adults restricted to the apteria.
Quinto-cubital.
Procoracoid approaching, or fusing with, acrocoracoid, forming a foramen.
Syrinx bronchial.
Intestinal convolutions of type V.

1. *Cuculidæ.*

Insectivorous. Cæca large.
Oil-gland nude.
Vomer present.
Coracoids separate.
14 cervical vertebræ.

2. *Musophagidæ.*

Ethiopian.
Frugivorous. Cæca absent.
Oil-gland tufted.
Vomer absent.
Coracoids overlapping.
15 cervical vertebræ.

II. PSITTACI.

Tropical. Nestlings downy. Phytophagous.
Downs of adults very complex, on apteria and pterylæ.
Aquinto-cubital. Bill globular, hooked.
Rhamphotheca with basal, soft ceroma surrounding the nostrils.
13 or 14 cervical vertebræ.
Syrinx with 3 pairs of muscles, and of *unique* structure.
Intestinal convolutions of type IV.; telogyrous.
Cæca absent.

1. *Psittacidæ.*

19. CORACIIFORMES.

Cosmopolitan. Nidicolous.
Feet four-toed, not zygodactylous, not webbed.
Metatarsus short. Flexors of type I., V., VII., or VIII.
Holorhinal. Nares impervious.
Sternum solid, or with small notches or fenestræ.
13, 14, or 15 cervical vertebræ.
Intestinal convolutions of type VI. or VII.

I. STRIGES.

Cosmopolitan. Zoophagous. Nestlings downy.
Downs of adults restricted to apteria. Plumage soft.
Feet raptorial, fourth toe reversible.
Flexors of type I. Hypotarsus simple.
Tibia without bony bridge for extensor tendons.
No spina interna. 14 cervical vertebræ.
Bill raptorial, without ceroma.
Schizognathous, with desmognathous tendency.
Basipterygoid processes complete.
Intestinal convolutions of type VI.
Cæca functional.

1. *Strigidæ.*

II. Macrochires.

Cosmopolitan.
10 remiges, terminal quill long.
Oil-gland nude.
Spina externa and interna very small or absent.
Coracoids separate.
13 or 14 cervical vertebræ.
Intestinal convolutions of type VI.

1. *Caprimulgidæ*.

Cosmopolitan.
Nestlings downy. Adult downs restricted to the apteria.
Bill broad, wide, short.
13 or 14 cervical vertebræ.
Hypotarsus complex.
Flexors of type V.
Syrinx bronchial.
Cæca functional.

2. *Cypselidæ*.

Cosmopolitan.
Nestlings naked. Adult downs restricted to the apteria. Insectivorous.
Bill broad, wide, short.
13 or 14 cervical vertebræ.
Hypotarsus simple.
Flexors of type V.
Syrinx tracheo-bronchial.
Cæca absent.

3. *Trochilidæ*.

American.
Nestlings naked. No downs in adults.
Bill long, slender. Tongue bi-tubular.
14 cervical vertebræ.
Hypotarsus simple.
Flexors of type I.
Syrinx tracheo-bronchial.
Cæca absent. Crop present (*unique* among Macrochires).

III. Colii.

Ethiopian. Phytophagous.
10 remiges. Oil-gland tufted. No downs in adults.
Desmognathous. No basipterygoid processes.
Spina externa well developed.
13 cervical vertebræ.
Left carotid only.
Hypotarsus complex. Flexors of type V.
Intestinal convolutions of type VI. Cæca absent.

1. *Coliidæ*.

IV. TROGONES.

Tropical. Frugivorous.
10 primaries. Oil-gland nude. No downs in adults.
Schizognathous. Basipterygoid processes rudimentary.
15 cervical vertebræ.
Spina externa long, forked. Coracoids touching each other.
Hypotarsus complex.
Flexors of type VIII. (*Unique.*)
Intestinal convolutions of type VI.
Cæca functional.

1. *Trogonidæ.*

V. CORACIÆ.

Cosmopolitan.
Desmognathous. Basipterygoid processes absent, or (*Coraciidæ*) sometimes rudimentary.
14 or 15 cervical vertebræ.
Hypotarsus complex.
Syrinx tracheo-bronchial.

1. *Coraciidæ.*

Palæogæan. Zoophagous.
Dorsal pterylosis with apterium.
10 primaries. Oil-gland nude.
No downs in adults.
14 cervical vertebræ.
No spina interna.
Procoracoid process large, but not fusing with the acrocoracoid.
Right and left carotids present.
Cæca functional.

2. *Momotidæ.*

Neotropical.
Without dorsal apterium.
10 primaries.
No downs in adults.
Spina interna absent.
Coracoids separate.
Procoracoid process very small.
15 cervical vertebræ.
Right and left carotids present.

3. *Alcedinidæ.*

Zoophagous. Cosmopolitan.
Without dorsal apterium.
11 primaries. Oil-gland tufted.

Downs present in adults, on pterylæ and on apteria. (*Unique* among Coraciæ.)
15 cervical vertebræ.
Spina interna absent.
Procoracoid process as in *Upupidæ*.
Cæca not functional. Tongue rudimentary.

4. *Meropidæ*.

Palæognæan. Insectivorous.
With dorsal apterium.
Oil-gland nude. No downs in adults.
15 cervical vertebræ.
Left carotid only.
Spina communis.
Procoracoids as in *Upupidæ*.
Cæca functional.

5. *Upupidæ*.

Palæognæan.
Oil-gland tufted. No aftershaft.
Spina communis.
Procoracoid process fused with acrocoracoid, forming a foramen.
14 or 15 cervical vertebræ.
Intestinal convolutions of type VII.
No cæca. Tongue rudimentary.

a. *Upupinæ*. Insectivorous.

With lateral cervical apteria.
10 primaries.
14 cervical vertebræ.
Flexors of type VII.

b. *Bucerotinæ*. Insectivorous and frugivorous.

Without lateral apteria.
11 primaries.
14 or 15 cervical vertebræ.
Flexors of type V.

c. *Irrisorinæ*. (Anatomy unknown to me.)

20. PASSERIFORMES.

Cosmopolitan. Nidicolous.
Neck with lateral apteria. Quinto-cubital.
No basipterygoid processes. Holorhinal.
14 or 15 cervical vertebræ.
Spina externa long; spina interna absent.
Sternum with small notches or foramina.
Second and third toes always turned forwards.
Flexors of type I., VI., or VII.
Hypotarsus complex.
Intestinal convolutions of type VII. or VIII.
Cæca not functional.

I. PICI.

Zygodactylous, or hallux absent.
Nestling and adult downs absent. Nesting in holes.
14 cervical vertebræ.
Flexors of type VI. (*Unique.*)
Intestinal convolutions of type VII. (*Galbula* and *Bucco* unknown.)
Cæca absent, except in *Galbulidæ*.

1. *Galbulidæ* (Galbulinæ + Bucconinæ).

Desmognathous.
Spina externa forked. Right and left carotids.
Oil-gland nude in *Galbulinæ* and in most *Bucconinæ*.

2. *Picidæ* (Picinæ, Yunginæ).

Schizo-ægithognathous.
Spina externa forked.
Oil-gland tufted. Left carotid only.

3. *Capitonidæ* (Capitoninæ + Indicatorinæ).

Ægitho-desmognathous.
Spina externa unpaired.
Oil-gland tufted. Left carotid only.

4. *Rhamphastidæ*.

Frugivorous.
Desmognathous.
Spina externa unpaired.
Oil-gland tufted. Left carotid only

II. PASSERES.

Ægithognathous.
Hallux present; 2nd, 3rd, and 4th toes always turned forwards.
Nestlings with downs of complex structure.
Oil-gland nude. Left carotid only.
Cæca not functional.
Intestinal convolutions of type VII. or VIII.

1. *Eurylæmidæ*.

Indian. Austro-Malayan.
Hallux weak; front toes syndactyle.
15 cervical vertebræ.
Spina externa long, single.
Intestinal convolutions of type VIII.
Flexors of type I.
Oligo-mesomyodous.

2. *Menuridæ*.

Australian.
Hallux the strongest toe. Front toes eleutherodactyle.
Flexors of type VII.
14 cervical vertebræ.
Spina externa forked.
Intestinal convolutions of type VII.
Di-acro-myodous.

a. *Menurinæ*. Furcula complete.
Three pairs of syringeal muscles.

b. *Atrichiinæ*. Clavicles rudimentary.
Two pairs of syringeal muscles.

3. *Passeridæ*.

Front toes eleutherodactyle.
Hallux the strongest toe.
14 cervical vertebræ.
Spina externa forked.
Flexors of type VII.
Intestinal convolutions of type VIII.

a. *P. oligomyodæ*. American.
Mostly mesomyodous, never di-acro-myodous.

b. *P. tracheophonæ*. Neotropical.
Syrinx tracheal.

c. *P. polymyodæ*. Cosmopolitan.
Di-acro-myodous.

APPENDIX.

List of the Characters employed in determination of the Affinities of the various Groups of Birds.

A. *Development*.

Condition of young when hatched: whether nidifugous or nidicolous; whether naked or downy, or whether passing through a downy stage.

B. *Integument*.

Structure and distribution of the first downs, and where distributed.

Structure and distribution of the downs in the adult: whether absent, or present on pterylæ or on apteria or on both.

Lateral cervical pterylosis: whether solid or with apteria.

Dorso-spinal pterylosis: whether solid or with apterium, and whether forked or not.

Ventral pterylosis: extent of the median apterium.

Aftershaft: whether present, rudimentary, or absent.

Number of primary remiges.

Cubital or secondary remiges: whether quinto- or aquinto-cubital.

Oil-gland: present or absent, nude or tufted.

Rhamphotheca: whether simple or compound, *i. e.* consisting of more than two pieces on the upper bill.

C. *Skeleton.*

Palate: Schizo-desmognathous. Nares, whether pervious or impervious, *i. e.* with or without a complete solid naso-ethmoidal septum.

Basipterygoid processes: whether present, rudimentary, or absent; and their position.

Temporal fossa, whether deep or shallow.

Mandible: os angulare, whether truncated or produced; long and straight or recurved.

Number of cervical vertebræ.

Hæmapophyses of cervical and of thoracic vertebræ: occurrence and shape.

Spina externa and spina interna sterni: occurrence, size, and shape.

Posterior margin of the sternum, shape of.

Position of the basal ends of the coracoids: whether separate, touching, or overlapping.

Procoracoid process: its size and the mode of its combination with acrocoracoid.

Furcula: shape; presence or absence of hypocleidium and of interclavicular process.

Groove on the humerus for the humero-coracoidal ligament: its occurrence and depth.

Humerus, with or without ectepicondylar process.

Tibia: with bony or only with ligamentous bridge, near its distal tibio-tarsal end, for the long extensor tendons of the toes: occurrence and position of an intercondylar tubercle, in vicinity of the bridge.

Hypotarsus: formation with reference to the tendons of the long toe-muscles:—(1) simple, if having only one broad groove; (2) complex, if grooved and perforated; (3) deeply grooved and to what extent, although not perforated.

Toes: number and position, and connexions.

D. *Muscles.*

Garrod's symbols of thigh-muscles A B X Y,—used, however, in the negative sense.

Formation of the tendons of the m. flexor perforans digitorum: the number of modifications of which is 8 (I.–VIII.) according to the numbering in *Bronn's Vögel*, p. 195, and *Fuerbringer*, p. 1587.

E. *Syrinx.*

Tracheal, broncho-tracheal, or bronchial.

Number and mode of insertion of syringeal muscles.

F. *Carotids.*

If both right and left present, typical: or whether only left present, and the range of the modifications.

G. *Digestive Organs.*

Convolutions of the intestinal canal. Eight types, numbered I.–VIII., according to *Bronn's Vögel*, p. 708, and P. Z. S. 1889, pp. 303–316.

Cæca: whether functional or not.
Tongue: its shape.
Food.—Two principal divisions, *i. e.* Phytophagous or Zoophagous, with occasional subdivisions such as Herbivorous, Frugivorous, Piscivorous, Insectivorous, etc.

List of Characters employed occasionally.

Shape of bill.
Pattern of colour. Number of rectrices; and mode of overlapping of wing-coverts, according to *Goodchild* (P.Z.S. 1886, pp. 184–203).
Vomer. Pneumatic foramen of humerus.
Supraorbital glands.
Crop.
Penis.
Certain wing-muscles according to *Fuerbringer*.
Mode of life: Aquatic, Terrestrial, Aerial, Diurnal, Nocturnal, Rapacious, etc.
Mode of nesting: breeding in holes.
Structure of eggs.
Geographical distribution.

April 5, 1892.

W. T. Blanford, Esq., F.R.S., F.Z.S., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March 1892:—

The total number of registered additions to the Society's Menagerie during the month of March was 107, of which 57 were by presentation, 17 by birth, 23 by purchase, 4 by exchange, and 6 were received on deposit. The total number of departures during the same period, by death and removals, was 96.

Among the deaths, I regret to have to announce that of the last of the Society's stock of Giraffes—a male, purchased Jan. 27th, 1879. We are now, therefore, for the first time since the arrival of the four original Giraffes on the 24th of May, 1836, without any representative of this Mammal in our series. Nor does there seem to be at present much chance of our being able to supply the deficiency. Owing to the closure of the Soudan by the Mahdists, the supplies of this and other large African Mammals, which were formerly obtained *viâ* Cassala and Suakim, have ceased, and, so far as I can make out, with the exception of a single old female (for which an exorbitant price is demanded), there are now no living Giraffes in the market.

From the table which I now exhibit, it will be seen that there have been 30 individuals of the Giraffe in the Society's Gardens since 1836, of which 17 have been born there, and 13 have been acquired by purchase. Of these 30, one was presented to the Royal Zoological Society of Ireland in 1844, five have been sold at prices varying from £450 to £150, and the remainder have died in the Gardens.

List of Giraffes that have lived in the Society's Gardens.

No.	Sex.	How obtained.	How disposed of.
1.	♀	Imported, May 24, 1836.	Died, Oct. 15, 1852.
2.	♂	Do. do.	,, ,, 29, 1846.
3.	♂	Do. do.	,, Jan. 14, 1849.
4.	♂	Do. do.	,, Jan. 6, 1837.
5.	♂	Born in the Menagerie, June 19, 1839.	,, June 28, 1839.
6.	♂	Born in the Menagerie, May 24, 1841.	Presented to the Dublin Zoological Society, June 14, 1844.
7.	♂	Do. do. Feb. 25, 1844.	Died, Dec. 30, 1853.
8.	♂	Do. do. April 22, 1846.	,, Jan. 22, 1867.
9.	♂	Do. do. Feb. 12, 1849.	Sold, April 27, 1850.
10.	♀	Imported, June 29, 1849.	Died, Nov. 3, 1856.
11.	♀	Do. do.	Sold, Oct. 29, 1853.
12.	♂	Born in the Menagerie, March 30, 1852.	,, March 29, 1853.
13.	♀	Do. do. April 25, 1853.	Died, May 21, 1872.
14.	♀	Do. do. May 7, 1855.	,, Nov. 6, 1866.
15.	♀	Do. do. July 16, 1859.	,, Dec. 2, 1859.
16.	♀	Do. do. May 26, 1861.	Sold, May 1, 1863.
17.	♀	Do. do. Oct. 7, 1861.	Died, Dec. 18, 1861.
18.	♂	Do. do. May 8, 1863.	,, Nov. 18, 1863.
19.	♂	Do. do. Sept. 24, 1863.	,, April 21, 1864.
20.	♂	Do. do. March 31, 1865.	,, April 3, 1865.
21.	♀	Do. do. April 20, 1865.	Sold, May 31, 1866.
22.	♀	Do. do. Sept. 14, 1866.	Died, Nov. 6, 1866.
23.	♀	Do. do. March 17, 1867.	,, June 20, 1881.
24.	♀	Purchased, July 23, 1867.	,, Sept. 12, 1869.
25.	♀	Do. Jan. 5, 1871.	,, April 27, 1874.
26.	♀	Do. Oct. 11, 1871.	,, May 21, 1878.
27.	♀	Do. July 25, 1874.	,, Jan. 8, 1879.
28.	♀	Do. do.	,, July 9, 1886.
29.	♀	Do. do.	,, Nov. 24, 1891.
30.	♀	Do. Jan. 27, 1879.	,, March 22, 1892.

Mr. Sclater called attention to two mounted heads of Swayne's Antelope[1] (*Bubalis swaynei*), which had been kindly lent to him by Messrs. Rowland Ward & Co. These were the specimens obtained by Mr. T. W. H. Clarke and Colonel Paget, and other members of the same party, which were alluded to in the 'Field' of March 26, 1892 (vol. lxxvi. p. 432), and one of which was there figured.

Mr. Sclater remarked that the heads now exhibited were evidently those of a male and female, the male in this, as in other species of the genus *Bubalis*, differing in the stouter and thicker horns.

Mr. Sclater stated that Prof. Giglioli, of Florence, had kindly sent him a coloured drawing of the head of an Antelope obtained by Count August Boutourline and Dr. Traversi in Shoa in 1882, which had been referred by Dr. Giglioli (Ann. Mus. Civ. Genova,

[1] See above, p. 98.

ser. 2, vi. p. 19) to the Hartebeest of South Africa (*Bubalis caama*), but that it was evident, from the shape of the horns and colour of the hairs, that this specimen also belonged to *B. swaynei*.

In reference to some remarks that had been made upon his usage of "*Bubalis*" instead of "*Alcelaphus*" for this group of Antelopes, Mr. Sclater pointed out that "*Bubalis*" of Lichtenstein was proposed in 1814 (Mag. d. Gesellsch. nat. Fr. vi. p. 152), two years before "*Alcelaphus*" of Blainville, and had been constantly used by Sundevall, Peters, and other writers, so that it had undoubtedly good claims to priority.

A note was read from Professor Jeffrey Bell regarding the habitat of *Bipalium kewense*. This interesting Planarian, first found in Kew Gardens, had been observed in very various parts of the world. In only one case, however, did the circumstances of its discovery make it possible that the worm was indigenous to the place where it was met with. That one place was Samoa, where Mr. J. J. Lister found it under stones in the bush. Mr. Fletcher, in communicating this fact to the Linnean Society of New South Wales (see Zool. Anzeig. 1891, p. 139), had expressed the opinion that there was little ground for supposing that the species was indigenous in Samoa. Further reason, however, for supposing that Samoa may be one of the places in which the worm is indigenous was to be found in the fact that Mr. R. B. Leefe had recently collected the same worm in Tongatabu. Prof. Bell had learnt from the Director of the Royal Gardens, Kew, that though no plants had, to the Director's knowledge, been received directly from Tongatabu, exchanges had been made with Fiji. It might be urged that the probability of the group of islands just named being the original home of the species was, on the whole, increased by the facts now stated.

The following papers were read :—

1. On the Land-Shells of St. Helena. By Edgar A. Smith.

(Plates XXI. & XXII.)

[Received March 2, 1892.]

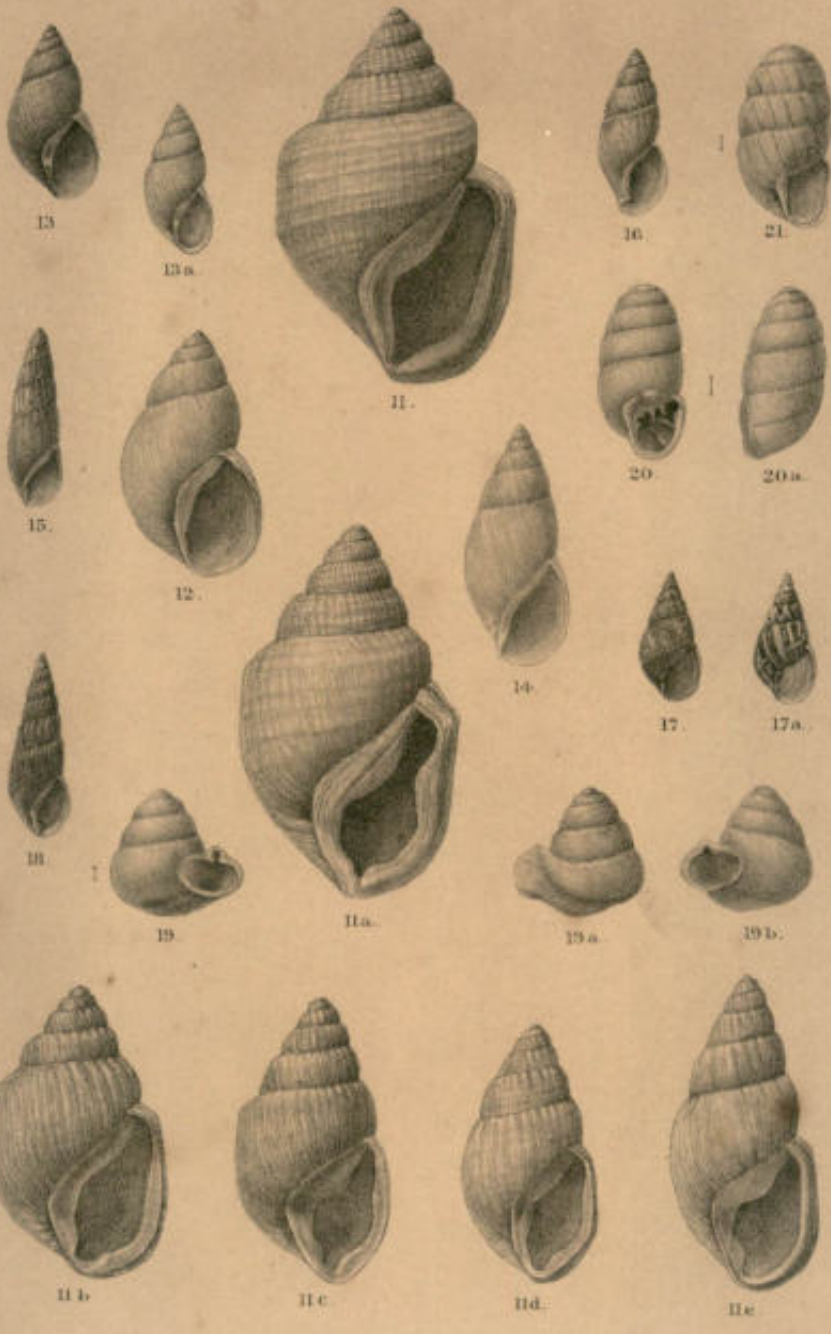
Last year I had the honour of presenting to the Society an account of the marine Mollusca of St. Helena. I now propose to introduce to its notice some remarks upon the terrestrial fauna of that island. Like the former, the present report is based chiefly upon collections made by Capt. W. H. Turton, R.E., and presented to the British Museum. The collection is the most complete that has ever been made, and contains examples not only of most of the known species, but also of as many as eleven undescribed forms, a proportion of more than one third of the entire fauna. Our best thanks are due to Capt. Turton for the labour of getting together such an interesting



R. Mintern lith.

Mintern Bros. imp.

LAND SHELLS OF St HELENA.



R. Masters, lith.

Masters Bros. imp.

LAND SHELLS OF St HELENA.

collection, and for the careful notes regarding localities which accompany the specimens.

The most complete account of the terrestrial fauna[1] of St. Helena hitherto published is that given by Mr. Wollaston in his work 'Testacea Atlantica,' published in 1878. He there enumerates 29 species of Land-Shells, of which 9 at least must be regarded as introductions since the discovery of the island 390 years ago. Some of these species—for example, *Limax gagates*, *Vitrea cellaria*, *V. alliaria*, *Helix pulchella*, *H. aspersa*, and *Pupa umbilicata* (=*helenensis*, Pfr.)—were doubtless introduced along with European shrubs and plants. *Patula pusilla* probably was imported from Madeira, the Canary Islands, or the Azores, where it is very abundant; and the two remaining species, *Stenogyra compressilabris* and *Acicula vera*, upon which some remarks will be made at the end of this paper, are evidently West-Indian forms. With regard to the twenty indigenous species mentioned by Mr. Wollaston, some, in my opinion, are merely varieties and not specifically distinct. After a careful study of all the forms, including the eleven new species now described, the total number of indigenous species may be estimated at twenty-seven. Of these, seven are living on the island at the present time, eighteen have become extinct since the destruction of the primæval forests, and two are found both recent and semi-fossil.

A great deal has been written upon the relationship of the fauna of St. Helena with regard to other parts of the globe, and an interesting *résumé* of this subject is given by Mr. Wallace in his work 'Island Life,' pp. 281–297.

Professor Forbes many years ago, from a study of the Mollusca, hazarded the theory of a possible ancient connection of St. Helena with South America. This view, however, was vigorously rejected by Wollaston, Jeffreys, and others, and, considering the present isolated position of the island, the actual enormous depth of the surrounding ocean, and other cogent reasons[2], this theory certainly does appear unsupportable. There is, however, a greater resemblance between the shell-fauna of the two localities than was recognized either by Forbes or Wollaston; and the occurrence of a species, discovered since they investigated this subject, and more resembling a group (*Tomigerus*) which is exclusively Brazilian in distribution than any other, together with the reasons which influenced Forbes, would seem to indicate that country as the probable source whence some of the indigenous but now extinct species, or their ancestors, originated. How they were transmitted is a hopeless problem to solve, and although drift-wood, carried by oceanic currents, is doubtless answerable for a good deal in the way of distribution, the subject must apparently ever remain one of mere speculation. It has been stated by Mr. Wollaston that the large *Bulimus auris-vulpina* is represented in the Solomon Islands and New Zealand by

[1] No freshwater forms have as yet been discovered.

[2] Neither the flora of St. Helena nor the insect-fauna suggests particularly a South-American relationship or origin.

species which have much the same type of form; but this supposed resemblance, in reality, proves to be less, on a careful comparison of the two types, than one at first would imagine. Perhaps the most striking similarity to Pacific forms occurs among the *Patulæ*. Such species as *P. radiella*, Pfr., *P. multilamellata*, Garret, *P. acuticostata*, Mousson, and others from the Polynesian Archipelago are exact representatives of the *Endodontæ*, or toothed group of *Patulæ*, from St. Helena. Still, although these Pacific forms are certainly of the same type, we must also remember that the same form of *Patula* occurs in the island of Fernando Noronha, namely, *P. quinquelirata*, Smith, and possibly also on the adjacent mainland of Brazil itself, although its presence there has yet to be discovered.

In the following complete list of the *indigenous* species references are not given, as they are obtainable by consulting Mr. Wollaston's work. In conclusion I propose to discuss one or two of the introduced species.

A. *Indigenous Species.*

1. Vitrea mellissii (Wollaston).

This minute species, which is known to me only by description, is possibly an introduction.

Patula (without teeth).

2. Patula spurca (Sowerby). (Plate XXI. figs. 1, 1 *a*.)

This species was unknown to Mr. Wollaston, and consequently being misled by the somewhat poor figure given by Forbes, he has placed it in the genus *Hyalina* (=*Vitrea*). The examination, however, of a number of specimens, some received from Mr. Alexander, who furnished Forbes with his examples, others from Capt. Turton, proves that it should be located in the group *Patula*. Sowerby's description being so brief, I think it advisable to recharacterize it, thus:—

Testa anguste umbilicata, suborbicularis, tenuis, albida, rufo-variegata, haud nitida; spira parum elevata, ad apicem obtusa; anfractus 5, *convexiusculi, regulariter et lente accrescentes, lineis incrementi tenuibus confertis flexuosis obliquis striati, ultimus ad peripheriam rotundatus, antice haud descendens; apertura late lunata, simplex, haud dentata vel lirata; peristoma tenue, margine columellari leviter expanso et reflexo.*

Diam. maj. 5 *millim., min.* 4½, *alt.* 3⅝; *apertura* 2¼ *longa*, 1⅔ *lata*.

Hab. Sugarloaf Hill and Quarry (*Turton*). Extinct (? living).

In some specimens the spire is more elevated than in others, and occasionally the apex is scarcely raised above the last whorl. The majority of the examples examined have to a great extent lost their original colour and are now of a uniform whitish tint; but a few from Sugarloaf Ridge, which have the appearance of live shells, look of a pale reddish colour to the naked eye, but when viewed under a

lens it is seen that they are variegated with irregular radiating blotches of red and white intermingled. The lines of growth are distinct, finely hair-like, arcuate and oblique on the upper surface, and gently undulating on the body-whorl. The umbilicus is deep but narrow, equalling about one fifth the diameter of the base.

3. Patula dianæ (Pfeiffer). (Plate XXI. figs. 2–2 *b*.)

This species does not belong to the group *Hyalina* (= *Vitrea*), as supposed by Wollaston, but falls naturally into *Patula* together with the preceding species, which it very closely resembles.

Hab. Diana's Peak. Living (*Pfr.*).

4. Patula persoluta, sp. nov. (Plate XXI. figs. 3–3 *b*.)

Testa minuta, late et aperte umbilicata, discoidalis, planorbiformis, pallide rufescens (?); anfractus 3½, perconvexi, sutura profundissime discreti, subceleriter accrescentes, lineis incrementi obliquis striati, ultimus tubiformis, rotundatus, antice solutus et descendens; apertura subcircularis, margine columellari leviter planato.

Diam. maj. 3½ *millim., min.* 2¾, *alt.* 2.

Hab. Side Path (*Turton*). Extinct.

This is a very remarkable little species, at once recognizable by its Planorbiform appearance, and the detached anterior portion of the body-whorl. The upper whorls do not rise above the last, and the suture is remarkably deep. The umbilicus is very wide and open, permitting the convolution of the whorls to be observed to the apex. Both of the specimens examined exhibited traces of red towards the apex, and there is every probability of the living shell having exhibited more or less of that tint.

5. Patula lætissima, sp. nov. (Plate XXI. figs. 4–4 *b*.)

Testa minuta, anguste umbilicata, depresse subconoidea, alba, maculis radiantibus rufis supra et infra picta; anfractus 5½, lente accrescentes, superne convexiusculi, sutura subprofunda sejuncti, lineis incrementi fortibus striati, ultimus ad peripheriam rotundatus, antice haud descendens; apertura semilunata, edentula; peristoma tenue, simplex, margine columellari dilatato; umbilicus profundus, angustus, diam. totius ⅛ *adæquans.*

Diam. maj. 4 *millim., min.* 3½, *alt.* 2½.

Hab. Sugarloaf Ridge, near the top (*Turton*). Extinct.

This little species is remarkable for its small deep umbilicus, the toothless aperture, rather well-marked lines of growth, the rounded periphery to the body-whorl, and the red colour-markings. These consist of radiating blotches on the upper surface of the whorls, which become rather angular and wavy on the middle and lower part of the body-whorl.

PATULA (with teeth, *Endodonta*).

6. PATULA BIPLICATA (Sowerby).

Hab. North of the island. Extinct.

A small species with two palatal folds. Unknown to me.

7. PATULA BILAMELLATA (Sowerby). (Plate XXI. fig. 5.)

Var. UNILAMELLATA. Aperture with the lower parietal lamella wanting.

Hab. Sugarloaf Ridge, rare (*Turton*). Extinct.

This name was also applied by Pfeiffer to a small species of "*Helix*" in 1845, or one year after the publication of Sowerby's description. As it cannot be regarded as generically distinct, although very different in form, I propose to substitute the name *Patula pagodiformis*.

8. PATULA VERNONI, sp. nov. (Plate XXI. figs. 6–6 *b*.)

Testa anguste perforata, depresse discoidea, superne planata, ad peripheriam acute carinata, alba, superne et infra rufo radiata; anfractus 6, *lente accrescentes, vix convexiusculi, lineis incrementi tenuibus striati, ultimus acute carinatus, supra et infra carinam leviter compressus, antice haud descendens, lineis radiantibus rufis undulatis infra pictus, radiatim tenuiter striatus; apertura parva, subrhomboidalis, lira parietali tenui intrante munita; peristoma simplex, tenue, umbilicum versus leviter incrassatum.*

Diam. maj. 12 *millim., min.* 11, *alt.* 4.

Hab. Side Path (*Turton*). Extinct.

This species is at once recognized by its very flat spire, the compressed very acute keel, the minute umbilicus, the single fine lira-tion upon the upper part of the body-whorl, running within the aperture, and the style of colouring. The red rays upon both the upper and lower surfaces are more or less wavy and interrupted. There is no other sculpture excepting the fine lines of growth which cross the upper surface of the whorls obliquely and are a little flexuous beneath. The body-whorl has a more distinct impression below the keel than above it. I have much pleasure in naming this very distinct species after my late friend T. Vernon Wollaston, whose work 'Testacea Atlantica' is one of the most accurate and complete hitherto published upon any Molluscan fauna.

9. PATULA PSEUSTES, sp. nov.[1] (Plate XXI. figs. 7–7 *b*.)

Testa conoidea, pyramidalis, anguste umbilicata, albida, superne maculis quadratis, inferne flammulis rufis picta; anfractus $6\frac{1}{2}$, *convexi, sutura profunda discreti, radiatim tenuiter costulati, ultimus ad peripheriam rotundatus, inferne striis tenuissimis flexuosis sculptus; apertura lunata, obliqua, intus denticulis inæqualibus sex (duobus lamelliformibus parietalibus prominentibus, tribus minimis supra columellam, una*

[1] ψεύστης, a deceiver.

tenui prominenti in medio palati) instructa; peristoma tenue, marginibus remotis, columellari leviter dilatato.

Longit. 2⅔ *millim., diam.* 3½; *apertura* 1¼ *longa,* ½ *lata.*

Hab. Flagstaff Hill (*E. W. Alexander*). Extinct.

This species has the spire more elevated and conical than the other species of *Patula* from the island. *P. cutteri*, Pfr., may approach it somewhat, but that species is said to have only two parietal lamellæ, and two basal denticles near the columella. The present species has an additional basal denticle, and a prominent thin palatal lamella, which falls as it were between the two on the inner or parietal side of the aperture.

10. Patula cutteri (Pfeiffer).

Hab. Diana's Peak. Living (*Pfr.*).

A small species, unknown to me, apparently similar in general features to the preceding, but with only four teeth within the aperture, two parietal and two basal near the columella, more narrowly umbilicated and probably more strongly sculptured.

11. Patula polyodon (Sowerby). (Plate XXI. figs. 8–8 *c*.)

This is the most widely umbilicated of all the species of *Patula* from St. Helena, and this feature alone is sufficient to distinguish it from the rest. The whorls also, in adult shells eight to nine in number, enlarge very slowly. The striæ are fine, regular, arcuately oblique above, and slightly wavy on the last whorl. There are *three parietal liræ* extending far within the aperture, of which the upper and lower are nearly always double. The plicæ within the outer lip are almost invariably (in adult shells) seven in number, subequidistant, but not of equal thickness, two or three towards the columella being stouter than the rest, which are slender and extend some distance within.

Diam. maj. 5½ mill., min. 5, alt. 2½.

Hab. Side Path, Sugarloaf Quarry, Sugarloaf Ridge (*Turton*). Extinct.

The species to which the foregoing remarks apply is certainly the *Helix alexandri* of Forbes, for in the British Museum there are specimens of it presented by Mr. Alexander, who also furnished Forbes with the shells he described. Moreover the description is fairly applicable, especially that portion of it referring to the umbilicus, which is described as "*maximus*." It is much less certain that this is the *H. polyodon* of Sowerby, but as Mr. Wollaston has united these species as well as *H. helenensis* (Forbes), Pfeiffer, it will probably be advisable to acquiesce in this decision. There are, however, certain differences in the descriptions, which seem to indicate that more than one species was described by these authors, for instance:—*H. polyodon* is said to consist of six striated whorls, with three parietal and five palatal liræ, and a moderate-sized umbilicus, whereas *H. alexandri* is described as having seven strongly striated whorls, three parietal and eight palatal liræ, and a very large umbilicus. *H. helenensis* is characterized as possessing eight very

narrow closely costate whorls, and only two parietal liræ and the same number within the outer lip. Pfeiffer states that *H. helenensis* was described by Forbes in the Proc. Zool. Soc. for 1851, and this statement is copied both by Reeve and Wollaston. This appears to be an error, for after a careful search I have been unable to discover in any publication the description by Forbes of any species of *Helix* under that name.

12. PATULA MINUTISSIMA, sp. nov. (Plate XXI. figs. 9–9 *c*.)

Testa conoidea-depressa, mediocriter late umbilicata, albo et rufo maculata et variegata; spira leviter elevata, superne obtusa; anfractus 7, primi duo læves, pallide rufescentes, cæteri convexiusculi, lirulis tenuibus arcuatis obliquis, in anfr. ult. flexuosis, ornati, ultimus ad peripheriam acute rotundatus, vel interdum obsolete subangulatus, antice haud descendens; apertura oblique semilunata; lamellæ parietales tenuissimæ, in cochleis adultis sex, in exemplis juvenilioribus quatuor vel quinque; plicæ palatales 8–10; *peristoma tenue, margine columellari expanso.*

Diam. maj. 4¾ *millim., min.* 4½, *alt.* 2½.

Hab. Sugarloaf Ridge (*Turton*). Extinct.

This species is smaller than *P. polyodon*, more narrowly umbilicated, has fewer whorls, coarser and more remote striæ, and a different armature within the aperture. In full-grown shells there are as many as six parietal liræ, as it were, in two groups of three. They are very fine and extend a long way within. The plicæ within the outer lip vary apparently from seven or eight to ten or eleven, and some of them are more prominent than others. The red markings take the form of radiating blotches on the upper surface, and more undulating or zigzag streaks beneath.

13. PATULA LEPTALEA, sp. nov.[1] (Plate XXI. figs. 10–10 *c*.)

Testa orbicularis, depressa, late umbilicata, albida rufo variegata; spira vix elevata; anfractus 5, primi 1½ *læves, cæteri convexiusculi, tenuissime arcuatim striati, lente accrescentes, ultimus ad peripheriam acute rotundatus, antice haud descendens; apertura oblique semi-lunata; lamellæ parietales tres (quarum suprema et mediana duplices sunt) tenues, longe intrantes; plicæ palatales circa sex.*

Diam. maj. 3¼ *millim., min.* 3, *alt.* 1½.

Hab. Sugarloaf Quarry (*Turton*). Extinct.

This species is much smaller than *P. polyodon* and not quite so large as *P. minutissima*; it is flatter than either, much more finely striated than the latter, and has a different oral armature from both. The parietal liræ are unequal in size, that nearest the collumella being the smallest. The two others are about equal and double, and between occasionally a very small and slender intermediate lira is observable.

[1] λεπταλέος, delicate.

Bulimus (Pachyotus).

14. Bulimus auris-vulpina (Chemnitz). (Plate XXII. figs. 11–11*d*.)

Hab. All along Sugarloaf Ridge (*Turton*). Extinct.

With regard to this, the largest extinct snail of St. Helena, Mr. Wollaston admits the resemblance "*to a certain extent*" to certain Brazilian species, at the same time observing "that much the same type of form exists equally in the Solomon Islands and New Zealand." Whilst agreeing with those remarks, I would point out that although in the Pacific shells referred to the apertures are somewhat similar, the general form, especially of the body-whorl, is much more elongate. On the contrary, *B. melanostoma* and *B. bilabiatus* from Brazil, cited by Forbes in comparison, exhibit not only like proportions, but also similar oral characters.

Captain Turton in his notes remarks: "The shape appears to me to vary immensely, and therefore I have sent as many as 30 specimens, so as to show all the intermediate forms. The very slender ones are, I suppose, *B. darwinianus*, but I can scarcely draw any line between them. I noticed that the different varieties of this shell generally (always, I think) came from different parts of the ridge; and you will observe that the more recent shells which retain their colour do not grow to the same size as the more fossilized ones."

I fully concur in the opinion arrived at by Captain Turton respecting *B. darwinianus* (Plate XXII. fig. 11 *d*) being merely an elongate form of the *B. auris-vulpina*.

His other observation, with regard to the smaller size of the more recent specimens, is also very interesting. This diminution might be accounted for by the vegetation being less luxuriant and other conditions being less favourable to finer growth than in former times, before the partial destruction of the primæval forests which then clothed the island.

The freshest examples are of a light reddish colour and generally of a somewhat darker tint towards the apex. The top of the plications at the suture are whitish, and there is more or less of this colour variously distributed over the surface in the form of irregular streaks and blotches. A few subfossil snails' eggs obtained at Sugarloaf Ridge along with this species evidently from their size belong to it. They are roundly ovate, being 6½ millim. in length and 6 broad. Some other much smaller eggs were also found by Captain Turton at the same place, but in this instance it would be mere guesswork to suggest to which species they belong.

(Bulimulus.)

15. Bulimulus blofeldi, Forbes. (Plate XXII. fig. 12.)

Hab. Side Path; very common (*Turton*).

This species is very like the following in form, but has not the same strong spiral sculpture. However in the best preserved example indications of transverse striæ and some oblique faint reddish markings are observable.

16. Bulimulus helena, Quoy and Gaimard. (Plate XXII. figs. 13, 13 *a*.)

With this species I unite *B. fossilis*, of Sowerby, and *B. scaleianus* of Forbes (Pl. XXII. fig. 13 *a*). Typical specimens are of the same general form as the S.-American *B. proteus*, Broderip, and have somewhat similar granular sculpture.

Hab. Sugarloaf Ridge and Quarry, and the Barn (*Turton*). Extinct (? living).

(Section —— ?)

17. Bulimulus subtruncatus, sp. nov. (Plate XXII. fig. 14.)

Testa subfossilis, elongato-ovata, superne acuminata, imperforata, lineis incrementi obliquis tenuibus striata; anfractus 7, convexiusculi, sutura subprofunda sejuncti, ultimus oblique declivis, sed prope labrum leviter ascendens, apertura inverse auriformis, longit. totius ⅓ haud æquans; labrum tenue, antice leviter patulum vel expansum; columella obliqua, rectiuscula, callo tenui superne labro juncto induta, antice plus minus subtruncata.

Longit. 31½ *millim., diam.* 12½; *apertura* 14 *longa*, 7 *lata.*

Hab. Side Path, common (*Turton*). Extinct.

Although not particularly like *B. virgulatus*, Fér., it is perhaps more allied to that species than any other. The subtruncation of the columella, however, is more pronounced.

(Peronæus ?)

18. Bulimulus subplicatus (Sowerby). (Plate XXII. fig. 15.)

Hab. Sugarloaf Ridge, common (*Turton*). Extinct.

Quite distinct from any other known species and of elongate form like the section *Peronæus*. The *Cochlicopa terebellum* of Sowerby, a slightly more slender form, is evidently merely a slight variety in which the plications at the suture, probably through the worn condition of the specimens, appear to be less developed.

(Section —— ?)

19. Bulimulus exulatus (Benson). (Plate XXII. fig. 16.)

Hab. Sugarloaf Ridge, common (*Turton*). Extinct.

Remarkable for the distinct truncation of the collumella like *Leptachatina*.

(Section —— ?)

20. Bulimulus turtoni, sp. nov. (Plate XXII. figs. 17, 17 *a*.)

Testa anguste perforata, ovato-conica, tenuissima, nitida, fusco-cornea, strigis irregularibus opaco-lacteis, longitudinaliter picta; anfractus 7, convexiusculi, lineis incrementi obliquis striati, ultimus ad peripheriam rotundatus, in exemplis juvenilibus obsolete angulatus; apex subpapillaris; apertura ovata, superne acuminata, longit. totius ½ haud æquans;

peristoma tenuissimum, margine exteriore simplice, haud expanso, columellari supra umbilicum anguste reflexo, tenuiter calloso, in medio plica parva vel denticulo munito.

Longit. 17 *millim., diam.* $7\frac{3}{4}$; *apertura* $7\frac{3}{4}$ *longa,* 4 *lata.*

Var. *Testa fusco-cornea, lineis opaco-lacteis tenuibus confertis plus minus irregularibus et interruptis picta, circa medium anfractus ultimi zona pallida cincta.*

Hab. High Peak, among native vegetation (*Turton*). Living.

This perhaps is the prettiest land-shell occurring in the island, and it is remarkable that it has escaped the notice of most of the explorers and naturalists who have visited and collected at St. Helena. Two specimens, however, have been in the collection at the British Museum for many years. They were received from the Museum of Economic Geology in January 1860, but it is uncertain by whom they were collected.

The substance of the shell is extremely thin and fragile and the surface exhibits no other sculpture excepting lines of growth. The colour-ornamentation is variable. In what may be regarded as the typical form the opaque creamy longitudinal markings take the form of broadish irregular wavy stripes, which frequently run into one another, so that they exhibit a more or less zigzag appearance. In other specimens these broadish stripes are replaced by very numerous and slender lines, which are more or less wavy and sometimes considerably interrupted and broken up.

The plait or denticle upon the columella is peculiar, giving to it a subtruncate appearance. *B. neglectus*, Pfr., *B. costatus*, Pfr., and some other forms of *Peronæus* have a somewhat similar plication on the columella, but rather higher up. I have much pleasure in associating this beautiful species with the name of Capt. W. H. Turton.

(Section —— ?)

21. Bulimulus melanioides (Wollaston). (Plate XXII. fig. 18.)

Hab. Diana's Peak, at an elevation of over 2000 feet (*Turton*). Living.

This is very distinct and quite unlike any other known species. It was located by Mr. Wollaston in the genus *Subulina* on account of the truncation or fold at the base of the columella. This feature, although rather higher up on the columella, is also met with in certain *Bulimi* from Brazil, as I have already pointed out in connection with the preceding *B. turtoni*. I therefore am inclined to assign this species rather to *Bulimulus* than to *Subulina*, as moreover it bears very little resemblance to any species of that group.

22. Tomigerus (?) perexilis, sp. nov. (Plate XXII. figs. 19–19 *b*.)

Testa dextrorsa vel sinistrorsa, minuta, obtuse pyramidalis, imperforata, albida vel dilute rufescens; anfractus 5, *convex-*

iusculi, lente accrescentes, lineis incrementi tenuibus obliquis striati, ultimus antice valde ascendens, pone labrum constrictus, scrobiculatus et distortus, inferne quoque scrobiculatus, ad anfractum penultimum appressus; spira ad apicem valde obtusa; apertura transversim ovata, superne sinu fere circulari instructa, intus angustata; perist. continuum plus minus expansum.

Longit. 1½ *millim., diam. maj.* 1½, *min.* 1; *apertura* ½ *longa,* ½ *lata.*

Hab. Side Path, and the sinistral form from Sugarloaf Ridge (*Turton*). Extinct.

This is a very remarkable little species and quite unlike any other from the island.

The manner in which the last whorl ascends in front upon the penultimate recalls certain species of *Tomigerus* and *Boysia*. The emargination at the upper part of the peristome is most remarkable. It has the appearance of being the termination of a tube, the edge of which is notched at one place. The shallow depression on the lower part of the body-whorl towards the aperture and the more distinct groove behind the peristome give the last volution a decidedly distorted appearance. It is difficult to decide whether this species should be classed as a *Tomigerus* or a *Pupa*. In size it more resembles the latter genus, but in outline the former; it has not, however, the same armature to the mouth.

23. PUPA TURTONI, sp. nov. (Plate XXII. figs. 20, 20 *a*.)

Testa minuta, cylindracea, superne obtuse conoidea, albida, subrimata; anfractus 5–6, convexi, lente crescentes, sutura vix obliqua sejuncti, lineis perobliquis tenuissime striati, ultimus haud descendens, pone labrum in medio uni-scrobiculatus; apertura parva, irregulariter subquadrata, longit. totius ⅓ *haud æquans, intus dentibus sex (tribus parietalibus, uno columellari, duobus palatalibus) munita; peristoma niveum, leviter expansum et reflexum, continuum, superne indentatum.*

Longit. 3 *millim., diam.* 1; *apertura* ⅔ *longa et lata.*

Hab. Sugarloaf Quarry, common (*Turton*). Extinct.

This species might be found anywhere. It is not unlike *P. solitaria*, Smith, from Fernando Noronha, but rather more cylindrical, less conical towards the apex, and has different armature to the mouth.

24. PUPA OBLIQUICOSTULATA, sp. nov. (Plate XXII. fig. 21.)

Testa minuta, cylindracea, pallide fuscescens, rimata; anfractus sex, convexiusculi, sutura profunda sejuncti, costulis arcuatis tenuibus perobliquis ornati, ultimus antice leviter contractus, paulo ascendens, pone labrum haud profunde impressus; apertura rotunda, subquadrata, longit. totius ⅓ *adæquans, intus haud dentata; peristoma tenue, undique anguste expansum, marginibus superne conniventibus.*

Longit. 2 *millim., diam.* ¾; *apertura* ⅔ *longa,* ½ *lata.*

Hab. Sugarloaf Quarry (*Turton*). Extinct.

This is a very minute species, with very oblique, slender, and somewhat remote costulæ and no teeth within the aperture.

25. Succinea sanctæ-helenæ (Lesson).

Hab. High ground among native vegetation (*Turton*). Living.

26. Succinea picta, Pfeiffer.

Hab. All over Sugarloaf Ridge, common (*Turton*). Living.

27. Succinea bensoniana, Forbes.

Hab. Long Range, Sugarloaf Ridge, common, both living and extinct (*Turton*).

Little can be suggested with regard to the origin or relationship of the above three species, for, as is well known, *Succineas* all the world over have a remarkably strong family likeness. That they are not importations of modern times, however, is proved by the fact that one of them occurs in a semifossil condition along with other extinct forms of land-shells.

B. *Introduced Species.*

Through the kindness of Mr. E. L. Layard I have had the opportunity of examining the types of two of Benson's species, namely:—*Achatina vera* and *Bulimus compressilabris*. The former I regard as identical with the West-Indian *Cæcilioides gundlachi* (Pfeiffer), which is synonymous with *Macrospira aperta* of Guilding from St. Vincent's, specimens of which, from Guilding's collection, are now in the British Museum. As it was found in the Public Gardens at Jamestown there is every probability of its being a comparatively recent introduction along with West-Indian plants.

The *Bulimus compressilabris* also appears to be an introduction from the West Indies, for it is identical with the *Stenogyra ascendens* of Poey from Cuba, which I believe to be merely a slender form of *St. goodallii*, Miller. The remaining introduced species have been enumerated in the early part of this paper.

EXPLANATION OF THE PLATES.

Plate XXI.

Figs. 1, 1*a*. *Patula spurca*, p. 260.
2–2*b*. —— *dianæ*, p. 261.
3–3*b*. —— *persolata*, sp. n., p. 261.
4–4*b*. —— *latissima*, sp. n., p. 261.
5. —— *bilamellata*, p. 262.
6–6*b*. —— *vernoni*, sp. n., p. 262.
7–7*b*. —— *pseustes*, sp. n., p. 262.
8–8*c*. —— *polyodon*, p. 263.
9–9*c*. —— *minutissima*, sp. n., p. 264.
10–10*c*. —— *leptalea*, sp. n., p. 264.

PLATE XXII.

Figs. 11–11 *d*. *Bulimus auris-vulpina*, p. 265.
12. *Bulimulus blafeldi*, p. 265.
13. —— *helena*, p. 266.
13 *a*. —— ——, var., p. 266.
14. —— *subtruncatus*, sp. n., p. 266.
15. —— *subplicatus*, p. 266.
16. —— *exulatus*, p. 266.
17, 17 *a*. —— *turtoni*, sp. n., p. 266.
18. —— *melanioides*, p. 267.
19–19 *b*. *Tomigerus perexilis*, sp. n., p. 267.
20, 20 *a*. *Pupa turtoni*, sp. n., p. 268.
21. —— *obliquicostulata*, sp. n., p. 268.

2. On an apparently undescribed Pheasant from the Province of Zarafshan in Central Asia. By HENRY SEEBOHM, F.Z.S.

[Received April 5, 1892.]

Through the kindness of Mr. Tegetmeier I have been able to add to my collection an example of a Pheasant from Central Asia which appears to be undescribed. It is closely allied to *Phasianus principalis*, but differs from that species in having a very conspicuous white collar round the back of the neck but not quite meeting in front. It further differs from that species (and resembles *P. persicus*) in having no dark margins to the scapulars, and in having the dark tips to the feathers of the flanks and of the sides of the breast much narrower.

From *Phasianus mongolicus*, which is also a ring-necked Pheasant, it differs in having the upper parts below the white ring brick-red, without any trace of the green reflexions so conspicuous in that bird. It further differs from that species (and resembles *P. principalis*) in having the feathers of the breast broadly margined with golden red, instead of being narrowly margined with black bronzed with green. It is also a smaller bird, with a smaller spur.

It can scarcely be a cross between *P. mongolicus* and *P. principalis*, because the white ring is an absolutely perfect one in the most typical example of the former, whilst it is as absolutely free from the green reflexions which characterize *P. mongolicus* as the most typical example of *P. principalis*.

The example of this apparently new species of Pheasant was sent to Mr. Tegetmeier by Lieutenant G. Tarnovski of Samarkand as a specimen of the Pheasant of the Zarafshan, described by that Russian sportsman in the 'Field' newspaper of the 21st of March 1891 (vol. lxxvii. p. 409), under the name of *Phasianus zerafshanicus* sive *klossovskii*; but in the detailed description of that species it is stated that "on specimens shot last autumn I found on nape and sides of neck from six to eight white small feathers invisible from without. On the birds which are the subject of this description I have been unable to find any of these neck-feathers." From this statement it

is quite obvious that neither of the names proposed by Lieutenant Tarnovski can be applied to the bird in question. I therefore propose to call it *Phasianus tarnovskii*, after its discoverer.

It is quite possible that *Phasianus zerafshanicus* is distinct from *P. principalis*, but its distinctness can scarcely be fully admitted without a comparison of specimens. According to Lieutenant Tarnovski, *P. zerafshanicus* has only recently made its appearance in the upper valley of the Zarafshan. He writes:—"Mr. Klossovski, who had resided in Katta-Koorgan for thirteen years, informed me that Pheasants had made their appearance in the district of Katta-Koorgan (where we were shooting) about 1883, and that they had immigrated from the Bokharian dominions, probably from the Kara-Kool lakes and reeds (the Zarafshan does not reach the Amoo-Daria, but is lost in the sands near Kara-Kool), whence they were driven forth by the invasion of the Kisil Koom sands, which gradually bury the western part of Bokhara under their hills."

Lieutenant Tarnovski further adds that "the Pheasant of the Zarafshan has a mode of life totally differing from its other Asiatic brethren, owing to the high state of cultivation of the Zarafshan valley; it breeds and nests in the reedy swamps and marshes bordering on this stream, and takes its food from the neighbouring fields and gardens."

3. Note on *Bulimus oblongus*.

By R. J. Lechmere Guppy, C.M.Z.S.

[Received March 19, 1892.]

The specimens of the anatomy of *Bulimus oblongus* which I exhibit may have some interest for Fellows of this Society.

In my paper on the Mollusca of Trinidad published in the 'Annals and Magazine of Natural History' for January 1866 (ser. 3, vol. xvii. p. 48), I mentioned some peculiarities of the structure of this mollusk, which had been figured by d'Orbigny in his 'Voyage dans l'Amérique Méridionale.' The tentacular appendages of the head call to mind the Cephalopoda, and the jaw in two horny portions strengthens the analogy. The specimens now shown are:—(1) the jaw preserved in glycerine, (2) the anterior portion of the animal in spirit, (3) the dental membrane in Canada balsam, (4) the shell and egg. These are all probably well known. I have had the pleasure on more than one occasion of presenting living examples of this fine species to the Gardens of the Society; but, owing to its habit of burrowing, I fear few of the visitors have had the opportunity of seeing the creature in motion.

I take the opportunity of mentioning another fact concerning this mollusk which may possibly be new. The family Helicidæ, to which *Bulimus oblongus* belongs, is generally considered to have the sexes united, nevertheless requiring the congress of two individuals for reproduction. I am not able to assert that *Bulimus oblongus* is

anatomically unisexual, yet functionally I believe it to be so. Having observed numerous individuals and pairs, I am able to say that the female is constantly larger than the male.

I may add a word as to the best method of killing these mollusks. If placed in a sort of vapour-bath or in a vessel of water, and heated very slowly and gradually, they die painlessly and in a condition with the tissues relaxed much more suitable for the purposes of the anatomist than if killed by immersion in hot water or in any acrid fluid. When it is desired to preserve the shell in a perfectly clean condition, the whole should, after the animals are dead, be boiled so that the soft parts may readily come away from the shell.

4. Descriptions of new Species of Lepidoptera Heterocera from Brazil, Mexico, and Peru.—Part I. By W. Schaus, F.Z.S.

[Received March 16, 1892.]

The following descriptions are all taken from specimens in my own collection, and those of the Brazilian and Mexican species were chiefly collected by myself.

Fam. Agaristidæ.

Othria meridionalis, sp. nov.

Velvety black; the primaries with a narrow transverse band of a creamy white, extending from the middle of the subcostal vein to close to the inner angle. Underneath the transverse band is slightly wider than on the upper surface.

Expanse 34 mm.

Hab. Petropolis, Brazil.

Fam. Zygænidæ.

Harrisina janeira, sp. nov.

Dull greenish black; the second and third abdominal segments bright red.

Expanse 26 mm.

Hab. Petropolis, Brazil.

Harrisina dantasi, sp. nov.

Dull black; a bright orange spot on either side of the collar.

Expanse 21 mm.

Hab. Novo Friburgo, Brazil.

Harrisina eminens, sp. nov.

Bluish black; the base of the wings yellow and on the primaries a yellow mark crossing the wing from the subcostal vein at about two thirds from the base and extending to the outer margin just above the inner angle; this mark is somewhat in the shape of a T,

having the upper portion along the subcostal vein. At the base of the abdomen a short lateral yellow streak.

Expanse 28 mm.

Hab. Tijuca, Brazil.

This species bears a very strong resemblance to *Dyeladia correbioides*, Felder.

EUPYRA PSITTACUS, sp. nov.

Primaries above dull metallic green, with the outer margin broadly black; underneath bright metallic green, except the apical third which is black. Secondaries above black, the costal margin bright metallic green, and the inner margin shot with bluish green; underneath bright metallic green, with a very narrow black outer margin. Head and thorax black; a white spot behind the eyes, and six white spots on the thorax. Abdomen above black, with a subdorsal row of white spots, the one on the first segment being much larger than the others; laterally metallic green; underneath brownish black, with two rows of large white spots. Coxæ white. Antennæ black.

Expanse 41 mm. Four males.

Hab. Peru.

EUPYRA CONSORS, sp. nov.

Primaries above dark green with a golden tinge, the outer margin broadly black; near the end of the cell a small hyaline spot; underneath the same as above but of a brighter metallic green, and there is a second small spot denuded of scales just beyond the cell, and in some specimens a third similar spot below the middle of the median vein. Secondaries above black, the costal margin bright green, at the base of the inner margin a small white spot and a small semihyaline streak in the cell; underneath bright green, with the spots as above and a narrow black outer margin. Thorax black, with white spots as in *E. psittacus*. Abdomen above black, golden between the segments, and a subdorsal row of small white spots; laterally golden; underneath brown, with an outer row of white spots.

Expanse 44 mm.

Hab. Peru.

EUPYRA AURATA, sp. nov.

Wings above dull golden green. The inner margin of the secondaries black. Underneath the same as above, with the apex and the outer margin of the primaries dark brown. Head black, two small white spots on the frons and a similar spot behind each antenna. Thorax black with white spots. Body golden, with a black subdorsal band and a narrow black transverse line separating each segment; laterally a broad brown band with a row of large silver spots; dorsally there are two small white spots on the first segment.

Expanse 42 mm. Two females.

Hab. Peru.

EUPYRA BACCHANS, sp. nov.

Primaries above dark green, with a broad black outer margin and a white spot at the base of the costa; underneath the wings are more of a dull golden green, the outer margins blackish brown. Secondaries above black, a few dark green scales between the second and third median nervules; underneath golden green. Antennæ black with white tips. Thorax black, two white spots mingled with bluish scales on the collar and similar spots on the thorax. Abdomen black, a subdorsal and two lateral rows of small white spots, each spot having anteriorly a cluster of bright blue scales.

Expanse, ♂ 45 mm., ♀ 48 mm.

Hab. Peru.

ISANTHRENE GAZA, sp. nov.

Primaries yellowish hyaline, darker along the costal and inner margins; the outer and inner margins with a very narrow black border, the apices broadly black; at the base of the wings a few blue scales. Secondaries above yellowish hyaline, the outer margin very narrowly bordered with black, the inner margin very narrowly orange; underneath the same as above, with the costal margins of a much deeper yellow. Frons orange. Metallic blue spots at the base of the antennæ. Collar orange, with two black spots having bright blue centres. Tegulæ orange inwardly, black outwardly. Thorax black, with two patches of metallic blue scales. Abdomen above with the first segment yellow, the following segments orange with two rows of transversely elongated metallic blue spots bordered with black, the black meeting subdorsally; these spots are placed on the posterior portion of each segment; laterally are similar blue and black markings; underneath abdomen pale yellow.

Expanse 37 mm. ♀.

Hab. Peru.

GYMNELIA SERRA, sp. nov.

Primaries yellowish hyaline, the margins broadly bordered with black. A black mark at the end of the cell. Secondaries whitish hyaline, the outer margin broadly black. Antennæ, head, and thorax black; two small dark metallic blue spots on the collar. Abdomen velvety black, with a lateral row of dull red spots separated by clusters of dark metallic blue scales.

Expanse 40 mm. ♀.

Hab. Rio Janeiro, Brazil.

PSEUDOMYA PELLUCIDA, sp. nov.

Male. Primaries with the basal half semihyaline, black, the apical half hyaline. Secondaries hyaline, a few dark scales along the costal margin. Body black, subdorsally velvety black.

Expanse 20–24 mm.

Female. Primaries entirely semihyaline black. Secondaries slightly more transparent. Body as in the male.

Expanse 29 mm.

Hab. Rio Janeiro, Brazil.

PSEUDOMYA TIJUCA, sp. nov.

Female. Primaries semihyaline black. Secondaries hyaline, darker towards the outer margin. Head black; thorax orange; abdomen black above, whitish underneath.

Expanse 30 mm.

Hab. Tijuca, Brazil.

PSEUDOMYA MUSCA, sp. nov.

Wings black, semihyaline and iridescent. Head, thorax, and first abdominal segment black; abdomen otherwise bright yellow. The sexes are similar.

Expanse 23 mm.

Hab. Jalapa, Mexico.

COSMOSOMA HARPALYCE, sp. nov.

Primaries hyaline, the inner and outer margins very narrowly black, the apex broadly black, a black spot at the end of the cell. Secondaries hyaline, the outer margin narrowly black, more widely so at the apex and along the inner margin. Antennæ, head, and thorax black, the latter reddish outwardly. Abdomen above dull black, with two reddish spots at the base; underneath yellowish, except the last two segments, which are black.

Expanse 34 mm.

Hab. Petropolis, Brazil.

DYCLADIA CATHERINA, sp. nov.

Wings hyaline, the apices black, the margins very narrowly black. Antennæ, head, thorax, and abdomen black. A large crimson spot on each side of the thorax, and a round crimson spot on each side of the fourth segment of the abdomen.

Expanse 26 mm. ♂.

Hab. Santa Catharina, Brazil.

DYCLADIA ROGENHOFERI, sp. nov.

Wings hyaline. Primaries with the apices and fringe black; a little yellow at the base of the wing. Frons white. Head, thorax, and abdomen bright yellow, with a subdorsal black line.

Expanse 19 mm.

Hab. Petropolis. Brazil.

This species is most closely allied to *Dycladia felderi*, Druce, but differs in the subdorsal markings and the smaller extent of black at the apices of the primaries.

DYCLADIA EPIMETHEUS, sp. nov.

Wings hyaline, with the margins rather broadly black, especially the apices; base of the primaries red; a small black mark at the end of the cell of the same wing. Head black. Thorax and base of the abdomen, laterally, red; abdomen otherwise black.

Expanse 25 mm. ♀.

Hab. Novo Friburgo, Brazil.

DYCLADIA BROTEAS, sp. nov.

Primaries hyaline, the outer margin broadly black, the inner margin narrowly so, a small black spot at the end of the cell; the hyaline portion of the primaries is white crossed by black veins, until the end of the cell, beyond which and up to the marginal border the hyaline portion is yellowish with orange veins. Secondaries hyaline, the outer margin broadly black. Head and thorax black, collar and tegulæ crimson. Abdomen black, laterally crimson, dorsally on the first segment are two conspicuous silvery-white spots.

Expanse 22 mm.

Hab. Santa Catharina, Brazil.

ARGYROEIDES MAGON, sp. nov.

Wings yellowish hyaline, fringe black. Body black.

Expanse 29 mm.

Hab. Santa Catharina, Brazil.

TRICHURA CYANEA, sp. nov.

Wings hyaline, yellowish along the costal margins, and narrowly bordered with black on the outer and inner margins. A minute blue spot at the base of the primaries. Antennæ black. Frons metallic blue. Thorax black; two metallic blue spots on the collar. Abdomen black; subdorsal blue spots on the first three and the last segment. Underneath, at the base of the abdomen, two silvery-white streaks. Legs black outwardly, dark metallic blue inwardly.

Expanse 38 mm.

Hab. Petropolis, Brazil.

SYNTRICHURA DOERI, sp. nov.

Wings hyaline. Primaries narrowly margined with black. Secondaries having only the costa and apex black. Head and thorax black, with a yellow lateral streak. Abdomen black, with a lateral row of yellow spots. Abdomen below whitish.

Expanse 21 mm. ♂.

Hab. Petropolis, Brazil.

Fam. ARCTIIDÆ.

ACLYTIA PETRA, sp. nov.

Primaries brownish black, with all the veins clearly defined. Secondaries hyaline, with a broad black margin. Head and thorax black; a metallic blue spot between the antennæ. Abdomen dorsally black, laterally metallic blue, underneath white. Legs black; joints and coxæ white.

Expanse 32 mm.

Hab. Peru.

ACLYTIA HECALE, sp. nov.

Primaries dull black, faintly hyaline in the disk and darkest on the margins and at the end of the cell. Secondaries hyaline, with a broad black margin. Antennæ, head, and thorax black; two crimson spots behind the antennæ. Abdomen black, with a lateral band of metallic blue. Base of all the legs bright crimson.

Expanse 39 mm. ♀.

Hab. Petropolis, Brazil.

CHARIDEA INACHIA, sp. nov.

Female. Primaries above velvety black, with a large orange space extending in its anterior portion from the base along the subcostal vein to beyond the cell, and posteriorly along the submedian vein to close upon the inner angle, and divided by two black lines, one just below the median vein, the other just above the submedian; a small black transverse mark at the end of the cell. Secondaries velvety black. Underneath black, with a large triangular orange spot on the primaries. Head and thorax black. Abdomen above steel-blue, with two black dorsal lines; underneath black.

Expanse 33 mm.

Hab. Petropolis, Brazil.

METRIOPHYLA LENA, sp. nov.

Primaries above velvety black, fringe white; the basal third of the costal margin narrowly white. Secondaries above black, glossed with dark blue; the outer margin narrowly, the apex broadly, white. Underneath: wings black, glossed with dark blue; the apices and outer margins white. Antennæ black. Head crimson. Frons white. Thorax black, with a white spot on either side. Abdomen black above, tinged with dark blue; underneath black, with a white ventral line. Anus crimson. Legs black exteriorly, white inwardly.

Expanse 36 mm.

Hab. Peru.

AUTOMOLIS ELISSA, sp. nov.

Wings pale yellow, secondaries slightly hyaline. Head orange. Collar and thorax yellow. Abdomen dorsally black, except fourth and fifth segments, which are orange with two black subdorsal spots; abdomen laterally and underneath orange, with three lateral black spots on the third, fourth, and fifth segments.

Expanse 54 mm. ♀.

Hab. Rio Janeiro, Brazil.

GALETHALEA PERUVIANA, sp. nov.

Male. Primaries above white, shaded with greenish grey; along the costal margin five large irregular black spots, also three similar spots on the inner margin and three small black spots on the outer margin; underneath the spots are suffused and occupy nearly the entire wing, forming a broad submarginal band. Secondaries above

white, slightly hyaline, the apex broadly, the outer margin faintly, clouded with black; underneath the same, with a long black spot on the costal margin. Antennæ black, with a broad white space near the base and also near the tip. Head white. Thorax white, spotted with black. Abdomen above brown, the last three segments yellow with subdorsal black spots; underneath white. Anus black.

Expanse 32 mm.

Hab. Peru.

CTENUCHA AZTECA, sp. nov.

Primaries brownish green. Secondaries bluish black. Fringes on all the wings white. Head and thorax black, collar crimson. Abdomen dark metallic blue. Anus crimson.

Expanse 38 mm.

Hab. City of Mexico.

Very closely allied to *Apistosia terminalis*, Walker.

THEAGES VESTALIS, sp. nov.

White; wings semihyaline, slightly iridescent.

Expanse 22 mm.

Hab. Peru.

EUCEREON LADAS, sp. nov.

Male. Primaries grey; the veins, a median and a marginal angulated band, some streaks between the veins on the extreme margin, and a few shades at the base of the wings dark brown; there is a minute spot in the middle of the cell connected with a similar spot at the end of the cell by a fine black line. Secondaries dark brown. Head and thorax grey, with brown spots on the collar. Abdomen brown dorsally, the last three segments yellow; underneath two white streaks.

The female is paler on the primaries, and the secondaries are greyish with darker margins.

Expanse 28 mm.

Hab. Rio Janeiro, Brazil.

AMAXIA HEBE, sp. nov.

Male. Primaries above pale yellow, a large purplish-brown spot broadly bordered with roseate occupying the base of the wings for one third from the base along the subcostal vein, and the entire inner margin, except a small yellow spot about the middle of the inner margin. At the apices two small brownish spots surrounded by roseate. The intermediate yellow space with widely separated and very small indistinct pinkish spots. Secondaries above slightly hyaline, rose colour, whitish along the costal margin. Underneath whitish, the base of the primaries roseate, the apical spots smaller than on the upperside. Head yellow above, crimson underneath. Collar yellow, thorax and abdomen dorsally crimson; underneath whitish.

Expanse 33 mm.

Hab. Rio Janeiro, Brazil.

AMAXIA PYGA, sp. nov.

Female. Primaries above pale yellow; the entire basal portion to the inner angle, except the costa, purplish brown, faintly mottled with red, especially on the veins and the margins of this dark space; four elongated brown spots, exteriorly shaded with red, at the apex; a marginal row of small brown spots, and a few other similar minute spots scattered over the yellow portion; underneath pale yellow, with the entire inner margin and base, except the costa, dull brown; four brown spots at the apex. Secondaries above brown, the costal margin and apex yellow; underneath yellow. Head and collar yellow. Thorax and abdomen dorsally brown. Abdomen underneath white. Legs yellow.

Expanse 33 mm.

Hab. Rio Janeiro, Brazil.

SCAPTIUS JUNO, sp. nov.

Female. Primaries pale purplish brown, a white spot at the base near the inner margin, beyond this a transverse yellow band from the subcostal to the submedian vein, and on this band is a wavy reddish line; close beyond it and just above the inner margin are three small yellowish spots; a submarginal row of four hyaline spots and a marginal row of small irregular yellow spots. Fringe alternately yellow and brown. Secondaries roseate, fringe yellow. Head yellow. Thorax brownish. Abdomen fawn-colour.

Expanse 39 mm.

Hab. Petropolis, Brazil.

IDALUS ORTUS, sp. nov.

Female. White, the disk of the primaries slightly iridescent, a few black specks at the base of the primaries, and some short black marks just beyond the cell, a conspicuous black dot near the outer margin below the apex. Head and thorax white, pinkish between the antennæ. Abdomen white, dorsally shaded with pink.

Expanse 37 mm.

Hab. Rio Janeiro, Brazil.

AMELES BYBLIS, sp. nov.

Primaries above dark brown, a space at the base, and a large subapical space on the outer margin, testaceous, with two rows of paler spots. About the middle of the costal margin are two nearly contiguous testaceous spots, and likewise two about the middle of the inner margin. Secondaries above blackish, a yellow basal spot on the costa. Underneath dull brown, orange at the base of the four wings, and orange shades along the basal half of the costal and inner margins of the primaries. The subapical patch on the outer margin as on the upperside. Head and thorax yellow, with two broad brown bands. Abdomen dorsally dark brown, laterally yellow, with two rows of black spots; underneath whitish.

Expanse 37 mm.

Hab. Corcovado, Rio Janeiro.

AMMALO THRAILKILLI, sp. nov.

Primaries dark brown, indistinctly mottled with paler scales. Secondaries reddish yellow. Head and thorax brown. Abdomen dorsally red, with transverse black bands; underneath brownish.

Expanse 55 mm.

Hab. Paso de San Juan, Vera Cruz, Mexico.

HALISIDOTA ORUBA, sp. nov.

Primaries above pale fawn-colour, mottled with brown, a brown line extending through the middle of the wing, from the base to the apex, a brown discal spot, a marginal and a submarginal row of brown spots. Secondaries whitish, a row of small spots on the apical half of the outer margin. Head and thorax fawn-colour, with a central brown line. Abdomen fawn-colour dorsally, white laterally and underneath.

Expanse 58 mm.

Hab. Petropolis, Brazil.

SYCHESIA HARTMANNI, sp. nov.

Primaries dark brown, an indistinct wavy submarginal shade. Secondaries black-brown, faintly hyaline in the disk. Head and thorax above brown, an orange spot at the base of the antennæ; thorax underneath orange. Abdomen dorsally black, laterally orange, underneath brown.

Expanse 40 mm.

Hab. Petropolis.

SYCHESIA JANEIRA, sp. nov.

Male. Primaries above light brown, with numerous transverse pale streaks, all the veins orange-brown; secondaries yellowish white, black on the margins. Head and thorax brown, the collar edged with dull orange. Abdomen dorsally orange, the first segment unspotted, the following three with large transverse black spots, the other segments with subdorsal black spots; abdomen underneath brown, wavy along the sides where confluent with the orange. The anus dark brown.

The *female* differs in having the secondaries entirely dull brownish black.

Expanse 52 mm.

Hab. Rio Janeiro, Brazil.

PHÆGOPTERA SCHÄFFERI, sp. nov.

Primaries white, mottled with brown, chiefly across the centre of the wing. Two orange basal spots, beyond which is a broken curved row of orange spots, and orange spots at the end of the cell; two rows of orange spots beyond the cell, and an orange spot at the extremity of each vein. Secondaries whitish, with black margins. Head and thorax brown, spotted with orange. Abdomen dorsally

with the basal half brown, otherwise orange; underneath brown, a lateral row of orange spots.

Expanse 53 mm.

Hab. Petropolis, Brazil.

PHÆGOPTERA PROBA, sp. nov.

Primaries fawn-colour, minutely speckled with darker scales. Secondaries yellow, slightly hyaline at the base and in the disk. Head and thorax brown, two black dots on the collar. Abdomen yellow dorsally, pale brown underneath.

Expanse 80 mm.

Hab. Paso de San Juan, Vera Cruz.

PHÆGOPTERA NOTATA, sp. nov.

Primaries brown, with three large yellowish-white spots on the costal margin. Secondaries whitish, with the veins and margins brown, and a yellow spot at the base on the costal margin. Head and thorax brown; two yellow dots on the collar, and a large yellow spot on either side of the thorax. Abdomen black dorsally, with narrow crimson transverse bands; underneath brown, with two rows of white spots.

Expanse 51 mm.

Hab. Petropolis, Brazil.

PHÆGOPTERA GRANIFERA, sp. nov.

Primaries dark brown, crossed by six rows of yellowish-brown spots; a small white space at the base, another on the middle of the costal margin, and a third subapical. Secondaries uniform blackish brown. Head and thorax brown, spotted with yellow and white. Abdomen dorsally brown on the first four segments, subsequently orange; underneath whitish, laterally orange with some minute whitish spots.

Expanse 45 mm.

Hab. Petropolis, Brazil.

PHÆGOPTERA URSINA, sp. nov.

Primaries rich brown; a large irregular whitish spot at the base of the wings; a whitish spot on the costa at a third from the base, and a large whitish spot extending from the costa just beyond the middle of the wing, and inwardly contiguous to a small pinkish crescent at the end of the cell; an irregular and sometimes broken band of white along the outer margin, extending from just below the apex to the inner angle. Secondaries above duller brown, the costa mottled with white. Underneath pale brown, the spots on the primaries less distinct, and on the secondaries there are two large whitish spots on the costal margin. Head and thorax pale brown, with a broad whitish band on either side. Abdomen above pink, with a subdorsal row of black spots; underneath white; laterally a row of black spots.

Expanse, ♂ 42 mm., ♀ 53 mm.

Hab. Rio Janeiro, Brazil.

ECPANTHERIA PELLUCIDA, sp. nov.

Male. Primaries hyaline, except the base and the costal and inner margins, which are white spotted with grey edged with black. Secondaries hyaline, except along the costal and inner margins, which are white, the costal margin being spotted with black. In some specimens there is a black spot at the anal angle. Head and thorax light grey, with darker spots edged with black. Abdomen dorsally bluish black; ventrally white.

Expanse 55 mm.

The *female* has the body as in the male. The primaries are white crossed by six rows of large grey spots edged with black. The secondaries are black, with the costal and outer margins white spotted with grey, and there is a white band starting from the costal margin beyond the middle and extending halfway across the wing.

Expanse 62 mm.

Hab. Rio Janeiro, Brazil.

CARALES CELER, sp. nov.

Primaries above light brown; a black dot at the end of the cell; a basal and a median irregular transverse row of small and widely separated blackish streaks; a minute blackish streak at the apex and also one at the inner angle. Secondaries above smoky. Underneath: primaries brown; a large dark patch at the end of the cell; the secondaries paler, with a median transverse smoky band. Head and thorax light brown. Abdomen brown dorsally, yellow laterally, light brown underneath.

Expanse 38 mm.

Hab. Rio Janeiro, Brazil.

OPHARUS LUGUBRIS, sp. nov.

Dark grey, the abdomen laterally shaded with pale grey.

Expanse 56 mm.

Hab. Petropolis, Brazil.

OPHARUS MOROSUS, sp. nov.

Primaries grey, a darker shade crossing the cell near its extremity, and a similar undefined shade just beyond the cell. Secondaries white with grey margins. Head and thorax grey. Abdomen very light grey, darker subdorsally.

Expanse 42 mm.

Hab. Peru.

SERMYLA MORTA, sp. nov.

Primaries above brownish black, yellow along the costal margin for two thirds from the base, which yellow is joined at its extremity by an oblique yellow band crossing the wing from the costal margin to the outer margin just above the inner angle; underneath black, with a yellow space at the base, and the yellow oblique band as on the

upperside. Secondaries brownish black. Head, thorax, and abdomen black; yellow spots on the collar, and two on the thorax.

Expanse 60 mm. ♀.

Hab. Petropolis, Brazil.

PERICOPIS MONTEZUMA, sp. nov.

Primaries above brown, paler between the median and submedian veins; on the costal margin a red streak at the base, a yellow spot about the middle, and a little beyond this a second yellow spot; below the first-mentioned yellow spot two vitreous spots; below the second yellow spot also two vitreous spots, and below these again two, but closer to the outer margin: underneath black; the costal margin, apex, and outer margin red; the vitreous spots as on the upper surface, and two whitish spots below the median vein. Secondaries above yellowish white, with a broad black outer margin spotted with yellowish; the costal margin black; underneath as on the upper surface, the black replaced by red except at the anal angle; the marginal spots are larger than on the upper surface and are edged with black. Head and thorax black spotted with yellow. Abdomen dorsally black, with two broad grey stripes; laterally black, with a single grey stripe; underneath yellow. Anus crimson.

Expanse 85 mm. ♀.

Hab. Las Vigas, Mexico.

Probably a variety of *Pericopis humeralis*, Walker, only differing in the secondaries and in being slightly larger than the typical females of *P. humeralis* captured in the same locality.

Fam. LITHOSIIDÆ.

TRICHOMELIA CELENNA, sp. nov.

Primaries above white, all the veins grey; the costal margin very broadly grey for two thirds from the base; a large grey space on the inner margin near the angle. Secondaries above grey. Underneath all the wings grey. Head and thorax whitish. Abdomen dark grey.

Expanse 23 mm.

Hab. Rio Janeiro, Brazil.

CISTHENE PETROVNA, sp. nov.

Primaries above grey, slightly paler at the base, with the veins darker; a broad white median band, and a white spot at the apex. Secondaries grey; towards the base and along the inner margin yellowish. Underneath: primaries grey; secondaries whitish, with the apex broadly grey. Head grey, collar yellow. Thorax grey. Abdomen yellow.

Expanse 24 mm.

Hab. Petropolis, Brazil.

BRYCEA PERUVIANA, sp. nov.

Wings black; a broad orange longitudinal streak from the base

to nearly the outer margin on both the primaries and secondaries, the former having also a transverse subapical orange spot. Head and thorax black. Tegulæ orange. Abdomen black, orange laterally.

Expanse 35 mm.

Hab. Peru.

ARDONEA METALLICA, sp. nov.

Primaries above greenish black. Secondaries metallic blue. Underneath all the wings metallic bluish green. Head and thorax black. Abdomen dark green.

Expanse 30 mm.

Hab. Peru.

EUDULE VENATA, sp. nov.

Wings orange-red; the primaries with the apex and outer margin black; the subcostal and median veins black; a black streak in the cell, and a long black streak below the median vein; a transverse subapical black line from the costa to the middle of the outer margin. Secondaries with the apex broadly black; the outer margin narrowly black. Body orange.

Expanse 20 mm.

Hab. Peru.

EUDULE AURATA, sp. nov.

Primaries above golden yellow; the subcostal vein and base of median vein black; a large dusky circle on the outer half of the wing connected by a dusky line with the inner angle. Secondaries above golden yellow; an irregular dusky line starting from the base and following the contour of the wing to the anal angle. Underneath the wings are yellow, the costal margin of the primaries black. Body yellow.

Expanse 25 mm.

Hab. Rio Janeiro, Brazil.

Very similar to *Eudule citrosa*, Hübner, which differs in having all the veins along the outer margins black.

Fam. MELAMERIDÆ.

VIRBIA VARIANS, sp. nov.

Primaries above brown; at the base a broad but short longitudinal streak, and beyond this a white spot. Sometimes the spot is absent and at other times absorbed by the longitudinal streak. Secondaries above orange, with broad black costal and outer margins. Underneath the wings are orange, with the costal and outer margins broadly brown. Head and thorax brown. Body orange, black subdorsally and below.

Expanse 31 mm.

Hab. Peru.

Allied to *Virbia brevilinea*, Walker.

VIRBIA PARVA, sp. nov.

Primaries above brown; underneath orange, with brown margins, the outer being the broadest. Secondaries above black; a broad orange band from the base to nearly the outer margin, just below the apex; the inner margin and anal angle narrowly orange; underneath the same as above. Head and thorax brown. Abdomen black dorsally, orange laterally, white underneath.

Expanse 25 mm.

Hab. Peru.

Allied to *Virbia minuta*, Felder.

LYCES MAERA, sp. nov.

Primaries above black; a transverse orange band from the middle of the costal margin to the inner angle; underneath black, the transverse band much broader, and two greyish streaks at the base of the wing. Secondaries above orange; the costal margin narrowly, the outer and inner margins very broadly black; underneath the same, except that the inner margin is also orange, and there is a white streak on the costal margin at its base. Head and thorax black. Abdomen black dorsally; laterally a narrow yellow streak; underneath white.

Expanse 38 mm.

Hab. Petropolis, Brazil.

SCEA SOLARIS, sp. nov.

Primaries black; a large yellow space extending from the base to close to the centre of the outer margin, this space follows anteriorly along the costa to beyond the cell, and then crosses the wing obliquely; the veins and a conspicuous streak in the cell are also black. Secondaries black; a yellow streak beginning towards the end of the cell and extending beyond it. Underside the same as the upper. Body dull black.

Expanse 33 mm.

Hab. Peru.

GANGAMELA AYMARA, sp. nov.

Male. Primaries above bright yellow: the base black; the costal and subcostal veins finely black; the apex and outer margin broadly black; the inner margin narrowly black and glossed with dark blue; underneath similar, except that a portion of the base and inner margin are pearl-white instead of black and there is no blue gloss. Secondaries above black, glossed with blue at the base; yellow towards the apex, which is itself black; underneath pearl-white; the costal margin yellow; the apex narrowly black. Head black, frons white. Thorax dark blue. Abdomen above blue, with a subdorsal yellow line; underneath white.

Expanse 24 mm.

The *female* has the primaries above as in the male. The secondaries above are entirely dull black, glossed with blue at the base and along the inner margin; underneath the pearly white is replaced

by black and the yellow margin of the secondaries is very indistinct. The abdomen is also black underneath.

Expanse 29 mm.

Hab. Peru.

DARNA INCA, sp. nov.

Male. Primaries above velvety black, shaded with metallic blue at the base and along the inner margin; a broad orange band crosses the wing from the middle of the costal margin to nearly the inner angle; underneath as on the upper surface, the inner margin, however, denuded of scales. Secondaries above having the anterior half denuded, greyish, with the male sexual gland; posterior half black; along the inner margin bluish; underneath pale metallic green, the outer margin black. Body metallic blue.

The *female* differs in having the secondaries black, and the metallic colour of the inner margins more extended.

Expanse 35 mm.

Hab. Peru.

FLAVINIA DUBIA, sp. nov.

Primaries black, a large yellow space at the base confined within the subcostal and submedian veins; a large subapical elongated yellow spot. Secondaries yellow, with all the margins black. Underside the same. Body black; thorax and abdomen laterally yellow.

Expanse 34 mm.

Hab. Corcovado, Rio Janeiro.

FLAVINIA DARNA, sp. nov.

Very similar to *Flavinia dubia*, Schaus; the subapical spot smaller in proportion, and it is easily recognized from that species by its smaller size and white abdomen underneath.

Expanse 22 mm.

Hab. Novo Friburgo, Brazil.

FLAVINIA JANEIRA, sp. nov.

Primaries above black, a long yellow spot at the base confined within the median and submedian veins; a subapical roundish yellow spot; the extreme apex white. Secondaries yellow with black margins, except the base of the inner and costal margins; underneath the same. Body black; collar yellow. Abdomen with a lateral yellow stripe and underneath white.

Expanse 34 mm.

Hab. Rio Janeiro, Brazil.

Most nearly allied to *Flavinia approximans*, Walker, but differs in the white apices of the primaries, and the costal margins of the secondaries, which in *F. approximans* are broadly black, with a short yellow basal streak.

FLAVINIA QUICHA, sp. nov.

Primaries black; a basal oblong spot confined within the median

and submedian veins, and an oblong subapical yellow spot; apices faintly tipped with white. Secondaries yellow; the outer margin broadly black; the costal margin yellow; a subcostal ill-defined black band from the base to the apex. Body black; abdomen laterally yellow, underneath white.

Expanse 31 mm.

Hab. Peru.

Closely allied to *Flavinia isis*, Hübner, but has broader margins to the secondaries and is a smaller insect.

FLAVINIA CHIBCHA, sp. nov.

Primaries above black; an oblong yellow spot at the base confined within the median and submedian veins; an elongated subapical yellow spot. Secondaries yellow; the outer margin broadly black, but abruptly narrowing near the anal angle; the costal margin yellow, in most specimens with a black line from the base to the apex; underneath the same, but the black marginal border of the secondaries ceases abruptly before reaching the anal angle. Thorax black; tegulæ orange. Abdomen black dorsally; a yellow stripe laterally; white underneath.

Expanse 25 mm.

Hab. Peru.

MENNIS SCEATA, sp. nov.

Primaries orange; the costa finely, the inner margin narrowly, the apex broadly, and the outer margin black, all the veins finely black. Secondaries black, slightly greyish along the inner margin. Head, thorax, and abdomen black.

Expanse 25 mm.

Hab. Peru.

MENNIS CYTHEREA, sp. nov.

Wings above orange-red; all the veins black; the apex and outer margins of the primaries narrowly black; the costal margin of the secondaries broadly black. Fringe black. Body black.

Expanse 23 mm.

Hab. Peru.

MENNIS UNA, sp. nov.

Red; the costal and outer margins narrowly black on the primaries; also a few black specks on the veins near the apex. Secondaries with only the outer margins black.

Expanse 22 mm.

Hab. Petropolis.

NELO LIPPA, sp. nov.

Primaries above brownish black; a broad orange-red median band from the costa to the submedian vein; underneath dark grey; a large orange spot at the disk. Secondaries above brownish black,

a few clusters of reddish scales about the centre of the wing; underneath dark grey, the veins black; a small orange spot on the costa at its base. Head black, a white streak behind the eyes. Thorax dark brown, a red spot on either side. Abdomen brown, a lateral reddish streak.

Expanse 30 mm.

Hab. Peru.

NELO CAULLAMA, sp. nov.

Primaries red; the costal and inner margins narrowly, the apex and outer margin broadly black. Secondaries black. Body black.

Expanse 30 mm.

Hab. Peru.

MELANCHROIA BRAGANZA, sp. nov.

Primaries velvety black, the veins clearly defined, especially towards the base; a transverse subapical white band. Secondaries black, glossed with dark blue; fringe white. Underneath black, glossed with dark blue; veins on secondaries whitish; transverse white band on the primaries as on the upper surface. Head black above, orange underneath. Thorax blue-black, with a few faint whitish streaks. Abdomen blue-black; white underneath in the male.

Expanse 38 mm.

Hab. Rio Janeiro, Brazil.

Very closely allied to *M. circe*, Cramer.

MELANCHROIA PALMEIRA, sp. nov.

Primaries black; a white subapical elongated spot. Secondaries bluish black; the apex white. Underneath the same. Body black; the abdomen slightly glossed with blue.

Expanse 35 mm. ♀.

Hab. Palmeiras, Rio Janeiro.

Fam. LIPARIDÆ.

AGAREA MINUTA, sp. nov.

Primaries light brownish grey, somewhat hyaline, with all the veins somewhat darker. Secondaries paler and semihyaline. Head and thorax grey. Abdomen yellow, with a row of black subdorsal spots.

Expanse 20 mm.

Hab. Corcovado, Rio Janeiro.

ARCHYLUS MEXICANA, sp. nov.

Pure white, the primaries with the costal margin finely black; a black spot at the end of the cell, and a smaller black spot on the inner margin near the angle. Antennæ orange.

Expanse 25 mm.

Hab. Jalapa, Mexico.

ARCHYLUS VESTA, sp. nov.

Silvery white; the costal margin of the primaries indistinctly brown.

Expanse 18 mm.

Hab. Novo Friburgo, Brazil.

Fam. CERATOCAMPIDÆ.

SYSSPHINX BASIREI, sp. nov.

Primaries above fawn-colour at the base and along the outer margin, the median space darker, and separated from the paler portions by a basal and marginal dark brown line; almost the entire median spaces from the subcostal to the submedian vein vitreous, here and there flecked with opaque clusters of scales. Secondaries fawn-colour, with a dark marginal line, beyond which the wing is slightly darker than at the base; the disk of the wings occupied by large vitreous patches as on the primaries. Body fawn-colour, slightly darker on the first two segments of the abdomen dorsally.

Expanse 104 mm. ♀.

Hab. Rio Janeiro.

When the male is known, this species will require a new genus.

OTHORENE ARPI, sp. nov.

Male. Primaries deep yellow; the veins, inner and outer margins greyish, also a large triangular space extending along nearly the entire costal margin and defined by a darker line starting from the costal margin at one third from the base, and extending obliquely to the middle of the wing, from which point it returns to the costal margin near the apex; this greyish space becomes paler towards its extremity and includes a large yellow discal spot; a white spot at the base of the wings. Secondaries reddish. Body deep yellow: a grey and white spot on the first segment of the abdomen.

Expanse 70 mm.

Hab. Rio Janeiro, Brazil.

OTHORENE JANEIRA, sp. nov.

Male. Primaries deep yellow, tinged with purplish along the costal margin; fringe and veins dark grey; a dark grey line from the apex to the inner margin near the base, before reaching which it is formed by a basal grey line; at the base of the wings a large white spot. Secondaries deep yellow, red along the inner margin, and with a narrow dark transverse band. Body orange; reddish dorsally; a large white spot on the first segment.

Expanse 85 mm.

Hab. Rio Janeiro, Brazil.

ADELOCEPHALA INVALIDA, sp. nov.

Primaries above dark brown, tinged with purple; paler along the outer margin; a dark line, outwardly shaded with a slightly paler tint, from the apex to the middle of the inner margin; discal point

white. Secondaries above dark red; fringe yellow. Underneath: primaries reddish; beyond the transverse line, which is purplish, the wing is yellow. Secondaries underneath yellow, speckled with reddish; a transverse reddish streak; reddish along the inner margin. Thorax and first segment of abdomen dorsally orange-red; abdomen otherwise dorsally purplish red, underneath yellowish white.

Expanse 42 mm.

Hab. Rio Janeiro.

Fam. Saturniidæ.

Automeris macareis, sp. nov.

Male. Primaries brown, tinged with pinkish; darker beyond the outer transverse line, which extends from the middle of the inner margin to the apex; on this darker portion a marginal, wavy, lighter shade; a narrow basal transverse line; the discal spot finely outlined with dark brown. Secondaries pinkish brown; a little yellow between the ocellus and a transverse black line; the outer margin paler. The ocellus small, black, with a brownish centre containing a few white scales. Thorax brown. Abdomen reddish.

Expanse 76 mm.

The *female* is more of a pinkish grey; the space between the ocellus and transverse black line pink. Abdomen reddish brown, with broad black transverse bands.

Expanse 85 mm.

Hab. Petropolis, Brazil.

Automeris nopaltzin, sp. nov.

Female. Primaries violaceous brown, a basal transverse shade, and an outer dark transverse line, inwardly shaded with yellow. The discal spot dark, ill defined, containing a minute white spot. Secondaries reddish, paler along the outer margin; a large black ocellus with a light brown centre, containing three black spots speckled with white, the central spot, which is the largest, being also crossed by a white line; the ocellus is externally bordered with yellow, and beyond this there is a fine, indistinct black line. Thorax violaceous brown. Abdomen red.

Expanse 80 mm.

Hab. Paso de San Juan, Vera Cruz.

Allied to *Automeris rubrescens*, Walker.

Automeris rubicunda, sp. nov.

Male. Primaries above brown; the base fawn-colour and limited by a very narrow, transverse, dark line; a lunular transverse line beyond the cell; the discal spot dark brown, oblong; a dark triangular spot on the costal margin near the apex. Secondaries above bright red; the ocellus small, black, with a brownish centre containing a few white scales: beyond this a black transverse line; a submarginal brownish band, and a marginal brownish shade on a

paler ground. Underneath the primaries are yellowish, with a large black discal spot containing a white point; a submarginal dark lunular line. Secondaries underneath reddish brown, thickly speckled with black; a white discal point, and a transverse, lunular brown line. Thorax brown, with posteriorly a number of white hairs. Abdomen reddish.

Expanse 54 mm.

Hab. Petropolis, Brazil.

AUTOMERIS TAMPHILUS, sp. nov.

Primaries above fawn-colour, tinged with reddish; the outer margin yellowish; the basal and outer transverse lines a little paler than the ground-colour; the outer line extending from near the apex on the costal margin to the inner margin at three fourths from its base. Secondaries yellowish red, the outer margin paler; the ocellus not very large, brown, circled with black and then with yellow; in its centre a minute greyish spot with a white streak; a submarginal black line inwardly edged with yellow. Head and thorax dark brown. Abdomen reddish.

Expanse male 90 mm.

Hab. Rio Janeiro, Brazil.

5. Notes on the Anatomy and Osteology of the Indian Darter (*Plotus melanogaster*). By FRANK E. BEDDARD, M.A., F.R.S.E., Prosector to the Society.

[Received March 15, 1892.]

The structure of the soft parts of both *Plotus anhinga* and *P. melanogaster* has been fairly completely described by my two predecessors, Prof. Garrod[1] and Mr. Forbes[2]. Prof. Garrod has also given a brief account of some of the peculiarities of the third species, *P. levaillanti*, in a later paper[3]. So far as I am aware, the only existing account of the visceral anatomy of *P. melanogaster* is to be found in Mr. Forbes's notes upon this bird. More recently Prof. Fürbringer, of Jena, has contributed[4] to our knowledge of this genus in his great work upon the shoulder-girdle of birds. Having recently had the opportunity—afforded me by the death, on December 31st of the present year, of a female *P. melanogaster*, which arrived at the Gardens on May 1883—of dissecting an example of that species, I have been able to make some slight additions to what is already on record about the bird. As will be easily imagined, I have only to confirm the careful work of Mr. Forbes, so far as that goes;

[1] "Notes on the Anatomy of *Plotus anhinga*," P. Z. S. 1876, p. 335.

[2] "On some Points in the Anatomy of the Indian Darter (*Plotus melanogaster*), and on the Mechanism of the Neck in the Darters (*Plotus*), in connexion with their Habits," P. Z. S. 1882, p. 208.

[3] "Note on Points in the Anatomy of Levaillant's Darter (*Plotus levaillanti*)," P. Z. S. 1878, p. 679.

[4] Untersuchungen zur Morphologie und Systematik der Vögel, &c., 1888.

there are a few points, however, to which Mr. Forbes does not refer. To these I have naturally paid particular attention. As regards the musculature, Mr. Forbes only refers to some of the muscles of the neck; but, Fürbringer having dissected the shoulder-muscles, I have confined my attention to the muscles of the hind limb.

Myology.

As I have already said, the muscles of the anterior limb have been described by Fürbringer. In the hind limb I find no noteworthy differences from *P. anhinga*. The "muscle formula" is the same, *i. e.* AX+.

The *Semitendinosus* is a comparatively slight muscle; Garrod speaks of it in *P. anhinga* as being very large. It arises entirely from the pubis, and is inserted in common with the *Semimembranosus*.

The *Semimembranosus* is a very large and stout muscle; at its origin it is nearly as wide as the *Biceps*; it is inserted by a strong flat tendon, on to which tendon, just at its commencement, is inserted the *Semitendinosus*.

There are two *Adductors*, of which the inner is much the largest; this muscle is tendinous at its origin, and it has also a tendinous insertion of some length on to the underside of the femur.

The *Gastrocnemius* has the usual three heads of origin; the middle head arises partly from the innermost adductor, and also by a very slender tendon from the *Semimembranosus*.

The *Tibialis anticus* has a single and undivided tendon; in many birds the tendon of this muscle splits into two at its insertion.

There are two *Peroneals* present; the *Peroneus longus* is, as is invariably the case with this muscle when present, attached to the tendon of one of the deep flexors.

As to the deep flexors, the *Flexor hallucis* is bound by a strong vinculum to the *Flexor profundus* just at its trifurcation.

Viscera.

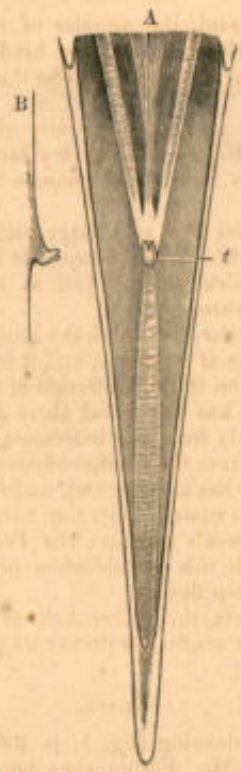
The accompanying drawing (fig. 1, p. 293) illustrates the very rudimentary tongue. Mr. Forbes does not mention the tongue, though it might be inferred from his silence on the point that the organ resembles that of *Plotus anhinga*. I have thought it worth while to have a drawing prepared, as this structure has not been, to the best of my knowledge, figured. Professor Garrod's remark that "the tongue, as an independent organ, does not exist" applies to *Plotus melanogaster* no less than to *Plotus anhinga*; there is in the former species, as apparently in the latter, a minute process, shown in the drawing, which is all that is left of the tongue.

I may remark that the right lobe of the liver, as in *P. anhinga*, is larger than the left; and that there is a well-developed gall-bladder (see fig. 2, p. 294), the duct of which opens as shown in the drawing.

The same drawing also illustrates the arrangement of the pancreatic ducts, to which neither Garrod nor Forbes make any allusion in either species. There were two minute cæca in my specimen.

The stomach agrees perfectly well with Mr. Forbes's description of that organ. Some of the membranes surrounding the stomach have

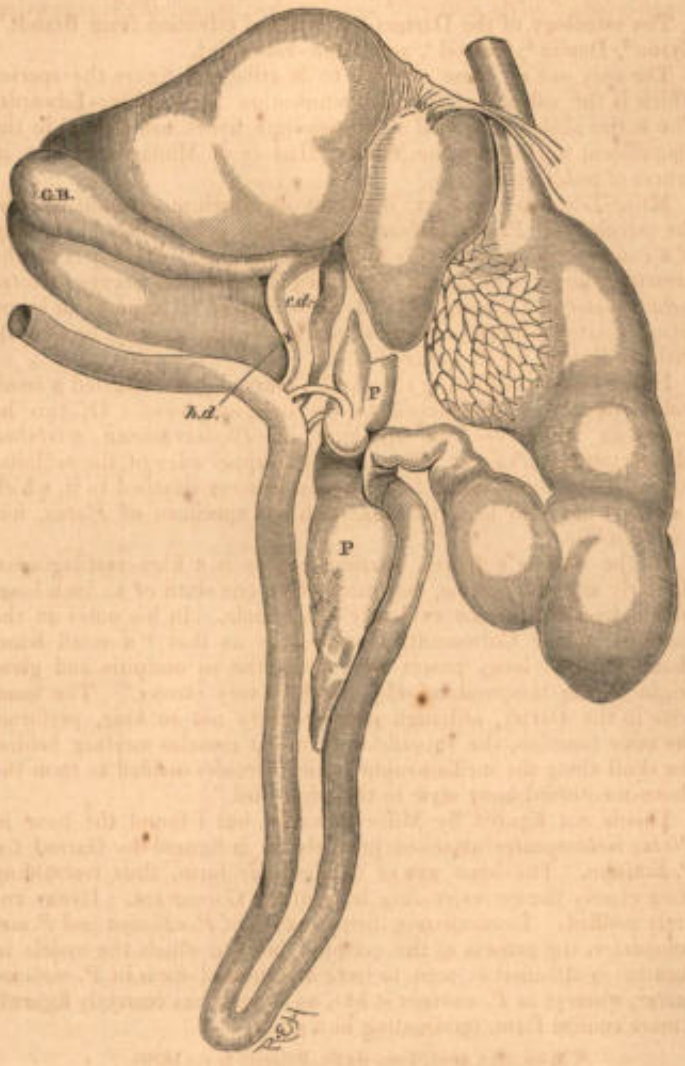
Fig. 1.



A. Lower mandible of Indian Darter, to illustrate rudimentary tongue (*t*);
B. Rudimentary tongue in profile.

rather a peculiar arrangement. The liver lies near to the posterior end of the thoracic cavity, and a considerable space is thus left between its anterior border and the apex of the heart. This is a very unusual state of affairs. As a general rule the front end of the liver is nearly in contact with the heart. Unfortunately I have not had the opportunity of observing how matters stand with *Phalacrocorax*, *Pelecanus*, and *Sula*. This space which divides the liver from the heart is of course bounded laterally by the oblique septa, and behind by a membrane shutting off this space from the liver. It

Fig. 2.



Alimentary viscera of Indian Darter.
G.B., Gall-bladder; *h.d.*, *c.d.*, Bile-ducts; P, Pancreas.

probably has, though I have not definitely made out the fact, a connection with the air-sacs.

Osteology, and Comparison with Plotus anhinga.

The osteology of the Darters has received attention from Brandt[1], Eyton[2], Donitz[3], Garrod[4], and Milne-Edwards[5].

The only one of these authors to describe and figure the species which is the subject of this communication is M. Milne-Edwards. The entire skeleton, as well as the separate bones, are figured in the magnificent work upon the Natural History of Madagascar, now in course of publication.

Milne-Edwards, however, does not do much more than describe the osteology of *Plotus melanogaster*; there is but little in the way of a comparison between this and other species. My object in the present paper is to point out the principal differences between *Plotus melanogaster* and *P. anhinga*. I must first of all refer to an interesting matter concerning the skull, which has already been dealt with by Garrod for *P. anhinga*.

In the figure illustrating the skull[6], Garrod has indicated a small rod (lettered "*a*") attached to the occipital bone. Of this he writes as follows:—"In speaking of *Phalacrocorax cristatus*, Mr. Eyton remarks, the tubercle on the upper edge of the occipital bone has a pointed, movable, triangular process attached to it, which I suspect has also been the case with my specimen of *Plotus*, but has been lost."

In the Society's female specimen there is a fibro-cartilaginous, similarly situated process, not more than one sixth of an inch long, which is ossified in the evidently older male. In his notes on the anatomy of the Cormorant, Hunter tells us that "a small bone, about an inch long, passes back from the os occipitis and gives origin to the temporal muscle, which is very strong." The same bone in the Darter, although comparatively not so long, performs the same function, the superficial temporal muscles meeting behind the skull along the median raphe, which becomes ossified to form the above-mentioned bony style in the adult bird."

This is not figured by Milne-Edwards, but I found the bone in *Plotus melanogaster* attached precisely as is figured by Garrod for *P. anhinga*. The bone was of a triangular form, thus resembling more closely the corresponding bone of the Cormorant. It was entirely ossified. In comparing the two skulls of *P. anhinga* and *P. melanogaster*, the process of the occipital bone to which the ossicle in question is attached is seen to have a truncated form in *P. melanogaster*, whereas in *P. anhinga* it has, as Garrod has correctly figured, a more conical form, terminating in a point.

[1] Mém. de l'Acad. Imp. de St. Pétersb. t. v. (1839).
[2] Osteologia Avium, p. 218.
[3] Archiv f. Anat. u. Phys. 1873, p. 357.
[4] *Loc. cit.*
[5] Histoire nat. de Madagascar, t. xii. p. 690.
[6] *Loc. cit.* pl. xxviii. fig. 1.

The chief difference between the skulls of *P. melanogaster* and *P. anhinga*, apart from the form of the occipital style, is in the form of the palatine bones; in *P. anhinga* these bones are rounded off posteriorly, the lateral margins curving inwards gradually. In *P. melanogaster*, on the other hand, the thin lateral wings of the palatines form a right angle behind; they are cut perfectly square.

There are no other very salient points of difference in the skulls of these two species; in *Plotus melanogaster* the ridges which bound the temporal fossæ above are more pronounced than in *P. anhinga*; but possibly this is rather a difference of age than of species. However, in Garrod's figure of the skull of *P. anhinga*, which represents that of an adult bird, and has been drawn, no doubt, from one of the two skulls now in my custody, the same difference is apparent; the stronger development of the occipital style in *P. melanogaster* perhaps needs a stronger development of these ridges, for the two together form the line of origin of the temporal muscle.

The postorbital processes are better developed in *P. anhinga* than in *P. melanogaster*; this cannot be a question of age, for the skull of *P. melanogaster* is that of a younger bird than that of *P. anhinga*.

With regard to other parts of the skeleton, the only differences that I could detect concerned the ribs and the vertebral column.

The skeleton of *Plotus anhinga* has a very rudimentary rib, consisting of a small bit of bone, not more than half an inch in length, attached to about the middle of the last complete rib. This is absent from the skeleton of *P. melanogaster*, and has certainly not been lost, for that skeleton was prepared with the greatest care.

The ossification of "Donitz's" Bridge has been mentioned by Mr. Forbes.

6. Descriptions of Seven new Species of Land-Shells from the U.S. of Colombia. By G. B. Sowerby, F.L.S., F.Z.S.

[Received March 1, 1892.]

(Plate XXIII.)

Bulimus guentheri, n. sp. (Plate XXIII. figs. 7, 8.)

Testa anguste perforata, ovata, solida, lævis, fusca, flammis albidis irregulariter angulatis et undulatis picta; spira conica, breviuscula, apice obtusiusculo; anfractus 4½, convexi, ultimus ⅔ longitudinis æquans, inflatus, basi rotundatus; columella fere verticalis, plica obliqua crassiuscula munita; apertura ovalis, leviter obliqua, intus griseo-fusca; peristoma crassum, reflexum, marginibus callo crassiusculo junctis.

Long. 41, *diam. maj.* 26 *millim.*; *apertura* 12 *lata*, 22 *longa*.

Hab. U.S. of Colombia.

This species is remarkable for the smoothness of its surface, having neither granules nor striæ. In form it somewhat resembles *B. cardinalis* (Pfeiffer), while its markings are like those of a



G.B. Sowerby lith. Hanhart imp.

NEW SHELLS FROM U.S. OF COLOMBIA.

variety of *B. succinoides* (Petit). The only specimen I have seen belongs to the National Collection at South Kensington.

BULIMULUS KOPPELI, n. sp. (Plate XXIII. figs. 9–12.)

Testa imperforata, ovato-conica, tenuis, nitens, carneo-albida vel luteo-straminea, plerumque maculis parvis nigro-fuscis promiscue conspersis picta, ad apicem carnea; spira acute conica; anfractus 6, convexiusculi, longitudinaliter lævissime irregulariter striati; sutura leviter impressa; anfractus ultimus subventricosus, ½ longitudinis fere æquans, basi rotundatus; apertura subovalis, leviter obliqua, latiuscula, intus albida, maculis anfractus ultimi transmeantibus; peristoma tenue, roseo marginatum; marginibus callo tenuissimo junctis.

Long. 25, *diam. maj.* 15 *millim.*

Hab. Bogota.

A pretty little shell, varying considerably in form and colour, but the lip appears to be always thin and prettily edged with red. Of the two specimens lent me for description by Mr. Da Costa, one is nearly white, profusely sprinkled with small brown spots, while the other is of a yellowish straw-colour (more decided yellow towards the apex), with only a few pale spots. I have as yet only seen very few specimens, but these exhibit considerable variations in their proportions. One apparently abnormally inflated specimen measures nearly 15 millimetres in width and only about 20 in length; while the narrowest specimen measures scarcely more than 11 millimetres in width to 21 in height.

BULIMULUS DA-COSTÆ, n. sp. (Plate XXIII. figs. 15, 16.)

Testa anguste sed profunde umbilicata, elongata, nitida, irregulariter striata, pallide fulvo-carnea, longitudinaliter fusco undulatim strigata, maculis parvis nigro-fuscis bifasciatim picta; spira convexo-conica, apice acuto; sutura leviter impressa; anfractus 6, convexiusculi, ultimus spiram subæquans, basi attenuatus; columella obliqua, reflexa; apertura subverticalis, intus rosea, maculis perlucentibus; peristoma simplex, leviter reflexum.

Long. 26, *diam. maj.* 11 *millim.*

Hab. Bogota (*Mus. Da Costa*).

I have as yet only seen a single specimen of this species, which may be found to vary as much as the last. It seems, however, to be distinct from any hitherto known.

BULIMULUS GLANDINIFORMIS, n. sp. (Plate XXIII. figs. 13, 14.)

Testa anguste perforata, oblonga, tenuissima, nitida, pellucida, stramineo-albida, longitudinaliter ruguloso-striata; spira turrita, apice obtuso; anfractus 7, convexiusculi, sutura anguste canaliculata sejuncti; anfractus ultimus ½, longitudinis vix æquans, basi leviter attenuatus; apertura subovalis, fere verticalis; columella rectiuscula, reflexa, perforationem fere tegente; peristoma simplex, acutum.

Long. 21, *diam. maj.* 7 *millim.*

Hab. Bogota (*Mus. Da Costa*).

A transparent, fragile shell, with very much the appearance of a *Glandina*.

HYALINIA GOMEZI[1], n. sp. (Plate XXIII. figs. 5, 6.)

Testa perforata, depresso-rotundata, tenuis, pellucida, nitida, fusca, vix striatula; spira parum elevata, regularis, apice obtusiusculo; sutura appresso-marginata; anfractus 5, *convexiusculi, ultimus non descendens, rotundatus, subtus convexus; apertura transverse lunato-ovalis; peristoma acutum, marginibus distantibus; columella subverticalis, dente minuto instructo.*

Diam. maj. 11, *min.* 9½, *alt.* 8 *millim.*

Hab. Bogota (*Mus. Da Costa*).

A small hyaline shell, the only remarkable character of which is the presence of a minute tooth or tubercle on the columella. In this and other respects it bears a strong resemblance to some of the Polynesian species of *Microcystis*, though from its habitat it is probably rightly placed in the genus *Hyalinia*.

CLAUSILIA MAGISTRA, n. sp. (Plate XXIII. figs. 1–4.)

Testa magna, anguste fusiformis, solidiuscula, sinistrorsa, nigro-fusca; spira elongata; anfractus superstites 7, *convexiusculi; costulis obliquis irregulariter undulatis ornati, sutura impressa sejuncti; anfractus ultimus leviter attenuatus, ad basin rotundatus, breviter solutus* ⅓, *longitudinis subæquans; apertura late auriformis, majuscula; peristoma continuum, expansum, non reflexum; lamella superior arcuatim subverticalis, pareiuscula, subcompressa; lamella inferior obliqua, latiuscula; clausilium tenue, leviter arcuatum; plicis nullis; lunella nulla.*

Long. 38, *diam. maj.* 7 *millim.*

Hab. Bogota (*Mus. Da Costa*).

A fine large species, elegantly sculptured with irregularly undulating oblique costulæ. In form it closely resembles the smaller species, *C. epistomium* (Pfeiffer), which is found in the same locality. The internal structure presents the somewhat unusual character of being destitute of plicæ.

CYCLOTUS FILO-LIRATUS, n. sp. (Plate XXIII. figs. 17–19.)

Testa late umbilicata, depressiuscula, olivacea, saturate olivaceo-fusco zonata, liris numerosis concentricis filiformibus instructa; spira levissime elevata; sutura profunda; anfractus 5, *convexi,*

[1] Since this paper was read Mr. Da Costa has called my attention to the proximity of this shell to a species named by Bland *Proserpina swifti*, from which it differs in being more convex and in having a much less pronounced tooth on the columella. There is no doubt that the two species belong to the same genus; but the animals being unknown it is impossible to speak with certainty as to their position. Judging from the shells, however, I think it very unlikely that they belong to the Proserpinidæ. The little *Microcystis excrescens* (Mousson), from Viti Levu (Feejee Islands), has a similar dentiform callus on the columella.—G. B. S.

ultimus non descendens, prope suturam concavo-depressus, ad peripheriam carinatus, aliter rotunde convexus; apertura subcircularis; peristoma continuum, simplex, leviter incrassatum.

Diam. maj. 36, *min.* 30, *alt.* 20 *millim.*

Hab. Bogota (*Mus. Da Costa*).

The thread-like ridges on the body-whorl of this shell are much more distant and prominent than in *C. blanchetianus* (Moricand) and in other allied species. I have at present only seen a single specimen.

EXPLANATION OF PLATE XXIII.

Figs. 1–4. *Clausilia magistra*, p. 298.
5, 6. *Hyalinia gomezi*, p. 298.
7, 8. *Bulimus guentheri*, p. 296.
9–12. *Bulimulus koppeli*, p. 297.
13, 14. —— *glandiniformis*, p. 297.
15, 16. —— *da-costæ*, p. 297.
17–19. *Cyclotus filo-liratus*, p. 298.

May 3, 1892.

Prof. Flower, 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 April 1892:—

The total number of registered additions to the Society's Menagerie during the month of April was 83, of which 31 were by presentation, 2 by exchange, 27 by purchase, 10 by birth, and 13 were received on deposit. The total number of departures during the same period, by death and removals, was 84.

Amongst the additions special attention may be called to:—

A Finely-marked Owl (*Pseudoscops grammicus*), from Jamaica, presented by the Jamaica Institute, April 8th, being the first living example of this Owl that has reached us.

Mr. Sclater exhibited and made remarks upon a nearly perfect egg of one of the extinct gigantic birds of Madagascar of the genus *Æpyornis* (probably *Æ. medius*), obtained from the sands near Cape S. Marie in the South of Madagascar, by a correspondent, resident at Fort Dauphin, of Mr. W. Clayton Pickersgill, H.B.M. Vice-Consul at Antananarivo, and lately brought to England by that gentleman.

The egg measured 11½ by 8½ inches. Its larger circumference was 31½ inches, and its smaller 26⅞ inches. It was therefore not quite so large as the specimen figured by Rowley (Orn. Misc. iii. pl. cxii.), and came nearer in dimensions to the specimen in the British Museum (41,484) referred by Mr. Lydekker (Cat. Fossil Birds, p. 214) to *Æ. medius*.

The following papers were read:—

1. Field-Notes on the Antelopes of Northern Somaliland.

By H. G. C. Swayne, Capt. R.E., C.M.Z.S.[1]

[Received April 5, 1892.]

1. The Oryx (*Oryx beisa*).

Baet (pronounced *Beyt*).

The Oryx inhabits open stony ground, or barren hills, or open grass plains.

It is very widely distributed over the Somali Country and not at all uncommon, and it may be found in all kinds of country except in the thick jungles with aloe undergrowth so much liked by the Lesser Kudu, and in the cedar forests on the higher ranges.

The Oryx feeds chiefly on grass, and is often found very far from water. It has keen sight, and protects itself more by this than by its sense of hearing or smell.

Oryx are found in herds of moderate size, chiefly composed of cows. The herds number from half a dozen to thirty or forty.

The only Antelopes which go in very large herds in Northern Somaliland are the Hartebeeste and Sœmmerring's Gazelle.

Numbers of bull Oryxes are found scattered singly all about the country, and possibly these make up in number for the preponderance of cows in the herds.

Single Oryxes are almost always bulls. Often two or three cows with growing calves will be found together, making up a small herd of half a dozen.

It is nearly impossible to distinguish which are the bulls in a herd, and they are so few in proportion to the cows that it is best not to fire at a herd at all. The bull is slightly higher in the withers than the cow, and the horns, though an inch or two shorter in the bull, are more massive, especially about the burr at the base, and they are more symmetrical. The cows' horns are often bent or of unequal length.

The Oryx is often revengeful when wounded and brought to bay. Twice I have seen a wounded Oryx make a determined charge into a mob of Somalis armed with spears.

The Midgans, who are the outcast race, and are armed with bows and poisoned arrows, hunt the Oryx with packs of savage yellow pariah dogs; the thick skin round the withers of a bull Oryx is made by them into a white "gáshan" or shield 18 inches in diameter.

The hunting as carried out by the Midgans in the Bulhar Plain is as follows:—Three or four Midgans with about fifteen dogs go out just before dawn, and walk along silently through the scattered thorn-

[1] [Capt. Swayne has now kindly sent me the promised field-notes on the Antelopes of Somaliland of which I have lately given an account to the Society, mainly based upon his valuable specimens (see P. Z. S. 1892, pp. 98, 117). The first set of all the specimens sent to me by Capt. Swayne has been presented in his name to the British Museum, and the duplicates to the U.S. National Museum at Washington. I have added, at Captain Swayne's request, the scientific names and some references to these Notes.—P. L. S.]

jungle till fresh tracks are found. These are followed till the game is sighted. By throwing stones towards the Oryxes, whistling, and other signs, which the dogs thoroughly understand, they are shown the game, and settle down to their work methodically. The dogs run mute, the men following at a crouching trot, which in a Somali is untiring, and this lasts for a mile or two, when the dogs run into their game and open in chorus round the herd of Oryxes as it stands at bay. The Oryxes make repeated charges at the dogs, which are often badly wounded. The dogs generally try to pull down a calf, avoiding the mother's sharp horns. Sometimes the whole herd will charge the dogs together to rescue a calf. The Midgans come crouching up amongst the bushes and let off a flight of poisoned arrows into the mass of Oryx. On seeing the men, the herd breaks up like a bursting shell. An animal wounded by one of these arrows takes a line of its own, and is carefully followed till found dead, or it is easily pulled down by the dogs in its weak state.

I have often joined the Bulhar Midgans in their trips. They sleep out night after night under the trees, guarded by the half-tamed dogs. Their camping arrangements are primitive. They slightly roast the Oryx-meat in the fire and eat it nearly raw. If one has no matches, one may have the pleasure of helping them light a fire by rubbing two sticks together. It takes twenty minutes; special wood has to be selected. It would take Europeans a very long time to get a light.

The pariah dogs have no affection for their masters, and growl and snap when approached; but, curiously, when hunting they are very obedient and obey every sign or call.

The skin on the withers of a bull Oryx is about $\frac{3}{4}$ inch thick. The average length of horns in a good bull is 32 inches, in a cow 34 inches.

Young Oryxes when caught and confined in a cage will sometimes show their stubborn, wild nature by charging the bars, head down, and killing themselves. A case of this occurred in Berbera.

Oryxes are by no means fast Antelopes, and when wounded are easily ridden down.

The young calves are very like those of English cattle, but smaller, with stumpy black horns a few inches long. They give out a peculiar half-bleat, half-bellow, when attacked by dogs or wounded.

Oryxes sometimes strike sideways with their horns as we use a stick. When angry an Oryx suddenly lowers his horns till they are nearly parallel with the ground, and makes a dash forward with surprising swiftness.

Lions are very fond of Oryx-meat. I have often seen Oryxes in company with Hartebeestes and Gazelles. Once I saw a small herd with some of the Flabby-nosed Gazelles, and amongst them were two Ostriches.

2. The Kudu (*Strepsiceros kudu*).

Gódir or *Gorialeh-Gódir* (male); *Adér-yu* (female); *Adér-yu* (collective name for herd-animals of both sexes and all ages).

Kudus are found in mountainous or very broken ground where there is plenty of bush and good grass and water.

Sometimes a solitary old bull Kudu will make his mid-day lair close to water, in some quiet part of the hills. They are very retiring, and live in small families, two bulls and seven cows being the largest number I have noticed together. They prefer the steepest mountains, but wander about at night in search of grass in broken ground in the neighbouring plains.

An old male with a heavy pair of horns avoids thick jungle, where they may catch in the branches, and likes to spend the heat of the day under the shadow of some great rock on the mountain-side, where he can get a good view around. His eyes, nose, and ears appear to be equally on the alert, and he is often very cunning.

Although such a heavy animal he is a good climber. He is hard to stalk, but, once successfully approached, the steep nature of the ground generally yields him up an easy victim to the rifle.

The alarm-note of the female Kudu is a loud startling bark, which echoes far into the hills around, and is similar to that of the Indian Sambar hind. The bark is accompanied by an impatient pawing of the ground with the hoofs.

The habits of the Greater and Lesser Kudu of Somaliland exactly correspond respectively to those of the Indian Sambar and Spotted Deer. Great Kudus live in the mountains; Lesser Kudus live on the bush-covered slopes at their base.

Kudus are generally timid, but care must be taken when coming suddenly on them, as I once saw an unwounded bull Kudu make a very determined charge from some thirty yards' distance at a solitary man, who had been sent to stop the mouth of a gorge. The man jumped to one side and threw his spear, grazing the beast's flank. The Kudu galloped out into the plain and escaped. I had a good view of this, and there could be no doubt as to the intention of the beast.

The Kudu is the largest of all the Somali Antelopes, a large bull standing about 13 hands 1 inch. A good pair of horns in Somaliland will measure nearly 3 feet from base to tip, and 48 inches round the spiral of each horn. The largest Somali Kudu head I have ever seen measured 56 inches round the spiral.

The Kudu is rare except in the highest mountains. It is found on the highest ground of Northern Somaliland, inhabiting the top of Wagar Mountain and Golis Range, which rise respectively to six thousand eight hundred and six thousand feet.

Kudus have lately become very shy and scarce in these mountains. A Kudu head is a great prize, and a good pair of horns should be ample reward for a fortnight's climbing in the hills.

Kudus, although active climbers, are not fast on level ground.

3. The Lesser Kudu (*Strepsiceros imberbis*).

Gódir or *Arreh-Gódir* (male); *Adér-yu* (female); *Adér-yu* (collective).

This is quite the most beautiful of all the Somali Antelopes, and the skin is more brilliantly marked and the body more graceful than in the Great Kudu.

The Lesser Kudu is found in thick jungles of the larger kind of thorn tree, especially where there is an undergrowth of the "Hig" or pointed aloe, which is of a light green colour and grows four feet high. This Antelope may also be found hiding in dense thickets of tamarisk in the river-beds. It is never found in the open grass plains, and I have never seen one in the cedar-forests on the top of Golis.

The favourite haunt of the Lesser Kudu used to be along the foot of this range, but they are seldom seen there now. The Lesser Kudu likes to be near water if possible, and living, as it does, in thick bush, its ears are wonderfully well developed. It has strong hindquarters, and is a great jumper, the white bushy tail flashing over the aloe clumps as it goes away in great bounds.

Lesser Kudus are very cunning and will stand quite still on the farther side of a thicket, listening to the advancing trackers; then a slight rustle is heard as they gallop away on the farther side.

The best way to get a specimen is to follow the new tracks of a buck, the shooter advancing parallel with the tracker, but some 50 yards to one flank and in advance; a snap shot may then be obtained as the Kudu bounds out of the farther side of the thicket, first giving the warning rustle. One may be months in the country before getting a really good specimen.

Lesser Kudus go in small herds of about the same number as the Great Kudus. Old bucks are nearly black, and the horns become smooth by rubbing against trees.

The average length of a good buck Lesser Kudu's horns is about 25 inches from base to tip. The longest I have shot or seen was between 27 and 28 inches in a straight line. The horns are very sharp. I have never seen a Lesser Kudu charge anybody.

4. The Somali Hartebeeste (*Bubalis swaynei*)[1].

Sig.

South of the highest ranges, and at a distance of about 100 miles from the coast, are open plains some four or five thousand feet above sea-level, alternating with broken ground covered with thorn-jungle, with an undergrowth of aloes growing sometimes to a height of six feet.

This elevated country, called the "Haud," is waterless for three months, from January to March; it was crossed by Mr. James's party in 1884, when their camels were thirteen days without water.

Much of the Haud is bush-covered wilderness or open semi-desert, but some of the higher plains are, at the proper season, in early summer, covered, far as the eye can reach, with a beautiful carpet of green grass, like English pasture-land. At this time of the year pools of water may be found, as the rainfall is abundant.

This kind of open grass country is called the "Ban." Not a bush

[1] Sclater, above, p. 98, pl. v.

is to be seen, and some of these plains are thirty or forty miles each way.

There is not always much game to be got in the Haud; but a year ago, coming on to ground which had not yet been visited by Europeans, I found one of these plains covered with herds of Hartebeestes, there being perhaps a dozen herds in sight at one time, each herd containing three or four hundred individuals.

Hundreds of bulls were scattered singly on the outskirts and in spaces between the herds, grazing, fighting, or lying down.

The scene I describe was at a distance of over a hundred miles from Berbera; and the game has probably been driven far beyond that point by now.

The Hartebeeste bulls are very pugnacious, and two or three couples may be fighting round the same herd at one time. Often one of the bulls will be sent rolling head over heels.

The easiest way to get a specimen is to send a couple of Midgans round above the wind to drive the Hartebeeste towards you, at the same time lying down in the grass. A shot may be got within fifty yards, but no one would care to shoot many Hartebeestes, as the trophy is poor.

Often Oryxes and Sœmmerring's Gazelles are seen in company with these great troops of Hartebeestes, but the Oryxes are much wilder. The Hartebeestes are rather tame, and they and the Sœmmerring's Gazelles are always the last to move away.

Hartebeestes have great curiosity, and rush round a caravan, halting now and then within two hundred yards to gaze. This sight is an extraordinary one, all the Antelopes having heavy and powerful forequarters, head, and chest, of a different shade of chestnut to the hindquarters, which are poor and fall away. In the midday haze on the plains they look like troops of Lions.

The pace of the Hartebeeste is an ungraceful lumbering canter; but this is really the fleetest and most enduring of the Somali Antelopes. The largest herd I have ever seen must have contained a thousand individuals, packed closely together, and looking like a regiment of cavalry, the whole plain round being dotted with single bulls.

The coat is glossy like that of a well-groomed horse.

From their living so much in the open grass plains the Hartebeeste must live entirely on grass, for there is nothing else to eat; and it must be able to exist for several days without water.

Hartebeestes are the favourite food of Lions, and once, when out with my brother, I found a troop of three Lions sitting out on the open plains, ten miles from the nearest bush. They had evidently been out all night among the herds, and on their becoming gorged, the rising sun had found them disinclined to move.

Hartebeeste horns vary greatly in shape and size. There are the short massive horns and the long pointed ones, and all the gradations between. Some curve forward, with the points thrown back; others curve outwards in the same plane as the forehead, the points turning onward.

5. Waller's Gazelle (*Lithocranius walleri*).

Gerenouk.

The Gerenouk is the commonest and most widely distributed of the Somali Antelopes except the little Salt's Antelope, which springs like a hare from every thicket.

The long neck of the Gerenouk, large giraffe-like eyes, and long mobile muzzle are peculiar, the only other Antelope at all like it being the Dibatag (*Ammodorcas clarkei*).

The Gerenouk is more of a browser of bushes than a grass-feeder, and I have twice shot them in the act of standing on the hind legs, neck extended, and fore feet against the trunk of a tree, reaching down the tender shoots, which could not be got in any other way. Thus not only the appearance, but the habits of a Gerenouk are giraffe-like.

The skull goes far back behind the ears like that of a camel.

The Gerenouk is found all over the Somali Country in small families, never in large herds, and generally in scattered bush, ravines, and rocky ground.

I have never seen the Gerenouk in the cedar forests which crown Golis, nor in the treeless plains which occur in the Haud.

Gerenouk are not necessarily found near water, in fact generally in stony ground with a sprinkling of thorn-jungle.

The gait of this Antelope is peculiar. When first seen, a buck Gerenouk will generally be standing motionless, head well up, looking at the intruder and trusting to its invisibility. Then the head dives under the bushes, and the animal goes off at a long crouching trot, stopping now and again behind some bush to gaze.

The trot is awkward-looking and very like the trot of a camel. The Gerenouk seldom gallops, and its pace is never very fast.

In the whole shape of the head and neck and in the slender lower jaw there is a marked resemblance between the Gerenouk and the newly-discovered Dibatag. The texture of the coat is much alike in both. The horns of young buck Gerenouk are almost exactly the same shape as those of the Dibatag.

The average length of a Gerenouk's horns is about 13 inches. I have never seen a female with horns.

Female Gerenouks sometimes lose or desert their young ones, as I have now and then come on quite young Gerenouk living alone in the jungle.

6. Sœmmerring's Gazelle (*Gazella soemmerringi*).

Aoul.

Five years ago, when staying in quarters at Bulhar, I remember that the Aoul could be seen from the bungalow, grazing out on the plain. The Bulhar Maritime Plain used to be full of them, but they have been so persecuted by sportsmen that they have retired to a great distance, and are seldom shot near Bulhar now.

The Aoul weighs about the same as the Gerenouk, but has a shorter neck and a clumsy-looking head. It is altogether a coarse

animal. It is a grass-feeder, and lives in the open plains or in scattered bush, but never in thick jungle, and it prefers flat ground.

The white hindquarters can be seen from a great distance, making a herd of Aoul look like a flock of sheep in the haze of the plains.

I have never seen Aoul on the Golis Range, but in the Hartebeeste ground beyond they are common, and may often be seen in large herds along with the herds of Hartebeestes.

The Aoul are the most stupid and easy to shoot of all the Somali Antelopes, and their habits are identical with those of the Indian Blackbuck; but the Aoul is not to be compared with the Blackbuck for beauty or grace of movement.

Aoul often make long jumps when going away, and are apparently a near relative of the Cape Springbuck. I have never seen them spring vertically to anything like the height to which the Indian Blackbuck will spring. Presumably it is done to get a better view of the plain.

Aoul are inquisitive and will follow a caravan. If fired at they make off across the front at racing speed, drawing up in a troop now and then to gaze.

If much meat is required, it is easy in scattered bush to run into a large herd and shoot several. A large herd becomes confused, as the leaders cannot be seen in bush.

The bucks with a herd will often be seen fighting or chasing each other about at speed as Blackbuck do. Solitary bucks are sometimes found far from any herd.

Aoul can live a long way from water. Near the coast they often come down close to the shore, possibly to obtain salt.

A wounded Aoul buck does not hide, but will lie down in the most open spot he can find, and will generally have a circle of jackals waiting round him. Aoul can easily be shot at dusk, when they are apt to blunder close to a caravan.

The horns vary in shape, generally being lyrated, sometimes pointing forward like the Gerenouk horns. They are often malformed, and seldom have much symmetry. The largest pair I have seen measured 17 inches; the average is about 14 inches, following the curve.

I once saw a herd of about fifteen young fawns of this Antelope gathered together a mile away from the rest of the herd.

7 & 8. The Gazelles.

The Coast Gazelle (*Gazella pelzelni*).
The Big-nosed Gazelle (*G. spekii*). } Both *Déro*.

The ordinary Coast Gazelle almost exactly resembles the Arabian and the Indian Gazelle (*G. bennetti*). The other, the Big- or Flabby-nosed Gazelle, inhabits the elevated country, commencing about 35 miles from the coast.

I have shot numbers of Gazelles for food at various times, and have always noticed that the Flabby-nosed Gazelle has a much thicker and longer coat than the Coast Gazelle. This is evidently

the result of natural selection, as the high plains of Ogo and Haud, where it lives, are subject to sweeping cold winds, and the nights are very cold indeed. I have noticed the Oryx in the elevated country also have slightly thicker coats. The altitude of these plains inhabited by the Flabby-nosed Gazelle is from three thousand to nearly six thousand feet, but doubtless they go much lower towards Ogaden.

The great upheaval of Golis, and its prolongations east and west, which rise some forty miles inland and separate Guban, the low coast country, from Ogo, the high interior country, form the natural line of demarcation between these two Gazelles.

The short-coated, brightly-coloured Coast Gazelle is found below in Guban, to the north of Golis. The long-coated, dull-coloured, Flabby-nosed Gazelle is found south of Golis, in Ogo and in the Haud.

In Ogo-Gudan, the country near Hargeisa where Guban rises gradually into Ogo, I have found the Flabby-nosed Gazelle to prevail. I have found that the Gazelles of the low country carried longer horns, those of the Big-nosed Gazelle being shorter, thicker, more curved, and better annulated.

The habits of both are alike. They go in moderate herds from half a dozen up to about fifteen, and are fond of stony or sandy undulating ground and ravines, thinly dotted over with mimosas.

They are fond of salt, and do not want water, and it is hard to understand what they can pick up to eat in the wretched ground they frequent. They avoid thick bush. They have curiosity which amounts to impudence, but are wonderfully bright and on the alert, and are hard to shoot, knowing perfectly well the range of a rifle and presenting a small target.

9. Salt's Antelope (*Neotragus saltianus*).

Sakáro.

The Sakáro certainly weighs less than an English hare, and is the smallest of the Somali Antelopes. The horns are well-ringed at the base and sharply pointed, and about 1½ inch long.

There are two kinds of Sakáro, the larger and the smaller. They are alike in every other respect, but one is half as large again as the other. The smaller is found in Guban and Ogo. I shot the larger in the Gadabursi country, 150 miles inland. Mr. Clarke, who went to Mauhan, first noticed a difference in size and pointed it out to me. The skull is nearly twice as large in the larger kind.

The eyes of the Sakáro are larger in proportion to the head than any other of the Antelopes here.

Sakáro live in broken ground where there is good cover of low mimosa scrub. They are never seen in absolutely open grass plains. They are specially partial to the aloe undergrowth found in Lesser Kudu ground.

Sakáro go in pairs, hiding under the low bush. The female exposes herself to view most, and is consequently most often shot.

They lie very close, and when disturbed they dart off at speed with two or three sharp whistling alarm-notes uttered in quick succession. This often gives the alarm to larger game.

Three or four Sakáro may be seen together, seldom or never more.

Young Sakáro are soon able to take care of themselves, and only when very young can they be run down on foot by the Somalis, who often catch them to eat. The Somalis, who are sensible in most ways, are peculiar in that they do not eat birds, and know little about them, calling them contemptuously "Shimbir," the Arabic for bird, but generally having no names for the different kinds. They say birds are "Haram," or forbidden food.

I have seen probably eighty Sakáro in the course of a day. Their habits are those of the hare, and they live in similar ground.

They nibble the young shoots of the mimosa. They like to be near water, and go to drink at midday and just after nightfall. They are especially lively in the afternoon and evening.

10. The Klipspringer (*Oreotragus saltator*).

Alakud.

These Antelopes live in the most rugged mountains, poising themselves on large boulders, and leaping from rock to rock. They are neither shy nor hard to shoot.

Alakud go in twos and threes like Sakáro. The longest horns I saw in Somaliland were about three inches. The females have no horns.

11. Clarke's Gazelle (*Ammodorcas clarkei*).

Dibatag.

Clarke's Gazelle is very local in its distribution, and is not found nearer than Burao and the edge of the Haud. They are common in parts of the Dolbahanta country. I have never had time to shoot when in the country they inhabit, which has only lately been opened up. Its likeness to the Gerenouk is remarkable.

12. Beira.

My brother, while with me in the Gadabursi country last year, saw three specimens of an Antelope which the natives called "*Beira*," but he was not fortunate in obtaining a shot. He described it as a small reddish Antelope of the Klipspringer kind, the same size, with little black horns, much laid back. The natives said no Europeans had shot them.

2. On the probable Identity of certain Specimens, formerly in the Lidth de Jeude Collection, and now in the British Museum, with those figured by Albert Seba in his 'Thesaurus' of 1734. By Oldfield Thomas.

[Received April 5, 1892.]

In 1867 the British Museum purchased, through the late Mr. R. Damon, a large quantity of zoological specimens of all sorts out of the collection of Prof. Th. van Lidth de Jeude of Utrecht. Of the mammals, about 280 are preserved entire in old-fashioned glass jars with red wax tops, and 330 are skulls.

In the well-known folio work by Albert Seba, 'Locupletissimus rerum naturalium Thesaurus,' vol. i., there is a frontispiece with the author's portrait, and behind him are specimens in bottles so exactly like those of the Lidth de Jeude collection as to have attracted my attention to the circumstance; and although it has since proved that such bottles were used by Lidth de Jeude himself and others, yet as the suspicion thus aroused was confirmed by my finding some of the specimens to be similar to the animals figured by Seba in this work, a thorough examination has been made, with the startling and unhoped for result of showing that many of these Lidth de Jeude specimens are actually the very individual examples figured by Seba. Of course, one or two, or even five or six cases of resemblance might have been put down to accidental coincidences, but so large a number prove to correspond in every way to Seba's figures and descriptions, that I no longer have a doubt as to their being really Seba's specimens, carefully preserved by their successive possessors in the original hermetically sealed jars in which he placed them. Naturally, in the course of time, many have been lost, others have deteriorated and been destroyed, and others again have been alienated in ignorance of their special value and interest. But in spite of all, enough remain to raise their resemblance to Seba's figures far beyond the region of accidental coincidence, and, as each specimen identified increases the probabilities for the identification of the rest, in the aggregate to amount practically to a proof of the opinion now advocated. In fact the whole British Museum collection from other sources could not produce so many close resemblances to Seba's figures as occur in this one collection of Lidth de Jeude. It may be noted that, judging by the old tickets on the bottles, there appear to be two sets of specimens in the collection—the bottles of the one labelled with large printed numbers, and of the other with manuscript numbers, evidently of an earlier date; all the cases of asserted identity occur in the latter part of the collection, an evidence in itself that these have some common bond of origin. At the same time the importance of this piece of evidence is unfortunately much weakened by the fact that many of the identified specimens have

been rebottled, so that one cannot tell with certainty [1] to which part of the collection they belonged.

Owing in part probably to some of the intermediate possessors not having been interested in anything but Mammalia, and in part to the comparative absence of individuality in specimens of the lower classes, scarcely any identification has been made in other groups than the Mammalia. But as the Lidth de Jeude collection acquired by the Museum contains specimens of all classes, both of Vertebrates and Invertebrates, as did also the Seba cabinet, there is little doubt that some of Seba's specimens are contained in it, if only they could be identified. At the same time no members of other groups have upon them the old MS. labels to which I attach so much importance. Moreover, the Seba collection of Reptiles was wholly, or in part, purchased by the Emperor Peter the Great, and taken to St. Petersburg, where many of the specimens are still preserved [2]. Unfortunately they were all rebottled some years ago, so that none are left in the original bottles; Dr. Strauch, however, as I am kindly informed by Dr. Büchner, well remembers that the bottles were exactly like those figured by Seba, and therefore like those of the Lidth de Jeude collection. As to the labels, several sorts seem to have been on the bottles, but none quite like those now on our bottles.

Among the Reptiles and Fishes, in the examination of which I have had the assistance of my colleague Mr. Boulenger, one snake (*Euuectes murinus*, 66.8.14.308) and one fish (*Chætostomus cirrhosus*, 66.8.14.154) agree so well with Seba's Vol. ii. pl. xxix. fig. 1 and Vol. iii. pl. xxix. fig. 12 respectively, that, viewed in conjunction with the Mammal identifications, it appears very probable that these specimens are Seba's originals, and that they escaped Peter the Great, and passed with the Mammals into the hands of Prof. Lidth de Jeude.

It is an unfortunate thing that none of the many eccentricities figured by Seba, such as the Cat with two bodies, &c., are identifiable, as they would have been better evidence of identity than any I am able to produce; but the fact is easily explicable, as the British Museum never has purchased or collected any such specimens, and therefore even if, as no doubt was the case, any of Seba's monstrosities were included in the "collection très remarquable de fœtus monstrueux" of the Lidth de Jeude collection, they would not

[1] In an interesting leaflet which I owe to the kindness of Mr. R. F. Damon of Weymouth, there is a rough classification of the Lidth de Jeude Museum, and among the chief headings is one of "Une série de fœtus des races humaines et des Mammifères." Now, on examining the Museum specimens bearing the printed Lidth de Jeude labels, I find that without exception they are either young specimens or else mothers containing fœtuses, so that we may presume that of the rebottled specimens those at least which are adult would not have had the printed numbers, and would therefore in all probability have had the old MS. labels upon them.

[2] See Strauch, Zool. Mus. St. Petersb. in seinem fünfzigjähr. Best. p. 192 (1880). Dr. Büchner informs me that a large part of this collection was destroyed by fire in St. Petersburg in 1747.

have been acquired by our own Museum; nor am I able to trace where they have gone.

Before proceeding to a detailed account of my identifications, I propose to give such scraps of historical evidence about the Seba and Lidth de Jeude collections as I have been able to get together, and I hope that these in course of time will be supplemented by other similar items of information.

Firstly, from the preface to the fourth volume of the 'Thesaurus' we learn that, although Seba himself died in 1736, the collection was not dispersed until 1752, when it was sold by public auction in Amsterdam.

It next, probably not very long afterwards[1], passed into the possession of the Stadtholder, William V. of Holland, or at least of his guardians, he being a boy of four at the time of the sale. But when the French occupied Holland and the Stadtholder fled in 1795, the invaders, as was their habit in regard to objects of art and science, brought back with them to Paris certain of the specimens of the Stadtholder's collection. Of these, or at least of the Mammals, a list has most fortunately been preserved in the Archives of the Paris Museum, a copy of which I owe to the kindness of Prof. A. Milne-Edwards. This list, however (see below p. 317), shows that no such specimens as are now attempted to be identified went to Paris at that time. Indeed, such specimens as these animals in spirit would not have been very attractive to the French military and unscientific collectors, and they therefore, no doubt, remained in Holland, but in whose hands I cannot trace.

The next reference is one which, so far as it goes, is antagonistic to the idea of any of Seba's spirit-specimens having been preserved until now, and it deserves, therefore, careful consideration. In 1853 Temminck, the famous head of the Leyden Museum, made the two following statements[2]:—

"Seba rassemblait, sans choix ni ordre systématique, toutes sortes d'objets curieux; parmi les mammifères, les monstres et les fœtus étaient les plus nombreux; toute sa collection, conservée à l'esprit de vin dans des bocaux de verre, était, après sa mort, en grande partie détériorée." And:—

"Il y a plusieurs années (cinquante ans à peu-près) que je fis l'acquisition de quelques bocaux, provenant des débris des collections de Seba; dans ce nombre se trouvait un très-jeune individu de notre *Spiniger*; il était totalement décoloré et à peine reconnaissable. Ce sujet, qu'on a monté, se trouve dans nos galeries. C'est *peut-être* l'individu type du *Cervus perpusillus* ou bien de *Cervus pergracilis* de Seba."

[1] Perhaps Pallas visited Amsterdam in the interval, for in 1797 (Nov. Glires, p. 314) he says of *Mus longipes* (Seba, vol. ii. plate xxix. fig. 2): "vidi quondam Amstelodami e Museo Sebæ reliquum specimen in collectione DN. Chr. Paul Meier, mercatoris." Later on he speaks of this specimen as having been a skin, so that it could not be one of our specimens, but might have been one of the "Deux Gerboises de la petite espèce" that went to Paris (see below, p. 317).

[2] Esq. Z. Guin. pp. 202, 203 (1853).

Now in reference to these serious statements, it may be observed that Seba's great collection consisted of mammals, birds, reptiles, scorpions, shells, echinoderms, and many other invertebrates, and might, therefore, easily be "en grande partie détériorée," especially as regards the softer and more destructible invertebrates, and yet leave the majority of the mammals unhurt; while, as regards the Royal Antelope ("notre *Spiniger*"), of course the accidental opening or leakage of a single bottle would imply the destruction of its contents. But except for Temminck's bare statement, and it is by no means certain that he really knew much about the condition of "toute la collection," he only having obtained "quelques bocaux," there seems to be no reason whatever that specimens preserved as these are in hermetically sealed bottles and in good preserving fluid should be really seriously deteriorated merely by the lapse of time. Certainly, judging by the present condition of the Lidth de Jeude collection, there seems to be no reason against their having been in the bottles they now are for the past 160 years, or, if untouched, for their remaining very much in their present condition for centuries more.

Of other references to this collection, at this time or later, I can find no trace. Probably it got into the hands of one or several successive private and scientifically unknown collectors of curiosities before coming into the possession of Prof. Lidth de Jeude.

Of the latter's museum, we only know what is stated in the preface to his sale-catalogue of 1858. In this he utters a pathetic lament at being forced to part with his collection, the result of half a century's labour. This period would carry back the commencement of his collecting to 1808, a date very near that when some of the Seba specimens were certainly still in existence, as we know from Temminck. Among the collections and even "Musées entiers" which he acquired during the half-century were those of "Mr. le Baron van der Capellen, ancien Gouverneur des Indes Orientales, Mr. van Klinkenberg, amateur zélé à Utrecht, Messrs. Muller, Draak, etc."

Of these gentlemen the first would not have been likely to possess a general collection, of the last two I know nothing; but of the second, the most likely sounding of all, thanks to the kind researches of Dr. F. A. Jentink, of the Leyden Museum, we know that his full name was Gysbert Johannes van Klinkenberg, that he set up as an apothecary in Utrecht in 1802, that he had large Natural History collections, and that these were sold by auction on Nov. 8, 1841. The majority of the specimens were bought by Prof. Lidth de Jeude, but as this was done privately no sale-catalogue of them was printed. It may be noted, however, that among the books sold[1] at that sale there were *two* copies of Seba's 'Thesaurus,' rather a cumbrous work for an ordinary collector to have in duplicate, if he had not had some special reason for possessing them.

[1] I must sincerely thank Dr. Jentink for the care and trouble that he has taken in helping me to trace out the history of this collection, and, among other things, for having lent me a copy of this rare sale-catalogue, as well as a marked copy of Lidth de Jeude's own catalogue.

This being all the historical evidence that I have been able to gather about the Seba and Lidth de Jeude collections, I need scarcely say that I shall be most grateful to anyone who may happen to find any pertinent references to either of them and who would give me information thereof.

To pass now to the evidence derived from the specimens themselves and their agreements with the Seba's descriptions and figures.

In the first volume of Seba's work about 90 Mammalia are figured and described, and 7 in the second. Of these we must eliminate those that were probably among the Paris set (see below), besides a considerable number more which, owing to their size, could not have been preserved in spirit, and such again as Seba states were not in his own collection. This would leave some 70 or 80 for which originals may be sought. Many of these are of animals so rare, even to the present day, that their independent possession both by Seba and Lidth de Jeude would itself be unlikely; and still more unlikely that the specimens belonging to the latter should have been able so closely to match the figures given by the former, in age, size, and above all in sex, a point on which Seba was fortunately very careful to give particulars.

Of the cases put forward in the following list, some few depend of course merely on an ordinary specific resemblance, and one can only say that there is no disqualifying point, such as wrong sex or age; but in others, and indeed in the majority, there is a strong individual resemblance between the figure and the specimen, often confirmed by some collateral evidence extracted from Seba's descriptions. Such cases as those of the Opossums with their varying numbers of mammæ visible or in use, of the *Lutra brasiliensis* with its wrinkled sides, and of the pair of *Tamias* with the right sexes and number of stripes respectively, are far beyond anything that one could possibly suppose might be due merely to accidental coincidence.

In the table now exhibited (pp. 314–15) the first column gives the number of the plate and figure in Seba, the second the name of the species, and the third the British Museum register-number of the specimen I assign to the figure. These specimens will of course always be open to the inspection and comparison of anyone interested in the subject.

It is unfortunate that, before the history of the collection was suspected, many of the specimens were taken out for examination and rebottled in modern bottles, but in all cases the fact of their having actually come from the Lidth de Jeude collection is beyond question. Without such taking out, however, exact specific determination is occasionally very difficult, and some animals are therefore inserted in the table merely under their generic names, as without very special reason it would not be right to unseal the ancient and interesting bottles which contain them.

Seba, Plate and Figure.	Name.	Museum register-no. of Lidth de Jeude specimen.	Remarks.
Vol. I.		67.4.12	
XXXI. 1.	*Didelphys murina*, ♂.	541	
„ 2.	*Didelphys murina*, ♀.	542	Mammæ said to be 7 or 9 in text, but only shown as 7 in plate. Specimen with 9 in use, but only 7 easily visible. Full number 11.
„ 5.	*Didelphys murina*, ♀, and 6 young on back.	546	Specimen with 7 young, but the artist has represented as many as he could get in. Mother and young were all in one Lidth de Jeude bottle together, but unfortunately they were all taken out in 1887 and stuffed.
„ 6.	*Didelphys brevicaudata*, ♀.	540	
XXXII. 1.	*Talpa europæa*.	558	Common albino variety; several in the collection.
„ 5.	*Chrysochloris aurea*.	564	Rare species.
XXXIII. 2.	*Bradypus cuculliger*.	579	
XXXVI. 4.	*Didelphys philander*, ♀.	414	Four prominent mammæ drawn. *Specimen has 4 developed out of the full number of* 7. The same bottle also contains several young specimens very fairly corresponding to the letterpress of XXXVI. 3. "On y voit aussi plusieurs petites femelles, dont les petites bourses sont étroitement fermées."
XL. 2.	*Procyon cancrivorus*, juv.	455	
XLI. 1.	*Herpestes griseus*.	452	"From Ceylon." Specimen kept alive; no doubt drawn from life and then, as specially mentioned, drowned and placed in preserving fluid.
„ 3.	*Sciuropterus volucella*, ♂.	494	From Virginia.
XLII. 1.	*Nasua rufa*, imm.	447	Received alive from Surinam.

„ 2.	*Lutra brasiliensis*, juv.	445	The figure shows a series of peculiar transverse stripes on the flanks. The specimen has been compressed into too small a bottle, and has had a number of marked transverse wrinkles formed along its sides thereby. "Conservé dans une liqueur."
XLVII. 2.	*Tamias asiaticus*, ♂.	479	The extraordinary tail of the figure is of course an impossibility for this or any other specimen. But the floating out in bundles of the long hairs of the tail in the liquid may have given rise to the idea that the tail itself was "fendu en quatre." In other respects the figure and description agree remarkably well with this specimen.
„ 3.	*Tamias striatus*, ♀.	491	This and the last make a very noticeable pair of correspondences to the two Chipmunks figured by Seba.
XLVIII. 2.	*Felis tigrina*.	450	
XLIX. 1 & 2.	*Erinaceus europæus*, imm.	555	"De nos pais."
„ 4 & 5.	*Erinaceus*, sp., ♂.	557	"De Sibérie."
L. 3.	*Babirusa alfurus*, skull.	223	This skull precisely agrees with the figure in the relative development of the four long tusks, which are extremely variable in length.
LV. 1.	*Noctilio leporinus*, ♂.	339	
2.	*Hemiderma brevicaudatum*, ♀.	597	Determined of course from the specimen, but the agreement is very close.
LVI. 2.	*Kerivoula picta*, ♀.	343	From Ternate.
3.	*Kerivoula picta*, ♂.	342	These two specimens, male and female, are the only two in the collection.
LVII. 2.	*Pteropus vampyrus*, ♂.	325	Said by Seba to be from Ternate. Specimen determined by Dobson as *Pt. "edulis,"* a native of that island. (For nomenclature see next page.)
Vol. II.			
VIII. 3.	*Sorex*, sp.	570	Specimen apparently *S. vulgaris*.
LXIII. 5.	*Crocidura*, sp.	569	

Besides these cases there are a large number of instances, such as the young Opossum figured on Plates XXXI. & XXXVI., where although it is impossible to fix on individual specimens as their originals, yet practically the Lidth de Jeude collection does contain specimens fairly corresponding with them. Further research again will, I hope, reveal some few more cases of close identities, as I cannot feel that I have by any means exhausted the possibilities in this direction.

It would appear certain, then, that so large a number of resemblances as the above cannot be merely an accident, especially when some of the more remarkable cases are taken into account, and I can, therefore, only reiterate my belief that these are the actual specimens from which Seba took his figures.

But besides its extreme interest, this fact has a special scientific importance, for in many cases systematic names have been given, primarily or solely, to Seba's figures, and therefore, where the originals of these figures can be identified, the specimens are clearly the types of the species.

The tracing of such names, however, can only be properly done in connection with the systematic working out of the different groups, and the following cases are therefore only those of which I now have clear evidence and are perhaps but a small proportion of those which really exist.

Names of Species founded on Seba's figures, for which typical specimens have been identified.

Chrysochloris aurea[1], Zimm. Geogr. Gesch. ii. p. 391 (1780). Founded on Seba, XXXII. 4 & 5.
Specimen 67.4.12.564.

"*Vespertilio*" *vampyrus*[2], Linn. Syst. Nat. (10) p. 31 (1758). Founded on LVII. 1 & 2.
Specimen 67.4.12.325. *Pteropus edulis*, spec. *g*, Cat. Chir. B. M. p. 51.

Kerivoula picta, Pall. Spic. Zool. iii. p. 7. Founded on LVI. 2 & 3.
Specimens 67.4.12.342–3. *l*[3] of Cat. Chir. B. M. p. 334.

Noctilio leporinus, Linn. Syst. Nat. (10) i. p. 32 (1758). Founded on LV. 1.
Specimen 67.4.12.339. *f* of Cat. Chir. B. M. p. 396.

Didelphys philander, Linn. *t. c.* p. 54. Founded on XXXVI. 4.
Specimen 67.4.12.414. *g* of Cat. Mars. p. 338.

Didelphys murina, Linn. *t. c.* p. 55. Founded on XXXI. 1 & 2.
Specimens 67.4.12.541 & 2. *x* and *z* of Cat. Mars. p. 347.

Didelphys dorsigera, Linn. *l. c.* Founded on XXXI. 5.
Specimen 67.4.12.546. *f'* (of *D. murina*) Cat. Mars. p. 347.

Didelphys brevicaudata, Erxl. Syst. R. A. p. 80. Founded on XXXI. 6.
Specimen 67.4.12.540. *b* of Cat. Mars. p. 358.

[1] Linnæus's name "*asiatica*" is equally founded on this specimen, but, being erroneous, is not admissible.

[2] This will affect the name of the species, which will have to stand as *Pteropus vampyrus*, L. Even if the identification of the specimen is wrong, however, Seba's LVII. 1 & 2 clearly represent what has been known as *Pt. edulis*, Geoff., so that the change would have to take place in any case.

[3] The male specimen accidentally omitted from the list in the Catalogue.

Finally, in order to focus as far as possible all the existing information about the Seba cabinet, I have thought it well to reproduce just as it stands the list, obligingly hunted out for me by Prof. Milne-Edwards, of the specimens taken to Paris. The numbers placed in brackets are those of the Seba plates and figures which *may* be those of the specimens mentioned. How many of these interesting specimens still remain in the Paris Museum after the lapse of nearly a century, I will leave my *confrères* of that great institution to determine; but I am afraid there cannot be many, as the specimens seem to have been for the most part perishable skins or stuffed specimens.

Liste des animaux envoyés de la Haye l'an III.[1] *de la République Française.*

(Cabinet du Stathouder.)

Un Hippopotame adulte.
Un Hippopotame jeune.
Une tête de Narwal avec la corne.
Un Fourmilier de Cayenne [XXXVIII. 2, XL. 1, or Vol. II. XLVII. 2].
Un Pangolin [LIV. 1].
Un Singe nasique.
Un Tatou[2] [XXXVII. 2].
Portion de crâne et cornes de Coudou.
Deux peaux de Coudou, ♂ ♀.
Deux peaux du Buffle bleu du Cap.
Trois peaux de Chat-tigre.
Une peau de Rhinocéros bicorne (jeune).
Deux peaux de Bubale, ♂ ♀ [XLII. 4].
Un Tapir.
Un Gerboise de la grande espèce.
Un Cochon sanglier sauvage de Surinam [? L. 2].
Un petit Singe d'une espèce particulière [? XLVII. 1].
Une Loutre blanche.
Un Renard blanc.
Deux Gerboises de la moyenne espèce.
Deux Gerboises de la petite espèce [? II., XXIX. 2].
Un Faisan perlé de la Chine.
Des peaux d'Antilopes.
Un Éléphant avec son poil follet.
Un Sanglier du Cap qui a vécu à la Haye.
Un Daim du Cap.
Une sorte de Renard [? XXX. 1].
Un Cerf du Cap.
Un Castor de Westphalie.
Deux têtes de Babouines à dents dorées.
Un Paresseux de haute taille [XXXIV. 1].
Une jolie Chèvre de Surinam [? XLII. 3].
Des Écureuils volants.
Un Bouquetin.
Une tête de Rhinocéros à doubles cornes.

Some Reptiles were also taken, as several of Seba's specimens are known to be in the Paris Museum.

[1] Sept. 1794 to Sept. 1795.
[2] See I. Geoff. C. R. xxiv. p. 572 (1847).

Adding to this list the Royal Antelope (*Nanotragus pygmæus*), said by Temminck to be possibly the original of XLIII. 2, and the specimens asserted by Sundevall to be perhaps those of XLIII. 1 & 2[1], we are able to account, with the Lidth de Jeude specimens now in the British Museum, for a very large proportion of Albert Seba's historical collection of Mammalia.

3. Descriptions of new Species of Lepidoptera Heterocera from Brazil, Mexico, and Peru.—Part II.[2] By W. SCHAUS, F.Z.S.

[Received April 29, 1892.]

The following descriptions are all taken from specimens in my own collection, and, with the exception of those from Peru, they were collected by myself.

Fam. LASIOCAMPIDÆ.

ORMISCODES OPIS.

Primaries above reddish brown; a basal straight, and an outer oblique, transverse grey band; a marginal wavy whitish shade; a long white streak at the end of the cell. Secondaries reddish brown; a median transverse greyish band and a submarginal dark brown shade. Underneath brown, the outer portion of the wings crossed by four bands of whitish scales. Head and thorax reddish brown. Abdomen black dorsally, whitish between the segments; anal segment red; underneath reddish brown.

Expanse 100 mm. ♀.

Hab. Petropolis, Brazil.

LONOMIA CARNICA.

Male. Above red, the wings crossed from the apex of the primaries to the middle of the inner margin on the secondaries by a broad black line, divided by a greyish shade; on the primaries two discal spots, the anterior one blackish, the posterior one white. Underneath pale brownish red, with broad, marginal, paler shades; the transverse line very narrow and indistinct, inwardly shaded with white; on the primaries two white discal spots; on the secondaries a black discal spot circled with white; a large black spot at the apex.

Expanse 80 mm.

Hab. Petropolis, Brazil.

PREPTOS, nov. gen.

Antennæ minutely pectinated, and with long tufts of hairs at

[1] Pecora, p. 303 (1847). I have to thank Prof. W. Leche, of Stockholm, for information about the present condition of these specimens. See also Brooke, P. Z. S. 1872, p. 637.

[2] For Part I. see above, p. 272.

their base. Palpi very short, woolly, descending. Abdomen stout, not extending beyond the secondaries. Primaries broad, straight along the costal margin to near the apex, then convex; outer margin straight, the inner angle very convex. Secondaries with the costal margin very slightly convex; the outer margin convex. The discal cells very short, not extending beyond a third from the base.

PREPTOS OROPUS.

Fawn-colour, the outer margins broadly brown and separated from the ground-colour by a straight dark line, extending from the apices to the inner margins near the angles on both the primaries and secondaries; a median and on the primaries also an outer transverse dark wavy shade; a blackish spot on the subcostal vein of the primaries near the base. Underneath yellowish fawn-colour; a median and a submarginal dark brown, lunular, transverse band, and between these three similar but less distinct bands. Head and thorax pale fawn-colour. Collar dark brown. Abdomen dark fawn-colour.

Expanse 95 mm. ♀.

Hab. Jalapa, Mexico.

LEBEDA DOERI.

Male. Dark brown, reddish grey about the inner angle of the primaries, with three small black spots; the primaries also crossed by four pale lines, the inner two straight, the outer two slightly oblique; a small white point in the cell. Underneath brown flecked with greyish scales; two transverse pale lines from the costal margin of the primaries near the apex to the inner margin of the secondaries.

Expanse 75 mm.

Hab. Petropolis, Brazil.

ARTACE ANULA.

Female. Primaries above whitish with transverse greyish streaks, and a circular grey spot on the inner margin. Secondaries above greyish white, with a broad submarginal dusky band. Underneath grey, with a white marginal line. Body greyish.

Expanse 43 mm.

Hab. Rio Janeiro, Brazil.

ARTACE MERIDIONALIS.

Female. Primaries above white, with a basal, a median, and an outer row of dark grey spots on the veins, and two grey spots at the end of the cell; a marginal and a submarginal dusky grey transverse band, and a row of black spots on the extreme margin between the veins. Secondaries above grey, darker along the inner margin. Underneath: primaries grey, with the apex white and a row of dark spots on the extreme margin; secondaries grey, with the fringe white. Head and thorax grey. Abdomen dorsally dark grey, underneath white.

Expanse 44 mm.
Hab. Tijuca, Rio Janeiro.
Most nearly allied to *A. albicans*, Walker.

HYDRIAS THERESA.

Primaries above grey, the veins black towards the outer margin and some black scales at the base; two black points in the cell, and beyond the cell two transverse blackish lines, the inner one resembling a line of fish-scales, the outer one forming prolonged angles. Secondaries brown, the costal margin broadly grey, mottled with black; a marginal wavy, dusky grey line and a faint trace of a median transverse line. Head and thorax grey. Abdomen brown, grey subdorsally.
Expanse 35 mm.
Hab. Rio Janeiro, Brazil.

HYDRIAS BOCHICA.

Primaries light grey, the base brown with two contiguous wavy, brown, transverse lines; a black discal spot; beyond the cell another double transverse streak, and a submarginal row of brown spots; a brown spot on the costa near the apex; the outer margin brownish except at the apex and the inner angle. Secondaries with the costal and outer margins greyish; the inner margin and disk brown; two transverse wavy brown lines. Body brownish grey.
Expanse 38 mm.
Hab. Peru.

HYDRIAS BRAGANZA.

Male. Primaries above white; brown along the inner margin and posterior half of the outer margin, also a brown spot on the costal margin close to the apex, and a smaller spot near the base. Secondaries above brown, the costal margin broadly white. Underneath brown; a marginal wavy white line at the apex of the primaries, and a short broad white band at the apex of the secondaries. Head brownish. Thorax brown in the centre, on either side white. Abdomen brown.
Expanse 34 mm.
Hab. Rio Janeiro, Brazil.

HYDRIAS LACRIMOSA.

Male. Primaries above brown; a greyish basal transverse streak, also a similar outer wavy transverse streak, beyond which on the anterior half of the wing is a submarginal whitish band; a marginal broken white line from the apex to the inner angle. Secondaries light brown, darker along the costal margin and mottled with buff; a median and a marginal indistinct transverse line. Underneath light brown; beyond the cell the wings are crossed by three darker transverse lines. Body brown.
Expanse 26 mm.
Hab. Petropolis, Brazil.

HYDRIAS SORDIDA.

Male. Primaries above brown, slightly mottled with greyish scales; a transverse outer lunular line and a submarginal deeply angular black line. Secondaries rich brown; the costal margin mottled with greyish, and an indistinct wavy marginal line. Body brown; a few greyish hairs on the thorax.

Expanse 30 mm.

Hab. Petropolis, Brazil.

TALIMA CARMEN.

Male. Primaries above grey, brownish along the inner margin, whitish at the apex; beyond the middle of the wing a semicircular row of small black spots; an upright white streak on the inner margin near the angle. Secondaries above bright red; apex and fringe greyish brown. Wings underneath red; the costal margins and apices grey. Head and thorax grey. Abdomen red dorsally, grey underneath.

Expanse 23 mm.

Hab. Petropolis, Brazil.

Fam. LIMACODIDÆ.

ECHEDORUS ARGENTINA.

Male. Wings grey, slightly hyaline and iridescent, the outer third slightly paler in colour. The primaries crossed at a third from the base by two outwardly curved, narrow, whitish lines; beyond the cell two wavy whitish lines and a wavy marginal whitish band; a small black spot at the end of the cell. Underneath, the primaries are almost denuded of scales, and show the markings of the upper surface. The secondaries above have the dark and light portions separated by a faint whitish shade, the darker portion occupying the entire inner margin; underneath, a broad median, transverse, black band, shaded with white on either side. Thorax and abdomen dark grey, with tufts of brownish hairs at the base of the wings; also similar tufts on the last segments underneath.

Expanse 43 mm.

The female is altogether more woolly, the primaries are hardly iridescent, the markings a little less distinct, and the black spot at the end of the cell more conspicuous. The secondaries are uniform dull grey.

Expanse 60 mm.

Hab. Petropolis, Brazil; Buenos Ayres.

TITYA FUMIDA.

Male. Wings smoky brown; a black spot at the end of the cell on the primaries, and a submarginal greyish band, more distinct on the primaries than on the secondaries. Body brown.

Expanse 38 mm.

Hab. Petropolis, Brazil.

TITYA ARGENTATA.

Female. Primaries above silvery white, the margins and fringe finely brown; a broad brown band from the middle of the inner margin to the costal margin near the apex. Secondaries brown. Underneath, all the wings brown. Body brown, reddish brown towards the anal segment.

Expanse 52 mm.

Hab. Rio Janeiro.

MEGALOPYGE RADIATA.

Brown, the basal half of the primaries below the median vein much darker and outwardly bordered with white, whence white lines extend towards the outer margin; at the end of the cell a large velvety brown spot; beyond the cell white lines radiate towards the apex and outer margin. Secondaries brown. Body brown. Head behind the antennæ white.

Expanse 54 mm. ♀.

Hab. Petropolis, Brazil.

MEGALOPYGE ACCA.

Primaries above pinkish brown; a blackish median transverse line. Secondaries roseate. Underneath roseate, the apices of the primaries brownish. Head and thorax brownish. Abdomen red.

Expanse 30 mm. ♂.

Hab. Rio Janeiro.

DALCERA TIJUCANA.

Primaries yellowish white, faintly reddish along the outer and inner margins and through the centre of the wing; fringe yellow; a black oblique line at the end of the cell, and a black shade along the median vein. Secondaries bright yellow. Head orange, collar yellow, thorax pinkish, and abdomen dorsally yellow; underneath orange. The wings underneath are yellow, with a small black mark at the end of the cell on the primaries.

Expanse 35 mm.

Hab. Tijuca, Rio Janeiro.

PINCONIA COA.

Orange, all the veins on the primaries outlined with yellow, more distinctly so in the male than in the female.

Expanse, ♂ 33 mm., ♀ 44 mm.

Hab. Coatepec, Jalapa, Mexico.

PARASA MINIMA.

Primaries light brown; a transverse median green band, widening on the inner margin to the base of the wing; a submarginal wavy, darker brown shade; the veins on the outer margin finely outlined with darker brown. Secondaries very light brown, somewhat darker

along the outer margin. Head and thorax light green. Abdomen brown.

Expanse 19 mm.

Hab. Coatepec, Mexico.

TRABALA CICUR.

Male. Primaries reddish yellow, the veins slightly darker; a darker basal streak along the median vein, and below this an irregular darker shade curving round it towards the apex; a marginal darker shade. Secondaries and abdomen reddish yellow. All the fringes very long.

Expanse 34 mm.

Hab. Corcovado, Rio Janeiro.

TRABALA DRUCEI.

Wings and body bright brownish yellow. On the primaries a brown, slightly curved streak from about the middle of the inner margin to the costal margin, very close to the apex; a dark marginal line.

Expanse, ♂ 30 mm., ♀ 36 mm.

Hab. Jalapa, Mexico.

This species was described and figured in the 'Biologia Centrali-Americana' as the female of *Vipsania anticlea*, Druce.

TRABALA CEBRENIS.

Primaries light green, a large brown space occupying the basal half of the wing above the median vein; the outer margin and part of the inner margin light brown, with a greyish marginal streak. Secondaries brown, slightly blackish along the outer margins. Head and thorax light green. Abdomen brown.

Expanse 28 mm. ♀.

Hab. Coatepec, Mexico.

TRABALA BRUMALIS.

Primaries above brown, darkest along the costal margin; the basal half of the median vein blackish; below this an indistinct whitish line curving upwards to the apex; beyond this a submarginal greyish shade, and then a marginal whitish shade from the apex to the middle of the inner margin; the extreme margin and fringe brownish. Secondaries light brown, thickly speckled with darker scales. Body brown; two light streaks on the head and thorax.

Expanse 42 mm. ♀.

Hab. Petropolis, Brazil.

VIPSANIA FRIGIDA.

Primaries light brown, faintly tinged with pinkish; a pale olive-green patch at the base of the costal margin, including a minute brown spot; from the base of the wings, following parallel with the inner margin for a short distance and then extending to the costal margin close to the apex, an olive-green irregular line, partly shaded

with yellowish green. Secondaries brown, slightly reddish along the inner margin. Head and thorax light greenish yellow. Abdomen dull reddish.

Expanse 29 mm.

Hab. Las Vigas, Mexico.

NYSSIA SULLA.

Primaries light reddish brown, faintly tinged with violaceous along the outer margin; a submarginal row of black points on the veins, connected by a faint black line. Secondaries yellowish white, brown at the anal angle and partly along the inner margin. Body brown; abdomen yellowish laterally and underneath.

Expanse 21 mm.

Hab. Petropolis.

NEOMIRESA COPAC.

Primaries dark cinereous brown; a basal, a median, and a submarginal transverse, wavy, darker shade; a small black point in the cell; a small olive-green spot above the submedian vein; the fringe brown with darker spots. Secondaries paler, except along the inner margin. Body dark cinereous brown.

Expanse 24 mm.

Hab. Peru.

AMYDONA SERICEA.

Primaries light brown, having a silky and wavy appearance, and shaded with darker brown, especially at the base, at the end of the cell, and submarginally. Secondaries brownish yellow. Thorax shaded with dark brown. Abdomen light brown, somewhat reddish brown dorsally.

Expanse 35 mm.

Hab. Peru.

SEMYRA STRAMINEA.

Female. Primaries reddish brown, the veins finely brownish; the inner margin and part of the outer margin purplish; two indistinct dark wavy lines from the base of the wing to the costal margin near the apex. Secondaries purplish brown, yellowish along the costal margin. Body purplish brown.

Expanse 27 mm.

Hab. Rinconada, Vera Cruz, Mexico.

EULIMACODES MÖSCHLERI.

Wings brown, the primaries with a quadrate darker space occupying the basal half of the wing below the median vein and including a small reddish and two minute white spots; a darker streak in the cell, and a subapical darker shade, beneath which are two or three small dark streaks. Body brown.

Expanse 23 mm.

Hab. Jalapa, Mexico.

Very similar in its markings to *Eulimacodes distincta*, Möschler, but a much smaller insect.

TARCHON MINOIS.

Primaries above dark reddish brown, the costal margin narrowly luteous; a black point in the cell; an outer transverse dark shade and a submarginal dark wavy line: underneath with the disk dark brown, the margins broadly light reddish brown. Secondaries above dark brown, the fringes golden brown: underneath light reddish brown; a black point in the cell, and two dark wavy transverse lines. Body dark brown above, underneath light reddish brown.

Expanse 28 mm.

Hab. Petropolis, Brazil.

Fam. BOMBYCIDÆ.

HYGROCHROA LIMOSA.

Primaries above silvery grey, light reddish brown along the inner margin, and finely so on the costa; an outer and a submarginal transverse wavy black line; a dark shade along the anterior half of the outer margin. Secondaries bronze-grey, darker along the outer margin; on the inner margin some dark brown and whitish spots. Body grey.

Expanse 26 mm. ♂.

Hab. Corcovado, Rio Janeiro.

TAMPHANA, nov. gen.

Antennæ deeply pectinated, as long as the thorax. Abdomen extending beyond the wings and laterally tufted. All the legs with tufts. Primaries long, not very broad, straight along the costa, slightly convex at the apex, outer margin slightly convex. Secondaries with the anal angle slightly prolonged, and the outer margin somewhat excavated close to the anal angle.

TAMPHANA MARMOREA.

Primaries above light brown, finely striated with dark brown; the costal margin paler; a broad basal transverse greyish band; a minute greyish spot in the cell; an outer transverse, double, wavy brown line; a large apical space on the costal margin whitish crossed by a greyish shade; a dark spot on the inner angle: underneath light brown, whitish at the apex. Secondaries above brown, with a dark spot about the middle of the inner margin: underneath light brown, with two dark transverse streaks.

Expanse 27 mm. ♂.

Hab. Palmeiras, Rio Janeiro.

AROTROS, nov. gen.

Female. Antennæ longer than the thorax, pectinated. Palpi short, tufted. Abdomen stout, the anal segment with long stiff

hairs. All the legs tufted. Primaries broad, the apex rounded, the outer margin very convex.

AROTROS STRIATA.

Wings buff, all the veins and lines between the veins brown. The primaries with the base and half of the costal margin dark grey. Head dark grey. Collar brown, with dark margins. Thorax and abdomen buff, the latter with numerous longitudinal dark streaks.

Expanse 45 mm.

Hab. Novo Friburgo, Brazil.

OLCECLOSTERIA MAYA.

Primaries above very light grey, an indistinct basal and outer transverse shade, beyond the latter a row of minute spots on the veins; a subapical, small, quadrate vitreous spot; the fringe on the middle of the outer margin dark brown; a minute black spot in the cell. Secondaries pale brownish grey. Underneath brownish grey, somewhat darker on the outer margin of the primaries below the apex; a submarginal brown line and a median brownish shade on all the wings; a fine transverse streak in the cell on the primaries. Body above grey; underneath light brownish grey.

Expanse 35 mm.

Hab. Jalapa, Mexico.

OLCECLOSTERIA MUTUSCA.

Male. Primaries above light grey, speckled with blackish scales, the apices darker; a basal and a median transverse dark wavy line; an outer row of minute black points on the veins, and a very small subapical round vitreous spot. Secondaries brownish, with two dark transverse lines. Underneath greyish brown, the apices of the primaries darker; the outer line on the secondaries forming numerous acute angles, also a small black point in the cell.

Expanse, ♂ 32 mm., ♀ 44 mm.

Hab. Rio Janeiro.

Very similar to *Olceclosteria microps*, Walker, but differs in its colour, the vitreous spot and the outer line on the secondaries underneath.

Fam. DREPANULIDÆ.

PEROPHORA CORCOVADA.

Apices of primaries not prolonged. Primaries above grey, tinged with reddish at the base, and with brown on the costal margin near the apex; a blackish submarginal line outwardly shaded with reddish brown; a vitreous spot at the end of the cell. Secondaries above with the base grey; a transverse median black line, beyond which the wing is reddish brown, except the extreme outer margin, which is grey; a small vitreous spot as on the primaries. Underneath grey speckled with black; the disk of the primaries reddish,

also a large red space on the outer margin of the primaries. Body brownish grey.

Expanse 44 mm.

Hab. Corcovado, Rio Janeiro.

PEROPHORA ACUTA.

Primaries with the apices very much prolonged. Wings light grey, speckled with black; a black spot in the cell on the primaries; on the costal margin of the same wings, at about three fourths from the base, a faint brown oblique line, which forms a sharp angle and extends to the middle of the inner margin on the secondaries. Body grey, speckled with black.

Expanse 42 mm.

Hab. Petropolis, Brazil.

Fam. COSSIDÆ.

COSSUS PARILIS.

Primaries above black, covered with a network of velvety black lines and striæ, the most conspicuous forming an extra-basal and a marginal transverse line; all these velvety black lines are finely bordered with brownish scales: underneath blackish, the costa and the outer margin greyish, with darker spots and striæ. Secondaries above whitish, with numerous transverse indistinct striæ; the inner margin broadly black: underneath almost the same, but without the dark inner margin. Thorax and abdomen black, with a few brown and grey scales.

Expanse 45 mm.

Hab. Rio Janeiro, Brazil.

COSSUS HORRIFER.

Black, the primaries above with a few velvety black lines, chiefly along the costal margin; a broad basal line, posteriorly bifurcated, and a submarginal irregular line not reaching the inner margin; the outer margin with numerous deep black striæ. The secondaries above brownish black, with a few indistinct darker lines. Underneath, the wings are dark grey, covered with blackish striæ; the disk of the primaries with long black scales. Antennæ more deeply pectinated than in *Cossus parilis*, Schaus.

Expanse 70 mm.

Hab. Rio Janeiro.

COSTRIA ABNOBA.

Primaries above dark silvery grey, the outer margin broadly brown, with darker brown spots; a basal small brownish shade; a large, round, whitish discal spot. Secondaries above brown. Underneath greyish brown, the extreme margins spotted with dark brown; the apices with a small yellowish space. Head and thorax in front dark velvety brown, thorax otherwise silvery grey. Abdomen brownish above, light grey underneath.

Expanse 66 mm.

Hab. Palmeiras, Rio Janeiro.

DOLECTA JUTURNA.

Primaries above grey, with large black spots edged narrowly with luteous, three between the median and submedian veins, one in the cell, another beyond the cell, three near the outer margin and three subapical, also some smaller spots along the costal margin. Secondaries greyish white, blackish at the base; a marginal row of blackish spots and a submarginal dark irregular band.

Expanse 63 mm.

Hab. Rio Janeiro.

DOLECTA MACROCHIR.

Primaries light brown, covered with a network of yellowish-white lines, dividing the ground-colour into a mass of small spots; a few of the spots are dark velvety brown, chiefly on the margin, and the largest spot of all is submarginal, about the middle of the wing. Secondaries paler, and consisting of indistinct brownish spots and striæ; underneath, the markings on the secondaries are more distinct. Body brown.

Expanse 46 mm. ♂.

Hab. Rio Janeiro.

DOLECTA INVENUSTA.

Primaries light grey; a few dark spots on the costal margin; a short dark streak below the median vein at the base; a dark oblique shade beyond the cell; a broad, subapical oblique spot; wavy, longitudinal, dark lines along the outer margin between the veins; the fringe with large black spots. Secondaries dark grey; the fringe paler, with dark spots as on the primaries. Underneath dark grey, consisting of numerous striæ; the fringe spotted as on the upper side.

Expanse 45 mm. ♀.

Hab. Rio Janeiro.

COSSULA NOTODONTOIDES.

Primaries above with almost the entire basal half yellowish white, shading beyond from light brown to very dark violet-brown; along the outer margin are a few paler spots and a few very dark longitudinal streaks. Secondaries above brownish. Head and thorax whitish. Abdomen brownish.

Expanse 50 mm.

Hab. Rio Janeiro.

COSSULA PRÆCLARA.

Primaries above whitish, the costa finely dark brown; a basal, a median, and an outer transverse steel-grey band, the median band being the widest; along the inner margin numerous shorter grey streaks; on the outer margin two large, round, deep red spots. Secondaries brown. Head and thorax grey. Abdomen brown.

Expanse 45 mm.

Hab. Novo Friburgo, Brazil.

LANGSDORFIA POLYBIA.

Light greyish brown, the primaries with a large whitish space occupying the outer portion of the wing; apex and outer margin, however, greyish brown; a quadrate whitish space below the median vein; here and there a few dark striæ. Underneath, the secondaries almost entirely whitish, and on all the wings widely separated dark striæ.

Expanse 40 mm.

Hab. Petropolis, Brazil.

Allied to *Langsdorfia forreri*, Druce.

GIVIRA TECMESSA.

Primaries above violaceous brown, with interrupted transverse rows of small darker spots; the basal half of the inner margin broadly velvety brown. Secondaries whitish, the outer margins broadly blackish. Length of body 14 mm.

Expanse 42 mm.

Hab. Corcovado, Rio Janeiro.

GIVIRA PHILOMELA.

Primaries whitish grey, darker along the inner margin and at the apex, and crossed by numerous short dark lines; a black spot at the end of the cell. Secondaries dark grey. Body light grey, the base of the abdomen somewhat darker. Length of body 13 mm.

Expanse 37 mm.

Hab. Corcovado, Rio Janeiro.

ZEUZERA RAMOSA.

Male. Primaries above with the costal margin dark brown from near the base to the apex; a light brownish space occupying the cell and extending somewhat beyond it; from the middle of the median vein to the centre of the outer margin an irregular black line; the base, inner margin, and outer margin otherwise white with transverse black striæ. Secondaries above white, with a few blackish striæ along the outer margin. Body whitish, speckled with black.

Expanse 41 mm.

Hab. Rio Janeiro.

Closely allied to *Eudoxyla strigillatu*, Felder.

Fam. HEPIALIDÆ.

DALACA PRYTANES.

Primaries greyish brown, with some white streaks along the costa; a short, oblique, dark brown basal streak edged with whitish; a dark brown shade, enclosing some small silvery marks, from the end of the cell to near the inner angle; a submarginal, transverse, brownish band, darker where contiguous to the above mentioned dark shade; the primaries otherwise crossed by indistinct transverse

lines. Secondaries and body brown. Underneath brownish, the costal margins luteous with dark grey spots.

Expanse 33 mm.

Hab. Petropolis, Brazil.

DALACA MUMMIA.

Very light grey, with an outer and a submarginal paler transverse band; the submarginal band is formed of contiguous quadrate spots.

Expanse 40 mm.

Hab. Petropolis, Brazil.

DALACA OREAS.

Primaries dark brown, indistinctly mottled with slightly paler lines; a small dark shade and two minute silver spots beyond the cell; an outer transverse dark line and three silver spots on the outer margin below the apex. Secondaries and abdomen brown. Head and thorax velvety brown. Underneath dull brown.

Expanse 43 mm.

Hab. Petropolis, Brazil.

DALACA TEREA.

Primaries pale fawn-colour with a reddish tinge; a small dark streak at the end of the cell, beyond which is an interrupted transverse dark line; otherwise with numerous short, transverse, pale streaks outwardly bordered with brownish. Secondaries and body very light reddish.

Expanse 42 mm.

Hab. Paso de San Juan, Mexico.

PHASSUS ABSYRTUS.

Male. Light reddish brown, the primaries crossed beyond the middle by four darker bands from the costal margin to the median vein; darker shades and light wavy streaks about the inner angle and along the inner margin. The female has the bands less distinct and crossing the entire wing.

Expanse, ♂ 63 mm., ♀ 85 mm.

Hab. Petropolis, Brazil.

Fam. NOTODONTIDÆ.

CŒLODASYS TONAC.

Female. Primaries light grey; a short oblique black line at the base; some dark greyish lines on the costa, and long grey lines between the veins on the outer margin, a large dark spot at the end of the cell, from beneath which a large oblong dark space extends towards the outer margin just above the inner angle. Secondaries whitish, with the outer margin broadly shaded with dark grey. Underneath whitish, the primaries with the costal margin and apex broadly grey. Body greyish.

Expanse 40 mm.

Hab. Paso de San Juan, Mexico.

CŒLODASYS PEGASIS.

Primaries above with the costa broadly buff, the inner margin violaceous brown, and the intermediate portion brown shaded with buff and violaceous; the base of the wing narrowly buff, limited by a transverse blackish line; at the end of the cell a short transverse brown streak, followed by several longitudinal brown streaks; the basal and outer transverse lines angular and indistinct; a submarginal series of small dark spots, and a marginal row of black points; the fringe alternately brown and buff. Secondaries brown, the fringe yellowish. Underneath brown, the fringe buff. Body brown, the collar edged with black.

Expanse 40 mm.

Hab. Petropolis, Brazil.

ŒDEMASIA TERRENA.

Primaries fawn-colour, shaded with dark brown, darkest along the inner margin; a cluster of black scales below the middle of the median vein; halfway between this spot and the outer margin another similar spot resting on the posterior portion of a very indistinct, outwardly curved, and wavy pale line, which reaches from the costal to the inner margin; the outer margin with the veins dark, finely edged with buff; a series of oblique pale lines between the veins; a large pale space at the base of the primaries. Secondaries dark brownish grey. Centre of thorax and abdomen very dark cinereous. Thorax laterally and head light fawn-colour.

Expanse 50 mm.

Hab. Coatepec, Mexico.

ŒDEMASIA MAXTLA.

Primaries fawn-colour, shaded with brown along the inner and outer margin; longitudinal brown lines on the outer half of the wing and a few pale oblique lines on the outer margin between the veins; at two thirds from the base an indistinct, pale, outwardly curved, transverse line, angular near the inner margin. Secondaries brownish, whitish towards the base. Head and thorax fawn-colour. Abdomen brownish dorsally.

Expanse 38–42 mm.

Hab. Coatepec, Mexico.

This species is very similar to *Œdemasia terrena*, Schaus, but may be distinguished by its paler colour and by the thorax, which has no dark markings.

ŒDEMASIA GUARANA.

Primaries fawn-colour; a large basal space without markings; the median space shaded with brown, beyond which is a transverse, slightly curved, narrow, white band, divided by a blackish line; the outer third of the wing dark cinereous, except a small fawn-coloured space on the outer margin below the apex, a submarginal row of blackish marks, and a marginal row of similar but smaller spots;

the inner angle whitish. Secondaries brownish grey; the fringe luteous. Head and thorax fawn-colour. Abdomen dorsally brown.

Expanse 44 mm.

Hab. Corcovado, Rio Janeiro.

ŒDEMASIA INCA.

Primaries dark brown, slightly paler on the middle of the costal margin and at the inner angle; the median space crossed by several indistinct wavy lines from the costal to the inner margin; a marginal row of velvety brown dashes, inwardly shaded with fawn-colour. Secondaries whitish, with the veins brown and the outer margin broadly shaded with brown; an indistinct transverse row of brownish points on the veins. Body brownish above; underneath paler. The antennæ for half their length are twice as deeply pectinated as in any other species of *Œdemasia* known to me.

Expanse 45 mm.

Hab. Peru.

EDEMA MATHEIS.

Dark cinereous brown, except the apical third of the costal margin on the primaries, which is creamy white streaked with light brown; at a third from the base two parallel wavy dark lines from the costal to the inner margin, and beyond the cell two similar lines; a marginal wavy line. Underneath brownish grey; the apices of the primaries yellowish.

Expanse 40 mm.

Hab. Petropolis, Brazil.

EDEMA TLOTZIN.

Female. Primaries above light grey, with two median and an outer, nearly straight, transverse black lines; a submarginal black line, concave on its anterior half, angular posteriorly; the wings otherwise crossed by several angular greyish shades. Secondaries above white, with the costal margin and apical half of the outer margin broadly shaded with brown; the inner margin and outer margin towards the anal angle only narrowly shaded with brownish scales. Body brownish grey.

Expanse 40 mm.

Hab. Paso de San Juan, Mexico.

BLERA CAUSIA.

Primaries above with the basal half and a space extending towards the outer margin white with a few black scales; the outer portion of the wing otherwise light brown, here and there shaded with greyish scales, and separated from the white portion by a black line; there are two short, parallel, black streaks beyond the cell, starting from the subcostal vein; a submarginal, very angular black line; the terminal portion of the veins are blackish. Underneath white, broadly shaded with brown and grey towards the apex. Secondaries pure white, with a small brown streak at the anal angle on the

upper surface. Head and thorax light grey. Collar and abdomen brownish grey above. Underneath, abdomen white.

Expanse 48 mm.

Hab. Corcovado, Brazil.

BLERA BIANCA.

Primaries above white, thinly speckled with brownish scales, broadly shaded with light brown at the apex, and there is a cluster of brownish scales at the inner angle; a very indistinct median and outer transverse brown line; two fine dark lines at the end of the cell; from the base of the costa to the inner margin, at one fourth from the base, two parallel black lines; a marginal, nearly straight heavy black line, having outwardly a black dash in the spaces between the veins; a submarginal wavy black line. Underneath white, shaded with black along the costal and outer margins. Secondaries above white, with the veins slightly blackish; underneath white. Head and thorax brownish grey. Abdomen light grey above, white below.

Expanse 45 mm.

Hab. Rio Janeiro, Brazil.

BLERA APELLA.

Primaries above shining greyish brown, variegated with paler scales; an indistinct basal and median black transverse line, between which is a large cluster of white scales, confined between the median and submedian veins; a wavy, outer, transverse black line, within which is a large irregular, triangular, white space, situate on the costa and extending halfway across the wing, and enclosing at the end of the cell a black ring-shaped spot; a distinct submarginal wavy black line. Secondaries above brownish white at the base, dark brown along the outer margin. Underneath, the primaries are brown, shaded with grey; the secondaries yellowish white, with the costal and outer margins brownish. Body brownish grey.

Expanse 43 mm.

Hab. Corcovado, Rio Janeiro.

BLERA SIDA.

Primaries above light brown, darker towards the base, with the basal and outer lines dark brown and very indistinct, the inner margin shaded with grey; a small oblong white spot near the base, below the median vein; a large white space on the posterior portion of the outer margin. Secondaries above light brown, the outer margin narrowly dark brown, the fringe whitish. Underneath, the primaries brownish, the secondaries white. Body grey above, whitish underneath.

Expanse 41 mm.

Hab. Corcovado, Rio Janeiro.

HETEROCAMPA LÆCA.

Male. Primaries above rich brown, mottled with greyish white;

the entire inner margin broadly greyish white; the outer margin also greyish white, with two clusters of brown scales; some grey shades along the costal margin and a large greyish space at the end of the cell; fringe grey, spotted with brown. Secondaries above dull brownish black, with a transverse pale shade from the middle of the costal margin to the anal angle; the outer margin outlined with dull brown; fringe yellowish grey. Underneath, the wings are dull brown, with paler shades chiefly along the outer margins. Head and collar reddish brown; thorax and extremity of abdomen grey; abdomen otherwise brown dorsally, grey underneath.

Expanse 48 mm.

Hab. Tijuca, Rio Janeiro.

HETEROCAMPA HERTHA.

Female. Primaries above light brown, with the base, the costal and inner margins mottled with grey; an indistinct, darker, transverse median line, and an outer triple transverse lunular line, beyond which and up to a submarginal black, wavy line the wing is leaden grey, with a dark streak in each space between the veins, and these streaks are outwardly surmounted by a cluster of brownish scales; the outer margin light brown. Secondaries above brown. Underneath yellowish white, thickly covered with brownish scales. Body grey-brown.

Expanse 50 mm.

Hab. Petropolis, Brazil.

HETEROCAMPA LIMOSA.

Female. Primaries above blackish, mottled with grey along the costal margin and towards the apex; all the transverse lines almost lost in the ground-colour; a submarginal wavy line fairly distinct; a short longitudinal black streak beyond the cell. Secondaries above whitish, the margins clouded with black, and a small black spot at the anal angle. Underneath, the secondaries are about the same; the primaries are dull black, with the costal and outer margins greyish. Body greyish.

Expanse 48 mm.

Hab. Corcovado, Rio Janeiro.

HETEROCAMPA VIRGEA.

Male. Primaries above dark olive-green, with the transverse lines dark brown shaded with lighter brown; at the end of the cell a small brown streak surrounded by a paler shade, and there are some paler spots along the submarginal line near the apex. Secondaries above light grey, with yellowish scales along the inner margin; the outer margin thickly clouded with black scales. Underneath, the wings are dirty white, the costal margin of the primaries being slightly spotted with grey. Head and thorax olive-green. Abdomen brownish, with darker clusters of scales subdorsally. Underneath, body dirty white.

Expanse 45 mm.

Hab. Petropolis, Brazil.

HETEROCAMPA EPONA.

Primaries above dull greyish green, with a large grey space on the costal margin, from the middle of the wing to the marginal transverse line, which is wavy, brownish green; the basal and median lines rather indistinct; the outer line fine, lunular, dark grey; the extremities of all the veins brownish. Secondaries above light grey, with a brown transverse lunular line starting from the costal margin near the apex, but not extending far. Head and thorax dull greenish. Abdomen light brown, with somewhat darker subdorsal tufts.

Expanse 37 mm.

Hab. Peru.

HETEROCAMPA ATRAX.

Male. Primaries above blackish grey, light grey at the base; some submarginal light grey shades; the fringe light grey spotted with black; the transverse lines black, very indistinct, being absorbed by the general ground-colour. Secondaries white, the inner margin with long dark hairs, the outer margin narrowly dark grey; the fringe whitish; the costal margin with some transverse dark grey shades. Head and thorax dark grey. Abdomen dorsally reddish brown at the base and extremity, otherwise dark grey. Underneath, body and primaries light grey. Secondaries white.

Expanse 52 mm.

Hab. Corcovado, Rio Janeiro.

HETEROCAMPA PERILLEUS.

Primaries above light brownish grey; a median wavy black line, preceded by a large blackish space, on the costal margin; the median space is crossed by an angular, dark grey line, and there are two small pale shades in the cell; the outer line is black, irregular, and followed by some broad dark brown shades; there is a marginal white shade, with inwardly a series of irregular black spots; a submarginal fine, lunular line; the fringe light grey, spotted with brownish grey: underneath blackish. Secondaries white, with the outer margin broadly dark grey; the extreme margin whitish, with the end of the veins dark grey and the fringe white; just above the anal angle a dark streak. Head and collar dark brown. Thorax grey. Abdomen grey, darker dorsally, and with a black transverse line on the anal segment.

Expanse 46 mm.

Hab. Novo Friburgo.

SYMMERISTA DENTATA.

Primaries cinereous brown, the costal margin very broadly darker, the basal half being violaceous brown, the apical half paler brown; this space is limited by an irregular velvety brown line, which starts a short distance from the base, follows through the cell, at the end of which it has a posteriorly prolonged tooth, and continues to the outer margin. Secondaries cinereous brown. Palpi dark brown.

Head light grey. Thorax greyish, with the anterior portion velvety brown. Abdomen brownish.

Expanse 44 mm.

Hab. Rio Janeiro.

SYMMERISTA TETHYS.

Primaries dark cinereous with transverse brownish shades; two inner and an outer blackish line; a marginal row of black spots, inwardly edged with yellow; a yellowish spot circled with black at the end of the cell; a whitish crescent-shaped spot on the costa near the apex; the fringe with a yellow spot at the end of each vein. Secondaries brown, very dark on the outer half; the fringe and base yellowish. Underneath, the secondaries are yellow, with the costal margin narrowly, and the outer margin broadly, brown; the fringe, however, yellow. Body brown above, yellow underneath.

Expanse 45 mm.

Hab. Corcovado, Rio Janeiro.

SYMMERISTA PROCNE.

Primaries above light grey, irrorated with darker grey and reddish scales; a large space at the inner angle white; a marginal interrupted black line; a submarginal reddish transverse shade; the apex reddish brown; the fringe on the apical half of the outer margin reddish with black spots, containing each a white dot; the fringe near the inner angle white. Secondaries above brown; fringe whitish. Underneath brown; the outer margins luteous, the primaries having also a black band on the extreme margin; fringe on the primaries reddish, on the secondaries white. Head and anterior portion of thorax, also anal segment, reddish brown; body otherwise cinereous, with an indistinct greyish subdorsal line on the abdomen.

Expanse 63 mm.

Hab. Corcovado, Rio Janeiro.

SYMMERISTA MYCONOS.

Primaries above light grey; three basal irregular dark lines; in the cell a V-shaped black line; two outer, parallel, lunular lines, followed by a series of blackish spots, largest towards the costal margin; a submarginal, angular black line, preceded at the apex by a heavy blackish shade. Secondaries with the basal half whitish, the outer half dark grey, and the fringe white. Primaries underneath dull grey, with a little white towards the base and on the outer margin between the veins. Body light grey. Collar edged with black.

Expanse 34 mm.

Hab. Petropolis, Brazil.

HARPYIA (?) TENUIS.

Primaries above dull silvery white, thinly speckled with blackish

scales; a transverse, fine, black median line, preceded on the costa by a cluster of blackish scales; the costa beyond this with some small brownish spots; the outer line very fine, indistinct, followed by a broken series of large pale brown spots, not reaching the inner angle, and each outwardly enclosing a small cluster of blackish scales; the submarginal line fine, but distinct, wavy, black. Secondaries white, with a narrow brown outer margin, and the ends of the veins shaded with brownish. Underneath, the wings are whitish, the primaries with the veins and costa brownish. Head and collar light brown; thorax and extremity of abdomen grey; abdomen otherwise dorsally light brown, below white.

Expanse 36 mm.

Hab. Petropolis, Brazil.

ROSEMA EXCAVATA.

Primaries above green, a slight excavation on the outer margin just below the apex, in this excavation the fringe is white, otherwise it is brown; the costal margin is very narrowly edged with yellowish brown, and there is an indistinct whitish discal point. The secondaries above are yellowish brown in the male, yellow in the female. Underneath the wings are yellowish brown in the male, yellow in the female, with a brownish shade on the excavation of the primaries, and a row of marginal black points on the secondaries. Head and thorax green. Abdomen yellow, darker in the male.

Expanse 36 mm.

Hab. Petropolis, Brazil.

ROSEMA LUNA.

Male. Primaries above green, with the costal margin narrowly edged with white, and a small white spot in the cell; underneath whitish, with the fringe green and the costal margin reddish. Secondaries whitish. Head and thorax green. Abdomen roseate above, white underneath.

Expanse 30 mm.

The female differs in having the costal margin underneath white, and the abdomen is dorsally white, merely shaded with red towards its base.

Expanse 34 mm.

Hab. Peru, Brazil, Novo Friburgo.

ROSEMA LAPPA.

Male. Primaries with the costal margin straight for two-thirds, and then slightly convex to the apex. Above green, the costal margin very narrowly edged with yellowish; the inner margin with an irregular brown mark from the base to the inner angle, which is itself prolonged in a slight tooth; in the cell a black point. Secondaries above whitish, with the inner margin roseate. Underneath, all the wings are whitish. Head green. Collar and thorax greyish

brown, the latter green laterally. Abdomen red above, white laterally, brown underneath.

Expanse 41 mm.

Hab. Peru.

ROSEMA INCITA.

Male. The costal margin as in *Rosema lappa*, Schaus. Primaries above green; a small black point in the cell, and a long black mark on the middle of the inner margin. Underneath whitish, with the costal margin slightly roseate. Secondaries clear white. Head green. Collar brown. Thorax brown, green laterally. Abdomen above with the base brownish, otherwise reddish; underneath white.

Expanse 32 mm.

Hab. Peru.

ROSEMA LANGUIDA.

Male. Primaries with the costal margin straight; above green, the costal margin narrowly bordered with yellowish; a small black point in the cell; the inner margin with the fringe along the basal half greyish, and a small grey spot about the middle of the margin, containing a cluster of green scales. Secondaries above pale roseate. Underneath the wings are whitish, with the costal margin of the primaries reddish. Head green. Collar grey. Thorax greyish, laterally green. Abdomen roseate dorsally.

Expanse 37 mm.

Hab. Corcovado, Rio Janeiro.

ROSEMA UNDA.

Primaries above green, with the costal margin very narrowly yellowish; in the cell a black spot circled with yellowish; near the base of the inner margin a small cluster of brownish scales. Secondaries above yellowish roseate. Underneath yellowish white, with both costal margins distinctly reddish. Head green. Collar brownish. Thorax brown, laterally green. Abdomen red above, yellowish underneath.

Expanse 34 mm.

Hab. Peru; Brazil, Novo Friburgo.

RIFARGIA CLOELIA.

Primaries above cinereous, faintly mottled with greenish and roseate; at the base of the inner margin a streak of black scales, also a few at the base of the median vein; at the end of the cell a large crescent-shaped black line, from the interior of which to the apex the ground-colour is much lighter; there is a marginal row of velvety-brown streaks and three similar subapical streaks. Secondaries smoky grey, somewhat paler at the base. Underneath the wings are greyish, the secondaries paler than the primaries. Body greyish brown.

Expanse 37 mm.

Hab. Rio Janeiro.

RIFARGIA GELDUBA.

Female. Primaries above dull cinereous, with a few greenish scales along the inner and outer margins; a few black scales forming a streak at the base of the inner margin, and some similar scales at the base below the median vein; a curved brownish shade from the middle of the subcostal vein to the middle of the outer margin, enclosing a pale space; a pale space along the subcostal vein near the apex; four subapical brown streaks between these two pale spaces; a submarginal wavy brown line. Secondaries above dark grey, paler at the base. Underneath all the wings greyish. Body brownish.

Expanse 38 mm.

Hab. Jalapa, Mexico.

ETOBESA TIZOC.

Primaries above violaceous grey, darker at the base; on the outer half of the wing, longitudinal streaks of dark velvety brown, light brown, and creamy white, the latter streaks occurring only near the middle of the outer margin; the base of the submedian vein whitish. Secondaries above white, with the anal angle dark brown; the fringe spotted with brown. Body greyish brown; the posterior portion of the thorax darker.

Expanse 35 mm.

Hab. Peru.

PHYA PSAMATHE.

Male. Primaries light brown, a dark space at the base of the costa; a black spot in the cell, from which extends a broad brown shade to the outer margin, and beneath this on the outer margin a large brown space; the fringe spotted with dark brown. Secondaries whitish hyaline; a few brownish scales at the anal angle and along the inner margin. Body brown.

Expanse 38 mm.

Hab. Corcovado, Rio Janeiro.

HAPIGIA XOLOTL.

Primaries with the basal half of the inner margin slightly excavated; apex acute; outer margin very convex. Above dull brownish grey; the basal transverse line wavy, very indistinct; the outer line straight for two-thirds from the costa, then slightly curving towards the inner angle, brown, inwardly shaded with buff; a submarginal angular black line, shaded with silver scales, close to the apex; at the end of the cell a large irregular and a small round golden spot, the larger one having its centre reddish bronze. Secondaries above brownish grey, yellowish white towards the base. Underneath dull grey. Body grey.

Expanse 60 mm.

Hab. Paso de San Juan, Mexico.

HAPIGIA ACCIPITER.

Primaries with the costa straight; the apex acute; the outer margin straight just below the apex, then oblique to the inner angle, which is prolonged in a long, broad tooth. Above brown, shaded with olivaceous at the base; on the inner margin some pale reddish-brown marks; a median, transverse, wavy, blackish-brown line, further from the base on the inner margin than on the costal margin; in the cell a conspicuous black point, beyond which two indistinct, irregular, paler spots, faintly outlined with black; the outer line straight, dark, inwardly shaded with lighter brown; the submarginal line very irregular, black, preceded by a broad wavy shade, especially noticeable towards the apex. Secondaries above blackish brown, dull white along the costal margin; a yellow spot on the fringe at the end of each vein. Underneath all the wings yellowish, with long blackish scales on the primaries below the subcostal vein. Body dark olivaceous brown above, reddish brown underneath.

Expanse 70 mm.

Hab. Rio Janeiro.

HAPIGIA PHOCUS.

Shape of wings and markings very similar to *Hapigia apulus*, Cramer. Primaries above much darker than in *H. apulus*, being of a rich velvety brown, with the inner and outer margins paler; the outer transverse line is not so wavy as in *H. apulus*, and the two silver spots in the cell are closer together. Secondaries above white; the inner margin and fringe greyish brown; the veins brownish. In *H. apulus* the apex of the secondaries is broadly shaded with brown. Underneath the wings are whitish, with the costa and apex of the primaries powdered with brown. Head and thorax brown. Abdomen above black. Underneath brown. Anal hairs testaceous.

Expanse 70 mm.

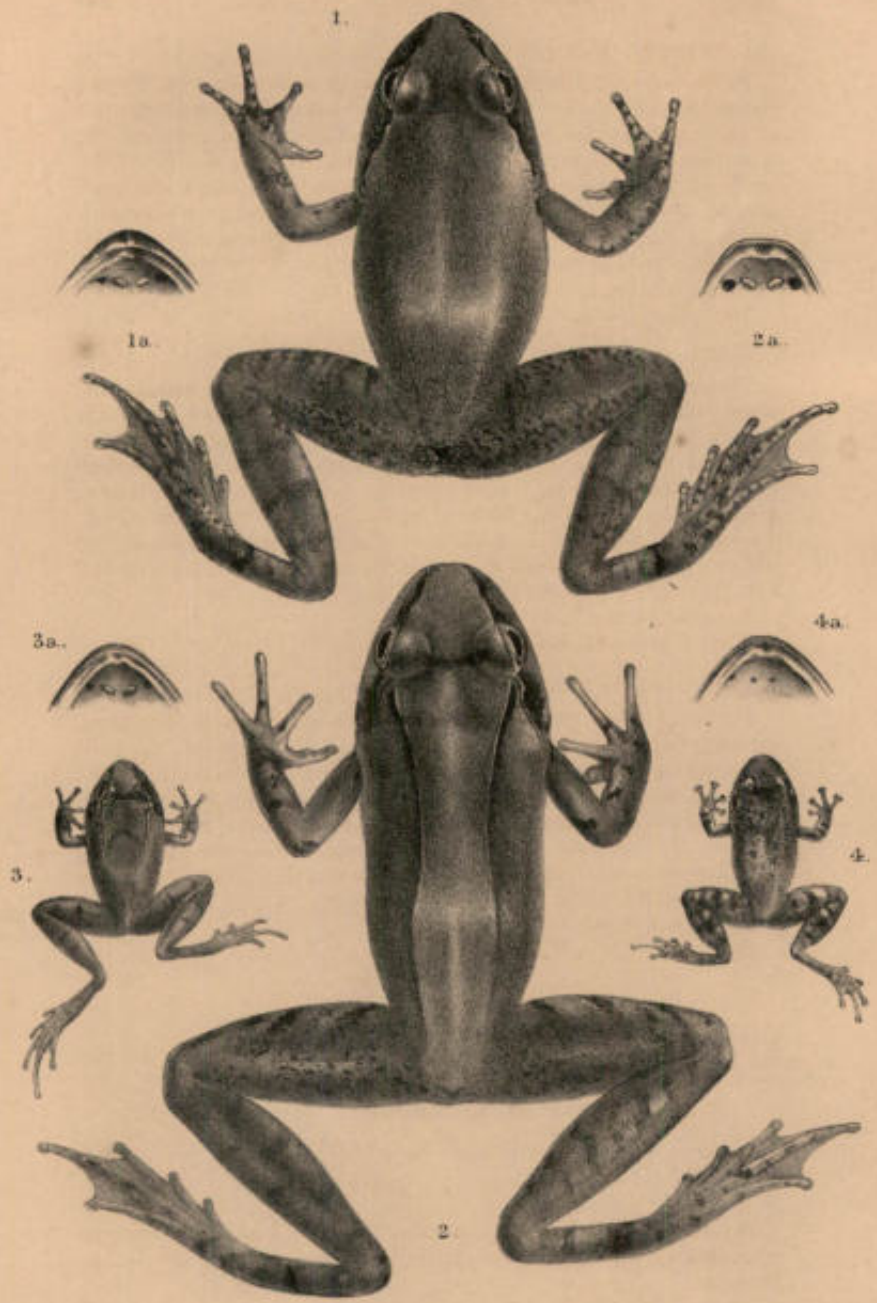
Hab. Rio Janeiro, Brazil.

RHUDA ENDYMION.

Primaries above with the anterior portion of the wing shading from light brown at the base to pale buff towards the outer margin, and with a few longitudinal dark streaks; a heavy velvety-brown line, extending from the base of the costa to the middle of the outer margin, separates the brownish portion of the wing from the posterior portion which is light grey; on this grey space a trace of the outer line is visible; the costal margin towards the apex is also greyish; on the extreme outer margin a row of V-shaped brown marks. Secondaries white; the inner margin broadly covered with long brown scales, and the outer margin spotted with brown. Underneath the wings are whitish, with the costal margin of the primaries broadly smoky brown. Head brown. Collar velvety brown. Thorax grey. Abdomen above brownish grey, below whitish.

Expanse 58 mm.

Hab. Rio Janeiro.



Peter Smit. del. et lith.

Mintern Bros. imp.

INDIAN FROGS.

ICHTHYOSOMA CASSIOPE.

Primaries very pale fawn-colour, crossed by four narrow, double, zigzag lines of a darker shade—one at the base, one through the end of the cell, the third beyond the cell, and the fourth marginal, the latter shaded inwardly with smoky brown; on the middle of the inner margin a reddish-brown spot. Secondaries white, the inner margin covered with long reddish-brown scales. Underneath white, slightly reddish on the costal margins. Thorax and abdomen above pale reddish brown; underneath white.

Expanse 49 mm.

Hab. Rio Janeiro.

MARTHULA NORA.

Primaries above brown, broadly lilacine on the inner margin, and some reddish-brown shades along the costal margin and about the middle of the outer margin; the basal, median, outer, and submarginal lines pale, the first three absorbed by the ground-colour on the costal margin, where crossing the reddish-brown shades. Underneath brownish, with a broad whitish marginal shade. Secondaries above white, with the veins and outer margin shaded with brown. Underneath white. Head reddish brown. Collar and abdomen brown. Thorax lilacine.

Expanse 34 mm.

Hab. Corcovado, Rio Janeiro.

MARTHULA PLEIONE.

Primaries above brown, the inner margin broadly grey; the basal, median, and outer lines only visible on the inner margin; the submarginal line distinct throughout; a marginal row of black points; on the costa near the base a small yellowish-white patch, and a much larger one about the middle of the costa, these are both crossed by irregular reddish-brown lines. Underneath brown. Secondaries above brown, slightly hyaline towards the base. Underneath yellowish white. Body greyish brown.

Expanse 36 mm.

Hab. Corcovado, Rio Janeiro.

4. On some Specimens of Frogs in the Indian Museum, Calcutta, with Descriptions of several new Species. By W. L. SCLATER, M.A., F.Z.S.

[Received May 2, 1892.]

(Plate XXIV.)

Before leaving Calcutta at the end of last year I had been engaged in examining the collection of Batrachians contained in the Indian Museum.

The collection comprises examples of 180 species, of which 103

are Indian and Malayan, and 77 are exotic. The number of specimens is 2045, of which again the bulk (1698) are Indian, and 347 are exotic.

The number of species of Batrachians described in Mr. Boulenger's recent book ('Reptilia and Batrachia of British India') is 130, of which 5 are referred to the Batrachia Apoda, and 1 to the Batrachia Caudata; leaving 124 belonging to the Batrachia Salientia; so that it will be seen that a considerable number of the Indian species are still unrepresented in the Indian Museum. A list of these desiderata is given below.

The collection contains a considerable number of types described by Stoliczka, Anderson, Blyth, and others. Of these also I have thought it worth while to give a list.

A complete list of the specimens of Batrachians in the Indian Museum which I have drawn up will shortly be printed and published by order of the Trustees. In the meanwhile I offer to the Society these notes upon some of the more noteworthy specimens.

My best thanks are due to Mr. G. A. Boulenger of the British Museum, who has most kindly assisted me both in naming obscure specimens and in drawing up the descriptions of the new species. The types of the latter will all be returned to the Indian Museum.

1. Rana vicina. (Plate XXIV. figs. 1, 1 *a*.)

This Frog was described by Stoliczka (Proc. As. Soc. Beng. 1872, p. 130), and was with doubt referred by Boulenger (Ind. Rept. p. 445) to *Rana liebigii*.

An examination of the type at once shows that this Frog has nothing to do with *R. liebigii*, but that it must remain separate as a distinct species.

The following is a redescription of the type:—Vomerine teeth, two small oblique groups commencing at the middle of the choanæ and extending somewhat behind them; no tooth-like prominence on the lower jaw in the two specimens available for examination; head moderate; snout somewhat oval; canthus rostralis slightly marked; nostril halfway between the eye and the tip of the snout; upper eyelid two-thirds the width of the interorbital space; no trace of the tympanum; fingers blunt, first slightly shorter than the second; toes webbed to the extreme tips; subarticular tubercles well marked and a long narrow not very large inner metatarsal tubercle, about half the length of the inner toes; no outer metatarsal tubercle; tibio-tarsal articulation reaches to in front of the eye; skin of back and belly smooth, a few tubercles on the flanks. Brown above; hind limbs mottled darker; upper lip dark brown and a dark irregular line from the nostril to the eye and from the eye to the commencement of the arm; below lighter brown, rather darker under the chin.

This Frog seems on the whole most nearly allied to *R. corrugata*, Peters, from Ceylon, from which, however, it differs in the absence of the tooth-like prominences of the lower jaw, the much broader

upper eyelid, and the longer legs; its aspect, too, is different, owing to the eyes being normally placed, instead of being prominently turned upwards.

Besides the original type, which was procured by Stoliczka at Murree, in the Himalayas, at an elevation of 6000 ft., there is a second specimen in the Indian Museum presented by Lieut. Newnham, and procured near Simla. The figure is taken from the former specimen, the type of the species.

2. Rana liebigii, Günth.; Boulenger, Ind. Rept. p. 445.

This species has not been known to occur west of Nepal, whence came the type. There is, however, an example in the Indian Museum from Tavoy in Southern Burma, which extends its geographical range considerably beyond what has hitherto been known.

3. Rana feæ, Boulenger, Ann. Mus. Genova, (2) v. 1887, p. 418, pl. iii.; id. Ind. Rept. p. 446.

Among the Frogs of the Indian Museum I have found a second specimen of this species. This was procured at Hotha in Yunan by Dr. J. Anderson, but was apparently not described by him in his 'Scientific Results of the Yunan Expedition.'

4. Rana assamensis, sp. n. (Plate XXIV. figs. 2, 2 *a*.)

Vomerine teeth in two strong, slightly oblique, series between the choanæ, commencing at the inner anterior corner; lower jaw not provided with bony prominences in the single specimen available for examination; head moderate, somewhat blunt and narrow; nostril equidistant from the eye and the tip of the snout; interorbital space very slightly broader than the upper eyelid; canthus rostralis marked, loreal region concave; tympanum very distinct, somewhat oval, barely half the diameter of the eye; fingers rather slender, the first and second nearly equal in length; toes webbed to the tips, with the tips slightly swollen; subarticular tubercles well developed, inner metatarsal tubercle elongate, and about two-thirds the length of the inner toe; no outer tubercle; a tarsal fold present; the tibio-tarsal articulation reaches well beyond the tip of the snout; skin smooth above and below.

Colour in spirit: above brown, the canthus rostralis and a patch behind the eye embracing the tympanum darker; a dark line with white edges running from the eye on either side backwards to the sacrum, corresponding in position to the glandular lateral folds, but no trace of a glandular lateral thickening can be distinguished; legs transversely barred; below lighter, with darker spots on the lower jaw.

Length from snout to vent 70 millim.

Allied to *Rana andersonii*, but the vomerine teeth commence at the anterior inner edge of the choanæ, and the legs are considerably longer, the tibio-tarsal articulation reaching some way beyond the tip of the snout.

Described from a single specimen in the Indian Museum, procured by the late Dr. Jerdon in the Khasia hills in Assam.

5. Rana hascheana, Stoliczka, Journ. As. Soc. Beng. xxxix. 1870, p. 147, pl. ix. fig. 3.

An examination of the type of this species preserved in the Indian Museum shows that it is nearly allied to *R. doriæ*, Boulg. The general shape is the same, the legs are about the same length, and the vomerine teeth commence on a level with the hinder edge of the choanæ. The only real distinction is in the toes, which in *R. doriæ* are webbed to the tips, but in *R. hascheana* for only about one-third of their length.

6. Rana limborgi, sp. n. (Plate XXIV. figs. 3, 3 *a*.)

Vomerine teeth in two oblique groups, commencing on a level with the choanæ and extending well behind them; slight traces of the bony prominences of the lower jaw; head moderate; snout short, hardly longer than the diameter of the orbit; canthus rostralis very rounded, hardly marked; loreal region almost flat; nostril about equidistant from the tip of the snout and the front of the orbit; interorbital space as broad as the upper eyelid; tympanum distinct, nearly as large as the eye, with a very thick fold above it; first finger extending slightly beyond the second; toes moderate, slender, only about a third webbed, the web extending only about halfway up the first joint of the digits; a slight cutaneous ridge along the fifth toe; tips of fingers and toes but very slightly swollen; subarticular tubercles fairly well developed; no outer metatarsal tubercle; a large, compressed, fairly sharp-ridged inner metatarsal tubercle, very nearly as large as the inner toe; traces of a tarsal fold present; the tibio-tarsal articulation reaches the nostril; skin above granular, with slight traces of a granular lateral fold running back on either side from behind the eye and a transverse fold between its posterior borders; below smooth.

Colour above a faded olive-brown, below lighter.

Length from snout to vent 24 millim.

This species is somewhat intermediate between *R. doriæ* and *R. rufescens*; from the former it differs in having only very slightly webbed toes and a compressed flattened metatarsal tubercle, and from the latter in its vomerine teeth, which commence only on a level with the posterior corners of the choanæ, and from both in the presence of its rudimentary glandular lateral fold.

This description is taken from a single specimen procured in Tenasserim by Mr. Limborg, to whom I have dedicated the species.

7. Rana tigrina, Daud.; Boulenger, Ind. Rept. p. 449.

A small Frog from Penang, described by Stoliczka (Journ. As. Soc. Beng. xxxix. 1870, p. 142) as *R. gracilis*, var. *pulla*, seems to be merely the young of *R. tigrina*; that the type has only just lost the larval tail is shown by the persistence of the tail-scar.

8. RANA TENASSERIMENSIS, sp. n. (Plate XXIV. figs. 4, 4 *a*.)

Vomerine teeth not well developed, in one specimen absent altogether, in another in two oval groups between the choanæ; no papillæ on the tongue; head short and rounded, with indistinct canthus rostralis and slightly concave loreal region; nostril a good deal nearer the tip of the snout than the eye; interorbital space somewhat wider than the upper eyelid; tympanum distinct, about two-thirds the size of the eye; fingers and toes moderate, the tips dilated into quite large disks, about one-third the size of the tympanum; first finger much shorter than the second; toes rather less than one-third webbed, webs extending to about a level with the first joint of the phalanges; subarticular tubercles moderate; a small oval, flat, inner metatarsal tubercle; no tarsal fold; a fringe along the fifth toe; tibio-tarsal articulation reaching to a level with the front of the eye; skin of the back wrinkled into short longitudinal glandular folds; a fold from the eye to the shoulder above the tympanum.

Above brown, with darker spots and scattered white blotches; limbs both fore and hind cross-barred; beneath lighter brown, minutely speckled with darker.

Length, snout to vent 22 millim.

This Frog seems to be most nearly allied to *R. leptodactyla*, from which, however, it differs in wanting the free pointed papillæ of the tongue and having shorter legs. It is altogether a very distinct species.

It is perhaps somewhat near to *R. hascheana*, Stol. (above, p. 344), from which, however, it differs in its rough granular skin, its indistinct vomerine teeth, and lastly, and chiefly, in its very much larger fingers and toe-disks.

There are five examples of this species in the Indian Museum, all collected by Mr. Limborg in Tenasserim.

9. RANA GRACILIS, Gravenh.; Boulenger, Ind. Rept. p. 456.

The type of *Lymnodytes macularius*, Blyth, which species has been identified by Boulenger with *R. gracilis*, Gravenh., agrees very well with the description given of this Frog by Boulenger (*loc. cit.*), except for the fact that the skin above is very distinctly granulate, as in *R. malabarica*.

10. RANA NIGROVITTATA (=TYTLERI) and R. ERYTHRÆA.

The distinction drawn by Boulenger, namely, the presence of an outer metatarsal tubercle in *R. tytleri* and its absence in *R. erythræa*, does not seem to be very constant; in fact the only difference of specific value between the two forms seems to be that in *R. erythræa* the dorsal glandular lateral fold is very much thicker and more prominent than in *R. tytleri*.

The type of *Hylorana tytleri* of Theobald, which is in the Indian Museum, has a very thick glandular lateral fold, and must therefore be referred to *R. erythræa*; the other species, the form described by Boulenger under the name *R. tytleri*, will therefore require

another name. *Hylorana leptoglossa*, Cope, the second name in Boulenger's list of synonyms, also refers to a species with a thick and heavy glandular lateral fold, and must therefore be referred to *R. erythræa* too; of *Hylorana pipiens*, Jerdon, the specific name "*pipiens*" is already engaged; *Hylorana granulosa*, Anderson, refers to a different species altogether (see below).

The type of *Limnodytes nigrovittatus* (Blyth, Journ. As. Soc. Beng. xxiv. 1855, p. 718) is still in the Indian Museum, and an examination of it shows that it must clearly be referred to Boulenger's *Rana tytleri*. The species will therefore stand under the name *Rana nigrovittata* (Blyth).

There are examples of this species in the Museum from all parts of Assam, Cachar, Pegu, and Tenasserim, and of *R. erythræa* from Lower Bengal (Calcutta and Dacca), Assam, and Burma.

11. Rana granulosa, Anderson, Journ. As. Soc. Beng. xl. 1871, p. 23.

This species has been provisionally identified by Boulenger (Ind. Rept. p. 458) with *Rana nigrovittata* (=*Rana tytleri*, Boul.), but it differs markedly from it in many ways. The vomerine teeth are longer, and usually reach to well behind the choanæ; the first finger extends well beyond the second; the toes are two-thirds webbed, the web being deeply incised and barely reaching to the tips of the third and fifth digits; the subarticular and the inner and outer metatarsal tubercles are all very strongly developed; the skin of the back is markedly granulate, with broad prominent glandular lateral folds; there is a second glandular fold along the upper lips from below the eye to the shoulder, ending in a large rounded granule; the colour is reddish brown above, irregularly spotted, darker below, speckled throughout.

12. Rhacophorus lateralis, Boulenger, Ann. Mag. N. H. (5) xii. 1883, p. 162; id. Ind. Rept. p. 473.

There is a second specimen of this hitherto unique species in the Indian Museum; it was obtained by Mr. W. M. Daly at Koppa in Mysore, and by him presented to the Museum.

13. Rhacophorus cavirostris (Günth.); Boulenger, Ind. Rept. p. 481.

There is a Frog in the Indian Museum resembling the type of *R. cavirostris* in every respect, except that the hind limbs are a little longer, since the tibio-tarsal articulation reaches the tip of the snout, whereas in the typical form the tibio-tarsal articulation reaches only to between the eye and the snout.

The Indian Museum specimen was procured by Limborg in Tenasserim, and, if correctly referred to *R. cavirostris*, considerably extends the distribution of this species, which has hitherto been known only from Ceylon.

14. Ixalus cinerascens, Stoliczka, Proc. As. Soc. Beng. 1870, p. 275.

This species has been referred by Boulenger (Ind. Rept. p. 510) to *Leptobrachium monticola*; but an examination of the type shows that it is a true *Ixalus*, and that it is most nearly allied to *Ixalus hypomelas*, Günth., from which it differs in its shorter snout and its shorter legs, the tibio-tarsal articulation only reaching as far as the eye; the legs also are cross-banded.

15. Ixalus glandulosus (Jerdon); Boulenger, Ind. Rept. p. 488.

Ixalus punctatus (Anderson, Journ. As. Soc. Beng. xl. 1871, p. 27), identified with doubt by Boulenger with *Ixalus leucorhinus*, is really, as shown by comparison of the type in the Indian Museum, identical with *Ixalus glandulosus*.

16. Ixalus asper, Boulenger, P. Z. S. 1886, p. 415.

The Indian Museum possesses an example of this species procured by one of the Museum Collectors in the Burma-Siam hills. It had previously been got only by Mr. Wray in Perak, so that it is an addition to the Indian fauna. The Indian Museum specimen agrees in every way with the type, with which it has been compared.

17. Microhyla achatina (Boie); Boulenger, Cat. Batr. Sal. p. 166.

The Indian Museum possesses an example of this little Frog from Ahsoon in Tenasserim. As this species has been hitherto recorded only from Java and the Moluccas, it is an addition to the fauna of British India.

18. Bufo stomaticus, Lütken; Boulenger, Ann. Mag. N. H. (6) vii. 1891, p. 463.

The Indian Museum possesses examples of this Toad from Calcutta and Burma, which agree very well with the type in the British Museum. This species is probably not uncommon in Lower Bengal, but has hitherto been confounded with *Bufo andersonii*.

19. Bufo parietalis, Boulenger, Cat. Batr. Sal. p. 312.

A Frog in the Indian Museum from Hongkong, received from the Hongkong Museum in exchange, seems referable to this species, which has hitherto been got only in Malabar. It is just possible that a mistake has been made in the labelling; but if this is not the case, the distributional area of this species is considerably extended.

20. Leptobrachium carinense, Boulenger, Ann. Mus. Genova, (2) vii. 1889, p. 748; id. Rept. Ind. p. 511.

An example of this species, procured very many years ago by Major Berdmore in Burma, and named *Megalophrys montana* by Blyth, is very interesting, in that it possesses vomerine teeth in two very nearly parallel lines between the choanæ, and separated

from one another by a considerable interval. In the types of *L. carinense* described by Boulenger the vomerine teeth are entirely absent, but they are to be found in the nearly allied *L. feæ*. This shows the uselessness of vomerine teeth alone as a generic or even as a specific distinction. Further, in this specimen the interorbital space is very wide, three times as broad as the upper eyelid; and there are two palpebral appendages on either side to the eyelids.

List of the Types of Species of Batrachia contained in the Indian Museum.

Rana vicina, *Stol.*
—— assamensis, *Scl. f.*
—— hascheana, *Stol.*
—— limborgi, *Scl. f.*
—— plicatella, *Stol.*
—— tenasserimensis, *Scl. f.*
—— nigrovittata (*Blyth.*).
—— granulosa, *Anders.*
—— nicobariensis (*Stol.*).
—— monticola (*Anders.*).
Rhacophorus maculatus, *Anders.*[1]
Rhacophorus tuberculatus, *Anders.*
—— cruciger (*Blyth.*).
Ixalus cinerascens, *Stol.*
Microhyla berdmorii (*Blyth.*).
Callula variegata, *Stol.*
Bufo olivaceus, *Blanford.*
—— penangensis (*Stol.*).
Cophophryne sikkimensis (*Blyth.*).
Hyla annectens (*Jerdon*).
Tylototriton verrucosus, *Anders.*

List of Species of Indian Batrachia unrepresented in the Indian Museum.

Rana corrugata, *Peters.*
—— khasiana (*Anders.*).
—— sternosignata, *Murray.*
—— andersonii, *Boul.*
—— dobsonii, *Boul.*
—— strachani (*Murray*).
—— leithii, *Boul.*
—— diplosticta (*Günth.*).
—— phrynoderma (*Boul.*).
—— lateralis, *Boul.*
—— margariana (*Anders.*).
—— humeralis, *Boul.*
—— formosa (*Günth.*).
Micrixalus sarasinorum (*F. Müll.*).
—— opisthorhodus (*Günth.*).
Nyctibatrachus pygmæus (*Günth.*).
Nannophrys ceylonensis, *Günth.*
—— guentheri, *Boul.*
Rhacophorus nasutus (*Günth.*).
—— reticulatus (*Günth.*).
—— dubius, *Boul.*
Rhacophorus jerdonii (*Günth.*).
—— fergusonii, *Boul.*
Ixalus schmardanus (*Kelaart*).
—— hypomelas, *Günth.*
—— vittatus, *Boul.*
—— femoralis, *Günth.*
—— beddomii, *Günth.*
—— adspersus, *Günth.*
Callula macrodactyla, *Boul.*
Glyphoglossus molossus, *Günth.*
Calluella guttulata (*Blyth.*).
Nectophryne tuberculosa (*Günth.*).
Bufo pulcher, *Boul.*
—— hololius (*Günth.*).
—— macrotis, *Boul.*
—— beddomii, *Günth.*
Leptobrachium feæ (*Boul.*).

Uræotyphlus malabaricus (*Bedd.*).
Gegenophis carnosus (*Bedd.*).

EXPLANATION OF PLATE XXIV.

Fig. 1. *Rana vicina*, Stol., p. 342.
2. —— *assamensis*, sp. n., p. 343.
3. —— *limborgi*, sp. n., p. 344.
4. —— *tenasserimensis*, sp. n., p. 345.

[1] This name has been changed by Boulenger (Cat. Batr. Sal. p. 90) to *bimaculatus*.

5. On some Aquatic Oligochætous Worms. By Frank E. Beddard, M.A., F.R.S.E., &c.

[Received May 3, 1892.]

In the following remarks I propose to bring together a few notes upon certain aquatic Oligochæta which I have had the opportunity of examining during the last year.

i. *On a Species of* Dero.

Our principal knowledge of this genus is due to Perrier [1] and to Štole [2]. A recent paper by Bousfield [3] is mainly devoted to discriminating the species, though it contains a brief *résumé* of the structure of the genus *Dero*.

I have recently been studying a species which I cannot identify certainly with any known form; my failure to identify it is largely due to the fact that the differences in the vascular system of different species have not been worked out. Only in two, viz. *D. perrieri* and *D. digitata*, has the vascular system been described; and as these two show dissimilarities, it is at least possible that the remaining species do also. In any case, the *Dero* at which I have worked differs from both these species. According to Perrier, *Dero perrieri* has three pairs of contractile perivisceral trunks in segments vi., vii., and viii. Behind the viiith segment the dorsal vessel is not directly united with the ventral.

Of *Dero digitata*, Štole says, in the French abstract with which his paper concludes, "Il y a toujours deux vaisseaux latéraux dans chaque anneau suivant jusqu'au treizième anneau (si l'animal est complètement développé). Dans les anneaux postérieurs les anses vasculaires remplacent les vaisseaux latéraux." I cannot, I confess, quite understand the distinction which is here drawn between the two kinds of perivisceral trunks; unless, indeed, it is meant that the anterior series are contractile. As Dr. Štole's paper is in Bohemian I am unable to say whether this is stated.

The *Dero* examined by myself is a small species about a quarter of an inch in length. Like other *Deros* it fabricates a tube, which was always in the interior of half-decayed stems of plants; the stems had to be carefully torn up with needles to liberate the worms [4]. The number of segments varied from 16 to 52. The characters of the setæ call for no comment; the branchial processes most resemble those of *D. limosa*.

The vascular system is remarkable for the fact that there are six pairs of contractile lateral vessels in segments vi.–xi. Those of

[1] "Histoire naturelle du *Dero obtusa*," Arch. Zool. Exp. t. i. p. 65. Bousfield points out that the species investigated by Perrier is not *Dero obtusa*, but a new form for which the name *D. perrieri* is suggested.

[2] "*Dero digitata*, O. F. Müller &c.," SB. böhm. Ges. 1885, p. 65.

[3] "The Natural History of the Genus *Dero*," J. Linn. Soc., Zool. vol. xx. p. 91.

[4] Bousfield mentions this habit in *D. furcata*.

segments viii. and ix. are wider than the others; the pair of segment vii. are hardly of less calibre; the other contractile lateral vessels are decidedly thinner. The non-contractile perivisceral vessels were obvious in the posterior segments of the body. The first pair of "hearts" each give off a slender branch, which runs forward in the direction of the pharynx. I did not find a corresponding branch to arise from the following "hearts."

The "stomach" is in segments x. and xi.; the wider part of the intestine commences in segment xiv., but there was some variability in this point. In some individuals I could recognize no narrow œsophagus following the "stomach." The lattice-work of blood-vessels upon the alimentary tract was in many specimens very clear. On the "stomach" this was particularly so, and I found a longitudinal trunk, such as Stole has figured in *Nais*, on one side; the nephridia vary much as to the segment where they begin. Perrier mentions the sixth segment, so too does Bousfield. In the first individual which I examined they were apparent from the viiith segment; in another they did not begin until the xiith segment; in a third the ninth segment contained the first pair.

ii. *Note upon* Pristina longiseta.

In a valuable paper upon the Naidomorpha, published in a recent number of 'The Quarterly Journal of Microscopical Science,' Prof. A. G. Bourne[1] remarks of *Pristina longiseta*, "This species has been recently re-described by Vejdovsky. I have not seen it, nor has it, so far as I know, ever been recorded from England."

Having lately had the opportunity of examining a specimen, I offer the following remarks upon it. Firstly, its occurrence in England is of interest. There is no doubt, however, that the small number of aquatic Oligochæta hitherto recorded from Great Britain is simply due to the fact that they have not been looked for. The worm has been figured by Leidy[2], d'Udekem[3], and Vejdovsky[4]. Neither d'Udekem nor Tauber[5] appear to have known of Leidy's paper. Vejdovsky does not refer to it in the list of synonyms of *Pristina longiseta*, but does mention both the paper and the species, without comment, under the description of the family Naidomorpha; in the table of known species of Naids and their distribution Vejdovsky does not cite N. America as a locality for *Pristina longiseta*. The double omission therefore leads me to the opinion that Vejdovsky was not certain as to the identity of the species termed by himself and Leidy *Pristina longiseta*. Vaillant, moreover, considers that the identity of the two is not fully established; the only difference, however, to which he calls attention is a difference of

[1] "On the Naidiform Oligochæta, &c.," Q. J. M. S. vol. xxxii. p. 352.
[2] "Descriptions of some American Annelida Abranchia," J. Ac. Nat. Sci. Philad. vol. ii. p. 44.
[3] "Nouvelle Classification des Annélides Sétigères Abranches," Bull. Ac. Roy. Belg. t. xxii. p. 552.
[4] System und Morphologie der Oligochaeten: Prag, 1884, p. 31.
[5] Annulata Danica, 1879, p. 73.

size. Leidy's specimen measured 1 line (=2 mm.), Vejdovsky's 8 mm. My own specimen being somewhat intermediate in size perhaps removes this difference. But a more important difference remains, which is not alluded to by Vaillant[1]. In Vejdovsky's figure[2] of *Pristina longiseta* no sharp line of demarcation is indicated between the prostomium and the first segment of the body, and in the description of the species[3] he remarks:—"Der Kopflappen verjüngt sich allmälig zu einem konischen fadenförmigen Rüssel." On the other hand, Leidy's figure indicates a sharp demarcation; the "proboscis" commences quite abruptly. So too, though perhaps to a less extent, does d'Udekem's figure. The specimen examined by myself resembles Leidy's figure much more than that of Vejdovsky. The location of the "stomach" by Leidy in the viith segment may be perhaps an error. I found, as Leidy has figured, tactile hairs to be very abundant upon the anal segment as well as upon the prostomium and first segment of the body. It appeared to me that the prostomium was deeply grooved upon the under surface, the groove becoming continuous behind with the mouth. In view of the slight difference recorded above, I am not assured that Leidy's and Vejdovsky's worms belong to the same species; the specimen seen by myself evidently is identical with the worms described by Leidy and d'Udekem. Prof. Bourne's paper, to which I have referred, seems to me to destroy the generic distinctions between *Pristina* and *Naidium*. Previous to the appearance of that paper they could be distinguished as follows:—

Pristina:

1. Dorsal setæ of segment iii. long.
2. Prostomium elongate.
3. Shorter dorsal setæ not bifid.

Naidium:

1. These setæ not longer than others.
2. Prostomium short with lateral processes.
3. These setæ bifid.

But in Bourne's *Pristina equiseta* the first character is that of *Naidium*, and in *P. breviseta* there are bifid setæ in the dorsal bundles much like those of *Naidium*. The only differential character which remains is therefore the prostomial tentacle; but in *Naidium luteum* the prostomium is said by Vejdovsky to be "lang ausgezogen," and in *P. longiseta*, as figured by the same author, the prostomial tentacle is not so distinct as in other species. I do not think, therefore, that these two genera can be any longer distinguished.

iii. *On Æolosoma niveum.*

The only description of this species was published nearly thirty years ago by Leydig[4]; it has since been met with by Timm[5], who

[1] 'Annelés' in 'Suites à Buffon,' vol. iii. p. 360.
[2] *Loc. cit.* pl. ii. fig. 13. [3] *Loc. cit.* p. 31.
[4] "Ueber die Annelidengattung *Æolosoma*," Arch. f. Anat. 1865, p. 360.
[5] "Beobachtungen an *Phreoryctes*, &c.," Arb. z. z. Inst. Würzb. 1883, p. 155.

called it—evidently by a slip of the pen—"*Æolosoma lacteum*." I have lately examined a single specimen of an *Æolosoma* which I refer to this species. Unfortunately I am not able to fix its locality with accuracy, as I found it in a bottle containing water and weeds from various sources.

Leydig himself was of opinion that the species might turn out on further study to be an immature stage of *Æ. hemprichii*, or of some species with coloured oil-drops in the integument; but he quoted, as against this possibility, Ehrenberg's observation that the red colour is visible in embryos still within the egg, and was therefore, on the whole, inclined to regard the worm as an adult form of a species with a colourless integument.

I have, however, recently pointed out that[1] the supposed cocoons are in all probability merely cysts into which the worms can temporarily withdraw themselves; so that Leydig's opinion as to the possibility of his *Æolosoma niveum* being an immature form is not necessarily rendered untenable by Ehrenberg's observations.

Vejdovsky[2] in describing briefly the characters of his new species, *Æolosoma variegatum*, remarked that it was "höchst wahrscheinlich von Leydig beobachtet und als *Æolosoma niveum* beschrieben." In a fuller account[3] of *Æ. variegatum* Vejdovsky establishes its distinctness from *Æolosoma niveum*; it agrees, however, with that form in possessing some colourless oil-globules in the epidermis, the rest being green. In *Æolosoma niveum* all the integumental oil-globules are colourless.

The most recent remarks upon Leydig's *Æolosoma niveum* known to me are to be found in Vaillant's account of the Oligochæta in the 'Suites à Buffon.' In that work Vaillant considers it to be not yet established that the supposed species is not the young form of some other *Æolosoma*. I am therefore particularly glad to be able, I think, to definitely settle this question.

I had on the same slide and under examination at the same time no less than three species of *Æolosoma*—an experience which is not, I imagine, very common. These species were, *Æ. quaternarium*, *Æ. niveum*, and a species of whose identity I am not quite certain; it was as large as my *Æolosoma headleyi*[4], but may be *Æolosoma variegatum*; I lost sight of it before I completed the examination. The worm which I believe to be *Æolosoma niveum* is at any rate a perfectly distinct species from any known to me. It comes nearest to *Æolosoma niveum* as described by Leydig. Nevertheless, it does not altogether agree with his description. It may therefore conceivably be a new form. It was fully as large as *Æ. quaternarium*, and there are other reasons for believing that it cannot be the young of that, or indeed of any other known species.

[1] "Note upon the Encystment of *Æolosoma*," Ann. Mag. Nat. Hist., Jan. 1892.

[2] System und Morph. d. Oligochaeten: Prag, 1884, p. 113 footnote.

[3] "*Æolosoma variegatum*, Vejd., Prispevek ku poznani nejnizsich Annulatuv," SB. böhm. Ges. 1885.

[4] "Observations upon an Annelid of the Genus *Æolosoma*," P. Z. S. 1886, p. 213.

The worm consisted of eight segments, after which came a bud that had been in part detached; but I succeeded in finding the rest of it upon the slide; the number of segments, therefore, is approximately the same as Leydig gives for *Æolosoma niveum*, and the same number also that Vejdovsky gives for *Æolosoma variegatum*. The prostomium, however, was large, squarish in front, and distinctly wider than the rest of the body. Leydig figures a very inconspicuous prostomium, which, in front at least, is actually narrower than the succeeding segments. With regard to the colourless oil-drops in the integument, I could see no structures that were at all obvious. There was no appearance such as is represented in Leydig's figures. Nor were there any clearly defined droplets such as Vejdovsky figures in his *Æolosoma variegatum*. I should be inclined to say that there were no oil-drops present at all. The epidermis was much more like that of a Naid or a *Chætogaster* than an *Æolosoma*; and even when the worm was treated with potash, which produces such recognizable effects[1] upon the oil-globules of other species, no alterations were observable, except that the worm was stained a faint yellowish. And yet there is no doubt whatever that I am right in referring the Annelid to the genus *Æolosoma*. In all other particulars it agreed with that genus. The prostomium was ciliated on the under surface, and the lateral ciliated pits are present. The mouth appeared to be situated rather further back than it has been usually figured for this genus; the constriction which marks off the prostomium posteriorly was situated some little way in front of the actual mouth-opening.

The most important difference, however, from Leydig's description concerns the setæ. In all the species of *Æolosoma* at present known, with the exception of Vejdovsky's *Æolosoma tenebrarum* and (if it be really distinct from this) *Æolosoma leidyi*[2], there are only capillary setæ present in both dorsal and ventral bundles. In the two species above mentioned cleft sigmoid setæ are also to be found[3]. In the specimen of *Æolosoma niveum* described here I have also found these sigmoid setæ, and it is principally the fact of the occurrence of these setæ which leads me to doubt the identity of this worm with Leydig's *Æolosoma niveum*. Had they been present Leydig would hardly have overlooked them. The existence of these sigmoid setæ also, I may point out, precludes the possibility of this worm being the young of *Æolosoma quaternarium*, and I do not think that it has anything to do with *Æolosoma tenebrarum*.

In the first seta-bearing segment there were not any sigmoid setæ, but four capilliform setæ in each of the dorsal, and three in

[1] "Note upon the Green Cells in the Integument of *Æolosoma tenebrarum*," P. Z. S. 1889, p. 51.

"Notes upon certain Species of *Æolosoma*," Ann. Mag. Nat. Hist., Oct. 1889.

[2] F. W. Cragin, "First Contribution to the Invertebrate Fauna of Kansas," Bull. Washb. Coll. Lab. 1887, no. 8, p. 31.

[3] I am not quite certain that the species described by me as *Æolosoma tenebrarum* (P. Z. S. 1889, p. 51) is really identical with Vejdovsky's species; I could not detect the cleft at the end of the setæ, and the colour of the oil-drops appears to be rather different.

each of the ventral bundles. The number of setæ per bundle diminishes in the posterior segments, and they become mingled with sigmoid setæ. In the seventh segment both setæ in one of the ventral bundles were sigmoid, as was one of the two setæ of the dorsal bundle. The sigmoid setæ occur, therefore, in both dorsal and ventral bundles; I was, however, quite unable to detect any bifurcation at the free extremity of these setæ, and I examined them with the highest power at my disposal (Zeiss's F lens with eyepiece). I could not detect the nephridia.

In the colourless integument and in the presence of two kinds of setæ this species evidently offers a transition to the Naidomorpha.

iv. *On* Clitellio *and* Limnodrilus.

These two genera, usually regarded as distinct, have been united by M. Vaillant in the recently published third volume of the 'Annelés' in the 'Suites à Buffon.'

M. Vaillant considers that the alleged absence of a prostate in *Clitellio* is not a sufficient difference.

As a matter of fact, my own paper[1] upon *Clitellio* showed other points of difference besides the absence of the prostate; the main distinction between the two genera, in addition to the want of a prostate, is the existence of two pairs of perivisceral trunks, which are specially enlarged and are contractile: I did not refer very definitely to their contractility in the paper cited, but I have since re-examined the species *Clitellio arenarius* and find that these dilated trucks *are* contractile, one pair contracting before the other. Now the fact of the existence of contractile trunks does not distinguish *Clitellio* from *Limnodrilus*. *Limnodrilus* has also two pairs of contractile periviscerals, but only one pair of these are dilated; whereas in *Clitellio* both pairs are wide tubes. This difference, at any rate, applies to the species of *Limnodrilus* known up to the present.

I take this opportunity of mentioning that *Clitellio arenarius* has, like *Limnodrilus*, a supra-intestinal blood-vessel. But I could find no integumental blood-capillaries such as are found in *Limnodrilus*. I looked for them very carefully, of course in living worms.

So far, therefore, my observations have rather tended to accentuate than remove the differences between *Clitellio* and *Limnodrilus*.

I have, however, found in a species of *Limnodrilus* an intermediate form between *Clitellio* and the typical *Limnodrilus*. This species is from New Zealand; I have already[2] recorded its occurrence in the South Island, though I was in error in stating that it presented no differences from the European species.

As a matter of fact, this New Zealand *Limnodrilus* has, like *Clitellio*, two pairs of greatly dilated hearts in segments viii. and ix.; there are no reasons for disbelieving that these wide trunks are

[1] "On certain Points in the Structure of *Clitellio* (Claparède)," P. Z. S. 1888, p. 485.

[2] "On the Oligochætous Fauna of New Zealand, &c.," P. Z. S. 1889, p. 381.

contractile. This species is, of course, freshwater in habitat. It was found in a forest-pool along with *Phreoryctes smithii*.

None of the specimens were mature, so I am unable to say how far they may agree with *Clitellio* in other particulars; but, in any case, they have the two pairs of dilated vessels in viii. and ix. that have hitherto served to distinguish *Clitellio* from *Limnodrilus*.

v. *On a new Genus* (Kerria) *intermediate between* Acanthodrilus *and* Ocnerodrilus.

Mr. J. Graham Kerr, who accompanied the "Pilcomayo Expedition" in 1890, has kindly given me a number of small Oligochæta which he collected in the upper reaches of that river. They were preserved with corrosive sublimate, and are in consequence in an excellent condition for microscopical examination. There are altogether about a dozen specimens, some fortunately being sexually mature. The water where they were met with was exceedingly salt and bitter, but contained a number of other animals, notably a few decapod Crustaceans. But animal life was not, Mr. Kerr informs me, very abundant in the stream. So far as I am aware, no Oligochæte of any kind has ever been described from a locality like the present, except a species of *Pachydrilus* referred to by Semper as occurring in the brine-springs of Kissingen in Germany. Salt water is not, however, entirely inimical to the existence of Oligochæta, for there are a few species known from the sea-shore; for example, *Clitellio*, referred to in the present paper, *Pontoscolex*, *Pontodrilus*, &c. I expected, therefore, that these worms would prove to be interesting, and my expectations were realized.

The worms are all very small, an inch to an inch and a half in length by 1 mm. in diameter. They are about the size of, and resemble in general appearance, *Ocnerodrilus eiseni*, and I at first was disposed to refer them to the same genus at least. Although a more careful examination of the worms showed that they could not be referred to the genus *Ocnerodrilus*, it became very soon evident that they were nearly related to that genus; they serve, in fact, to indicate the probable relations of *Ocnerodrilus*, concerning which I was formerly in doubt[1]. Eisen, the original describer[2] of the genus *Ocnerodrilus*, placed it in the family Lumbriculidæ. This conclusion was subsequently abandoned by Eisen himself[3], and I have myself[4] endeavoured to combat it; the genus is clearly to be referred to that very large and imperfectly known group of worms which I have called Cryptodrilidæ. I do not propose to give a detailed systematic account of the anatomy of this new worm, but merely to dwell

[1] "On the Anatomy of *Ocnerodrilus* (Eisen)." Tr. Roy. Soc. Edin. vol. xxxvi. No. 21.

[2] "On the Anatomy of *Ocnerodrilus*," Nov. Act. Reg. Soc. Upsal. ser. 3, vol. x.

[3] "On the Anatomy of *Sutroa rostrata*, &c.," Mem. Calif. Ac. Sci. vol. ii. no. 1.

[4] *Loc. cit.* p. 580.

upon its salient characters, particularly those which bear upon its affinities.

The setæ are strictly paired and show no noteworthy peculiarities; they are not in any way modified upon any segments of the body. The clitellum occupies segments xiv. to xix.

The alimentary canal is chiefly remarkable for two points: there is a gizzard present, not a very usual occurrence with aquatic Oligochæta. The gizzard, moreover, is well developed: it lies in segment vii.

In segment ix. are a pair of calciferous pouches; these are complicated in structure, being composed of a much-folded cellular membrane. Although the segment which they occupy is the same as that which in *Ocnerodrilus* contains a pair of œsophageal diverticula, the organs are simpler in their minute structure in the latter genus.

Some of the anterior mesenteries, as is usually the case in Oligochæta, are thickened; this statement applies to those which separate segments v./vi., vi./vii., vii./viii., viii./ix.

The nephridia are present in the genital segments; the posterior set are invested by a thick layer of peritoneal cells.

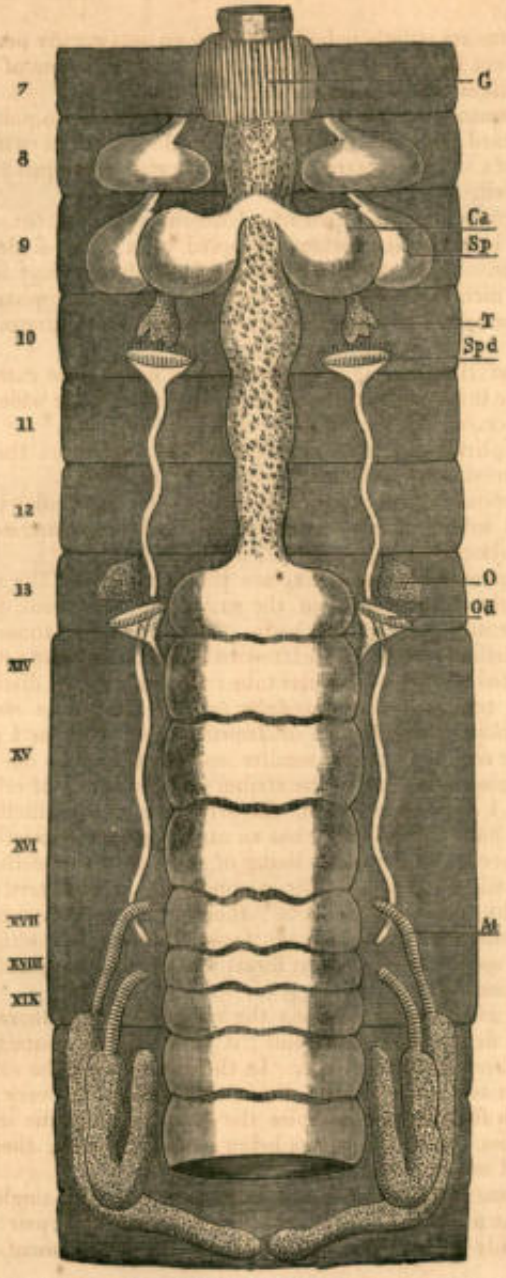
The genital organs conform in almost every particular to the plan met with in the genus *Acanthodrilus*, and are illustrated in the accompanying drawing (woodcut, fig. 1).

On segments xvii. and xix. are the openings of the atria; the actual pores are placed upon the summits of elevations near to the median ventral line of the body. The atria, like those of other Acanthodrilidæ, are divisible into two regions: with the actual orifice is connected a narrow muscular tube; this widens out distally into a glandular tube, but *this glandular tube is lined by a single layer only of cells.* In no species of *Acanthodrilus*, so far as I am aware, is this the case. Even in smaller species than the one described here the glandular part of the atrium has two layers of cells, resembling, as I have pointed out, the structure of the clitellum. On the other hand, *Ocnerodrilus* has an atrium which is exactly like the present species in having a lining of a single row of cells. These cells are tall and very granular in appearance. The atrial pores are close to the ventral pairs of setæ; there are no penial setæ. Penial setæ are only rarely absent from *Acanthodrilus*; *A. multiporus* and an allied species are the only forms which I can recollect that are thus deficient.

On the xviiith segment open the vasa deferentia: there is only a single vas deferens on either side; it runs in close contact with the body-wall, not embedded in it. In the xth segment the vas deferens widens out to form a funnel; this funnel is not only very large but very much folded, and occupies the greater part of the segment in which it lies. It struck me as being unusually large; there is only one funnel on each side.

The same segment, *i. e.* the xth, contained the single pair of testes. As a general rule, when there is a single pair of testes these gonads occupy the xith and not the xth segment. In the

Fig. 1.



Genital segments of *Kerria halophila*, as seen on a dissection.

G, Gizzard; *Ca*, calciferous glands; *Sp*, spermatotheca; *T*, testis; *Sp.d*, sperm-ducts; *O*, ovary; *Od*, oviduct; *At*, atrium.

Segments of clitellum indicated in Roman numerals.

present species, however, there is no doubt of their lying in the xth segment.

The sperm-sacs are in segments x. and xi. They partially involve the testes and vas deferens funnels. The ovaries are, it is almost unnecessary to state, placed in segment xiii. The oviducal funnels open opposite to them; the ovaries are so large that but little room is left between the end of the ovary and the funnel; I saw an ovum within the mouth of the oviduct. There are no egg-sacs. The oviducal pores are upon the xivth segment.

In the viiith and ixth segments are the spermatothecæ. These organs are large sacs, communicating with the exterior by means of a comparatively long duct; they were densely packed with spermatozoa, but had no diverticula.

It is evident from the above short and, in some respects, incomplete account of the Pilcomayo worm that it is most nearly allied to the genus *Acanthodrilus*. That genus, it should be remarked, is one which is less uniformly terricolous than any other genus of "earthworms." There are already several species known to occur in water. Among them are *Acanthodrilus stagnalis*, *A. dalei*, *A. schmardæ*. This is, however, the first species which has been met with in *saline* waters.

The other aquatic Acanthodrilidæ show no particular affinities to aquatic genera; but the present species does; and it distinctly approaches *Ocnerodrilus*. The resemblance is not only in the simplification of the structure of the atria; that of itself would not perhaps be a very important fact, since it might be put down merely to degeneration. A more important point of likeness is the existence of the single pair of œsophageal diverticula in segment ix.; this particular segment is not a usual one in which to find these calciferous glands. Besides, in other Acanthodrilids there are nearly always two or three pairs of these glands situated further back.

Very little is wanting to convert the species here described into an *Ocnerodrilus*; to refer it definitely to the genus *Acanthodrilus* would be to ignore the characteristic differences which it shows from that genus, with which, however, it undoubtedly agrees in all those points which are made use of to define the genus *Acanthodrilus*. On the other hand, it can hardly be put in the genus *Ocnerodrilus*. The principal difficulty in the way of this is the two pairs of atria and their position. The fact of there being two pairs of atria instead of one only would not deter me from this step; I think, for instance, that the genus *Neodrilus* must be merged in *Acanthodrilus*. The important difference appears to be the separation of the atrial and vas deferens pores by a septum in *Acanthodrilus*. If it were not for the position of the calciferous glands all the resemblances between this worm and *Ocnerodrilus* might fairly be set down to a convergence due simply to degeneration. As it is I am inclined to think that it will be necessary to institute a separate genus for this Acanthodriloid worm from the Pilcomayo; and I propose to call it *Kerria*, after Mr. Graham Kerr, with the specific term *halophila*. It may be useful to compare, by means of the following table, the

Table.

Comparison of *Kerria* with allied genera.

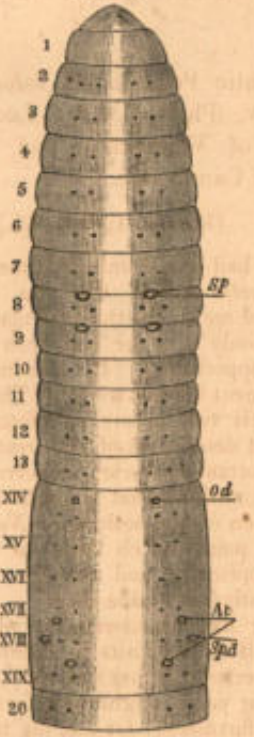
	Atrial pores.	Vas. def. pores.	Atria.	Penial setæ.	Calciferous glands.	Gizzard.	Spermatothecæ.
Kerria	XVII. and XIX.	XVIII.	Lined by single row of cells.	None.	One pair in IX.	Present.	Two pairs in VIII. and IX.; no diverticulum.
Acanthodrilus	XVII. and XIX.	XVIII.	Lined by double row of cells.	Nearly always present.	1–3 pairs in XIV. or XV.–XVII.	Rarely absent.	Two pairs in VIII. and IX.; always diverticula.
Gordiodrilus	XVII. and XVIII. or XVIII. and XIX.[1]	XVIII.[1]	Lined by single row of cells.	None.	Single pouch in IX.	Present or absent.	Two pairs in VII. and VIII.; no diverticulum.
Ocnerodrilus	XVII.	XVII.	Lined by single row of cells.	None.	One pair in IX.	Absent.	One pair in VIII.; no diverticulum.
Pygmæodrilus	XVII.	XVII.	Lined by single row of cells.	None.	One pair in IX.	Present or absent.	One pair in IX., with or without diverticula.

[1] Further back in *Gordiodrilus tenuis*, n. sp.

present species with some allied forms. The table (p. 359) gives some additional facts not referred to in the above description. Also, I introduce a few worms not yet fully described, which I have recently been studying.

The position of the external apertures of the male reproductive apparatus is, however, rather different from what is found in the genus *Acanthodrilus*. The accompanying figure (fig. 2) illustrates

Fig. 2.



Ventral surface of *Kerria halophila*, to show generative apertures.

Sp, Spermatothecal pores; *od*, oviducal pores; *At*, atrial pores; *Sp.d*, spermiducal pores.

The segments of clitellum are indicated by Roman numerals.

the arrangement in an individual which was studied by means of longitudinal sections; I found it impracticable to examine the ventral surface of the entire worm mounted in glycerine, for the reason that in the course of preservation a good deal of the corrosive sublimate used as a fixing reagent had crystallized upon the integument, rendering it therefore very opaque. In the sections the setæ were seen to be quite unaltered upon the genital segments, they were not even larger than those upon the neighbouring segments. The atrial pores, as well as those of the vas deferens, are in close relation to

the ventral pair of setæ: the anterior atrial pore of one side of the body lies a little in front of, and to the outside of, the pair of setæ: the posterior atrial pore, on the other hand, has a slightly different relation to the pair of setæ of its segment; it is placed a little behind the setæ. The pore of the single vas deferens again differs in position from both of these apertures; it lies on the same level as, but to the outside of, the ventral setæ of its segment, which is of course the xviiith. I am disposed to believe that Rosa's "*Acanthodilus*" *spegazzinii* will prove to be congeneric with this species.

6. On the Systematic Position of *Notoryctes typhlops*. By Hans Gadow, Ph.D., M.A., Lecturer on Advanced Morphology of Vertebrata, and Strickland Curator, University of Cambridge.

[Received April 9, 1892.]

Professor Stirling had kindly entrusted me with his most valuable material of *Notoryctes* before this was distributed to various museums. He asked me to fix the systematic position of this new mammal more precisely than he had been able to do, because of want of time and opportunity. He also modestly wanted me to verify and to supplement his own work [1]. This was both an easy and a difficult task. His two papers on *Notoryctes* contain a most carefully worked out description of the creature, and, with the exception of some important characters concerning the teeth and the cloacal region, leave nothing that could be of general interest and bear upon the question of the position of *Notoryctes* in the system. There are still some points which have not been worked out fully, *e. g.* the vascular, muscular, and nervous systems, but these will undoubtedly be investigated in due time.

Professor Stirling has discussed the whole matter with me thoroughly during his several visits to Cambridge; several parts of *Notoryctes* we redissected together and many questions were studied, so that the following pages might well form a paper of conjoint authorship; but, unfortunately for me, his time in Cambridge was limited, and thus I have become the only responsible author.

The advance copy of the 'Handlist of Australian Mammals,' by Mr. J. Douglas Ogilby, contains many important remarks on the systematic position of *Notoryctes*, with which we are unable to agree. This has necessitated, unfortunately, more argumentative reasoning in the following pages than would have been the case had *Notoryctes* been left in a less ambitious position than that of a link between the Proto- and Metatheria. The creature is interesting enough as a Marsupial.

[1] E. C. Stirling, "Description of a new Genus and Species of Marsupialia (*Notoryctes typhlops*)," Trans. R. S. South Australia, 1891, pp. 154–187, pls. ii.–ix.; "Further Notes on the Habits and Anatomy of *Notoryctes typhlops*," ibid. 1891, pp. 283–291, pl. xii.

With regard to the investigation of the affinities of *Notoryctes*, I trust that a word of warning will not be taken amiss. It concerns the danger which may result from the frequent habit of selecting the taxonomic characters from the skeleton only, to the exclusion of other organic systems. In case of fossils this cannot be helped, and we have then no further means of testing the validity of our conclusions. Now, supposing only the skeleton of *Notoryctes* were known, while the teeth and soft parts and the land where it was found were unknown; or let us suppose, for argument's sake, that it "came from America," neither an impossible nor an even improbable assumption. In this case many a zoologist, provided he knew his osteology well, would conclude that the skeleton in question belonged to a small, burrowing mammal, which was closely allied to the *Dasypodidæ*, especially to *Tatusia*, in fact that it was an Edentate. This conclusion would be based upon the following striking characters:—

1. Anchylosis of the second to sixth cervical vertebræ. In *Tatusia peba* anchylosis of vertebræ 2, 3, and 4.
2. The extraordinary strength of the first thoracic rib.
3. The acromial process of the scapula is very long and curved, and has a facet on its inner surface for the upper end of the humerus.
4. There is a second spine on the postscapular fossa; both spines enclosing a deep groove.
5. The clavicles are complete and are attached to the manubrium sterni by the intervention of a ligament of some length. Cf. *Choloepus*, &c.
6. The fibula has a large foramen near the proximal portion of its shaft (*cf.* Stirling, p. 179, and fig. 7, pl. viii.). Such a foramen is also present in the Cambridge specimen of *Tatusia peba*.
7. There is a large sesamoid bone on the plantar side of the foot.
8. As many as six vertebræ are anchylosed with the pelvis.
9. The caudal vertebræ possess movable chevron bones.
10. The type of the fore and hind limbs is decidedly fossorial.

We might go even further and insist upon some characters in which *Notoryctes* differs from all or from most Marsupials:—

1. The well-developed patella. Cf. *Perameles*.
2. The anchylosis of cervical vertebræ.
3. The great strength of first thoracic rib.
4. The possession of six sacral vertebræ, instead of 2, 3, 4, or 5, as *Phascolomys platyrhinus*.
5. The fusion of the cuboid with the ectocuneiform bone. Unique.
6. The decidedly fossorial type of the limbs.
7. The apparent absence of marsupial bones; for these, while scarcely visible without a lens, and not overlooked by the careful describer of the first entire specimen, would certainly be lost in a naturally bleached skeleton.

However, let us return to facts. *Notoryctes* occurs in the very middle of Australia, and every important part of its anatomy is known. Its teeth are not like those of any known Edentate, although they are aberrant enough in number and position even for Marsupials. It possesses a marsupium and an inverted inner angular process of the under-jaw—two characters which are together sufficient to prove that *Notoryctes* is a member of the Marsupialia or Metatheria in the sense hitherto defined and accepted.

Mr. Douglas Ogilby[1] has naturally and correctly placed *Notoryctes* as a separate family among the Polyprotodontia of the Marsupialia, but he hopes that "we have now obtained a definite link between the Proto- and Metatheria subclasses, a link which will perhaps eventually bridge over the gulf which at present separates the Monotremes from the Marsupials." A definite link would certainly, not perhaps eventually, bridge over that gulf, but unfortunately that much hoped-for link is still missing; certainly it is not represented by *Notoryctes*.

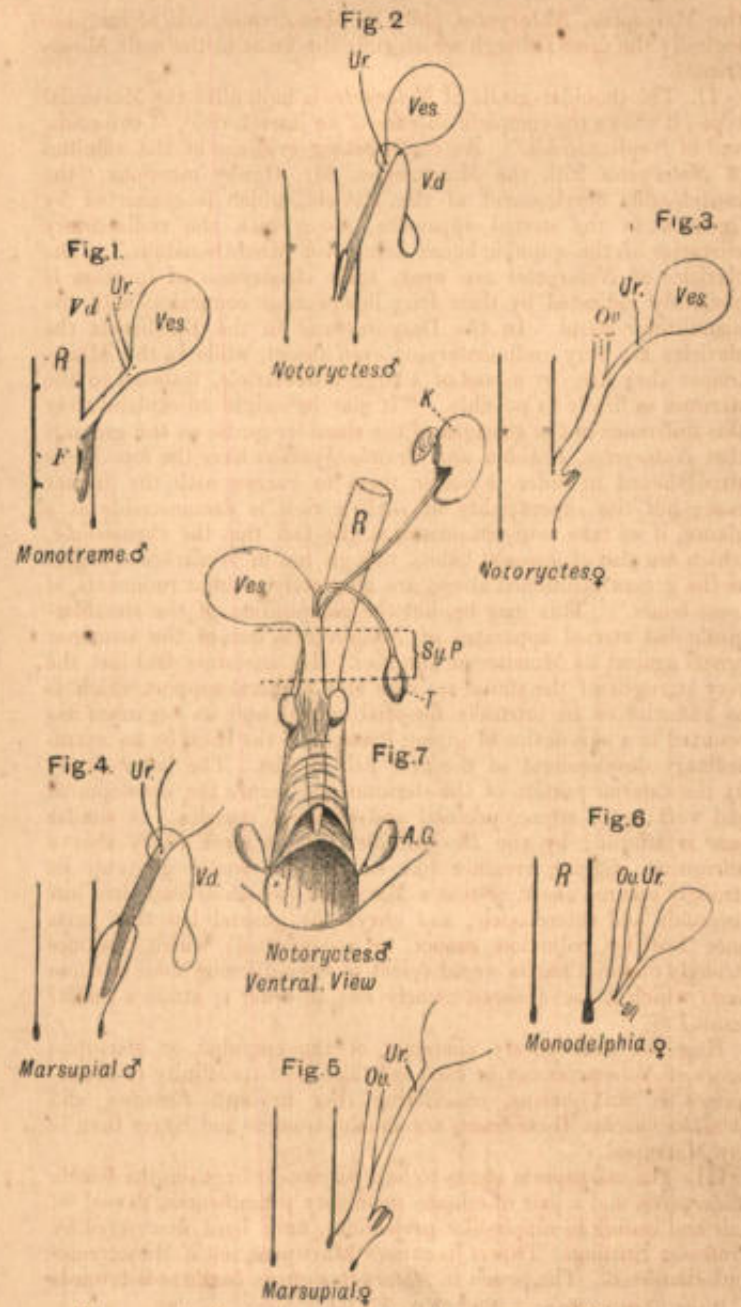
The Monotremes are characterized by the possession of:—(1) a typical cloaca; (2) a Saurian shoulder-girdle, *i. e.* an episternum or interclavicle, clavicles, complete coracoids, and considerable remnants of the ventral halves of precoracoids (epicoracoids of some authors). Additional characters are:—(1) absence of functional teeth in the adult; (2) a temporary marsupium without nipples.

Notoryctes differs in every one of these four points from the Monotremes and agrees with the Marsupials.

I. The cloacal arrangement appears at first sight strikingly like that of the Monotremes. The accompanying drawings (see p. 364) will explain the points better than a lengthy description. It must be borne in mind that there are Metatheria without a functional marsupium, while in the Prototheria this organ is functional; likewise there are monotrematous mammals besides the Prototheria. Marsupium and cloaca, taken alone, are therefore not sufficiently diagnostic for the separation of Proto- and Metatheria: they are differences of degree only, the intermediate links being furnished by the various Marsupialia themselves. I have shown elsewhere[2] that in the Marsupialia the urogenital and rectal openings are not completely divided off by a partition, there being still one common external opening which leads into a common, although mostly shallow chamber, viz. into the proctodæum or vestibulum cloacæ. In both male and female Marsupials (figs. 4 and 6, p. 364) the urogenital sinus is still of considerable length, and is completely shut off from the rectum, while in the male Monotremes (fig. 1) the urine passes into a urodæum, or middle chamber of the cloaca above the penis. In *Notoryctes* and in all other Marsupials, this separate exit of the urine and of the genital products is made impossible by the completion of the fold *F*. Urine and sperm pass through the penis in the male, and in the female the ovarial products (eggs or fœtus) have the same channel as the urine. This channel is the same in

[1] Advance copy of portion of 'Handlist of Australian Mammals,' issued July 31st, 1891: Sydney.

[2] "Remarks on the Cloaca and on the Copulatory Organs of the Amniota," Phil. Trans. 1887, pp. 5–37, pls. 2–5.



Diagrammatic illustrations of the cloacal arrangement of *Notoryctes* and other Mammals.

Ves, Urinary bladder; *Ur*, ureter; *V.d*, vas deferens; *Ov*, oviduct; *R*, rectum; *A.G*, anal glands; *Sy.P*, pubic symphysis.

the Marsupials, *Notoryctes*, and the Monotremes, and is morphologically the same through which runs the urine in the male Monotremes.

II. The shoulder-girdle of *Notoryctes* is built after the Marsupial type; it shows the complete absence of an interclavicle, of coracoids, and of "epicoracoids." As confirmatory evidence of the affinities of *Notoryctes* with the Monotremes, Mr. Ogilby mentions "the considerable development of the clavicle, which is connected by ligament to the sternal apparatus, along with the rudimentary character of the epipubic bones being also Monotrematous." The clavicles of *Notoryctes* are weak, their slenderness of function is obviously indicated by their long ligamentous connexion with the manubrium sterni. In the Dasyures and in the Bandicoots the clavicles are very rudimentary or even absent, while in the Monotremes they are, by means of a large interclavicle, fastened to the sternum as firmly as possible. "It may be sought to explain away this difference in the strength of the shoulder-girdle on the grounds that *Notoryctes*, *Echidna*, and *Ornithorhynchus* have the fore limbs strengthened in order to enable them to burrow with the greater ease; but the superficiality of such a view is demonstrable at a glance, if we take into consideration the fact that the *Peramelidæ*, which are also of fossorial habits, though not in so marked a degree as the genera mentioned above, are absolutely without rudiments of these bones." This may be, but the composition of the shoulder-girdle and sternal apparatus of *Notoryctes* is one of the strongest proofs against its Monotreme affinities. Its ancestors had lost the very strength of the sterno-scapular and humeral support which is so essential to an intensely fossorial animal, and its organism has resorted to a new device of giving strength to the chest by an extraordinary development of the first pair of ribs. The latter firmly fix the anterior portion of the sternum and secure the development and working of strong pectoral and humeral muscles. A similar case is afforded by the *Dasypodidæ*. Is it more likely that a burrowing, digging creature like an Echidna would give up its strongly secured chest, or that a Marsupial (which as such had lost coracoids and interclavicle, and obeys the general law that parts once lost by reduction cannot be redeveloped) which assumes strongly fossorial habits would resort to strengthening some of those parts which it does possess, namely ribs, in order to attain a similar result?

How the rudimentary character of the epipubic or marsupial bones of *Notoryctes* can be used as evidence of its affinity to Monotremes is not obvious, considering that in both *Echidna* and *Ornithorhynchus* these bones are much stronger and larger than in any Marsupial.

III. The marsupium seems to be a permanent organ in the female *Notoryctes*, and a pair of minute mammary prominences, devoid of hair and ending in nipple-like projections, have been discovered by Professor Stirling. This is likewise a Marsupial, not a Monotrematous character. The pouch in *Notoryctes* opens backwards towards

the anus: this is probably a character adapted to the fossorial habits of the creature, a parallel case being afforded by *Perameles*. It would be rash to infer from this similarity any special affinity between these two genera.

IV. The teeth are built after the zoophagous marsupial plan; it is, however, significant that the crowns of the teeth of the *Dasyuridæ*, and especially those of *Myrmecobius*, show the same type of structure as those of *Ornithorhynchus* (*cf.* Poulton and Leche [1]). The teeth are present in considerable numbers, and, with the exception of a few, remain functional throughout life. There is no indication whatever of their becoming superseded by a horny covering of the jaws, the naso-frontal horny shield of *Notoryctes* being a special feature which has no resemblance to, or connexion with, the covering of the jaws of the Monotremata.

The determination of the full number of teeth was wisely left in abeyance by Prof. Stirling, although he suggested the following formula: i. $\frac{3}{2}$, c. $\frac{1}{1}$, p. $\frac{2}{3}$, m. $\frac{4}{4}=\frac{10}{10}$. The material placed in my hands before the specimens were distributed to their ultimate places of destination has enabled me to arrive at some interesting results. For future reference and possibility of identification I append the following list, the numbers being those which Prof. Stirling had enclosed in the various bottles:—

Specimen A.—Refers to the specimen figured by Stirling on plate vi. of his monograph. Preparation of skull, in spirit. Cambridge Museum.
Specimen B.—Dry skull and skeleton. Cambridge Museum.
Specimen C.—A partly dissected specimen. Roy. Coll. Surg., London.

Male I.	—Spirit specimen.	Nat. Hist. Mus., S. Kensington.
Male II.	,, ,,	Roy. Coll. Surg., London.
Male V.	,, ,,	Cambridge.
Female I.	—Spirit specimen.	N. H. Mus., S. Kensington.
Female III.	,, ,,	Stockholm Zootom. Inst.
Female IV.	,, ,,	Cambridge.

The full number of teeth seems to be: i. $\frac{3}{3}$, c. $\frac{1}{1}$, pm. $\frac{2}{2}$, m. $\frac{4}{4}=\frac{10}{10}$.

Probably the two upper and the two lower premolars represent the original pm. 1 and pm. 3, it being supposed that, as in *Dasyuridæ* and some other Marsupials, the original pm. 2 and 4 have been lost.

Pm. 3 is fully developed and bicuspid in both mandibles of specimens A and B, and in the right mandible of female I.

Pm. 3 is reduced to a very small, short, and pointed tooth on both sides in male II., left side of female IV., and right side of specimen C.

Pm. 3 is absent on both sides in male I., male V., female III.; right side of female IV.; left side of specimen C.

[1] Poulton, Quart. Journ. Microsc. Sci. 1888. W. Leche, 'Biologiska Föreningens Förhandlingar,' Stockholm, 1891, iii. no. 17. pp. 136–154: "Beiträge zur Anatomie des *Myrmecobius fasciatus*."

Pm. 1 is canine-shaped, projecting above the incisors and the canine; it is present in both sides in males I., II., V., females III., IV., and specimen C.

Pm. 1 is very much reduced to a short pointed weak tooth in the right side of specimen B and female I., in both sides of specimen A.

Pm. 1 is absent in the left mandible of specimen B.

The canine tooth, *i. e.* the fourth in the series, fitting upon the fourth upper tooth, which latter is implanted immediately behind the premaxillary suture, is generally weaker than the incisors, never projects above the series, and shows occasionally a slightly uneven crown. The lower canine is thus fully developed in the right side in males I. and II., female I., and in specimens A, B, and C.

The canine is reduced to a very small pointed tooth on the left side in males I., II., V., and in female I.

The canine is reduced on both sides in female III.

The canine is absent on the left side in female IV., in specimens A, B, and probably in C.

Concerning the incisors, they diminish in size from the first to the third. In most specimens three incisors are present in both mandibles, but in the left of female IV. and of specimen C there are only two incisors, which in female IV. are followed by a gap in front of the first premolar, and in specimen C by a smaller gap in front of the reduced canine.

Comparison of these nine apparently adult specimens shows the tendency of reduction of the left lower canine and of either pm. 1 or pm 3. The reduction, resulting often in ultimate loss, seems quite irregular, there being apparently no compensation effected by the size of the neighbouring persisting teeth.

The most remarkable feature is, however, that the reduction either in numbers alone, or in size, or in both is undoubtedly greater in the left mandible than in the right. This fact seems well established, considering that out of the nine specimens examined the left-sided reduction is greater in not less than eight specimens; reduction in size alone in three, in numbers in five specimens.

The total number of teeth in the nine right mandibles is 86, in the corresponding left mandibles only 79. The number of reduced and of absent teeth on the right side is 11, on the left side 19. Such a decided asymmetry is practically unique; I have failed to perceive any corresponding asymmetry in the size of the two mandibles.

The teeth in the upper jaw are much more regular. Three incisors are followed by an equally small canine. The first of the premolars is small, the second large. The four molars are always present and do not vary in size.

In specimen C the right and left upper sides possess each only 9 teeth, the third right incisor has been lost and has left a gap, while on the left side the canine seems to be absent without a distinct gap.

In female IV. left side, and in female I. right side, there are likewise only 9 teeth; the four molars are complete and so are the two premolars, while the canines seem to be absent, with perhaps a slight gap.

The tooth formula of *Notoryctes* differs consequently from that of all other known Polyprotodonta in the smaller number of incisors, namely $\frac{3}{3}$ against $\frac{4}{5}$ in *Didelphidæ*, $\frac{5}{3}$ in *Perameliдæ*, and $\frac{4}{3}$ in *Dasyuridæ*; while the number of premolars, $\frac{2}{2}$, agrees with that of *Dasyurus* against *Didelphidæ*, *Thylacinus*, *Thylacoleo*, *Phascologale*, some *Perameles*, and *Myrmecobius*, in all of which the original fourth premolar is still present.

Variation of the Number and Size of Teeth in the Lower Jaws of *Notoryctes*.

	1	2	3	4	5	6	7	8	9	10	
	Incisors.			C.	Premolars.		Molars.				
	1	2	3		pm. 1.	pm. 3.	1	2	3	4	
Specimen A	+	+	+	+	*	+	+	+	+	+	Pm. 1 small.
	+	+	+	0	*	+	+	+	+	+	Pm. 1 small; canine absent.
Specimen B	+	+	+	+	*	+	+	+	+	+	Pm. 1 small.
	+	+	+	0	0	+	+	+	+	+	C. and pm. 1 absent.
Specimen C	+	+	+	+	+	*	+	+	+	+	C. and pm. 3 absent.
	+	+	+	0	+	0	+	+	+	+	Pm. 3 small.
Male I.	+	+	+	+	+	0	+	+	+	+	Pm. 3 absent.
	+	+	+	*	+	0	+	+	+	+	Pm. 3 absent; canine small.
Male II.	+	+	+	+	+	*	+	+	+	+	Pm. 3 small.
	+	+	+	*	+	*	+	+	+	+	C. and pm. 3 small.
Male V.	+	+	+	+	+	0	+	+	+	+	Pm. 3 absent.
	+	+	+	*	+	0	+	+	+	+	C. small, pm. 3 absent.
Female I.	+	+	+	+	*	+	+	+	+	+	Pm. 1 small.
	+	+	+	*	+	0	+	+	+	+	C. small, pm. 3 absent.
Female III.	+	+	+	*	+	0	+	+	+	+	C. small, pm. 3 absent.
	+	+	+	*	+	0	+	+	+	+	C. small, pm. 3 absent.
Female IV.	+	+	+	*	+	0	+	+	+	+	C. small, pm. 3 absent.
	+	+	0	0	+	*	+	+	+	+	I. 3 and c. absent, pm. 3 small.

While it was easy enough to disprove the existence of any Monotrematous affinities in *Notoryctes* and to refer it to the Marsupials, the question to which of the families of existing Marsupials *Notoryctes* is nearest related is rather difficult. Mr. Ogilby prefers to look upon it as an aberrant Polyprotodont, and he has based this opinion on the character of the teeth alone, with this reserve that, if canine teeth be absent (as he himself has suggested) it is not a typical Polyprotodont, but a true link between the Monotremata and Polyprotodonts. This reasoning is not quite obvious. If

his own suggestion as to the incisor nature of the so-called canines were correct, the creature would of course be an aberrant Polyprotodont; but this absence of true canines would not affect its Marsupial affinities, and would not in any way bring it nearer to the Monotremata, because we know several genera of true Marsupials which have no canine teeth. I have shown that *Notoryctes* is aberrantly polyprotodont in spite of the presence of canine teeth.

The enumeration of the following characters of *Notoryctes* will perhaps help to settle its affinities:—

A. Characters which prove *Notoryctes* to be a member of the Metatheria.
   1. Possession of an apparently permanent marsupium, with two localized mammæ and nipples.
   2. Well-developed inner angular process of the mandible.

B. Characters of *Notoryctes* which occur also in some Metatheria.
   1. Large movable chevron-bones in the caudal vertebræ: *Macropus, Dasyurus*, &c.
   2. Acromion much elongated and curved over the humerus: *Dasyurus*.
   3. Large osseous bulla auris: *Peragalea* (*Macrotis*) *lagotis, Perameles, Dasyurus ursinus, Phascologale*.
   4. Very rudimentary marsupial bones: *Thylacinus*.
   5. Opening of marsupium directed backwards: *Perameles*.
   6. Presence of a prehallux, *i. e.* the "sesamoid" bone attached by ligament to the entocuneiform, described by Stirling, p. 180, pl. viii. fig. 8 *s*. Occurs also in *Didelphys*.
   7. Presence of an osseous patella: *Perameles*.
   8. Clavicles not directly attached to sternum, but by intervention of ligaments. A precoracoid unossified segment is usually present in Metatheria.
   9. Presence of a "meso-scapular segment." Usual in Metatheria.

C. Characters of *Notoryctes*, not found in recent Marsupials: see numbers 1, 2, 4, 6, 7, 8 of Edentate resemblances (p. 362); further, in opposition to Monotremata, the prepenial, extrapelvic, not abdominal position of the testicles combined with the absence of a scrotum. Lastly, $\frac{3}{3}$ incisors.

D. Character unique in *Notoryctes*: fusion of the cuboid with the ectocuneiform of the foot.

It so happens that the characters enumerated above do not permit any decided conclusion, except that *Notoryctes* might be looked upon as a "very old and generalized form" which has some characters in common with almost every other existing Marsupial family. But this not unfrequent mode of cutting the knot of the difficulty of settling the systematic position of a peculiar nature will hardly be advisable in the face of the highly specialized structure of *Notoryctes*.

We have to make further inquiries. *Notoryctes* is fossorial to an

exaggerated extent and it is insectivorous. Consequently the feet and the cæcum might give some hidden clue as to its affinities.

The toes of the hinder extremities have to be considered as free. There is at the utmost a very slight indication of syndactylism of the second and third toes, far less obvious than it is even in *Phascolomys*. In its free toes *Notoryctes* agrees with *Didelphidæ*, *Dasyurus*, *Thylacinus*, *Phascologale*, *Myrmecobius*, *Phascolomys*.

The hallux is complete and functional, as in *Didelphidæ*, *Phascologale*, *Phascolomys*; this character excludes *Dasyurus*, *Thylacinus*, *Myrmecobius*, *Antechinomys*.

The pronounced syndactylism and the well-developed cæcum of the *Phalangistinæ*, *Phascolarctos*, *Perameles*, *Chœropus*, and the *Macropodidæ* exclude these families from comparison.

The structure of the foot invites, therefore, comparison of *Notoryctes* with *Didelphidæ*, *Phascologale*, and *Phascolomys*; the latter is excluded by its herbivorous life and by its Diprotodont teeth. The comparison is now restricted to the *Didelphidæ* and to certain *Dasyuridæ*, especially *Phascologale*.

The geographical distribution of the *Didelphidæ* would remove them from *Notoryctes*, but it is to be remembered that the *Didelphidæ* seem to be the lowest and most "generalized" of existing Marsupials, and that in bygone times they had a much wider distribution. *Chironectes* shows that the *Didelphidæ* are capable of a great amplitude of adaptation, namely to arboreal and to aquatic life. However, it is unnecessary to go so far afield in the search of the nearest kin of *Notoryctes*. Through the possession of an element of a prehallux, *Notoryctes*, like the *Didelphidæ*, stands below the *Dasyuridæ*; in the reduction of its teeth it is further advanced than the latter. Although its numerous Edentate resemblances are clearly all acquired owing to its mode of life, they are important enough to give *Notoryctes* the rank of a family of the Polyprotodont Marsupials, as has been done on other grounds by Mr. Ogilby, this family being nearer allied to the *Dasyuridæ* than to the *Peramelidæ*.

May 17, 1892.

Prof. Flower, C.B., LL.D., F.R.S., President, in the Chair.

Mr. W. T. Blanford exhibited for Major C. S. Cumberland the skin of a Wild Camel obtained by the latter in Eastern Turkestan, as described in 'Land and Water' for April 4th, 1891, p. 412, and expressed his belief that this was the first wild Camel's skin that had ever been brought to this country. Major Cumberland had hoped to be present, but was unfortunately prevented by illness. He had, however, sent the following notes to be read to the meeting:—

"The habitat of the Wild Camel is the Gobi steppe from Khotan to Lob Nor. Except when snow lies on the ground these animals may be met with here and there along the old bed of the Yarkand

and Tarim rivers, which they frequent for the pools of brackish water that are to be found here and there. But as soon as the snow falls they move off into the desert, as if then independent of the water-supply. They prefer the snow, I imagine, as being less salt than the water, although it also is impregnated to a certain extent soon after it falls. The Camel is very shy in its habits, and, so far as I could ascertain, has never been caught and domesticated. The natives told me that no horse in the country could catch the Camels in the deep sand of the region they frequent. They appear to me to be distinct from the Bactrian Camel; they are less stumpy in build, the hair is finer, closer, and shorter. They vary in colour, like the domestic species, from dark brown to lightish dun. Their origin has yet to be traced. I take it that they have sprung from Camels which escaped when the district known as Takla Makán was buried in a great sand-storm some centuries ago. Tradition relates that no human beings survived, but it is likely enough that some of the Camels and Horses did so, and that this was the origin of the Wild Camels and Ponies which are found in this district."

Mr. Blanford added that he had compared the skull of Major Cumberland's specimen with one of a Bactrian Camel in the British Museum. There was some difference, but without a much larger series it was impossible to say whether the difference was sufficient to indicate a distinction of race. In the rather small details in which *C. bactrianus* differs from *C. dromedarius* the Wild Camel skull agreed with the former, as it should do, for the skin was that of a two-humped Camel, although, as Major Cumberland had noticed, the humps were very small and represented by tufts of long hair.

The following papers were read:—

1. Résultats des recherches ornithologiques faites au Pérou par M. Jean Kalinowski. Par Hans von Berlepsch et Jean Stolzmann.

[Received April 27, 1892.]

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i. *Liste des Oiseaux recueillis par M. Jean Kalinowski dans les environs de Lima et d'Ica (Côte Péruvienne).*

M. Jean Kalinowski, explorateur intrépide du Kamtschatka et de la Corée, est parti en 1889 pour le Pérou en qualité de correspon-

dant du Musée des Comtes Branicki à Varsovie. Il a commencé ses recherches ornithologiques par l'exploration des environs de Lima et d'Ica. Voici la liste des localités où il a fait des collections :—

Lima—capitale de la république. *Callao*—port principal du Pérou. *Ancon*—petit port au nord de Lima. *Magdalena Vieja* et *Chorillos*—petites villes au sud de la capitale.

Ica—capitale du département de ce nom, située à la côte (14° 4′ 33″ lat. S.). Dans le voisinage se trouvent les haciendas *Huamani*, *Trapiche* et *Oeucaje*.

La faune ornithologique des environs d'Ica paraît presque identique avec celle de Lima, c'est pourquoi nous n'avons pas séparé dans la liste les oiseaux recueillis dans ces deux localités. Cependant il y a une espèce d'oiseau trouvée à Ica par Kalinowski qui n'est pas encore connue comme habitante des environs de Lima et peut-être ne se répandra pas si loin au nord, tandis qu'elle est connue des parties plus méridionales de la côte : c'est le *Xenospingus concolor*.

Des 80 espèces d'oiseaux trouvées par M. Kalinowski dans les environs de Lima et d'Ica il paraît que 10 espèces n'étaient pas encore mentionnées comme habitantes de ces localités, savoir :—

Progne purpurea.
Pyranga testacea tschudii.
Xenospingus concolor.
Dolichonyx oryzivorus.
Tyrannus tyrannus.
Asio clamator.
Ardea egretta.
Ardetta exilis.
Tringoides macularius.
Numenius hudsonicus.

Tous ces oiseaux étaient déjà connus comme provenants du Pérou, sauf l'*Ardetta exilis*, qui n'est pas mentionnée dans 'l'Ornithologie du Pérou' par le Dr. Taczanowski.

Il y a aussi un *Theristicus* (*Th. melanopis*) déjà connu de Lima, qui n'est pas décrit dans l'ouvrage de Taczanowski, qui l'avait confondu avec une autre espèce du Haut Pérou nommée par lui *Th. caudatus* (Bodd.), mais qui en diffère également et devrait peut-être recevoir un nouveau nom. C'est le même cas avec le *Chrysoptilus atricollis* de l'Orn. du Pérou, iii. p. 86.

Il nous a paru nécessaire de décrire comme espèces nouvelles ou sous-espèces nouvelles quelques oiseaux déjà mentionnés de ces localités, mais confondus avec d'autres espèces et cités sous des dénominations fausses. Les voici :—

Pyranga testacea tschudii, subsp. nov.
Saltator immaculatus, sp. nov.
Dives kalinowskii, sp. nov.
Pyrocephalus rubineus heterurus, subsp. nov.
Cinclodes taczanowskii, sp. nov.

Nous avons aussi donné un nouveau nom au *Molothrus* autrement nommé *M. purpurascens* (Hahn), mais qui n'est pas le *M. purpurascens* de cet auteur. Nous lui avons imposé le nom de *M. occidentalis*.

Toutes les peaux recueillies par M. Kalinowski sont d'une qualité

excellente et sont pourvues d'étiquettes contenant les indications de l'habitat, du sexe, des mesures, du couleur d'iris etc. Les mesures relatives à la longueur totale et l'envergure des ailes sont prises par M. Kalinowski des exemplaires frais avant de les dépouiller, de même que les couleurs des yeux, du bec et des pattes.

Fam. Turdidæ.

1. Turdus chiguanco, Lafr. et D'Orb.

Merula chiguanco, Tacz. Orn. du Pérou, i. p. 494.

Ica: une femelle; décembre 1889. "Iris brune claire, bec et pattes d'un jaune orangé."

2. Mimus longicaudatus, Tsch.

Lima et Ica: nombreux individus; octobre, novembre et décembre 1889. "Iris olive-jaunâtre."

Note.—Il faudra probablement séparer les oiseaux de Guayaquil comme espèce distincte ou comme race locale. Les oiseaux de l'Ecuadeur sont plus petits, ayant le bec, les ailes et la queue sensiblement plus courts. La poitrine paraît plus squamulé parce que les plumes sont d'un brun plus obscur vers la base, et bordées d'un blanc plus pur à la pointe. Le blanc à la pointe des rectrices externes est plus étendu. Le spéculum blanc formé par les pointes des tectrices des remiges primaires également plus étendu. La strie sourcilière blanche ne s'étend pas au-dessus des freins, ce qu'est le cas chez le *M. longicaudatus* typique du Pérou. Il faudra bien examiner les types du *Mimus leucospilos*, Pelzeln, et du *M. nigriloris*, Lawr., qui sont décrits par méprise comme provenants du Chile et du Mexique, s'ils appartiennent peut-être à la forme qui habite l'Ecuadeur.

Fam. Troglodytidæ.

3. Troglodytes musculus, Naum.

Troglodytes audax, Tacz. Orn. du Pérou, i. p. 525 part.

Lima: cinq individus; août, octobre, novembre 1889. "Iris brune foncée."

Les oiseaux de Lima ressemblent beaucoup aux oiseaux typiques de Bahia. En général ils sont un peu plus pâles et un peu plus petits, ce que se manifeste le plus dans la longueur de la queue. Ces points de différence ne paraissent pas être constants. Dans tous les autres détails ils s'accordent très bien avec les oiseaux de Bahia.

Il paraît que cette forme du *T. musculus* a été nommé par Lesson *T. murinus* (Less. Rev. Zool. 1844, p. 434, "du Pérou").

Les trois œufs recueillis par M. Kalinowski à Lima sont d'un blanc légèrement teint de rosé, couverts de petites taches d'un roux rouillé. Ces taches forment une couronne dense autour du gros bout et sont assez rares sur le reste de la surface. À la gamme inférieure les taches sont d'un cendré-violâtre pâle. Dimensions 18×13; 18×13; 18·25×13 mm.

Fam. MOTACILLIDÆ.

4. ANTHUS PERUVIANUS, Nichols.

Anthus rufus, Tacz. Orn. du Pérou, i. p. 460.

Lima: nombreux exemplaires; septembre et octobre 1889; mars 1890. "Iris brune foncée."

Les différences du *A. rufus* typique expliquées par M. Nicholson paraissent tout-à-fait constantes.

Fam. MNIOTILTIDÆ.

5. GEOTHLYPIS AURICULARIS, Salv.

Lima: cinq individus; septembre et octobre 1889. "Iris brune claire."

Un oiseau de Callacate, Pérou du nord (coll. Stolzmann, Mus. Berlepsch), diffère un peu. Il a les ailes, la queue et les tarses sensiblement plus longues, le bec plus court, le gris du pileum un peu plus clair, et le vert du dos plus clair.

Fam. HIRUNDINIDÆ.

6. PROGNE PURPUREA (L.)[1].

Ica: deux individus; novembre et décembre 1889. "Iris presque noire."

7. HIRUNDO ERYTHROGASTRA, Bodd.?

Lima: cinq jeunes oiseaux; octobre 1889.

Ica: décembre 1889. "Iris brune foncée."

Le plus adulte de ces oiseaux ressemble tellement à la *H. gutturalis*, Scop., de la Sibérie, qu'on serait tenté de croire qu'il appartiendrait à cette espèce. Il a le devant du cou et la gorge d'un roux cannelle assez intense, la bande pectorale bien prononcée et le ventre presque blanc, légèrement lavé de roussâtre. Néanmoins l'aile est un peu plus longue, ce que distingue la *H. erythrogastra* de l'espèce asiatique.

8. PETROCHELIDON RUFICOLLARIS (Peale).

Petrochelidon ruficollaris, Tacz. Orn. du Pérou, iii. p. 503.

Lima: quatre individus; octobre 1889. "Iris presque noire."

9. ATTICORA CYANOLEUCA MONTANA, Baird.

Atticora cyanoleuca, Tacz. Orn. du Pérou, i. p. 244 part.

Lima: septembre, octobre.
Ica: décembre.
} Nombreux exemplaires.

Fam. CŒREBIDÆ.

10. CONIROSTRUM CINEREUM, Lafr. et D'Orb.

Lima: nombreux exemplaires; septembre, octobre, novembre 1890. "Iris brune foncée."

[1] Pas examiné par moi. Peut-être = *P. furcata*, Baird.—BERLEPSCH.

Note.—Un oiseau d'Arequipa (coll. Whitely), Mus. H. v. B., a les ailes et la queue plus longues et les parties inférieures plus grisâtres que les oiseaux de Lima.

Fam. Tanagridæ.

11. Tanagra darwini, Bp.

Lima: nombreux exemplaires; septembre, octobre, novembre 1889. "Iris brune-rougeâtre."

Ces oiseaux ont le bec plus large et le jaune des parties inférieures un peu plus pâle que les oiseaux de Callacate (Pérou du nord) et de l'Ecuadeur.

Le *T. darwini* était décrit par Bonaparte comme provenant du "Chili." Si on voudrait faire une séparation ce serait probablement l'oiseau de l'Ecuadeur qui devrait recevoir un nouveau nom.

12. Pyranga testacea tschudii[1], subsp. nov.

Pyranga azaræ, Tacz. (nec D'Orb.) Orn. du Pérou, ii. p. 495.

Lima: deux oiseaux; septembre et octobre 1889. "Iris brune foncée."

Les oiseaux du Pérou présentent la couleur rouge de sang plus intense et plus vive que les oiseaux typiques de Veragua. C'est pourquoi nous proposons de les séparer comme sous-espèce nouvelle.

13. Saltator immaculatus[2], sp. nov.

Saltator similis, Tsch. (nec Lafr. et D'Orb.) Faun. Peruan., Orn. p. 209 (Küstenregion).

Saltator albicollis, Tacz. (nec Vieill.) P. Z. S. 1874, p. 517 (Lima), et 1880, p. 198, pt. (Chepen).

Saltator superciliaris, Tacz. (nec Spix) Ornith. du Pérou, ii. p. 541.

S. *capite supra collique lateribus cinerascentibus minime olivaceo lavatis; dorso tectricibusque alarum plus minusve olivaceo perfusis; uropygio cinerascente; superciliis ad angulum oculi posteriorem ductis, pure albis: subtus albus, striis mystacalibus pectorisque lateribus griseis; hypochondriis pallide griseo longitudinaliter striatis; crisso subalaribusque pallide isabellinis: remigibus nigricantibus olivaceo marginatis; campterio pallide flavo: rectricibus nigricantibus grisescente late limbatis: iride clare brunnea: rostro pedibusque nigris.*

Juv. *Adulto similis, sed pectore superiore toto grisescente (minime striato), iride olivaceo-brunneo.*

Obs. Species *S. albicolli*, Vieill., similis, sed capite supra cineraceo, dorso potius griseo-olivaceo, et striis pectoralibus fere evanescentibus distinguenda.

Cette espèce paraît la plus proche au *S. albicollis*, mais elle n'a que des indications faibles de stries sur la poitrine, et tout le dessus

[1] Peut-être *Pitylus puteus*, Less. Institut, 1834, p. 316, sera la femelle de cette espèce. Dans ce cas elle devrait porter le nom de *P. testacea puteus* (Less.).—Berl. et Stolzm.

[2] *Pitylus olivaceus*, Less. Institut, 1834, p. 316, pourrait être le jeune de cette espèce. Il faudra examiner l'exemplaire typique.—Berl. et Stolzm.

de la tête et du cou est d'un cendré presque pur à peine lavé d'olivâtre. Les dimensions sont plus grandes.

♂. Long. tot. 235, enverg. "345," aile 105, queue 99, bec 20, tarse 28 mm.
♂. „ 230, „ "330," „ 102, „ 91, „ 18, „ 25·5 „
♀. „ 233, „ "325," „ 98, „ 100, „ 20, „ 25 „

Lima: huit oiseaux; septembre et octobre 1889.

Fam. Fringillidæ.

14. Sporophila simplex (Tacz.).

Spermophila simplex, Tacz. Orn. du Pérou, iii. p. 16.

Lima: sept individus; janvier, février et mars 1890. "Iris brune foncée."

15. Sporophila telasco (Less.).

Spermophila telasco, Tacz. Orn. du Pérou, iii. p. 14.

Lima: nombreux exemplaires; septembre, octobre 1889, janvier 1890. "Iris brune."

Un mâle adulte du 31 octobre a le bec tout-à-fait noir, tandis qu'un autre mâle, peut-être plus jeune (mais en plumage parfait), du 21 septembre, l'a d'un brun rougeâtre. Les oiseaux de Guayaquil paraissent tout-à-fait identiques avec les oiseaux typiques de Lima.

16. Neorhynchus nasesus (Bp.)[1].

Ica: trois oiseaux; novembre et décembre 1889. "Iris brune foncée."

17. Catamenia analoïdes (Lafr.).

Lima: huit oiseaux; octobre et novembre 1889. "Iris brune foncée."

Les oiseaux du Pérou méridional sont plus grands. S'ils ne seront pas identiques avec la *C. analis*, Lafr. et D'Orb, ils appartiendront à une troisième forme qui devrait recevoir un nouveau nom.

18. Volatinia jacarina (L.).

Lima: nombreux exemplaires; août à novembre 1889, janvier 1890. "Iris brune foncée."

Tous les mâles envoyés se trouvent en plumage imparfait.

19. Xenospingus concolor (Lafr. et D'Orb.).



Xenospingus concolor.

Ica: six individus; novembre 1889. "Iris brune-rougeâtre."

La femelle adulte ne se distingue du mâle adulte que par des couleurs un peu plus ternes et paraît plus blanchâtre en dessous.

Le type de d'Orbigny venait d'Arica.

[1] Le nom le plus ancien pour cette espèce sera probablement *N. peruvianus* (Less.): cf. *Callyrhynchus peruvianus*, Less. Rev. Zool. 1842, p. 209 (de Callao). —Berl. et Stolzm.

20. Poospiza bonapartei, Scl.[1]

Lima et Ica: nombreux exemplaires; septembre, novembre et décembre 1889, février 1890. "Iris brune."

21. Phrygilus alaudinus (Kittl.).

Lima et Ica: six oiseaux; novembre et décembre 1889. "Iris brune foncée."

22. Zonotrichia pileata (Bodd.)[2].

Lima: nombreux exemplaires; septembre et novembre.
Ica: novembre et décembre 1889. "Iris brune-rougeâtre."

23. Chrysomitris capitalis, Cab.

Lima et Ica: sept oiseaux recueillis depuis septembre 1889 jusqu'à février 1890. "Iris brune foncée."

Ces oiseaux ressemblent aux oiseaux typiques de l'Ecuadeur oriental, mais le croupion est d'un jaune plus pur, le jaune à la base des rectrices plus étendu, et le miroir alaire plus grand. Quant à ces détails ils paraissent un peu intermédiaires entre la *Ch. capitalis* de l'Ecuadeur et la *Ch. icterica* du Brésil.

24. Sycalis arvensis luteiventris (Meyen).

Sycalis luteiventris et *S. arvensis*, Tacz. Orn. du Pérou, iii. pp. 59, 61.

Lima: six individus; août et septembre 1889, février 1890. "Iris brune."

Ces oiseaux s'accordent tout-à-fait avec des individus de l'Ecuadeur oriental. Les oiseaux de Chile (*arvensis*, Kittl.) sont un peu plus grands. La marque blanche sur les rectrices externes n'est pas constante.

Une ponte de trois œufs a été trouvé par M. Kalinowski à Lima le 9 novembre. Les œufs sont ovoïdes, légèrement amincis vers le petit bout, qui est assez fortement retroussé. Le fond est bleu-verdâtre pâle, comme dans les œufs des autres espèces de *Sycalis*. Le fond est couvert de taches d'un roux-brunâtre, ramassées principalement au gros bout, où elles forment une couronne plus ou moins dense. Le reste de la surface est couvert de taches plus rares et plus petites; le petit bout reste quelquefois immaculé. La grandeur des taches varie beaucoup, depuis petits points à peine visibles jusqu'à macules de quelques millimètres en diamètre. En général les grosses taches sont rassemblées sur le gros bout, où elles couvrent parfois le fond. Celles de la gamme inférieure sont d'une couleur

[1] Le nom le plus ancien pour cette espèce sera peut-être *Poospiza hispaniolensis*, Bp., mais on pourrait le rejeter comme fondé sur une erreur géographique —*consensu omnium*!—Berl. et Stolzm.

[2] Le nom le plus ancien pour cette espèce sera *Zonotrichia capensis* (Müll.), mais comme *Poospiza hispaniolensis* il pourrait être écarté *consensu omnium*. —Berl. et Stolzm.

rousse pâle, qui tire quelquefois au cendré. Dimensions 19·25 × 14; 20 × 14; 19·25 × 13·50 mm.

Fam. Icteridæ.

25. Dolichonyx oryzivorus (L.).

Ica: cinq jeunes oiseaux; novembre et décembre 1889. "Iris brune."

26. Molothrus occidentalis, sp. nov.

Molothrus purpurascens, Cassin (nec Hahn), Proc. Ac. N. Sc. Phil. 1866, p. 20; Taez. Orn. du Pérou, ii. p. 422.

♂ *mari* M. bonariensis *simillimus, differt pectore lateribusque nitore cupreo resplendentibus, necnon rostro longiore.*

♀ *feminæ* M. bonariensis *similis, differt corpore subtus clariore, fere albescenti, et stria superciliari pallida magis conspicua, corpore supra etiam pallidiore, plumarum marginibus pallidis.*

Hab. in Peru occ. (Lima etc.).

Lima: nombreux exemplaires; octobre et novembre 1889, janvier 1890. Iris brune chez l'adulte, "brune foncée" chez le jeune.

27. Trupialis bellicosa (De Filippi).

Lima et Ica: nombreux exemplaires recueillis depuis septembre jusqu'au décembre 1889. "Iris brune."

Deux œufs ont été fournis par M. Kalinowski, qui les a trouvé dans les environs de Lima. Ils sont presque elliptiques, courts, et bombés aux deux bouts presque également retroussés. La coque est lisse, avec un éclat assez fort. Le fond est blanc, légèrement bleuâtre, parsemé sur toute la surface de petits points brun-olivâtres, un peu plus denses sur le gros bout que sur le reste de la surface. Dimensions 24·25 × 19; 22·25 × 18·25 mm.

Les oiseaux de Lima ont le bec un peu plus long, mais les ailes plus courtes que les oiseaux de l'Ecuadeur occidental. L'espèce a été décrite comme provenante de "l'Am. mérid. occ."

28. Dives kalinowskii, sp. nov.

Dives warszewiczi, Taez. Orn. du Pérou, ii. p. 433 part.

Totus niger nitore chalybeo-cyaneo; rostro pedibusque nigris; iride sordide rubra.

♀ *mari similis, sed minor.*

Obs. D. warszewiczi similis, sed multo major, nitore cyaneo nec viridescente. Rostro multo longiore et robustiore.

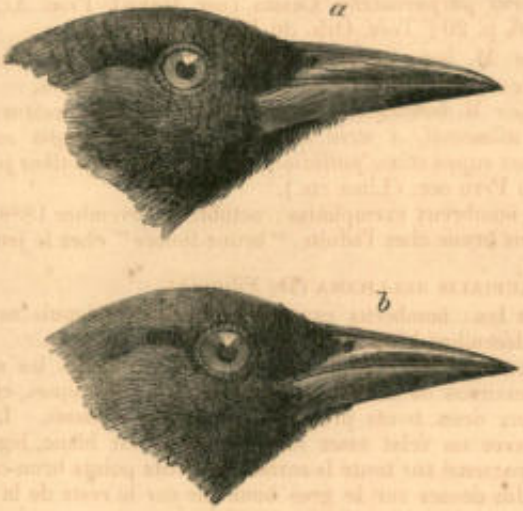
Hab. Peru occ. circum Ica.

Cet oiseau est d'un noir uniforme, avec un lustre bleu d'acier viride, qui est plus faible et plus verdâtre sur les remiges et les rectrices. Le bec et les pattes sont noirs, l'iris d'un rouge sale.

C'est une forme proche au *D. warszewiczi*, Cab., du Pérou septentrional et de l'Ecuadeur, qui s'en distingue au premier coup d'œil par une taille beaucoup plus forte, par le lustre du plumage plus fort et d'un bleu d'acier au lieu de verdâtre, et par la grandeur et la forme du bec, dont le culmen est un peu courbé, tandis qu'il est droit

chez la forme septentrionale. Voilà la table des mesures des deux espèces :—

	Long. tot.	Enverg.	Aile.	Queue.	Bec.	Tarse.
	mm.	mm.	mm.	mm.	mm.	mm.
D. kalinowskii, ♂ (Ica)	324, 323	"470"	146	134, 130	35, 33½	38
,, ♀ (Ica)	309, 305	"430, 445"	139, 137	126, 125	31, 32	37½
D. warszewiczi, ♂ (Yaguachi)	—	—	106	92	24	31
,, ♂ (Tumbez)	—	—	113	107	27·5	36
,, ♀ (Tumbez)	—	—	98	87	24	30



Dives kalinowskii: *a*, ♂; *b*, ♀.

Quatre oiseaux des deux sexes ont été fournis par M. Kalinowski, tués à l'hacienda de Huamani (près d'Ica) en décembre 1889. Une paire se trouve au Musée Branicki à Varsovie, une autre au Musée Berlepsch à Muenden.

Fam. TYRANNIDÆ.

29. MUSCIGRALLA BREVICAUDA, Lafr. et D'Orb.

Lima et Ica: six individus; septembre à décembre 1889, janvier et février 1890. "Iris brune claire."

Un oiseau de Tumbez diffère un peu. Il a les parties supérieures plus claires et l'abdomen fort lavé de jaune pâle, ce qui n'est pas le cas chez les oiseaux de Lima et d'Ica. L'oiseau de Tumbez a aussi les ailes plus courtes et le bec un peu plus long. Cependant cet oiseau paraît être plus jeune que ceux de Lima et d'Ica. L'espèce a été décrite de Tacna.

30. SERPHOPHAGA CINEREA, Strickl.

Lima: six oiseaux du septembre et novembre 1889 et du mars 1890. "Iris brune."

Ces oiseaux sont presque identiques avec d'autres de l'Ecuadeur et du Vénézuela. En général il paraît qu'ils ont les ailes et la queue un peu plus longues.

31. Anæretes reguloïdes (Lafr. et D'Orb.).

Culicivora reguloïdes, Lafr. et D'Orb. Syn. Av. i. (1837) p. 57 (typ. ex Tacna).

?? *Tyrannulus albocristatus*, Vig. Zool. Journ. v. (1829) p. 273 (typ. ex "Brazil").

Anæretes albocristatus, Tacz. Orn. du Pérou, ii. p. 241.

Lima, Callao, Ica: cinq individus; octobre et novembre 1889. "Iris brune foncée."

T. albocristatus, Vig., décrit comme ayant l'abdomen jaune et comme provenant du Brésil, ne nous paraît pas appartenir à cette espèce. Il faudra donc accepter le nom plus récent de *reguloïdes*, Lafr. et D'Orb.

32. Ornithion imberbe sclateri (Berl. et Tacz.).

Ornithion sclateri, Tacz. Orn. du Pérou, ii. p. 254.

Lima: cinq individus de septembre et octobre 1889, et du janvier et février 1890. "Iris brune foncée."

Ces oiseaux se trouvent en plumage très usé et ne présentent pas le blanc-jaunâtre à la pointe des rectrices externes et au croupion, ce que sont les caractères distinctifs de l'*O. sclateri* de l'Ecuadeur occ.

Deux pontes (de deux œufs chacune) ont été fourni par M. Kalinowski, trouvées à Lima le 1 novembre 1889. Les œufs sont blancs pur, avec une couronne disséminée au gros bout composée de quelques petites taches et points minimes d'un brun foncé presque noir. Le reste de la surface est immaculé; cependant un œuf possède quelques petits points disseminés ça et là. Dimensions par pontes:—

1°. { 16·25 × 12·25 mm. / 17·25 × 12·75 mm. } 2°. { 16·75 × 12·25 mm. / (cassé). }

33. Elainea albiceps modesta (Tsch.).

Elainea albiceps, Tacz. Orn. du Pérou, ii. p. 263.

Lima: nombreux exemplaires d'octobre, de novembre, et de décembre 1889, et de janvier 1890. "Iris brune claire."

Ces oiseaux ressemblent le plus aux oiseaux du Chile. Ils ne diffèrent que par les ailes et la queue un peu plus longues. Les bandes formées par les points claires des tectrices sus-alaires sont moins prononcées, plus verdâtres au lieu de grisâtres. La gorge et la poitrine d'un gris un peu plus clair.

34. Myiobius rufescens, Salvad.

Lima: quatre oiseaux de septembre et novembre 1889. "Iris brune foncée."

Les deux œufs trouvés par M. Kalinowski à l'hacienda Ocucaje le 10 décembre 1889 ont le fond d'un ocreux-roussâtre pâle, varié d'une couronne disséminée, composée de petits points d'un roux-rouille foncé. Le reste de la surface est uniforme. La grandeur de ces points ne dépasse pas celle de la fiente de la mouche ordinaire.

Chaque point est entouré d'une nuance roussâtre plus foncée que le fond. Les points de la gamme inférieure tirent au cendré. Dimensions 18·25 × 13·25; 17·75 × 13·25 mm.

Le *Myiobius rufescens*, Salvad., a été décrit comme provenant du Brésil. Il serait peut-être à recommander de réexaminer le type qui se trouve au Musée de Turin. En cas qu'il appartiendrait à une autre espèce, l'oiseau du Pérou occidental devrait porter le nom de *M. nationi*, Scl.

35. PYROCEPHALUS RUBINEUS HETERURUS, Berl. et Stolzm., subsp. nov.

Pyrocephalus rubineus coronatus, Tacz. (nec D'Orb. ex Gmel.) Orn. du Pérou, ii. p. 310.

Cette forme occidentale diffère de celui de l'orient (*rubineus* typique) en ayant la barbe externe des rectrices externes bordée de blanchâtre, ce qui n'est pas du tout le cas chez l'oiseau typique. Les oiseaux de Lima nous regardons comme types de cette sous-espèce nouvelle. Les oiseaux de l'Ecuadeur occidental ne s'en distinguent que par les ailes et la queue un peu plus longues.

Lima: nombreux exemplaires; septembre, octobre, novembre.

Ica: décembre 1889. "Iris brune foncée."

36. PYROCEPHALUS OBSCURUS, Gould.

Pyrocephalus rubineus obscurus, Tacz. Orn. du Pérou, ii. p. 311.

Lima et Ica: dix exemplaires de septembre, novembre et décembre 1889. "Iris brune foncée."

37. TYRANNUS TYRANNUS (Linn.).

Tyrannus pipiri, Vieill.; Tacz. Orn. du Pérou, ii. p. 329.

Lima: un oiseau très-jeune du 6 novembre 1889. "Iris brune."

38. TYRANNUS MELANCHOLICUS (Vieill.).

Lima: cinq exemplaires de septembre, octobre, et novembre 1889. "Iris brune claire."

Il n'y a pas de différence entre ces oiseaux et des individus de Bahia.

Fam. DENDROCOLAPTIDÆ.

39. GEOSITTA PERUVIANA, Lafr.

Lima, Chorillos, et Ica: six exemplaires, septembre à décembre 1889. "Iris brune."

Une femelle en plumage usé a le bec un peu plus long et plus fort que les autres. Elle ne présente pas une trace de taches noirâtres sur la poitrine qui se manifestent chez tous les autres exemplaires. Il paraît qu'un oiseau semblable a servi pour type à la description de Lafresnaye.

40. CINCLODES TACZANOWSKII, sp. nov.

Cillurus nigrofumosus, Tsch. (nec Lafr. et D'Orb.) Faun. Peruan.,

Aves, p. 235 ("Ganze Waldregion von Peru"); Tacz. P. Z. S. 1874, p. 526 (Chorillos).

Cinclodes nigrifumosus, Scl. et Salv. (nec Lafr. et D'Orb.) P. Z. S. 1867, p. 985 (Islay)?; Salv. P. Z. S. 1883, p. 424 (S. Lorenzo Island).

Cinclodes nigrofumosus, Tacz. Orn. du Pérou, ii. p. 110, pt. (descr. jun. *ex* Chorillos).

C. *corpore supra sordide brunneo-fumoso, pileo obscuriore nigro-fumoso, fronte rufescenti-grisco lavato; uropygio cum tectricibus supracaudalibus pallidioribus sordide fulvescente lavatis: stria superciliari e striis sordide albo-brunneis composita a naribus supra oculum ad nucham ducta vix conspicua: capitis lateribus fumoso-brunneis sordide brunneo-albo striatis: gula cum jugulo collique lateribus inferioribus sordide fulvescenti-albis, plumis apice fusco marginatis: pectore cum abdomine sordide grisco-terreno-brunneis, plumis pectoralibus stria mediana non satis definita sordide alba, abdominis plumis fere immaculatis, medio solummodo pallidioribus: tectricibus alarum superioribus omnibus basi nigro-fumosis, apice sordide rufescenti-albo-brunneo late terminatis: remigibus nigro-brunneis, nisi duabus primis, basi plus minusve* (*sicut in* C. nigrofumoso) *late albo-rufescenti fasciatis: tectricibus primariorum similiter rufescenti-albo extus marginatis: tectricibus alarum inferioribus pallide rufescenti-brunneis: tectricibus subcaudalibus terreno-brunneis unicoloribus: rectricibus brunneo-nigris, quatuor externis apicibus rufescenti-albis, duabus sequentibus apice anguste rufescenti-albo marginatis: rostro pedibusque brunneo-nigris, plus minusve flavo-brunneo variegatis.*

Obs. Sp. forma *C. nigrofumoso*, Lafr. et D'Orb., affinis differt coloribus pallidioribus et sordidioribus, gula juguloque in fundo sordidius fulvescenti-albis (nec pure albis), pectore abdomineque pallide griseo-terreno-brunneis (nec intense brunneis), striis in pectore vix conspicuis, in abdomine evanescentibus (in *C. nigrofumoso* plumis pectoris et abdominis distincte albo striatis): tectricibus alæ superioribus omnibus rufescenti-albo-brunneo terminatis (nec obscure brunneis unicoloribus): stria superciliari sordidiore vix conspicua: fascia alari pallidiore rufescenti-alba etc.

Hab. Chorillos prope Lima, Peruv. occ.

Cette espèce nouvelle, que nous avons nommée en mémoire à feu notre ami le Dr. L. Taczanowski[1], dans toutes ses formes s'accorde bien avec le *C. nigrofumosus* (Lafr. et D'Orb.), dont le type venait de Cobija, Bolivie. Cependant elle en diffère bien par sa coloration. Toutes ses couleurs paraissent plus pâles et plus sombres, les dessins blanchâtres plus sales et moins tranchées. La différence principale consiste dans la couleur de la poitrine et de l'abdomen, qui est d'un gris-brun très pâle presque uniforme, au lieu d'être d'un brun foncé moucheté de stries blanches au milieu de chaque plume. Ce ne

[1] Taczanowski autrefois avait communiqué à Berlepsch son opinion sur cet oiseau, qu'il croyait déjà espèce nouvelle — Berl. et Stolzm.

sont que les plumes de la poitrine qui présentent des stries d'un blanc-roussâtre terne pas bien définies. Le blanc de la gorge et du cou inférieur et latéral est plus sale, présentant une légère nuance roussâtre. Les plumes de ces parties sont bordées moins largement d'un brun grisâtre à leur pointe, tandis qu'elles sont plutôt des macules d'un brun intense qui terminent les plumes chez le *C. nigrofumosus*. Toutes les tectrices sus-alaires présentent des points d'un brun-blanc roussâtre, tandis qu'elles sont d'un brun obscur uniforme comme le dos chez l'autre espèce. La bande rousse à la base des remiges et les bordures rousses des petites tectrices des primaires sont plus pâles ou plus blanchâtres. La strie sourcilière, composée de stries d'un brun pâle ou roussâtre, est à peine visible, tandis qu'il y a des taches presque blanches chez le *C. nigrofumosus*. Le front est plus lavé d'un gris brunâtre, le pileum plus noirâtre. Le dos d'un brun plus pâle et plus enfumé. Le croupion beaucoup plus pâle et lavé un peu de roussâtre. Les rectrices externes terminées d'un roux plus pâle et plus blanchâtre. Les tectrices sous-caudales d'un brun terreux uniforme (pas striées d'un blanc roussâtre). Enfin, les tectrices sous-alaires d'un brun plus pâle et plus roussâtre.

Malheureusement M. Kalinowski n'a fourni que trois femelles adultes qui ont servi à la description précédente. Mais il est improbable que le mâle diffère beaucoup de la femelle. La comparaison a été faite avec un oiseau adulte du Chile du musée Berlepsch. Aussi bien qu'on peut juger d'après la description de MM. Lafresnaye et D'Orbigny du *C. nigrofumosus*, l'oiseau typique de Cobija, Bolivie, est identique avec celui du Chile.

Les oiseaux d'Islay, Pérou méridional, dont Sclater parle dans son catalogue des Dendrocolaptidæ[1], appartiendront peut-être au *C. taczanowskii*. Il faudra les comparer.

Trois ♀ ♀. Long. tot. 240, 235, 244, enverg. 380, 380, 372, aile 114½, 113, 112, caud. 87, 83½, 85½, culm. 25, 24¼, 24¼, tarse 30½, 29½, 30½ mm.

Chorillos: trois femelles du 26 octobre 1889. "Iris brune." Deux exemplaires se trouvent au musée Branicki, un autre au musée Berlepsch.

41. PHLŒOCRYPTES MELANOPS (Vieill.).

Callao: cinq exemplaires du 10 novembre 1889. "Iris brune."

Ces oiseaux ne diffèrent d'un individu provenant de Rio Grande do Sul (Mus. H. v. B.) que par le blanc du milieu du ventre plus pur et plus étendu, et par la queue, qui est plus longue. Un oiseau du Chile a le même blanc du ventre que l'oiseau de Callao, mais il a la queue beaucoup plus longue. Ces différences seront peut-être individuelles. L'oiseau typique habite le Paraguay.

[1] "The specimens from Southern Peru show less white on the throat, and are generally darker in colour" (Scl. Cat. Birds Brit. Mus. xv. p. 22).

Fam. Trochilidæ.

42 Myrtis fannyæ (Less.).

Myrtis fanny, Tacz. Orn. du Pérou, i. p. 312.

Lima et Ica: cinq exemplaires, septembre à décembre 1889.

La seule différence que nous avons pu trouver entre un mâle adulte de Lima et un mâle adulte de l'Equateur occidental c'est que le premier a la queue plus longue de 3½ mm. La *M. fannyæ* a été décrite par erreur comme provenant du Mexique.

43. Thaumastura cora (Less.).

Lima: septembre.
Ica: novembre et décembre. } Six exemplaires.

44. Rhodopis vesper (Less.).

Rhodopis vesper, Tacz. Orn. du Pérou, i. p. 316.

Chorillos et Ica: quatre exemplaires de novembre et décembre 1889.

45. Amazilia amazilia (Less.).

Amazilia pristina, Gould; Tacz. Orn. du Pérou, i. p. 406.

Lima: août et septembre.
Ica: novembre. } Neuf exemplaires.
Le type venait de Callao.

Fam. Micropodidæ.

46. Micropus andecola (Lafr. et D'Orb.)[1].

Cypselus andecolus, Tacz. Orn. du Pérou, i. p. 232.

Ica: deux oiseaux de novembre et décembre 1889. "Iris noire."

Nous n'avons pas eu l'opportunité de comparer ces oiseaux avec l'oiseau typique qui venait de la Paz en Bolivie (hauteur 3000 mètres). Il paraît que nos oiseaux sont plus petits, ayant l'aile de 135 mm., tandis que D'Orbigny la donne de 150 mm.

Fam. Caprimulgidæ.

47. Chordeiles acutipennis pruinosus (Tsch.).

Caprimulgus pruinosus, Licht. MS.; Tsch. Consp. Av., Wiegm. Arch. 1844, p. 8.

Chordeiles peruvianus, Peale, Unit. St. Explor. Exped., Birds (1848), p. 272, tab. 48. f. 2; Tacz. Orn. du Pérou, i. p. 210.

Lima: cinq exemplaires de septembre 1889 et février 1890. "Iris noire."

[1] Après la détermination de cet article Stolzmann a eu l'opportunité d'examiner dans le Musée de Paris l'individu typique du *Cypselus andecola* (Lafr. et D'Orb.) provenant de Yuracares (Bolivie orientale). Cet oiseau lui a paru bien distinct de nos exemplaires du Pérou occidental, qui sont beaucoup plus petits que l'oiseau de la Bolivie. La différence dans la longueur de l'aile est de 20 mm. et celle de la queue de 15 mm. Il paraît aussi que le noir chez les oiseaux d'Ica sera plus intense, mais l'oiseau typique est en mauvaise condition. En cas que cette différence sera constante nous réserverons à la forme d'Ica le nom de *M. andecola parvulus*.—Berl. et Stolzm.

48. Stenopsis decussata (Tsch.).

Caprimulgus decussatus, Tsch. Consp. Av., Wiegm. Arch. 1844, p. 8.

Caprimulgus æquicaudatus, Peale, Unit. St. Explor. Exped., Birds (1848), p. 168.

Stenopsis bifasciata, Tacz. (nec Gould) Orn. du Pérou, i. p. 221.

Stenopsis æquicaudata, Tacz. Orn. du Pérou, i. p. 222, pt.? (♂).

Lima: trois exemplaires de septembre et octobre 1889. "Iris noire."

Il n'y a pas de doute que le nom de Tschudi "*decussata*" serait plus ancien que celui de Peale "*æquicaudata*" adopté pour cette espèce par Mr. Sclater et d'autres. En outre la description de Tschudi est très bonne et ne peut pas être appliquée à une autre espèce. Tous les deux noms sont fondés sur des individus provenants de Lima.

Il paraît que dans son 'Ornithologie du Pérou' feu le Dr. Taczanowski a confondu la *St. decussata* avec la *St. bifasciata*, Gould, espèce plus grande qui habite le Chile et la Bolivie. Les oiseaux décrits par lui comme *St. bifasciata* appartiendront sans doute à la *St. decussata*. Quant à sa *St. æquicaudata* il paraît que la description du mâle appartiendra aussi à la *St. decussata*, tandis que la description de la femelle s'appliquera peut-être à la femelle de la vraie *St. bifasciata*, Gould (faite probablement d'après une femelle de la Bolivie du musée Berlepsch). Les mesures du mâle doivent aussi avoir de rapport à la *St. bifasciata*, comme elles sont trop grandes pour la *St. decussata*[1]. Il faut ajouter que dans la diagnose de la *St. æquicaudata*, Taczanowski dit "rectricibus lateralibus ternis albo terminatis," tandis qu'il dit dans les tables: "Deux rectrices latérales terminées de blanc."

Fam. Picidæ.

49. Chrysoptilus atricollis (Malh.).

Nec *Ch. atricollis*, Tacz. Orn. du Pérou, iii. p. 86.

Ica: sept exemplaires de novembre et décembre 1889. "Iris brune-rougeâtre."

Ces oiseaux s'accordent dans tous les détails avec la description de Malherbe (Rev. et Mag. de Zool. 1850, p. 156), et quoique l'auteur remarque seulement que le mâle unique qui lui a servi de type venait du Pérou, il est presque certain que l'exemplaire en question venait de la côte du Pérou, comme il était rapporté par l'expédition de "la Bonite." M. Taczanowski, dans son 'Ornithologie du Pérou,' sous le nom de *Ch. atricollis*, a décrit une espèce différente qui vient des vallées chaudes de la sierra du Pérou septentrional et qui paraît être nommé par Reichenbach (Handb. sp. Orn. Scans. p. 419) *Ch. peruvianus*. Le type du *Ch. peruvianus*, Reichb.,

[1] Il faudra bien examiner la "*St. æquicaudata*" recueilliée par Jelski à Pumamarca (Pérou central oriental) pour déterminer s'il appartiendrait à la *St. decussata* ou à la *St. bifasciata*.—Berl. et Stolzm.

venait du Pérou par Warszewicz, qui a fait des collections dans les montagnes du Pérou du nord.

L'espèce du nord diffère surtout par la couleur du dos, qui est d'un jaune pâle (quelquefois même jaune-orangé) traversé de bandes noires aussi larges que les intervalles jaunes, au lieu d'être olive traversé de bandes noires de moitié plus étroites que les intervalles olives, comme chez le *Ch. atricollis*, etc. On ne peut pas juger d'après la description et figure mauvaise de Reichenbach, mais il faudra examiner le type qui se trouve dans le Musée de Dresde.

En cas que l'espèce de Callacate et de Chachapoyas, du Pérou septentrional, manquerait de nom, nous lui réserverons celui de *Ch. chrysonotus*.

Fam. Alcedinidæ.

50. Ceryle americana cabanisi (Tsch.).

Ceryle cabanisi, Tacz. Orn. du Pérou, iii. p. 104.

La Gloria et La Merced: deux mâles d'août et de septembre 1890. "Iris brune foncée, bec jaune."

Ces exemplaires ont les ailes et la queue un peu plus longues et le bec un peu plus court que des oiseaux de Veragua et de Costarica. Le vert des parties supérieures plus obscur et plus bleuâtre, le front d'un vert plus pur, moins brunâtre et plus tacheté de blanc. La bande brune de la poitrine paraît un peu plus large.

Fam. Cuculidæ.

51. Crotophaga sulcirostris, Swains.

Lima: cinq exemplaires de septembre à novembre 1889 et de janvier 1890. "Iris brune."

Ces oiseaux ont le bec plus petit, les ailes et la queue un peu plus courtes, et le plumage plus uniforme (les bordures des pennes moins métalliques et les ailes plus d'un éclat verdâtre au lieu de violâtre) que les oiseaux typiques du Mexique. Peut-être les oiseaux de Lima ne seraient pas parfaitement adultes.

Une douzaine d'œufs a été fourni par M. Kalinowski (voir la description dans l'Orn. du Pérou par Taczanowski, iii. p. 182). Les dimensions varient entre 30·50–35 × 24, 25–26, c'est à dire qu'en général elles sont plus fortes que celles des œufs recueillis au Pérou septentrional (Tumbez).

52. Coccyzus melanocoryphus (Vieill.).

Lima: deux exemplaires d'octobre 1889 et de mars 1890. "Iris chez l'adulte brune claire, chez le jeune brune foncée."

Un exemplaire comparé par Berlepsch avec un oiseau typique de Paraguay diffère un peu, ayant le bec plus long, les ailes et la queue un peu plus courtes, et les parties inférieures d'une couleur ocreuse plus intense, surtout sur les côtés du ventre. Les parties supérieures sont aussi d'une couleur un peu plus intense ou plus brunâtre. Comme c'est un oiseau en plumage très-usé, les différences pourraient être individuelles.

Fam. Psittacidæ.

53. **Bolborhynchus aurifrons** (Less.).

Lima: septembre à novembre. Ica: décembre 1890. } Nombreux exemplaires.
"Iris brune claire."

Fam. Bubonidæ.

54. **Asio clamator** (Vieill.)[1].

Otus mexicanus, Tacz. Orn. du Pérou, i. p. 192.

Ica: trois exemplaires de décembre 1889. "Iris jaune-orangée."

Ces oiseaux, comparés avec des exemplaires du Brésil méridional (Sta. Catharina), présentent des différences bien marquées, surtout dans la taille, qui est beaucoup plus petite (l'aile 236 à 260 au lieu de 285 mm., queue 128 à 143 au lieu de 163). Ils s'en distinguent aussi par le plumage beaucoup plus ocreux. La face postérieure est blanche et ne présente pas des taches de brun-roussâtre. Les aigrettes sont plus courtes.

Deux ♂ ♂. Long. tot. 350, 340, "enverg. 900," 845, aile 250, 236, queue 145, 128, bec 28, 21½, tarse 50, doigt médian (sans ongle) 31, ongle 19, pouce (sans ongle) 14, ongle 15 mm.

♀. Long. tot. 370, "enverg. 930," aile 260, queue 140, bec 28, tarse 47, doigt médian (sans ongle) 33, ongle 20, pouce (sans ongle) 16, ongle 16·5 mm.

Un exemplaire de Tarapoto, Pérou septentrional-oriental, paraît un peu intermédiaire. En tout cas il faudra examiner plusieurs oiseaux avant de déclarer qu'il s'agissait d'une forme constamment plus petite de l'occident.

55. **Speotyto cunicularia** (Molina).

Pholeoptynx cunicularia, Tacz. Orn. du Pérou, i. p. 174.

Lima: quatre exemplaires de septembre et octobre 1889. "Iris jaune."

Ce serait peut-être la forme de l'Amérique du nord *S. hypogæa*, Bp., à laquelle il faudra rapprocher les oiseaux de Lima et de la valleé du Rio Tambo[2]. Ils sont plus petits que les oiseaux du Chile et ont le plumage plus noirâtre, moins mélangé de roussâtre, et le visage plus blanchâtre. En outre le style de coloration est plus d'accord avec la forme du Chile (*cunicularia* typique) qu'avec celui de l'orient (*grallaria*, Spix). Les bandes de l'abdomen sont très-bien marquées (pas déliées en taches), les bandes noirâtres sur les barbes internes des remiges et sur les rectrices externes également

[1] *Strix mexicana*, Gml. (ex Briss., ex Hernandez), est fondé sur une description tellement insuffisante qu'il paraît impossible de dire avec certitude à quelle espèce elle se rapporte. Mais c'est plus probablement le *Bubo virginianus* que M. Hernandez a indiqué sous le nom de Tecolotl. Par conséquence il faudra changer le nom de l'espèce d'*Asio* nommée généralement "*mexicana*," dont la dénomination la plus ancienne paraît être *Bubo clamator*, Vieill. Ois. de l'Am. Sept. (1807), p. 52, pl. 20, qui est évidemment fondé sur des oiseaux de Cayenne.—Berl. et Stolzm.

[2] Voir Sharpe, Cat. B. ii. pp. 144, 147.

bien marquées et presque aussi larges que les intervalles blanches. Il y a cinq bandes étroites blanchâtres sur les rectrices médianes.

Malheureusement nous n'avons pas des oiseaux des États Unis pour comparer. En cas que les oiseaux de Lima seront différents on pourrait les séparer comme *S. cunicularia nanodes*, subsp. nov.

♂. Aile 168, queue 80, bec 23, tarse 41 mm.
♀♀. „ 169–164, „ 83–77, „ 21–16½, „ 40 „

56. Glaucidium phalænoïdes (Daud.).

Glaucidium ferox, Tacz. Orn. du Pérou, i. p. 178.

Lima: septembre à novembre 1889. Ica: novembre et décembre 1889. Six exemplaires. "Iris jaune-orangée."

Nous n'avons pas encore décidé à quelle race locale il faudra rapprocher les oiseaux de Lima.

Fam. Falconidæ.

57. Antenor unicinctus (Temm.).

Urubitinga unicincta, Tacz. Orn. du Pérou, i. p. 106.

Lima (octobre) et Ica (décembre) 1889: deux exemplaires. "Iris chez le mâle adulte brune claire, chez la femelle jeune brun-rougeâtre claire."

58. Geranoaëtus melanoleucus (Vieill.).

Lima: trois exemplaires d'octobre et novembre 1889 et de janvier 1890. "Iris brune claire."

59. Falco cassini, Sharpe.

Lima: un mâle du 4 mars 1890. "Iris brune foncée."

60. Tinnunculus sparverius cinnamominus (Sws.).

Cerchneis cinnamomina, Tacz. Orn. du Pérou, i. p. 154.

Lima et Ica: cinq exemplaires d'octobre à décembre 1889. "Iris brune foncée."

Un mâle adulte examiné par Berlepsch s'accorde tout-à-fait avec un mâle adulte de Chota, Pérou du nord; il a néanmoins les ailes, la queue et le bec plus courtes. Nous n'avons pas pu comparer des oiseaux typiques du Chile.

Fam. Vulturidæ.

61. Cathartes atratus (Bartr.).

Catharistes atratus, Tacz. Orn. du Pérou, i. p. 84.

Ica: deux exemplaires de décembre 1889. "Iris brune."

62. Cathartes aura perniger (Sharpe).

Œnops pernigra, Tacz. Orn. du Pérou, i. p. 89.

Lima: novembre 1889 et janvier 1890.
Ica: décembre 1889. } Quatre exemplaires.

Un exemplaire examiné par Berlepsch est évidemment plus petit que les oiseaux d'Angostura (Vénézuela), qui appartiendront probablement au vrai *C. perniger*.

63. SARCORHAMPHUS GRYPHUS (Linn.).

Lima: deux exemplaires de février 1890. "Iris chez le mâle adulte orangée, chez le mâle jeune brune claire."

Fam. ARDEIDÆ.

64. ARDEA EGRETTA, Gml.

Lima: deux exemplaires de janvier. "Iris jaune, bec jaune-orangé, pattes noires."

65. ARDETTA EXILIS (Gmel.).

Espèce pas mentionnée par M. Taczanowski.

Lima; une paire 10 et 16 octobre 1889. "Iris jaune-orangée; pattes d'un vert-jaunâtre."

♂. Long. al. 127, caud. 48, culm. 50½, tars. 45 mm.
♀. „ 123½, „ 43, „ 50¾, „ 45 „

Malheureusement nous ne possédons pas des oiseaux de l'Amérique septentrionale pour comparer. Les exemplaires de Lima en général s'accordent bien avec les descriptions données par les auteurs des États Unis, mais ils paraissent avoir le bec plus long. On ne sait pas encore si cette espèce niche aussi dans l'Amérique du Sud ou si elle ne se trouve là qu'en passage.

66. THERISTICUS MELANOPS (Gmel.).

Nec *Th. caudatus*, Tacz. Orn. du Pérou, iii. p. 417!

Ica: une femelle adulte du 31 décembre 1890. "Iris rouge, bec noir avec le bout vert-bleuâtre, pattes d'un rouge vif." Envergure 1285, long. tot. 695, al. 368, caud. 175, culm. 138, tars. 70 mm.

Ayant comparé l'oiseau d'Ica avec un exemplaire du Brésil (Minas Geraes) et deux individus de Colombie (Bogotá et Antioquia), nous avons trouvé des différences tres marquées. L'oiseau d'Ica possède une sorte de poche ou un sac tout-à-fait nu au milieu de la gorge. Ce n'est que la partie supérieure de la gorge (ou le menton) qui présente une ligne emplumée le long du milieu. Cette ligne emplumée est séparée des plumes du cou inférieur par la poche nue dont nous venons de parler. *La poitrine inférieure est d'un roux blanchâtre*, formant une bande très large (large de 60 mm. à peu près), séparée du cou inférieur, qui présente une couleur roussâtre, par une bande plus étroite (large de 25 mm.) d'un gris d'ardoise couvrant la poitrine supérieure.

Les oiseaux du Brésil et de la Colombie n'ont pas une trace de la poche (ou sac) gutturale. Ils possèdent une large bande emplumée le long du milieu de la gorge, qui se joigne en bas avec les plumes du cou inférieur (sans interruption). Ce ne sont que les côtés de la

gorge le long de la bande emplumée, le menton supérieur, et les côtés de la tête autour de l'œil qui sont nus.

Le cou inférieur sur la poitrine est d'un roux plus intense, tirant au châtain. Les autres parties inférieures (poitrine et ventre) sont d'un gris d'ardoise uniforme, et il n'y a aucune trace d'une bande roussâtre sur la poitrine inférieure.

Chez l'oiseau d'Ica les côtés de la tête et le cou entier sont fortement lavés de roux (parties qui sont d'un blanc-roussâtre chez les oiseaux du Brésil et de la Colombie), mais on ne voit pas cette plaque bien dessinée d'un roux châtain que les autres oiseaux présentent sur le cou inférieur au commencement de la poitrine. L'oiseau d'Ica présente des bordures plus roussâtres aux plumes du dos et des tectrices sus-alaires médianes. Les petites tectrices sus-alaires en devant sont d'un gris d'ardoise (au lieu d'un noir d'acier) et bordées d'un brun-roussâtre à la pointe. En outre l'oiseau d'Ica a les ailes et la queue plus courtes et les tibias plus dénudés.

Une étude attentive de la littérature nous a démontré que notre oiseau d'Ica s'accorde parfaitement avec la description et figure du "Black-faced Ibis" de Latham (Synops. iii. 1. p. 108, pl. lxxix.), sur lequel Gmelin a fondé son *Tantalus melanopis*. L'individu décrit et figuré par Latham a été recueilli par le Dr. Forster dans l'île "du Nouvel An," près de la Terre de Feu. Dans la planche de Latham il se manifeste bien le sac nu jugulaire et le roux de la poitrine inférieure séparé du cou par une bande noirâtre. De même Gmelin disait dans sa diagnose "saccus jugularis rugosus."

De l'autre côté "le Grand Courlis de Cayenne" ou "Courlis à cou blanc," décrit et figuré par Buffon (Hist. Nat. Ois. viii. p. 47, Pl. Enl. 976), qui forme la base pour le *Scolopax caudatus*, Bodd., s'accorde dans tous les détails avec nos oiseaux du Brésil et de la Colombie. La planche de Buffon ne présente ni une poche ou sac nu sur la gorge, ni une bande rousse sur la poitrine inférieure. Aussi toutes les descriptions faites d'après des oiseaux du Brésil et du Paraguay (du Prince Wied, Burmeister, Azara, etc.) s'accordent avec la description et figure de Buffon et avec les individus du Brésil et de la Colombie, dont nous venons de parler. Enfin Stolzmann a examiné des exemplaires provenants du Chile semblables à l'oiseau d'Ica, et Berlepsch a vu dans le Musée de Vienne des exemplaires du Brésil recueillis par Natterer qui s'accordent avec l'oiseau de Buffon.

Il est donc évident qu'il y a deux espèces de *Theristicus* semblables l'une à l'autre, mais bien distinctes et habitantes de différentes régions. L'une paraît habiter le nord et l'orient de l'Amérique du sud, par exemple Cayenne, Vénézuela, la Colombie, le Brésil et le Paraguay, c'est le *Th. albicollis* (Gml.); l'autre habitera le sud et l'occident à l'ouest des Andes, par ex. Magellania, Patagonia, Chile, et la côte Péruvienne. C'est le *Th. melanopis* (Gml.). Il nous paraît qu'il y a une troisième espèce habitante le Haut Pérou, mentionnée par Tschudi et recueillie par Jelski dans les environs de Junin, que nous avons l'intention de décrire dans un autre article.

Voici la synonymie des deux espèces de *Theristicus*, distinguées

déjà par les auteurs anciens et quelques auteurs modernes comme Gray, Bonaparte, Reichenow, et Burmeister ('La Plata-Reise'), mais confondues par la plupart des auteurs de notre temps:—

(1) THERISTICUS MELANOPIS (Gmel.).

Black-faced Ibis, Latham, Gen. Synops. iii. 1 (1785) p. 108, pl. lxxix. (typ. *ex* "New Year's Island, near Staten Island;" *cf.* Forst. Voy. ii. p. 521).

Tantalus melanopis, Gml. Syst. Nat. ed. xiii. 1 (1788) p. 653 (*ex* Latham); Lath. Ind. Orn. ii. (1790) p. 704 (ex præced.).

Ibis melanopis, Vieill. Nouv. Dict. xvi. (1817) p. 20, descr. opt. (*ex* Lath.); id. Enc. méth. iii. (1820) p. 1148, pl. 65. f. 2 (*ex* Lath.); Reichb. Vollst. Natg. Grall. (1848) tab. 140. fig. 531; Burm. La Plata-Reise, ii. (1861) p. 511, sub *Ib. albicollis*; Schleg. Mus. d. Pays-Bas, gen. *Ibis* (1863), p. 7, pt. "adulte" (individ. de Chile); Scl. P. Z. S. 1867, p. 339 (Chile); id. ibid. 1870, p. 665 (Chile); Huds. & Scl. P. Z. S. 1872, p. 549 (Patagonia); Reichenow, J. f. O. 1877, p. 154, descr. vitios., et p. 275.

Theristicus melanops, Gould & Darw. Zool. Voy. 'Beagle,' Birds (1841), p. 128 (Patagonia; ova); Fras. P. Z. S. 1843, p. 117 (Chile); Cunningh. Ibis, 1868, pp. 126, 488 (Magellania).

Tantalus melanops, Forst. Descr. Anim. ed. Lichtenst. (1844) p. 332 (New Year's Island).

Theristicus melanopis, Bonap. Consp. Av. ii. (1855) p. 155 [*ex* Parag. (errore! Berl.), Chile, Ins. Nov. Anni]; Pelzeln, Novara-Exped. Vögel (1865), p. 127 (Chile); Scl. & Salv. Ibis, 1868, p. 189 (Magellania); Cunningh. Ibis, 1869, p. 233 (Magellania); Durnf. Ibis, 1878, p. 400 (Patagonia); Scl. & Salv. P. Z. S. 1878, p. 436 (Magellania); iid. Ibis, 1870, p. 499 (Magellania); A. Newton, Ibis, 1870, p. 502 (Magell.; ova); id. P. Z. S. 1871, p. 56, pl. iv. fig. 8 (Magell.; ova); Scl. & Salv. Nomencl. Av. Neotr. (1873) p. 127, part.

Ibis melanopis, Reichb. J. f. O. 1855, p. 56 (Chile septentr.).

Geronticus (*Theristicus*) *melanopis*, Gray, Hand-list Birds iii. (1871) p. 40, no. 10233 (Str. of Magellan, Chile).

? *Geronticus melanopis*, Huds. & Scl. P. Z. S. 1871, p. 261 ("South of Buenos Aires").

Ibis caudata, Hartert, Kat. Vogels. Mus. Senckenb. (1891) p. 205 (Chile).

Ibis (*Theristicus*) *caudatus*, Oust. Miss. Sc. Cap Horn, vi. Ois. (1891) p. 140 (Magellania).

Diag.—Th. *gula superiore stria mediana plumosa prædita, gula reliqua facieque nudis*, sacco rugoso nudo *in gulæ parte inferiore sito*[1]; capite colloque *toto pallide* rufescentibus, *pileo auche-*

[1] Cet article était déjà terminé quand Berlepsch a eu l'opportunité d'examiner dans le Musée de Berlin quelques individus du *Th. melanopis* provenants du Chile. L'un de ces oiseaux n'a pas une trace d'un sac sous la gorge, mais il possède la ligne emplumée au milieu de cette région comme le *Th. caudatus*. Néanmoins cet individu dans les couleurs s'accorde tout-à-fait avec les autres oiseaux du Chile qui sont pourvus d'un sac gulaire et portent la livrée typique

nioque ad initium dorsi obscurioribus, fere rufo-castaneis: pectore inferiore late pallide rufo, *fascia pectoris superioris corporeque inferiore reliquo fusco-nigris. Dorso cum tectricibus alarum superioribus minoribus mediisque posterioribus, necnon tertiariis ultimis, fusco-nigris griseo variegatis, plumarum* apicibus rufescenti marginatis: *tectricibus alarum superioribus majoribus mediisque posterioribus, necnon tertiariis nonnullis (extus) albis: remigibus rectricibusque æneo-nigris, nitore chalybeo: alis caudaque (quam in* Th. caudato) *brevioribus.*

Hab. Magellania (*Forster, Cunningh.*); ? Patagonia (*Huds.*); ? Argentina[1] (*Huds.* etc.); Chile (*Mus. d. Pays-Bas, Vars.*, etc.); Pérou occ.: Ica (*Kalin.*), Lima (*Less.*), Chorillos (*Jelski*).

(2) Theristicus caudatus (Bodd.).

Curicaca, Marcgr. Hist. Av. Brasil (1648), p. 191 (Bras. or.)[2].

Le Grand Courlis de Cayenne, Buff. Hist. Nat. Ois. viii. (1781) p. 47 (Cayenne).

Courlis à cou blanc, Buff. & Daubent. Pl. Enl. 976 (Cayenne).

Scolopax caudatus, Bodd. Tabl. Pl. Enl. (1783) p. 57 (ex Pl. Enl. 976).

White-necked Ibis, Lath. Gen. Syn. iii. 1 (1785), p. 109 (ex Buff.).

Tantalus albicollis, Gmel. Syst. Nat. ed. xiii. 1 (1788), p. 653 (ex Buff. & Lath.); Lath. Ind. Orn. ii. (1790) p. 704 (ex Buff., Gmel.).

Mandurria ó Curucáu, Azara, Apunt. iii. (1805) p. 189, no. 362 (Paraguay).

La Mandurria ou Curucau proprement dit, Sonnini, trad. d'Azara, iii. (1809) p. 217.

Ibis albicollis, Vieill. Nouv. Dict. xvi. (1817) p. 17 (Cayenne); id. Enc. méth. iii. (1820) p. 1146; Wied, Beitr. iv. (1833) p. 693 (descr. specim. ex R. Grande do Sul); Cab. Schomb. Reise Brit.

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du *Th. melanopis*. Il reste donc douteux s'il y aura deux formes de *Theristicus* au Chile ou si le *Th. melanopis* dans quelque âge (ou sexe?) manquera du sac sous la gorge. En tout cas les différences dans les couleurs des deux espèces paraissent tout-à-fait constantes, et parmi tous les individus de l'orient que nous avons examiné (dont plusieurs tout-à-fait adultes) il n'y a pas un seul qui possède un sac sous la gorge ou qui manque de la strie emplumée au milieu de cette partie.—Berl. et Stolzm.

[1] En Argentina peut-être les deux espèces de *Theristicus* se rencontreront, l'une venant du sud, l'autre du nord. M. Hudson dit que le *Theristicus* apparaît en mai et devient plus rare au nord de Buenos Aires. Il faudra donc bien examiner les *Theristicus* d'Argentina avant de pouvoir fixer la distribution géographique des deux espèces.

[2] *Numenius americanus minor*, Briss. v. p. 338 (unde *Tantalus griseus*, Gmel.), n'est pas fondé sur le Curicaca de Marcgrave, mais sur le "matuitui" de Marcgrave (dont Marcgrave ne dit que: "Alia species reperitur huic (Curicacæ) similis, sed multo minor, magnitudine fere gallinæ, quæ vocatur matutui"). Il est donc évident que cette espèce de Marcgrave restera toujours douteuse. Peut-être que l'oiseau en question était un vrai *Numenius*.

Guian. iii. (1848) p. 757 (Br. Guiana); Burm. La Plata-Reise, ii. (1861) p. 510 (Paraná, Mendoza, Tucuman), descr.

Ibis melanopis, Wagl. Syst. Nat. (1827), gen. *Ibis*, no. 17, descr. huj. spec. excl. synon. nonnull.; Burm. Syst. Uebers. Thier. Bras. iii. 2 (1856), p. 421; Schleg. Mus. d. Pays-Bas, gen. *Ibis* (1863), p. 7, part., "plumage imparfait" (Brazil and Cayenne); Burm. J. f. O. 1860, p. 265 (Mendoza, Paraná, Tucuman); Reinh. Bidr. Kundsk. Fuglef. Brasil. Camp. Vid. Meddel. 1870, p. 22 (Minas Geraes); Ernst, Cat. Aves Mus. Caracas (1887), p. 42 (Zulia et Orinoco).

Ibis alba (errore), Less. Trait. d'Orn. (1831) p. 567, no. 7.

Theristicus melanopis, Wagl. Isis, 1832, p. 1232; Scl. & Salv. Nomencl. Av. Neotr. (1873) p. 127, part.; Allen, Bullet. Essex Institute, viii. (1876) p. 82 (Santarem); ? Durnf. Ibis, 1877, p. 190 (Buenos Aires); Barrows, Auk, 1884, p. 272 (Uruguay); Berlp. J. f. O. 1877, p. 124 (Paraguay).

Theristicus albicollis, Bonap. Consp. Av. ii. (1855) p. 155 (Brazil, Cayenne).

Geronticus albicollis, Pelz. Orn. Brasil, iii. (1869), p. 307 (S. Paulo, Paraná, Mato Grosso).

Geronticus (*Theristicus*) *caudatus*, Gray, Hand-list Birds, iii. (1871) p. 40, no. 10234 (S. America).

Theristicus caudatus, Elliot, P. Z. S. 1877, p. 498, descr. opt. (excl. mult. syn.); Salv. Ibis, 1886, p. 171 (ex Schomb.); Durnf. Ibis, 1880, p. 424 (Tucuman); Graham Kerr, Ibis, 1891, p. 270 (Pilcomayo).

Ibis caudata, Reichenow, J. f. O. 1877, p. 154, descr. opt., et p. 275.

Ibis caudatus, Frenzel, J. f. O. 1891, p. 124 (Cordova).

Diag.—*Th.* gula tota medio longitudinaliter plumosa, *gulæ lateribus* (*fascium instar*) *cum mento facieque nudis: capite colloque* rufescenti-albis, *pileo auchenioque necnon* collo infimo *ad initium pectoris* circumscripte rufo-castaneis: corpore inferiore *reliquo fusco-nigro: dorso cum tectricibus alarum superioribus minoribus mediisque posterioribus, necnon tertiariis ultimis, fusco-nigris, griseo variegatis, plumarum apicibus pallidius* griseo-brunneo marginatis: *tectricibus alarum superioribus majoribus mediisque posterioribus, necnon tertiariis nonnullis,* (*extus*) *albis: remigibus rectricibusque cum tectricibus cubitalibus æneo-nigris, nitore chalybeo: alis caudaque* (*quam in* Th. melanopi) *longioribus.*

Hab. Cayenne (*Buff.*); Brit. Guiana (*Schomb.*); Vénézuela, (Orinoco et Zulia, *fide Ernst*); Colombia (Bogotá et Antioquia, *mus. Berlp.*); Brasil: Santarem (*Allen*), Pernambuco (Maregr.), Bahia (*Wied*), Minas Geraes (*Reinh. et Lund*), Mato Grosso (*Natt.*), S. Paulo et Paraná (*Natt.*), Rio Grande do Sul (*Wied*); Bolivia (Valle Grande, *coll. Garlepp*; *mus. Berl.*); Paraguay (*Azara et Kerr*); Uruguay (*Barrows*); Argentina: Tucuman, Paraná, Mendoza (*Burm.*), Cordova (*Frenzel*), ? Buenos Aires (*Durnf.*).

Fam. Columbidæ.

67. Zenaïda maculata (Vieill.).

Lima et Ica: cinq exemplaires de novembre et décembre 1889 et de janvier 1890. "Iris brune."

68. Metriopelia melanoptera (Gmel.).

? *Chamæpelia anais* (Bp.); Scl. P. Z. S. 1866, p. 100.

Lima: un exemplaire du 13 février 1890.

69. Melopelia meloda (Tsch.).

Lima: octobre 1889. } Trois exemplaires. "Iris brune claire, tour de l'œil bleu intense, pattes rouges."
Ica: décembre 1889. }

70. Columbigallina griseola (Spix).

Chamæpelia griseola, Tacz. Orn. du Pérou, iii. p. 244.

Lima: quatre exemplaires; août et octobre 1889, mars 1890. "Iris rouge pâle."

Trois pontes de Lima nous ont été envoyé par M. Kalinowski. Voici les dimensions par ponte:—

I. 21·50 × 15·50; II. { 21·75 × 15·50 ; 20·25 × 15·75 ; III. { 22·50 × 15·25 mm. ; 21·75 × 15·50 mm.

71. Columbigallina cruziana (Knip et Prév.).

Chamæpelia cruziana, Tacz. Orn. du Pérou, iii. p. 248.

Lima et Ica: nombreux exemplaires de septembre 1889 à février 1890. "Iris composée de deux anneaux, dont l'extérieur est jaune-rougeâtre et l'intérieur blanc."

Fam. Rallidæ.

72. Rallus rythirhynchus, Vieill.

Rallus cæsius, Tsch.; Tacz. Orn. du Pérou, iii. p. 316.

Lima: nombreux exemplaires de septembre et octobre 1889. "Iris rouge, bec vert sale, sur la partie supérieure de la base d'un bleu de ciel, sur la partie basale une tache d'un rouge sale; pattes d'un rouge carné."

Un individu examiné par Berlepsch ne se distingue des oiseaux de Rio Grande do Sul (Brésil mérid.) que par une nuance un peu plus claire en dessous. Un oiseau de Cutervo (Pérou du nord) ressemble tout-à-fait aux oiseaux de Rio Grande do Sul.

73. Porzana jamaicensis (Gmel.).

Lima: nombreux exemplaires de septembre et octobre 1889 et de janvier 1890. "Iris rouge, pattes d'un carné-brunâtre."

La diagnose de MM. Sclater et Salvin (P. Z. S. 1868, p. 456),

répétée par Taczanowski (Orn. du Pérou, iii. p. 321), n'est pas correcte. On y lit : " capite, dorso toto, et alis extus albo stellatis," tandis que la tête est d'un gris d'ardoise uniforme et sans taches chez les oiseaux de Lima, de même que chez les oiseaux des Etats Unis, aussi bien qu'on pourrait juger d'après les descriptions données par les auteurs de ce pays.

74. Porzana erythrops, Scl.

Lima : six exemplaires de septembre et octobre 1889 et janvier 1890. " Iris rouge-jaunâtre, pattes d'un rouge sale."

Fam. Œdicnemidæ.

75. Œdicnemus superciliaris, Tsch.

Ica : décembre 1889. }
Lima : février 1890. } Six exemplaires. " Iris jaune pâle, pattes jaunes encore plus pâles, bec jaune à la base, noir dans la partie supérieure et dans la troisième partie terminale, tour de l'œil couleur d'orange sale."

Fam. Charadriidæ.

76. Ægialitis semipalmata (Bonap.).

Ancon : trois exemplaires du 29 janvier 1890. " Iris brune foncée, pattes d'un jaune sale."

Fam. Aphrizidæ.

77. Arenaria interpres (L.).

Strepsilas interpres, Tacz. Orn. du Pérou, iii. p. 349.

Ancon : une femelle du 29 janvier 1890. " Iris brune foncée, pattes d'un jaune orange-rougeâtre."

Fam. Scolopacidæ.

78. Actitis macularia (L.).

Lima : six exemplaires de septembre et novembre 1889. " Iris brune foncée."

79. Bartramia longicauda (Bechst.).

Actiturus bartramius, Tacz. Orn. du Pérou, iii. p. 371.

Magdalena Vieja et Lima : cinq exemplaires de mars 1890. " Iris brun foncé, bec noir-corné avec la mandibule inférieure d'un jaune-orange à bout noir ; pattes d'un jaune-olivâtre."

80. Numenius hudsonicus, Lath.

Lima : un mâle du 6 octobre 1889. " Iris brune foncée."

ii. *Aperçu des ouvrages relatifs à la Faune Ornithologique de la côte du Pérou.*

(1) Duperrey. Voyage autour du monde sur la corvette "La Coquille" pendant les années 1822–25. Zoologie, par MM. Garnot et Lesson. 1829.

Descriptions de quelques espèces d'oiseaux rapportés des environs de Lima :—*Pelecanus gaimardi, Procellaria urinatrix, Sterna inca, Cathartes urubu, C. aura, Crotophaga casasii, Pyrrhula telasco, Orthorhynchus cora, O. amazilia, Muscicapa coronata, Tanagra rubra.* L'expédition y avait recueilli 45 oiseaux appartenants à 31 espèces. Voyez pp. 586 et 587 de cet ouvrage.

(2) L'Institut, 1834, p. 316 [1].

Descriptions de deux espèces du Pérou par R. P. Lesson.

(3) Bougainville (Baron de). Journal de la Navigation autour du Globe de la Frégate 'La Thétis' et de la Corvette 'L'Espérance en 1824–26. 2 vols. Paris, 1837 [2].

(4) Note sur les Oiseaux nouveaux ou peu connus rapportés de la Mer du Sud. Par M. Adolphe Lesson. Rev. Zool. 1842, pp. 135, 209.

Psittacus aurifrons, Less., de Callao, et *Callyrhynchus peruvianus*, n. sp.[3], de Callao.

(5) The Zoology of the Voyage of H.M.S. 'Beagle.' Edited by Charles Darwin. Birds by John Gould. 1838–41.

Pyrocephalus obscurus, Gould, de Lima, et "*Puffinus cinereus*," de "Callao Bay," et quelques autres espèces mentionnées de la côte du Pérou.

(6) Tschudi (von). Fauna Peruana. Ornithologie. 1845–46.

Tschudi mentionne beaucoup d'espèces trouvées par lui dans la région de la côte du Pérou, surtout des environs de Lima.

(7) Quelques oiseaux nouveaux ou rares rapportés par M. Delattre de Bolivia (etc.). Par M. de Lafresnaye. Rev. Zool. 1847, p. 67 ff.

Linaria analoïdes, n. sp., *Spermophila telasco*, et *Geositta peruviana*, n. sp., tous de Lima.

[1] Nous n'avons pas vu cet article. Selon les diagnoses des deux espèces décrites par R. P. Lesson, *Pitylus olivaceus* et *P. puteus*, qui sont reproduites dans l'ouvrage de Taczanowski, il paraît que le premier sera un jeune oiseau de notre *Saltator immaculatus*, et le dernier peut-être la femelle de la *Pyranga testacea tschudii*, Berl. et Stolzm. Il faudra examiner les types qui se trouveront probablement dans le Musée de Paris.—Berl. et Stolzm.

[2] Nous n'avons pas vu cet ouvrage.

[3] C'est presque sûrement la femelle du *Neorhynchus nasicus*, Bp. Il faudra donc probablement changer le nom de *N. nasicus* en *N. peruvianus* (Less.).—Berl. et Stolzm.

(8) Peale, Titian R. Mammalia and Ornithology of the United States Exploring Expedition. Philadelphia, 1848.

16 espèces mentionnées des environs de Lima [1].

(9) Animaux nouveaux ou rares, Expéd. Castelnau. Oiseaux, par Des Murs. Paris, 1855.

Note sur la *Thaumastura cora* de Lima.

(10) On the Birds of the vicinity of Lima, Peru. By P. L. Sclater, With Notes on their Habits by Professor W. Nation, of Lima. Part I. Proc. Zool. Soc. 1866, pp. 96–100, pl. xi.

(11) Même titre. Part II. Op. cit. 1867, pp. 340–344.

(12) Même titre. Part III. Op. cit. 1869, pp. 146–148.

(13) Même titre. Part IV. Op. cit. 1871, pp. 496–498.

(14) Description des Oiseaux nouveaux du Pérou central. Par L. Taczanowski. Proc. Zool. Soc. 1874, pp. 129–140.

Spermophila simplex, Jelski, n. sp., et *Sycalis raimondi*, n. sp., de Lima.

(15) On the Habits of *Spermophila simplex*. By W. Nation. Proc. Zool. Soc. 1874, pp. 329, 330.

(16) Liste des Oiseaux recueillis par M. Constantin Jelski dans la partie centrale du Pérou occidental. Par L. Taczanowski. Proc. Zool. Soc. 1874, pp. 501–565.

(17) Descriptions of six new Species of South-American Birds. By P. L. Sclater and Osbert Salvin. Proc. Zool. Soc. 1877, pp. 521–523, pl. lii.

Fuligula nationi, n. sp., de Lima.

(18) Further Remarks on *Fuligula nationi*. By P. L. Sclater. Proc. Zool. Soc. 1878, pp. 477–479.

(19) On the Birds of the vicinity of Lima, Peru. By P. L. Sclater. With Notes on their Habits by Prof. W. Nation, of Lima. Part V. Proc. Zool. Soc. 1881, pp. 484–488, pl. xlvi.

(20) Proc. Zool. Soc. 1883, p. 348.

Mr. Sclater exhibited two birds obtained near Lima, Peru, and transmitted to him by Prof. William Nation:—*Buteo abbreviatus* (des environs de Lima) et *Polyonymus caroli* (des Cordillères).

(21) A List of the Birds collected by Captain A. H. Markham on the West Coast of America. By Osbert Salvin. Proc. Zool. Soc. 1883, pp. 419–432.

Plusieurs espèces mentionnées des environs de Lima et d'autres localités de la côte du Pérou.

[1] Nous n'avons pas pu nous procurer cet ouvrage. Il faudra bien examiner la description et la figure du *Camarhynchus leucopterus*, sp. n., de Peale, pour déterminer si cet oiseau sera peut-être le même que *Sporophila simplex*, Tacz., ou = *Neorhynchus nasesus*!—Berl. et Stolzm.

(22) Ornithologie du Pérou. Par Ladislas Taczanowski. Trois volumes. Rennes, 1884–86.

(23) Notes on Peruvian Birds. By Prof. W. Nation. Proc. Zool. Soc. 1885, pp. 277–279.

[(24) Description of a new Ground-Finch from Western Peru. By P. L. Sclater. Ibis, 1886, pp. 258, 259, pl. viii.
Hæmophila pulchra, n. sp., des Cordillères au-dessus de Lima.]

iii. *Liste des Espèces d'Oiseaux mentionnées des environs de Lima, qui ne sont pas trouvées là par* M. Kalinowski.

81. Campylorhynchus balteatus, Bd. Lima (*Nation*), Callao (*Markham*).

82. Dendroica aureola peruviana (Sundev.). Callao (*Sundev.*)[1].

83. Hirundo tytleri, Jerd. Callao (*Markham*).

84. Iridornis analis (Tsch.). Lima (*Tsch.*)!?

85. Tanagra cyanocephala (Lafr. et D'Orb.). Lima (*Jelski* et *Tsch.*)!

86. Pheucticus chrysogaster (Less.). Lima (*Nation*).

87. Chrysomitris uropygialis (Lafr. et D'Orb.). Lima, San Mateo (*coll. Raimondi*).

88. Pseudochloris lutea (Lafr. et D'Orb.) (*Sycalis chloris*, Cab.). Lima (*Nation, Jelski*, et *Raimondi*).

89. Phrygilus plebejus, Tsch. Lima (*Nation*)[2].

90. Muscisaxicola mentalis, Lafr. et D'Orb. Lima (*Nation*).

91. Hapalocerus fulviceps (Scl.). Lima (*Nation*).

92. Cyanotis rubrigastra (Vieill.) (=*azaræ*, Naum.). Lima (*Nation*).

93. Geositta crassirostris, Scl. Lima (*Nation*)[3].

94. Geositta maritima (Lafr. et D'Orb.). Lima (*Jelski*).

95. "Cinclodes fuscus, Vieill." (an =*C. rivularis*, Cab.?). Lima (*Nation*)[4].

96. Hemiprocne zonaris (Shaw). Lima (*Raimondi*).

[1] *Cf.* Sundev. Öfvers. K. Vet.-Akad. Förhandl. 1869, p. 609.
[2] *Cf.* Sharpe, Cat. Birds B. M. xii. p. 796.
[3] L'exemplaire trouvé par Prof. Nation paraît unique encore.
[4] *Cf.* Scl. Cat. Birds B. M. xv. p. 24.

97. Micropus montivagus (Lafr. et D'Orb.). Lima (*Jelski*).

98. Ceryle torquata (Linn.). Lima (*Tsch.*), Rio Rimac (*Markh.*).

99. Conurus frontatus, Cab. "Lima (*Nation*)" (*fide Taez.*).

100. Strix flammea perlata (Licht.). Lima (*Jelski*).

101. Tachytriorchis abbreviatus (Cab.). Lima (*Nation*).

102. Phaëthon æthereus (L.). Ile S. Lorenzo (*Tsch.*).

103. Pelecanus molinæ, Gray. Callao (*Stübel*)[1], Pt. Ancon (*Oustalet*).

104. Sula variegata (Tsch.) Callao Bay et Ile S. Lorenzo (*Markham*).

105. Phalacrocorax brasilianus (Gmel.). Chorillos (*Jelski*).

106. Phalacrocorax bougainvillei (Less.). Chorillos (*Jelski*).

107. Phalacrocorax gaimardi (Less.). Ile S. Lorenzo, commun (*Tsch. et Markh.*).

108. Dendrocygna viduata (L.). Entre Lurin et Chorillos (*Tsch.*).

109. Cairina moschata (L.). Entre Lurin et Chorillos (*Tsch.*).

110. Querquedula cyanoptera (Vieill.). Chorillos (*Jelski*).

111. Fuligula nationi, Scl. et Salv. Lima (*Nation*).

112. Gymnopelia erythrothorax (Meyen). Lima (*coll. Raimondi*).

113. Rallus virginianus, L. Lima (*Nation*).

114. Aramides ruficollis (Gmel.). Lima (*Mus. Brit., fide Sclat. et Salv.*[2]).

115. Gallinula galeata (Licht.). Lima (*Jelski*), Callao (*Markham*).

116. Fulica ardesiaca, Tsch. Chorillos (*Jelski*).

117. Charadrius dominicus, Müll. (*virginicus*, Borkh.). Chorillos (*Jelski*).

118. Ægialitis nivosa, Baird. Chorillos (*Jelski*).

119. Totanus melanoleucus (Gmel.). Callao (*Jelski*).

[1] *Cf.* A. B. Meyer, J. f. O. 1890, p. 165.
[2] *Cf.* Scl. & Salv. P. Z. S. 1868, p. 448.

120. Totanus flavipes (Gmel.). Chorillos (*Jelski*).

121. Totanus solitarius (Wils.). Chorillos (*Jelski*).

122. Calidris arenaria (L.). Chorillos (*Jelski*).

123. Micropalama himantopus (Bp.). Chorillos (*Jelski*).

124. Tringa maculata, Vieill. Lima (*Jelski*).

125. Tringa fuscicollis, Vieill. Chorillos (*Jelski*).

126. Tringa bairdi, Coues. Chorillos (*Jelski*).

127. Tringa minutilla, Vieill. Chorillos (*Jelski*).

128. Phalaropus lobatus (L.). Chorillos (*Jelski*).

129. Hæmatopus ater, Scl. Ile S. Lorenzo (*Markh.*).

130. Thinocorus rumicivorus, Eschsch. Lima (*Nation* et *Jelski*).

131. Sterna hirundinacea, Less. Callao (*Markh.*).

132. Sterna elegans, Gamb. Callao (*Markh.*).

133. Sterna exilis, Tsch. Lima (*Nation*).

134. Nænia inca (Less.). Chorillos (*Jelski*), Callao (*Markh.*).

135. Rhynchops melanura, Boie. Callao Bay (*Markh.*).

136. Larus dominicanus, Licht. Chorillos (*Jelski*), Callao (*Markh.*).

137. Larus belcheri, Vig. Chorillos et Callao (*Jelski*).

138. Larus modestus, Tsch. Callao (*fide Saunders*[1]), Lurin (*Tsch.*).

139. Larus franklini, Swains. et Rich. Chorillos et Callao (*Tsch.*).

140. Larus serranus, Tsch. Callao (*Markh.*).

141. Larus cirrhocephalus, Vieill. Chorillos (*fide Saunders*[2]), Iles de Chinchas (*Grec*[3]).

142. Xema sabinei (Sabine). Callao (*Markh.*).

143. Stercorarius chilensis, Saunders. Callao (*Markh.*).

144. Stercorarius pomarinus (Temm.). Callao (*Markh.*).

? 145. Stercorarius crepidatus (Banks). Callao (*Gervase Mathew, fide Saunders*[3]).

[1] *Cf.* Saunders, P. Z. S. 1878, p. 183.
[2] *Id. ibid.* p. 204.
[3] *Id. ibid.* 1876, p. 330.

146. Diomedea irrorata, Salv. Callao (*Markh.*).

147. Puffinus griseus (Gmel.) (*Nectris amaurosoma*, Coues). Chorillos (*Jelski*), Callao Bay (*Markh.*).

148. Puffinus "cinereus, Steph." Callao (*Darwin, Gould*).

149. Thalassœca glacialoïdes (Smith). Callao (*Raimondi*).

150. Daption capensis (L.). Callao (*Raimondi*).

151. Œstrelata defilippiana, Gigl. et Salvad. Callao (*Gigl.*[1]).

152. Halodroma garnoti (Less.). Callao (*Nation*).

153. Halodroma berardi, Quoy. Callao (*Tsch.*).

Il paraît que deux espèces de Trochilidées mentionnées par M. le Dr. L. Taczanowski comme provenantes des environs de Lima, où elles seraient recueillies par M. Constantin Jelski[2], ne sont pas des habitants de cette contrée, savoir:—

Phaëthornis malaris (Licht.) et
Campylopterus largipennis (Bodd.).

Grâce à la bonté de feu Dr. Taczanowski, Berlepsch a eu l'occasion d'examiner les deux oiseaux en question appartenants au Musée de Varsovie. Ce sont des individues montées qui ne portent plus d'étiquettes originales du collecteur, et Berlepsch ne doute pas qu'en vérité elles sont provenues des collections faites par Jelski à Cayenne, et non de Lima! Dans une lettre de M. Taczanowski à Berlepsch le premier a concédé que l'indication d'habitat, "Lima," pour ces deux espèces était donnée par méprise, mais il persistait que les individues en question seraient venues du Pérou, probablement du Pérou central. Berlepsch insiste sur son opinion qu'elles seraient venues de Cayenne, car autrement nous aurions l'espèce amazonine *Campylopterus obscurus*, Gould, tandis que l'oiseau en question du Musée de Varsovie s'accorde tout-à-fait avec le *C. largipennis* typique de Cayenne[3].

[1] *Cf.* Gigl. et Salvad. Ibis, 1869, pp. 63, 64.

[2] Tacz. P. Z. S. 1874, p. 541.

[3] Stolzmann est de l'avis qu'il serait presque absolument impossible que le *Phaëthornis supercilicaus* envoyé par M. Jelski provenait des environs de Lima. Tous les Colibris appartenant au genre *Phaëthornis* sont propres aux forêts humides. Il y a une seule exception de cette règle, formée par le *Ph. griseigularis*, Gould. Mais même cette espèce se tient dans les vallées chaudes de la Sierra, où la végétation est assez riche et où il y a ça et là des fourrés très épais. Aux environs de Lima cependant la végétation est extrêmement pauvre, et par conséquent ne présente pas des conditions favorables pour les espèces du genre *Phaëthornis*. On peut supposer que M. Jelski, en partant de Cayenne pour le Pérou, a pris avec soi quelques peaux de ce pays qu'il a ajouté à son premier envoi péruvien qui provenait des environs de Lima. Peut-être il a oublié de les pourvoir des étiquettes, ce qui a induit en erreur le Dr. Taczanowski. La même remarque s'appliquerait au *Campylopterus largipennis* (Bodd.).

Quoiqu'il serait très probable que notre connaissance de la faune ornithologique des environs de Lima ne sera pas encore tout-à-fait parfaite, on voit bien que cette contrée n'est pas riche en espèces d'oiseaux.

On ne devrait pas y ajouter les espèces trouvées dans les vallées de la pente occidentale des Andes au-dessus de Lima. La faune de cette contrée sera probablement plus riche, mais jusqu'à présent elle est très peu connue. Autant que nous savons, elle est tout-à-fait différente de celle de la côte. M. le Prof. Nation à Lima a reçu une petite collection faite dans les vallées élevées à la source du fleuve Rimac (hauteur 8000 à 14,000 pieds), qui contenait les espèces suivantes, qui ne se trouvent pas dans la région de la côte, comme :—

1. *Buarremon nationi*, Scl.
   (= *Pipilo mystacalis*, Tacz.).
2. *Catamenia inornata* (Lafr.).
3. *Pseudochloris lutea* (Lafr. et D'Orb.).
4. *Hæmophila pulchra*, Scl.
5. *Phrygilus gayi punensis*, Ridgw.
6. *Phrygilus fruticeti* (Kittl.).
7. *Diuca speculifera* (Lafr. et D'Orb.).
8. *Ochthœca leucometopa*, Scl. et Salv.
9. *Leptasthenura pileata*, Scl.
10. *Chalcostigma olivaceum* (Lawr.).
11. *Metallura opaca* (Tsch.).
12. *Polyonymus caroli* (Bonap.).
13. *Colaptes puna*, Cab.
14. *Bolborhynchus andicola* (Finsch)[1].

Peut-être on y pourrait ajouter d'autres mentionnées par Tschudi de la pente occidentale des Andes péruviennes.

iv. *Considérations générales sur la Faune ornithologique des environs de Lima.*

Des 153 espèces mentionnées de cette contrée il y a du moins 31 qui ne s'y trouvent que de passage en hiver, venant de l'Amérique du nord, où elles nichent. Les autres 122 espèces probablement nichent dans la région de la côte du Pérou, mais on ne peut pas être sûr dans tous les cas, surtout en regard des oiseaux maritimes, qui quelquefois vaguent très loin de leur pays natal. Néanmoins, de ces 122 espèces il y a à peu près 95 espèces terrestres, dont nous proposons d'expliquer les relations géographiques.

1. Il y a 9 de ces 95 espèces terrestres (ou plus de 9 pour-cent)

[1] Il faudra encore ajouter à cette liste une espèce recueillie par Jelski à Obrajillo, qui est une vallée voisine de la vallée du Rimac (pente occidentale), à savoir : *Synallaxis pudibunda*, Scl. En outre M. le docteur Sclater nous a autorisé d'annoncer qu'il vient de recevoir par le Prof. Nation un exemplaire de l'*Attagis gayi*, Geoffr. et Less., tué dans les Andes au-dessus de Lima.—Berl. et Stolem.

qui paraissent exclusivement propres à la région de la côte des environs de Lima et d'Ica :—

Mimus longicaudatus[1].
Petrochelidon ruficollaris.
Dives kalinowskii.
?Cinclodes taczanowskii[2].
Geositta crassirostris.
Amazilia amazilia.
Chrysoptilus atricollis.
Porzana erythrops.
Fuligula nationi.

À la côte péruvienne plus au nord, dans le voisinage de Tumbez et de Chepen, quelques de ces espèces sont représentées par des espèces voisines :—

Mimus longicaudatus par *Mimus* espèce inédite ;
Amazilia amazilia par *A. leucophæa*, Reichb.[3] ;
Dives kalinowskii par *D. warszewiczi*, Cab. ;
aussi *Chrysomitris capitalis* par *Ch. siemiradzkii.*

Il n'y a que deux espèces (des huit nommées plus haut) qui paraissent d'être représentées dans la partie méridionale de la côte par des formes voisines, savoir :—

Cinclodes taczanowskii par *C. nigrofumosus*, Lafr. et D'Orb. ?

Catamenia analoïdes par une forme plus grande (*C. analis*, Lafr. et D'Orb. ?).

Dans la vallée du Rio Chota, système du Marañon, aux environs de Callacate (et Cutervo), le *Chrysoptilus atricollis* est représenté par une forme voisine : *Ch. peruvianus*, Reichb., qui habite aussi les environs de Chachapayas.

2. Il y a 4 espèces qui sont conjointement propres à la faune de Lima (et d'Ica) et celle de Tumbez (et Chepen) :—

Geothlypis auricularis.
Saltator immaculatus. Lima et Chepen.
Poospiza bonapartei.
Geositta peruviana. Lima et Pacasmayo.

Néanmoins la faune de Tumbez présente beaucoup de différences, possédant à peu près 7 espèces qui lui sont propres, et à peu près

[1] Stolzmann pense que le *Mimus* de Tumbez sera identique avec celui de Guayaquil, mais nous n'avons pas encore eu l'opportunité de comparer des oiseaux de cette localité.—Berl. et Stolzm.

[2] Cette espèce se trouvera peut-être aussi dans les environs d'Islay, dans la partie méridionale de la côte du Pérou. En même temps il est probable qu'elle habitera aussi les régions au nord de Lima, car dans la baie de Chimbote Stolzmann a vu plusieurs fois un *Cinclodes* qui lui a paru identique avec le *C. taczanowskii*.—Berl. et Stolzm.

[3] Le type de l'*A. leucophæa*, Reichb., est dit d'être recueilli au volcan d'Arequipa par Warszewicz, mais ce serait probablement une erreur, ou l'espèce de Tumbez (aussi de Pacasmayo et de Callacate) sera distincte. Selon l'expérience de Stolzmann il est peu probable que le type d'*Amazilia leucophæa* venait d'Arequipa, car les espèces du genre *Amazilia* alliées à l'*A. amazilia* dans leur distribution verticale ne dépassent pas la hauteur de 5000 pieds (à cette hauteur l'*A. leucophæa* a été trouvée par Stolzmann à Callacate), tandis que la ville d'Arequipa est située à 7845' au-dessus du niveau de la mer, et le volcan Misti est encore plus élevé.—Berl. et Stolzm.

35 espèces qui sont conjointement propres à cette faune et celle de Guayaquil (de l'Ecuadeur occidental)[1].

3. Il y aura 5 espèces qui sont conjointement propres à la faune de Lima, de Tumbez, et de Guayaquil :—

Campylorhynchus balteatus.
Dendroica aureola peruviana.
Neorhynchus nasesus[2].
?*Ornithion imberbe sclateri.*
Hapalocercus fulviceps.

Les deux dernières espèces se trouvent aussi dans les environs de Callacate (vallée du Rio Chota), tandis que le *C. balteatus* y est représenté par l'espèce voisine *C. fasciatus*, Sws.

4. Stolzmann a déjà démontré[3] que la faune des environs de Callacate et de Cutervo, dans la vallée du Rio Chota (système du Marañon) entre les deux chaînes occidentales des Andes, possède quelques espèces qui autrement paraissent tout-à-fait propres à la faune de la côte. C'est une chose remarquable parce que la hauteur de ces localités est d'à peu près 5000 pieds. Outre les deux espèces que nous venons de nommer (*Ornithion imberbe sclateri* et *Hapalocercus fulviceps*) cette particularité est illustrée par trois espèces qui habitent les environs de Lima :—

Sporophila simplex ;
Molothrus occidentalis ;
Bolborhynchus aurifrons :

dont la première n'est trouvée qu'à Lima, Nancho, et Callacate, la deuxième qu'à Lima, Tumbez, et Callacate (et Cutervo), et la troisième qu'à Lima et à Callacate. La dernière espèce est aussi mentionnée de Titicaca (Tacz. Orn. du Pérou, p. 211), mais cette indication de M. Raimondi manque encore de confirmation.

5. Quant à la partie méridionale de la côte, il y a 8 espèces qui sont conjointement propres à la faune de Lima (et d'Ica) et celle d'Islay (Pérou du sud) jusqu'à Tacna et Tarapacá (Chile du nord, ancien territoire péruvien et bolivien) :—

	Jusqu'à
Anthus peruvianus	Islay.
Conirostrum cinereum[4]	Tarapacá.
Xenospingus concolor	Tarapacá.
Anæretes reguloides	Tacna.
Pyrocephalus obscurus	Islay.
Geositta maritima	Cobija.
Rhodopis vespera	Tacna.
Chordeiles acutipennis pruinosus	Tambo.

Autant que nous savons, il n'y a aucune espèce propre à cette faune de la côte méridionale qui ne se trouve également dans les environs de Lima, sauf quelques formes purement chiliennes qui ne se répandent pas si loin au nord, comme *Agriornis maritima*,

[1] *Cf.* Berl. P. Z. S. 1885, p. 122.

[2] Le *Neorhynchus* de Tumbez est beaucoup plus petit que celui de Lima, et appartiendra probablement à une sous-espèce distincte.

[3] Voyez Tacz. Orn. du Pérou, i. p. 42 ff.

[4] D'Orbigny dit qu'il a trouvé cette espèce aussi à Inquisivi, Prov. Sicasica (Bolivie orientale), mais ce sera peut-être une erreur.—Berl. et Stolzm.

Agelæus thilius, Geositta cunicularia, Leptasthenura ægithaloïdes, Synallaxis modesta, et d'autres dont plusieurs seront peut-être limitées aux régions élevées de la pente occidentale des Andes.

6. Deux espèces paraissent conjointement propres à la faune de Chepen (Pacasmayo), de Lima et d'Islay (vallée de Tambo) :—

Myiobius rufescens ;
Thaumastura cora.

7. Une espèce se répand sur toute la côte péruvienne de Tumbez jusqu'à la vallée du Rio Tambo :—

Œdicnemus superciliaris.

8. Les espèces suivantes se répandent de la côte de l'Ecuadeur (Guayaquil) jusqu'à la côte du Pérou méridional ou du Chile septentrional (Tacna, etc.) :—

Sporophila telasco. Jusqu'à la vallée de Tambo.
Muscigralla brevicauda. Jusqu'à Tacna.
Pyrocephalus rubineus heterurus. Jusqu'à Tacna et Arica.

9. Une espèce se répand de Lima jusqu'au Chile central (Santiago) :—

Chrysomitris uropygialis.

10. Une autre espèce se trouve dans toute la région de la côte du Pérou de Tumbez jusqu'au Chile central :—

Melopelia meloda.

11. Les suivantes habitent la région de la côte péruvienne de Lima au nord jusqu'au Chile et la Patagonie. Quelques-unes habitent même une partie de l'Argentina, et d'autres se trouvent encore dans l'étroit Magellan :—

Muscisaxicola mentalis. Jusqu'à la Patagonie.
Elainea albiceps modesta. Jusqu'à la Patagonie et l'Argentina occ.
Thinocorus rumicivorus. De Pacasmayo à la Patagonie et l'Argentina.
Theristicus melanopis. Jusqu'à l'étroit Magellan.
Falco cassini. Jusqu'à l'étroit Magellan.

12. Les espèces qui suivent sont connues de toute la côte péruvienne, commençant de la vallée du Rio Tambo au sud, et en même temps se répandent le long de la côte de l'Ecuadeur et de la Colombie occidentale jusqu'à l'Amérique central et le Mexique :—

Ceryle americana cabanisi.
Crotophaga sulcirostris.

13. En tout il y aura à peu près 44 espèces terrestres (des 95 nommés plus haut), ou plus de 41 pour-cent, qui sont limitées à la région de la côte[1] et ne se trouvent pas sur la pente orientale des

[1] Probablement quelques-unes de ces espèces s'éleveront aussi dans les montagnes de la pente occidentale des Andes jusqu'à une certaine hauteur. Malheureusement la faune de ces contrées est encore très-peu connue. Néanmoins nous savons que 5 espèces qu'on doit regarder comme des formes caractéristiques de la côte se trouvent à Callacate et Cutervo à une hauteur de 5000' etc.—Berl. et Stolzm.

Andes. Nous y avons compris les cinq espèces qui sont constatées d'habiter aussi la région de Chota (à l'orient de la chaîne la plus occidentale des Andes de la latitude de Pacasmayo) parce que la faune de cette contrée a une certaine ressemblance avec celle de la côte.

De ces 44 espèces il n'y a qu'à peu près 10 qui peut-être seraient représentées dans l'orient ou au plateau des Andes par des formes voisines :—

Geothlypis auricularis par *G. velata*?
Molothrus occidentalis par ?
Cyanotis rubrigastra par *C. sp. nov.*[1] (de Junin).
Ornithion imberbe sclateri par *O. imberbe*?
Pyrocephalus rubineus heterurus par *P. rubineus*.
Geositta peruviana par *G. frobeni*?
Chrysoptilus atricollis par *Ch. peruvianus*. De Chota et Chachapoyas.
Ceryle americana cabanisi par *C. americana*.
Crotophaga sulcirostris par *C. ani*.
Chordeiles acutipennis pruinosus par *Ch. acutipennis*.

Les autres 34 espèces terrestres de la région de la côte ne sont pas représentées par des espèces ou formes voisines dans la région de l'orient du Pérou.

À ces 44 espèces terrestres nommées plus haut on pourrait ajouter à peu près 25 espèces maritimes qui certainement ne se trouveront pas dans la région orientale. Ce fera 69 de 122 espèces qui probablement nichent dans la région de la côte et qui manquent à l'orient—ou plus de 56 pour-cent. Peut-être quelques-unes des espèces de passage aussi ne se trouveront pas dans l'orient du Pérou, comme *Hirundo tytleri, Dolichonyx oryzivorus, Ardetta exilis, Arenaria interpres, Ægialitis semipalmata, Æ. nivosa, Calidris arenaria, Tringa minutilla, Phalaropus lobatus, Porzana jamaicensis, Sterna elegans, Larus franklini, Xema sabinei*. Alors il y aura 82 espèces de 153 mentionnées des environs de Lima et d'Ica qui ne se trouveraient pas dans l'orient du Pérou, ou à peu près 54 pour-cent.

14. Quant à les espèces qui se trouvent en même temps dans les environs de Lima (et d'Ica) et dans l'orient du Pérou, il y a à peu près 4 espèces qui paraissent conjointement propres à l'occident et à l'orient du Pérou, mais il y a de doute sur quelques-unes de ces espèces qui ne sont mentionnées de Lima que par le voyageur Tschudi :—

Iridornis analis. Lima (Tschudi)[2].
Pyranga testacea tschudii.

[1] Il y a une forme distincte de *Cyanotis* à Junin que nous avons l'intention de décrire prochainement.—Berl. et Stolzm.

[2] Selon l'expérience de Stolzmann les espèces du genre *Iridornis* sont propres aux forêts humides élevées et ne descendent pas au-dessous de 5000'. Aussi ce genre paraît absent complètement sur la pente occidentale des Cordillères, car Jelski ne l'a pas trouvé à Paucal, ni Jelski et Stolzmann à Tambillo ou Cutervo.

Stenopsis decussata.
Conurus frontatus. Lima (Tschudi).

15. Quelques espèces de la faune de Lima ne se trouvent pas dans la région orientale du Pérou de la même latitude, mais dans des contrées de l'orient plus septentrionales, à Chachapoyas, etc. :—

Pheucticus chrysogaster.
Trupialis bellicosa.
Myrtis fannyæ.

Ces espèces traversent aussi les Andes en Ecuadeur, où elles sont trouvées à Riobamba, etc.

16. Les suivantes ne sont pas encore trouvées dans l'orient du Pérou, mais elles traversent les Andes en Ecuadeur, en Colombie ou en Bolivie :—

Catamenia analoïdes. Cuença (Ecuador or.), Bogotá (Colombie or.).
Phrygilus alaudinus. Riobamba (Ecuador or.).
Micropus andecolus. Bolivia alta or.
Columbigallina cruziana. Bolivia or.
Pseudochloris lutea. Bolivia alta et Argentina occ.

17. Les espèces suivantes se trouvent en même temps dans l'occident et l'orient de l'Ecuadeur, du Pérou, et de la Bolivie :—

Turdus chiguanco.
Tanagra darwini.
—— *cyanocephala.*
Metriopelia melanoptera [1].

18. Une forme habite les deux régions de la Colombie, de l'Ecuadeur, et du Pérou :—

Sycalis arvensis luteiventris.

19. Dans l'ouest et l'orient de l'Ecuadeur et du Pérou se trouve :—

Chrysomitris capitalis.

20. Trois espèces se trouvent dans l'ouest et dans l'orient du Pérou et de la Bolivie :—

Phrygilus plebejus.
Micropus montivagus.
Gymnopelia erythrothorax.

21. Une espèce se répand sur toutes les régions andines de Costarica, de la Colombie, du Vénézuela, de l'Ecuadeur et du Pérou jusqu'en Bolivie ; c'est la

Serphophaga cinerea.

22. Les autres 32 espèces terrestres qui habitent les environs de

[1] Dans l'Ecuadeur elle paraît limitée à l'occident.

Lima (et d'Ica), et en même temps l'orient du Pérou, sont très répandues dans l'Amérique du sud, savoir :—

Troglodytes musculus.
Volatinia jacarina.
Zonotrichia pileata.
Cyanotis rubrigastra.
Tyrannus melancholicus.
Cinclodes fuscus.
Phlœocryptes melanops.
Ceryle torquata.
Hemiprocne zonaris.
Coccyzus melanocoryphus.
Strix flammea perlata.
Glaucidium phalœnoïdes.
Asio clamator (subsp. ?).
Speotyto cunicularia (subsp. ?).
Sarcorhamphus gryphus.
Cathartes atratus.
—— *aura perniger* ?
Geranoaëtus melanoleucus.
Tinnunculus sparverius cinnamominus.
Antenor unicinctus.
Tachytriorchis abbreviatus.
Zenaïda maculata.
Columbigallina griseola.
Aramides ruficollis.
Rallus rythirhynchus.
Ardea egretta.
Phalacrocorax brasilianus.
Dendrocygna viduata.
Cairina moschata.
Gallinula galeata.
Fulica ardesiaca.
Larus serranus.

23. Les 31 espèces suivantes nous regardons comme oiseaux de passage dans ces contrées, ou oiseaux qui ne s'y trouvent que pendant le temps de leur migration :—

Progne purpurea ?
Hirundo erythrogastra.
—— *tytleri.*
Dolichonyx oryzivorus.
Tyrannus tyrannus.
Querquedula cyanoptera.
Ardetta exilis.
Arenaria interpres.
Ægialitis semipalmata.
—— *nivosa.*
Charadrius dominicus.
Numenius hudsonicus.
Actitis macularia.
Bartramia longicauda.
Totanus melanoleucus.
—— *flavipes.*
Totanus solitarius.
Calidris arenaria.
Tringa maculata.
—— *fuscicollis.*
—— *bairdi.*
—— *minutilla.*
Micropalama himantopus.
Phalaropus lobatus.
Rallus virginianus.
Porzana jamaicensis.
Sterna elegans.
Larus franklini.
Xema sabinei.
Stercorarius pomarinus.
—— *crepidatus.*

24. Vingt-trois espèces qui habitent des contrées plus septentrionales paraissent atteindre à Lima la limite la plus méridionale de leur propagation :—

Campylorhynchus balteatus.
Dendroica aureola peruviana.
Geothlypis auricularis.
* ? *Pyranga testacea tschudii.*
Saltator immaculatus.
Sporophila simplex.
Neorhynchus nasesus.
* ? *Catamenia analoïdes.*
Poospiza bonapartei.
Molothrus occidentalis.
Hapalocercus fulviceps.
**Serphophaga cinerea.*

Ornithion imberbe sclateri.
**Tyrannus melancholicus.*
Geositta peruviana.
Myrtis fannyæ.
**Hemiprocne zonaris.*
**Coccyzus melanocoryphus.*
* ?*Bolborhynchus aurifrons.*
**Asio clamator.*
**Tachytriorchis abbreviatus.*
**Columbigallina griseola.*
Aramides ruficollis.

Les espèces qui sont marquées d'un astérisque se répandent plus au sud dans l'*orient* des Andes (jusqu'en Bolivie etc.).

À ces 23 espèces on pourrait ajouter les 9 espèces qui paraissent propres à la faune de Lima et les 3 espèces qui ne sont mentionnées de la côte occidentale que par Tschudi (*Iridornis analis, Tanagra cyanocephala, Conurus frontatus*), ce que fera un total de 35 espèces qui ne se trouveraient pas dans les régions de la côte plus méridionales que Lima et Ica.

25. Au contraire, il y a à peu près 21 espèces qui habitent des contrées plus méridionales et paraissent d'atteindre à Lima ou Ica la limite la plus septentrionale de leur propagation :—

Anthus peruvianus.
Chrysomitris uropygialis.
Pseudochloris lutea.
Phrygilus plebejus.
Xenospingus concolor [1].
Muscisaxicola mentalis.
Anæretes reguloides.
Cyanotis rubrigastra.
Elainea albiceps modesta.
Pyrocephalus obscurus.
Geositta maritima.
Cinclodes taczanowskii.
Phlæocryptes melanops.
? *Rhodopis vesper.*
Chordeiles acutipennis pruinosus.
Stenopsis decussata.
Falco cassini.
Phalacrocorax gaimardi.
—— *bougainvillei.*
Theristicus melanops.
Gymnopelia erythrothorax.

À cette liste on pourrait également ajouter les 9 espèces qui jusqu'à présent ne sont connues que des environs de Lima et d'Ica. Il y aura donc 30 espèces de cette catégorie.

26. Il y a 15 genres d'oiseaux qui dans les environs de Lima et d'Ica atteindront la limite méridionale, et 8 qui y atteindront la limite septentrionale de leur propagation :—

I. Genres qu'on ne rencontre pas dans la région de la côte au sud de Lima et d'Ica :—

Campylorhynchus.
Dendroica.
Geothlypis.
Pyranga.
Saltator.
Neorhynchus.
Poospiza.
Molothrus.
Ornithion.
Tyrannus.
? *Myrtis.*
Coccyzus.
Tachytriorchis.
Columbigallina.
Aramides.

[1] Peut-être limité dans la propagation septentrionale dans le département d'Ica.—Berl. et Stolzm.

II. Genres qu'on ne rencontre pas dans la région de la côte au nord de Lima et d'Ica :—

Pseudochloris.	*Phlœocryptes.*
Xenospingus.	*Cinclodes.*
Muscisaxicola.	? *Stenopsis.*
Cyanotis.	*Gymnopelia.*

Il doit être réservé à des recherches futures de trouver les limites géographiques exactes de toutes ces espèces et genres entre Lima et Pacasmayo de l'une, et entre Lima et Islay de l'autre côté. Stolzmann a déjà donné quelques renseignements en ce regard concernant la flore de la côte du nord, qui se change subitement en dépassant le 7ième degré de latitude sud (voyez Tacz. Orn. du Pérou, i. p. 19).

v. *Postscriptum de Jean Stolzmann.*

En étudiant l'avifaune de la côte du Pérou nous pouvons distinguer deux districts bien caractérisés au point de vue ornithologique, à savoir un septentrional et un méridional. La limite entre ces deux régions coïncide plus ou moins avec la vallée Chicama (Trujillo, 8° 6' 9'' lat. sud).

Le district septentrional s'étend vers le nord jusqu'au Rio Tumbez, et même il comprend aussi plusieurs parties de l'Equadeur méridional, les environs de Santa-Rosa, de Guayaquil et de Babahoyo, qui lui ressemblent sous le point de vue physiographique. En revanche il faudra exclure l'embouchure du Rio Tumbez, qui est couverte de rhizophores, et en conséquence présente un caractère tout-à-fait différent, et la vallée du Zarumilla, formant une transition aux forêts humides de l'Equadeur occidental.

Le district septentrional possède trois genres qui ne se trouvent pas autre-part, à savoir :—

Piezorhina, Gnathospiza, Myrmia.

En outre nous trouvons ici 19 genres qui manquent complètement au district méridional[1]. Les voici :—

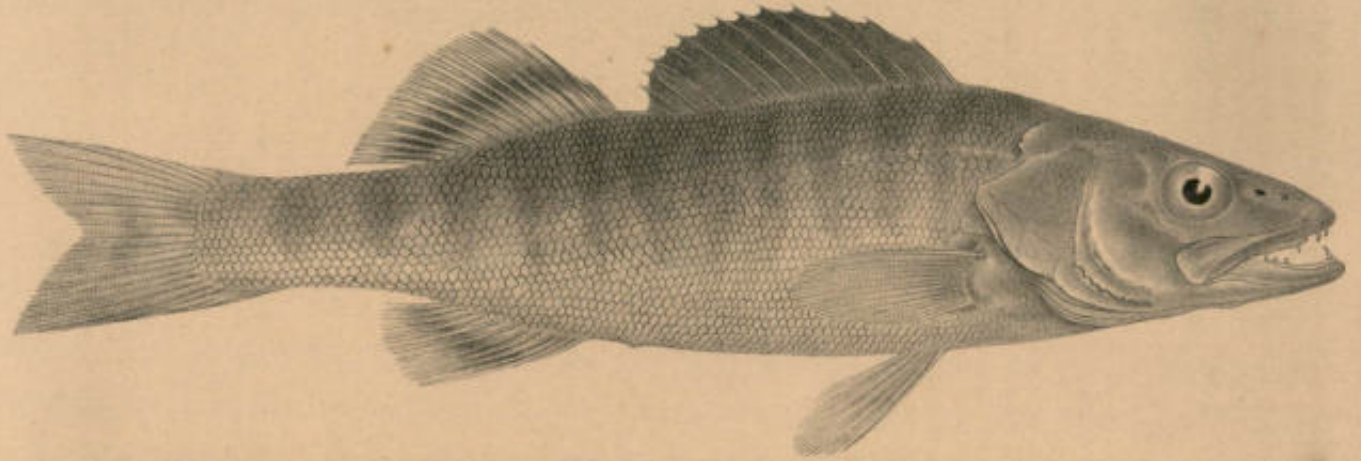
Thryothorus, Parula, Polioptila, Cyclorhis, Euphonia, Coryphospingus, Icterus, Cyanocorax, Furnarius, Picolaptes, Thamnophilus, Todirostrum, Phyllomyias, Myiodynastes, Myrmia, Chloronerpes, Psittacula, Floricola, et *Penelope.*

Parmi ces genres il y a 12 qui sont caractéristiques pour la sous-région Amazonine (forêts), à savoir :—

Thryothorus, Parula, Cyclorhis, Euphonia, Picolaptes, Thamnophilus, Todirostrum, Phyllomyias, Chloronerpes, Psittacula, Floricola, et *Penelope.*

C'est le voisinage des forêts de l'Equadeur occidental qui donne ce caractère à la côte septentrionale du Pérou, quoique elle est

[1] Dans notre statistique nous n'avons pas fait compte des oiseaux à l'aire, qui sont très répandus ; de même nous avons omis toutes les espèces caractéristiques pour Tumbez et pour la vallée du Rio Zarumilla.



Peter Smit del. et lith.

Mintern Bros. imp.

LUCIOPERCA MARINA.

(½ nat. size)

dépourvue de vraies forêts et présente en général une végétation très pauvre.

Quant à la statistique des espèces, en négligeant toutes les espèces très répandues et celles qui ne se trouvent qu'à Tumbez et à Zarumilla, nous trouvons 52 espèces d'oiseaux terrestres, parmi lesquels 35 espèces qui ne se recontrent pas dans le district méridional, ce qui fait 67 pour-cent.

Le district méridional, par ses caractères ornithologiques, appartient plutôt à la sous-région Chilio-Argentine[1]. Il possède un genre (*Xenospingus*) qui ne se trouve pas autre-part. Parmi les genres d'oiseaux nous y trouvons 13 qui ne se rencoutrent pas dans le district septentrional, à savoir :—

Anthus, *Petrochelidon* (?), *Conirostrum*, *Catamenia*, *Serphophaga*, *Anæretes*, *Phlœocryptes*, *Myrtis*, *Rhodopis*[2], *Chrysoptilus*, *Bolborhynchus*, *Metriopelia*, *Thinocorus*.

Les genres *Anthus*, *Catamenia*, *Anæretes*, *Phlœocryptes*, *Metriopelia*, et *Thinocorus* sont propres à la sous-région Chilio-Argentine. Parmi les oiseaux terrestres caractéristiques pour le district, sur 81 espèces nous trouvons 36 qui ne se rencontrent pas dans le district septentrional, ce qui fait 44 pour-cent.

2. On *Lucioperca marina*, C. & V.

By G. A. Boulenger.

[Received April 30, 1892.]

(Plate XXV.)

Thanks to the kindness of Drs. Strauch and Herzenstein, I have been favoured with the loan of a specimen of the rare perch *Lucioperca marina*, C. & V. (*Perca labrax*, Pall. nec L.), of which very few examples have been examined since its first description by Pallas in 1811. The only recent author who has contributed original notes on the subject is Kessler[3], who showed that this fish is distinguished from the Zander (*L. sandra*) by fewer branched dorsal rays, and that therefore Pallas's statement "12 rays" was not a misprint for 22, as suggested by Cuvier and Valenciennes. The specimens examined by him have 16 or 17 rays; the St. Petersburg specimen 17. Whether any have as few as 12 rays remains to be ascertained by the inspection of a greater number of examples than have hitherto been available for study. The point to which I now wish to draw special attention is the close affinity which the Black-Sea and Caspian species bears to the North-American, and especially to *L. canadensis*. Leaving aside the

[1] Cette sous-région comprend non seulement les parties méridionales de l'Amérique du Sud, mais elle s'étend aussi le long des Cordillères en occupant les parties très élevées et déboisées de ces montagnes ("puna" et "haute sierra" des habitants). Ainsi elle s'étend jusqu'à la Colombie et au Vénézuela.

[2] Ce genre peut être considéré, avec le genre *Xenospingus*, comme caractéristique pour ce district.

[3] Bull. Soc. Nat. Mosc. 1859, p. 187, and Fish. Aralo-Casp. Exped. p. 4 (1877).

hitherto little-understood *L. marina*, it will be found that the Europæo-Asiatic and American species form two well-marked groups: the former (*L. sandra* and *L. volgensis*), characterized by the lesser space between the ventrals and the greater development of the ventral and anal spines, is nearer related to *Perca*, with which it is connected by *L. volgensis*, a fish almost as much a true Perch as a Pike-Perch; the latter (*L. canadensis* and *L. vitrea*) characterized by the wider separation of the ventrals and weaker ventral and anal spines.

These two groups are so well marked that one might feel tempted to treat them as distinct genera, were it not for the information now afforded by *L. marina*, which although agreeing in most respects with the American *L. canadensis*, yet differs from it in the more approximate ventrals, in this point resembling its European congeners, and thus forming a very interesting connecting group, as may be seen from the following synopsis of the five species which constitute the genus *Lucioperca*[1].

I. The distance between the ventrals about two-thirds the width of their base; ventral and anal spines free.	
Canine teeth weak, or altogether absent in old specimens; D. XII–XIV, I–II 21–22; A. II 9–10; Sq. 110–117 $\frac{10-13}{21-28}$; L. l. 71–83[2].	1. *volgensis*, Pall.
Canine teeth very strong; D. XIII–XV, I–II 19–23; A. II 11–12; Sq. 132–150 $\frac{13-16}{30-35}$; L. l. 80–95	2. *sandra*, L.
II. The distance between the ventrals about two-thirds the width of their base; ventral and anal spines very feeble and closely attached to the soft rays.	
D. XII–XIII, I–II (12?) 16–17; A. II 11–12; Sq. 115 $\frac{10}{30}$; L. l. 78–84.	3. *marina*, C. & V.
III. The distance between the ventrals equals the width of their base; ventral and anal spines very feeble and closely attached to the soft rays.	
Top of head and cheeks closely scaled; back flattened; D. XII–XV, I–II 17–19; A. II 11–12; Sq. 110–125 $\frac{9-10}{25-28}$; L. l. 80–90	4. *canadensis*, C. H. Smith.
Top of head and cheeks entirely or partly naked; D. XII–XIV, I–II 19–21; A. II 12–14; Sq. 110–132 $\frac{9-10}{21-28}$; L. l. 86–95	5. *vitrea*, Mitch.

[1] *Lucioperca* should date from the first edition of the 'Règne Animal,' 1817, where Cuvier (p. 295) does use the Latin name ("ce qui leur a fait donner le nom de *lucioperca*"), although indirectly and without a capital.

[2] The transverse series of scales are counted along the back, a little above the lateral line; the longitudinal series are counted at the highest point between the spinous dorsal and the lateral line and between the latter and the mid-ventral line; under L. l. the number of perforated scales is given.

Lucioperca marina thus agrees in its scale- and fin-formula with *L. canadensis*, whilst in its compressed back and almost naked head it agrees with *L. vitrea*. The following description is taken from the specimen in the St. Petersburg Museum (No. 6205, Alexandrowsk, Caspian Sea).

Depth of body 4¼ times in total length, length of head 3⅔ times; diameter of eye about ⅔ length of snout and ⅓ length of head, and nearly equal to interorbital width; strongly enlarged, canine-like teeth in jaws and palate; lateral præmaxillary teeth forming a single series; maxillary reaching to below posterior fourth of eye, the width of its distal extremity rather more than ½ diameter of eye; head naked, except a few scales on the operculum; opercular spine feeble. Dorsal XIII, I 17; originating above axilla, the two portions nearly equally deep, the spinous ⅓ longer than the soft, from which it is separated by an interspace equal to ⅔ the diameter of eye; first spine ⅔ length of second, ½ length of longest. Anal II 12; a little deeper than dorsals; spines very feeble and closely attached to the soft rays. Pectorals ⅓ length of head. Ventrals separated by an interspace equal to ⅔ the width of their base; spine very feeble and closely attached to the soft rays. Middle caudal rays ⅔ length of outer. Scales 115 $\frac{10}{30}$; L. l. 79. Pyloric appendages 5, the longest as long as the stomach, the shortest only half as long. Brown above (in spirit), whitish beneath; ten dark vertical bars on the sides; first dorsal blackish, second with a blackish bar along the middle.

Total length 280 millim.[1]

3. On the Antelopes of the Genus *Cephalolophus*.

By Oldfield Thomas, F.Z.S.

[Received April 30, 1892.]

The genus *Cephalolophus* has long stood in need of a general revision, and I am enabled to undertake such a work owing to the fact that the types of a very large number of the described species, valid and invalid, are in the collection of the British Museum. These types have all been carefully examined and compared, and, whatever its other shortcomings may be, it is hoped that the present paper will at least be of service to zoologists by clearing up some of the many doubtful questions of which the solution depends on these typical specimens.

It has not been thought necessary to give full synonymies of the species, these being fully given in Gray's numerous papers on the

[1] The total length of a Percoid fish should be given to the extremity of the middle caudal rays. In describing the proportions, it is of course necessary to exclude the caudal fin altogether, as we exclude the vertical fins in measuring the depth of the body.

subject. In the same author's 'Knowsley Menagerie' figures of the majority of the species will also be found.

The genus *Cephalolophus* is a remarkably uniform one, the species, while widely differing in size, colour, and other superficial characters, agreeing exceedingly closely with one another in all the more essential features. I have therefore no hesitation in placing them all under one single generic heading, with the synonymy as follows:—

CEPHALOLOPHUS[1].

	Type.
Cephalophus, Ham.-Sm. Griff. Cuv. An. K. v. p. 344 (1827)	*C. sylvicultor.*
Cephalolophus (emend.), Wagner, Giebel, and other German authors	*C. sylvicultor.*
Sylvicapra, Ogilb. P. Z. S. 1836, p. 138	*C. grimmii.*
Cephalophorus, Gray, List Mamm. B. M. p. 162 (1843)	*C. grimmii.*
Grimmia, Gray, P. Z. S. 1871, p. 589	*C. grimmii.*
Terpone, Gray, P. Z. S. 1871, p. 592	*C. sylvicultor.*
Potamotragus, Gray, Cat. Rum. B. M. p. 24 (1872)	*C. sylvicultor.*

Of this genus 18 species appear to deserve recognition, and of these the following is a synopsis:—

A. Horns, when present, pointed directly backwards, in a line with, or below the line of, the nasal profile. Horns generally present in female. Ears moderate or short, rounded, their length much less than the distance from the eye to the nose. General colour fulvous, red, grey, or black, generally marked or striped.

a. Size large: hind foot (without hoof) more than 280 mm.; basal length of skull more than 240.

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[1] See also the two following species, the position of which I have not been able to determine with certainty:—

(1) *Antilope quadriscopa*, Ham. Sm. Griff. Cuv. An. K. iv. p. 261, pl. (animal) (1827).

Hab. Senegal.

The general appearance of this animal is more that of a Gazelle than a *Cephalolophus*, but the "narrow dark streak, not open but naked, between the eye and the nose" would seem to show that it is a member of the present genus. Its remarkable character of tufts on all the four limbs is rendered less improbable by the recent discovery of the heel-tufts in *C. dorsalis* (*infrà*, p. 424).

(2) *Cephalolophus ruficrista*, Boeage, P. Z. S. 1878, p. 744.

Hab. W. Africa; probably Angola.

Only known from the head, which is like in general appearance to that of *C. niger*, but is decidedly larger.

Horns rounded, but little roughened at base, placed in the line of the face.

Dimensions.—Occiput to tip of muzzle 260 mm.; eye to muzzle 140; length of horns 100.

a'. General colour blackish, with a yellowish lumbar stripe. W. Africa ..... 1. *C. sylvicultor*, [Afz.
b'. General colour of body grey, of head and neck black. W. Afr. ..... 2. *C. jentinki*, [Thos.
b. Size medium or small: hind foot less than 260 mm.; basal length of skull less than 220.
a'. General ground-colour fulvous, rufous or chestnut.
a². Back not transversely striped. No heel-tufts.
a³. Colour quite uniform, no mesial dark markings on face or elsewhere.
a⁴. Size larger; hind foot (? hoof included) 241 mm. Kilima-njaro ..... 3. *C. spadix*, True.
b⁴. Size smaller; hind foot without hoof 193 mm. E. & S.E. Afr. ..... 4. *C. natalensis*, [A. Sm.
b³. Mesial dark markings present either on face or back or both. All W. Afr.
a⁴. Darker markings shining black or brown.
a⁵. Back uniform rufous, no dorsal stripe ... 5. *C. nigrifrons*, [Gr.
b⁵. Back with a black dorsal stripe continued on the tail.
a⁶. Tail black and white; back of hams red or white.
a⁷. Centre line of face decidedly darker than flanks. Dorsal line from nape.
a⁸. Sternal region and back of hams white. Tail tufted at tip..... 6. *C. leucogaster*, [Gr.
b⁸. Sternal region and back of hams as dark as or darker than the body. Tail evenly haired, not tufted ..... 7. *C. dorsalis*, Gr.
b⁷. Face uniformly rufous yellow, like the flanks. Dorsal line from withers ..... 8. *C. ogilbyi*, [Waterh.
b⁶. Tail nearly wholly black; back of hams also black ..... 9. *C. callipygus*, [Pet.
b⁴. Darker markings bluish grey ..... 10. *C. rufilatus*, Gr.
b². Back transversely banded. Heels with tufts. W. Afr. ..... 11. *C. doria*, Og.
b'. General colour smoky brown or blackish.
a². Size larger; hind foot 210 mm. Face more rufous than body. W. Afr. ..... 12. *C. niger*, Gr.
b². Size smaller; hind foot less than 190 mm. Face like back.
a³. Legs greyish brown, like body.
a⁴. Rump not particoloured. Sierra Leone ... 13. *C. maxwelli*, [H. Sm.
b⁴. Rump particoloured. Cameroons to Zanzibar ..... 14. *C. melanorheus*, [Gr.
b³. Legs rufous; rump not particoloured. S.E. Africa ..... 15. *C. monticola*, [Thunb.

B. Horns, when present, slanting upwards at a sharp angle above the nasal profile; female normally hornless. Ears long, pointed, their length equal to or exceeding the distance from eye to rhinarium. General colour yellow or greyish; no darker markings on body, but a brown nasal patch present.
a. Size smaller: hind foot less than 230 mm.; basal length of skull than 140. [Gr.
a'. Colour bright yellow. W. Afr. ..... 16. *C. coronatus*,
b'. Colour grizzled greyish brown. Abyssinia ..... 17. *C. abyssinicus*, [Thos.
b. Size larger: hind foot more than 240 mm.; basal length of skull than 145. Southern Afr. ..... 18. *C. grimmii*, L.

1. CEPHALOLOPHUS SYLVICULTOR, Afz.

Antilope sylvicultrix, Afz. N. Act. Ups. vii. p. 265 (1811).

Cephalophus longiceps, Gray, P. Z. S. 1865, p. 204 (woodcut of skull).

Cephalophus melanoprymnus, Gray, P. Z. S. 1871, p. 594 (woodcut of skull), pl. xliv. (animal). Juv.

Size large; form stout and heavy. Ears short, broad and rounded, their length much less than the distance from eye to muzzle. Fur very short on the fore-quarters, longer on the hind back, but in adults worn off and showing the whitish underfur or naked skin round the base of the tail. General colour all over, of face, body above and below, and of limbs, dark blackish brown. Muzzle, cheeks and chin, and extreme tips of ears whitish. Lumbar region with a broad pale yellowish mesial stripe running from the middle of the back on to the loins.

In extreme youth the hairs of the posterior half of the body are all tipped with white, except just along what is afterwards the pale lumbar stripe, where they have long blackish tips, entirely hiding the white; and the caudal region, afterwards whitish and partly naked, is clothed with long black hairs. (See Gray's figure and description of "*C. melanoprymnus*.")

Horns long and tapering, lying back in or below the line of the nasal profile, but rather bowed downwards terminally. Divergent, slender, evenly tapering, but little roughened at base:—

♂ and ♀ almost precisely alike, except that the latter are slightly smaller. Length (♂) 163 mm.; basal diameter going about 5 or 5½ times in the length.

Skull, in proportion to the size of the animal, delicate, slender, and elongate. Muzzle slender, tapering, not laterally swollen between the premolars and the anteorbital fossa. Anteorbital fossæ of medium depth, their bottoms from 22 to 24 mm. apart[1]. Mesial notch of palate surpassing anteriorly the lateral ones by some 10 or 12 mm., these latter comparatively deep and V-shaped. Bullæ without any secondary inflation behind the point where the stylohyal articulates.

Dimensions.— ♀. Height at shoulder 880; ear 105; hind foot 345.

Skull (♂)—basal length 262; greatest breadth 125; anterior rim of orbit to gnathion 166; nasals, length 123, breadth 46; muzzle[2] 99; length of upper molar series 89.

Hab. West Africa. Sierra Leone (*Afzelius*) [*Whitfield* (Brit. Mus.)]; Liberia [*Schweitzer* (Berl. Mus.)]; Fantee [*Aubinn* (Brit. Mus.)]; Lagos [*Moloney* (Brit. Mus.)]; Gaboon [*Du Chaillu* (Brit. Mus.)].

This, the largest species of the genus, is remarkable for the great change of colour which takes place as the young grows up, a change which, although brought about by very simple means, is so great as

[1] Measured with calipers across the muzzle.

[2] Front of the anterior premolar to gnathion.

very much to excuse Dr. Gray in his supposition that the young "*melanoprymnus*" represented a different species.

The occurrence of *C. sylvicultor* on the Gaboon, as evidenced by the identification of *C. melanoprymnus* with it, is here of importance as confirming my allocation of "*C. longiceps*," also from the Gaboon, to its synonymy. The typical skull of the latter agrees in every respect with a Fantee skull of *C. sylvicultor*, although it is, as Gray said, somewhat slenderer in the nasal region than the only skull which he then had for comparison with it.

2. Cephalolophus jentinki, sp. n.

Size large, though smaller than *C. sylvicultor*; form stout. Ears short, broad and rounded. Colour of head, ears, neck all round as far back as the withers, throat, and a narrow sternal line deep uniform black; of body above and below coarsely grizzled grey, the hairs ringed with black and white. Lips and chin, a line all round the fore-quarters separating the black from the grey, axillæ, groins, fore and hind legs whitish; a rather darker mark running across the outer side of the forearm.

Horns long, tapering, placed in the line of the nasal profile, divergent as in *C. sylvicultor*:—

♀. 155 mm. long, base not specially thickened, basal diameter going about 5½ times in the length.

Skull much longer in proportion to the size of the animal than in *C. sylvicultor*, agreeing, in fact, precisely in size with that of the larger species. In other respects also it agrees so closely with that of *C. sylvicultor*, that had the external characters not been known the two species would have been hardly supposed to be different. Such as they are, however, the following are the differences that I am able to find between the two skulls. The frontal outline is flatter, and the horn-cores are perfectly straight, not bowed downwards terminally; the facial region above the tooth-row and below the anteorbital fossa is markedly swollen out laterally, so that the teeth and their alveoli for a vertical height of nearly an inch are quite hidden in an upper view of the skull; the outer edges of the infra-orbital foramen are rounded instead of being sharp; the three posterior notches in the palate, approximately equal in breadth in *sylvicultor* are very unequal in *jentinki*, as the lateral ones are broad, shallow, and open, while the mesial one, and with it the whole posterior nares, is markedly narrower; the bullæ have, just behind the articulation of the stylohyal, a very marked secondary inflation, projecting outwards and forwards and cutting off the extension backwards of the bony lamina external to the articulation; this extra swelling is quite absent in *C. sylvicultor*. In all these characters, slight as they seem to be, the five skulls of *C. sylvicultor*, including the type of *C. longiceps*, agree absolutely with each other, and differ from the single skull before me of *C. jentinki*.

Dimensions.—♀. Height at withers 770; ear 105; hind foot 310.

Skull—basal length 267; greatest breadth 126; outer rim of

orbit to gnathion 166; nasals, length 122, breadth 45; muzzle 91; length of upper molar series 90.

Hab. Liberia (*F. X. Stampfli*).

This fine species, discovered in Liberia by Dr. F. X. Stampfli, from whom, through Dr. Büttikofer, the Museum obtained the specimen above described, was referred[1] by Dr. F. A. Jentink, of the Leyden Museum, to Gray's *C. longiceps*. This reference, in my opinion, was most wise and prudent under the circumstances, not only on account of the extraordinarily close resemblance of its skull to that of *C. longiceps*, the only part of the latter form known, but also because there was at that time no evidence that *C. sylvicultor*, to which I refer *C. longiceps*, inhabited the Gaboon, whence came the latter animal. Now, however, that the reference of *C. melanoprymnus* to *C. sylvicultor* shows that the latter form does inhabit that district, the true owner of the typical skull of *C. longiceps*, practically identical as it is with that of *C. sylvicultor*, becomes at once evident. It is therefore clear that the Liberian species, so different from *C. sylvicultor* externally, but so like cranially, requires a new name, and I think no better name can be given it than that of my friend Dr. Jentink himself, whose valuable papers on the Liberian mammals are characterized by a carefulness above all praise, and whose very carefulness, led astray by Dr. Gray's more serious mistakes, caused him to make the venial error in the determination above referred to. In fact, it could scarcely be called an error at all, for at that time it would have been quite unjustifiable for him to have described the Liberian form as new, in face of the extraordinary resemblance of its skull to that figured by Dr. Gray as *C. longiceps*.

3. CEPHALOLOPHUS SPADIX, True.

Cephalophus spadix, True, P. U. S. Nat. Mus. xiii. p. 227 (1890).

Size comparatively large. General colour "dusky chestnut-brown without spots or bands, and not lighter on the belly. Face, chin, and throat pale greyish brown. Hairs of crest bright chestnut at the base, and tipped with black. Tail dusky, except at the tip, where the hairs are nearly pure white throughout."

Horns "directed backwards, and lying below the plane of the upper surface of the skull":—

♂. "4½ inches (114 mm.) long; slender, straight, not thickened at the base in front."

Dimensions.— ♂. "Head and body 965 mm., ear 107, hind foot (hoof to hock) 241."

Skull—basal length, from occipital condyle, 216; greatest breadth 104; nasals, length 95; length of molar series 67.

Hab. Mount Kilima-njaro, at high elevations [*Abbott* (U. S. Nat. Mus.)].

The above is extracted from the original description of the species,

[1] N. L. M. vii. p. 272, pl. x. (animal) (1885); *op. cit.* x. p. 19, pl. i. (horns) (1887).

of which I have as yet seen no specimen. It is evidently allied to *C. natalensis*, but may readily be distinguished by its much greater size.

4. Cephalolophus natalensis, Sm.

Cephalophus natalensis, A. Smith, S. Afr. Q. J. i. p. 113 (1834).

Size rather small. Form slender. Colour bright rufous chestnut all over, without marks or stripes of any kind, except that there is a faintly marked red superciliary line. Back of neck greyish brown. Chin and throat whitish. Tail slender, rufous at base; brown, tipped with white, at its extremity.

Horns set parallel to nasal profile:—

♂. Short, conical, much thickened at their bases; their greatest basal diameter going about 2½ times into their length; length about 70 mm. in an old specimen.

♀. Similar to male, but smaller, slenderer, and more sharply pointed. 37 mm. in length.

Skull: frontal region markedly roughened and convex: anteorbital fossæ of medium depth, their bottoms 14 mm. in a male, 12 in a female, distinct from one another; edge of median posterior palatal notch but little anterior (3 or 4 mm.) to the lateral notches.

Dimensions.— ♀. Height at withers 450; length of ear 63; hind foot 193.

Skull (♂)—basal length 150; greatest breadth 77; orbit to gnathion 85; nasals, length 64, greatest breadth 36; muzzle 56; upper molar series 50.

Range. Eastern and South-eastern Africa, from Zanzibar to Natal.

5. Cephalolophus nigrifrons, Gray.

Cephalophus nigrifrons, Gray, P. Z. S. 1871, p. 598, pl. xlvi.

Cephalophus aureus, Gray, Ann. Mag. N. H. (4) xii. p. 42 (1873).

Size medium. Colour of body rich chestnut, scarcely or not at all paler below. Centre of face and crest deep black, contrasting markedly with the rufous superciliary streaks. Nape browner. Feet and tip of tail blackish, a few white hairs in the terminal tuft of the latter. Hoofs apparently longer in proportion than usual; lower edge of the posterior outer one 40 mm. in length.

Horns, judging only from the cores, decidedly short, and but little expanded at their base; the cores in an adult male about 48 mm. long. Their set parallel to, and a little below, the level of the nasal profile.

Skull with the frontal region decidedly convex. Muzzle rather narrow and elongated. Anteorbital fossæ of medium depth, their bottoms about 16 mm. from each other. Median posterior palatine notch some distance (7 mm. in type) in front of the level of the lateral notches.

Dimensions.— ♂. Approximate height at withers 500; ear 60; hind foot 235.

Skull—basal length 160; greatest breadth 80; orbit to gnathion 91·5; nasals, length 69, greatest breadth 34; muzzle 61; upper molar series 50.

Hab. Cameroons [*Buchholz, fide* Peters]. Gaboon [*Du Chaillu* (Brit. Mus.)].

The type of Gray's *C. aureus*, which I refer with some doubt to this species, is a young animal, and the differences in coloration are probably due to this cause. Its body is far brighter and more fulvous than that of the adult, the withers and shoulders are browner, and the caudal tuft is more abundantly mixed with white.

6. Cephalolophus leucogaster, Gray.

Cephalophus leucogaster, Gray, Ann. Mag. N. H. (4) xii. p. 43 (1873).

Size medium. General colour dull chestnut-rufous, with a black dorsal band. Face rufous, darker down the centre; crest mixed rufous and black. Nape browner. Dorsal stripe commencing in front of the withers, not pure black, but grizzled with rufous, and not at all sharply defined laterally. Posteriorly, however, on the tail it becomes abruptly very narrow and sharply defined, not covering the whole breadth of the tail, but bordered on each side with rufous or white. End of tail with a large mixed black and white tuft. Under surface of body from chin to anus, inner sides of forearms and hips, and also a line passing down the anterior side of the metatarsi, whitish or pure white; no trace of a darker sternal patch. Posterior faces of buttocks also pure white, very different from the deep chestnut of this part in *C. dorsalis*.

Horns of type (apparently ♀) conical, sharply pointed.

Skull, so far as can be gathered from a young and very imperfect example, with a slender narrow muzzle like that of *C. dorsalis castaneus*, quite unlike the short conical one of *C. d. typicus*.

Dimensions of the type, an immature specimen with the milk-premolars still in position, and m^3 still below the bone:—Height at withers 400; ear 65; hind foot 203.

Skull, breadth of m^1 at cingulum 10·1.

Hab. Gaboon [*Du Chaillu* (Brit. Mus.)].

7. Cephalolophus dorsalis, Gray.

a. Subsp. typicus.

Cephalophus dorsalis, Gray, Ann. Mag. N. H. (1) xviii. p. 165 (1846).

Cephalophus badius, Gray, Cat. Ung. 1852, p. 85.

Cephalophus breviceps, Gray, P. Z. S. 1866, p. 202.

Size medium. Ears extremely short and broad. General colour bright chestnut-rufous, with a dark mesial stripe running from the nose to the tail, only interrupted at the crest, which is sometimes rufous. Centre line of face brown; superciliary streaks bright rufous. Crest variable, either black, mixed black and rufous, or wholly rufous. Dorsal stripe becoming absolutely black on the

back, sometimes sharply defined throughout, sometimes broadening out on the withers into an ill-defined band passing down the shoulders towards the fore legs. Under surface, inner sides of limbs, and back of hams rufous like the sides; a black or blackish longitudinal patch present in the sternal region. Fore limbs brown, from the shoulder downwards, hind limbs from just above the heel. Tail black above throughout, the black covering nearly the whole breadth of the tail; white below terminally.

Horns placed about in the same straight line as the nasal profile:—

♂. About 70 mm. long, slender, tapering, not thickened or roughened basally, the basal diameter going nearly five times in the length.

Skull with a remarkably short conical muzzle, the distance from the anterior rim of the orbit to the gnathion less than the zygomatic breadth. Anteorbital fossæ of medium depth, their bottoms 19 mm. distant from one another in a not fully mature female. Mesial notch of palate about 4 or 5 mm. in advance of the lateral ones. Bullæ with a small supplementary inflation, something like that distinguishing *C. jentinki* from *C. sylvicultor*.

Dimensions.—♀ (not fully adult). Height at withers 370; ear 47 × 44; hind foot 170.

Skull—basal length (c.) 143; greatest breadth 81; orbit to gnathion 77; nasals, length 55, greatest breadth 32; muzzle 46; upper molar series (milk-teeth in place) 52.

Hab. W. Africa from Sierra Leone to the Gold Coast. Replaced in the Cameroons by subsp. *castaneus*. Sierra Leone [*Whitfield* (Brit. Mus.)]; Liberia [*Büttikofer* and *Stampfli* (Leyd. Mus.)]; Fantee [*Aubinn* (Brit. Mus.)].

b. CEPHALOLOPHUS DORSALIS CASTANEUS, subsp. n.

Rather larger than var. *typicus*, and ears apparently rather larger. Colour deep chestnut all over, the dorsal line deep black, the metacarpals and metatarsals brown. Superciliary stripe chestnut, indistinct, far less bright than in var. *typicus*, and the general colour of the head darker and duller.

Skull with the muzzle of the ordinary slender elongate shape, the distance from the anterior edge of the orbit to the gnathion exceeding the zygomatic breadth. Bullæ with scarcely a trace of the extra inflation behind the base of the stylohyal.

Teeth decidedly larger than in the typical form, the combined lengths of the three milk-premolars 30·3 as against 25·5 in a similarly aged example of *C. d. typicus*.

Dimensions of the type, an immature female.—Height at withers 485; ear 60; hind foot 205; tip of muzzle to eye 106.

Skull—basal length (c.) 159; greatest breadth 83; orbit to gnathion 90; nasals, length 70, breadth 35; upper molar series (milk-teeth still in place) 60.

Hab. Cameroons [*Crossley* (Brit. Mus.)].

This subspecies is based on the female specimen called by Gray[1]

[1] Hand-l. Rum. p. 94 (1873).

"Cephalophus badius, 418 *c*"; and its skull was figured by him under that name[1]. As, fortunately, the types of his *C. badius* and *breviceps* are both still in the Museum, I am able to state that it belongs certainly to neither of them, but its proper determination has caused me much perplexity. On the one hand, its skull, so far as one may judge from a single immature specimen, is so different from similarly aged specimens of *C. dorsalis* as apparently to demand full specific distinction; while, on the other hand, it is externally almost precisely identical. For the present, therefore, I take a middle course, and make it into a subspecies, trusting that further specimens from different localities will clear up the precise relationship it bears to the true *C. dorsalis*, and also to its close ally *C. leucogaster*.

8. Cephalolophus ogilbyi, Waterh.

Antilope ogilbyi, Waterh. P. Z. S. 1838, p. 60.

Size medium. General colour bright orange, becoming rather more rufous on the hind-quarters. Nose brown, but otherwise the face is of the same colour as the body. Nape and sides of neck brown or blackish, but the hairs here so thin and short that the skin shows through and the general colour is but little affected. Hinder back with a marked black central dorsal streak, commencing vaguely at the withers, becoming narrower and more sharply defined posteriorly, and running on to the tail. Limbs dull yellowish, except on the phalanges, where they are brown or black.

Horns in the direct line of the nasal profile:—

♂. About four inches long (109 mm.), conical, slightly incurved, much broadened basally, their greatest basal diameter going $2\frac{1}{2}$ or 3 times in their length.

♀. About a inch and a half in length, conical, smooth, broad at base, pointed terminally, their length not twice their basal diameter.

Skull with a very considerable convexity in the frontal region. Anteorbital fossæ shallow, their bottoms 23 mm. distant from one another in a male, 19 in a female. Posterior palate with the three notches, median and two lateral, all at about the same level.

Dimensions.—♂. Height at withers 560 mm.; ear 76; hind foot 240.

Skull (♂, not fully adult)—basal length 185; greatest breadth 90; orbit to gnathion 112; nasals, length 88, greatest breadth 37; muzzle 69; upper molar series (c.) 60.

Hab. West Africa. Liberia [*Büttikofer* and *Stampfli* (Leyd. Mus.), *fide* Jentink]; Cameroons [*Preuss* (Berl. Mus.), *fide* Matschie]; Fernando Po [*G. Knapp*, *T. Thomson*, *R.N.* (Brit. Mus.)].

9. Cephalolophus callipygus.

Cephalophus callipygus, Peters, MB. Ak. Berl. 1876, p. 483, pls. iii. & iv. (animal and skull).

Size about as in *C. dorsalis*. General colour of body yellowish brown, becoming more rufous posteriorly. Forehead and crest

[1] *T. c.* pl. xxx. fig. 1.

rich rufous. Chin and throat white, rest of under surface yellowish grey. Back with a broad black dorsal band commencing behind the withers, broadening posteriorly, and involving the whole of the hams and backs of the hind legs down to the heels, and also the tail, with the exception of the extreme tip below, where the hairs are white-tipped. On the sides of the thighs, edging the black, the general body-colour becomes rich rufous.

Horns short, directed backwards, lying below the level of the nasal profile.

Dimensions.—♀. "Total length to tip of tail 1170 mm."; "tail 210;" "ear 70."

Skull (taken from figure, and therefore only approximate):—Basal length 164; anterior edge of orbit to gnathion (more or less decreased by perspective) 98; nasals, length 74; length of molar series (milk-teeth still in place) 60. "Length of skull" (*fide* Peters) 180 (the greatest length of the drawing is 184 mm.).

Hab. Gaboon [*Buchholz* (Berl. Mus.).].

The description is compiled from Dr. Peters's description and figure of this striking species, of which I have never seen a specimen.

10. CEPHALOLOPHUS RUFILATUS, Gray, Ann. Mag. N. H. (1) xviii. p. 166 (1846).

Size small; form slender. General colour partly bright yellowish rufous, and partly a peculiar bluish grey, the former colour covering the sides of the face, the whole of the neck, the shoulders, flanks, rump, and belly, while the latter prevails on the middle line of the nose, on the forehead, occiput, back of ears, centre of back from withers to rump, and all four limbs, from the elbows and middles of lower legs downwards. Crest long, blackish. Tail rufous above basally, black terminally.

Horns placed in the same line as the nasal profile:—

♂. Short, conical, pointed (but no adult wild specimen available for description).

♀. Rudimentary, mere low rounded knobs, hardly projecting above the skin of the head.

Skull with a long and slender muzzle. Anteorbital fossæ remarkably deep, more so than in any other species, their bottoms within from 5 to 10 millim. of each other. Mesial palatal notch some distance (5 to 7 mm.) anterior to the lateral ones.

Dimensions.—♂. Height at withers 360; ear 58; hind foot 179.

Skull (♀)—basal length 132; greatest breadth 66; orbit to gnathion 73; nasals, length 53, breadth 25; muzzle 45; upper molar series 49.

Hab. W. Africa. Gambia [*Whitfield* (Brit. Mus.)]. A young skull from the Niger [*Baikie* (Brit. Mus.)] has also, and probably correctly, been referred to this species.

It is difficult to say to which of the other species this peculiar little animal is most allied, especially as the absence of wild-killed male specimens renders me unable to describe the fully developed

horns. It is perhaps a dwarf form of the *dorsalis*-group, with the black replaced by grey, and the chestnut much lightened in tone. Were there not, however, so many specimens known, all alike, one might be forgiven for supposing it to be a hybrid between *C. coronatus* and *C. maxwelli*, the former being responsible for the rufous, and the latter for the grey in its generally piebald appearance.

11. Cephalolophus doriæ, Ogilb.

Antelope (?), Benn. P. Z. S. 1832, p. 122.
Antilope doria, Ogilby, P. Z. S. 1836, p. 121 (*ex* Benn.).
Antilope (*Cephalophus*) *doria*, Jent. N. L. M. vii. p. 270, pl. ix. (skull) (1885).
Cephalophus doria, Jent. N. L. M. x. p. 21, pls. ii. & iii. (animal and skull) (1887).
Antilope zebra, Gray, Ann. N. H. i. p. 27 (1838).

Size small. General colour pale rufous, broadly banded with black. Face, ears, neck, and shoulders rufous or chestnut, except the nasal region, which is blackish. Back from withers to rump pale rufous, conspicuously banded transversely with deep shining black. Under surface from chin to anus pale rufous, slightly paler than the ground-colour between the bands. Limbs rufous, but with broad black patches on the outer surfaces of the forearms and lower legs, and with the phalanges black all round. Heels with large glandular tufts of black hair on their postero-inferior surfaces. Tail rufous, more or less mixed with black above, white below.

Horns in the same line as the nasal profile:—

♂. Short (barely two inches long), conical, tapering, sharply pointed, their greatest basal diameter going about 2½ times in their length.

♀. Short (less than one inch in an adult), smoother than in the male, but otherwise similar in character.

Skull stoutly built. Nasal region broad, flat, parallel-sided. Anteorbital fossæ very shallow and little prominent, their bottoms 28 to 31 mm. distant from one another. Frontal region not specially swollen. Horn-cores so pressed downwards and backwards as to cause marked depressions behind and below them on the parietals. Palate with its three posterior notches about level.

Dimensions.—♂. Height at withers 405; ear 75; hind foot 175 (in a female, rather older, 185).

Skull—basal length 148; greatest breadth 72; orbit to gnathion 87; nasals, length 63, greatest breadth 36·7; muzzle 55; length of upper molar series 48.

Hab. Liberia.

Long only known from pieces of flat skin, this remarkable animal has now been made thoroughly familiar to mammalogists through the exertions of Dr. J. Büttikofer, who collected many specimens of it, and of Dr. F. A. Jentink, who described them (*ll. cc.*). Although its plan of coloration, possession of heel-tufts, peculiar parallel-sided skull, depressed horn-cores, and shallow anteorbital

fossæ separate it from all other known species, yet it is, I think, a much modified offshoot of the group of which *C. dorsalis* is typical.

12. Cephalolophus niger, Gray.

Cephalophus niger, Gray, Ann. Mag. N. H. (1) xviii. p. 165 (1846).

Cephalophus pluto, Temm. Esq. Zool. Guin. p. 214 (1853).

Size medium. Colour of body uniform dark smoky brown or black, becoming darker on the rump and limbs; paler on the throat and chest. Face fulvous, darkening into rich rufous on the crest; the centre of the forehead sometimes brown or black. Ears black haired externally, rufous internally. Tail black above, but with a whitish terminal tuft.

Skull long and narrow. Forehead swollen; anteorbital fossæ rather shallow, their bottoms 19 mm. apart; mesial notch of palate about 6 mm. in advance of lateral ones.

Horns, ♂, "straight, rough at their base, smooth and pointed at their extremity, 3–3½ inches (=80–95 mm.) in length" (Temminck, *l. c.*).

♀. Short, barely an inch in length, blunt and rounded, not expanded basally.

Dimensions.—♀. Approximate height at withers 450 mm.; length of hind foot 210; of ear 71.

Skull (♀)—basal length (c.) 174; greatest breadth 85; anterior edge of orbit to gnathion 106; nasals, length 72, breadth 34; muzzle 66; upper molar series 60.

Hab. Fantee [*Aubinn* (Brit. Mus.)]; Gold Coast [*Pel* (Leyd. Mus., Brit. Mus.), *Burton and Cameron* (Brit. Mus.)]; Liberia (*Stampfli* (Leyd. Mus.)].

13. Cephalolophus maxwelli, H. Sm.

Antilope (*Cephalophus*) *maxwelli*, Ham. Smith, Griff. Cuv. An. K. iv. p. 267 (1827).

Cephalophus punctulatus, Gray, Ann. Mag. N. H. (1) xviii. p. 167 (1846).

Antilope frederici, Laurill. Dict. Univ. d'H. N. i. p. 623 (1849).

Cephalophus whitfieldi, Gray, Knowsley Men. p. 12, pl. xi. fig. 2 (1850).

Size considerably smaller than in the previous species. Colour uniform slaty brown, becoming paler below and on the inner sides of the limbs. Superciliary streaks whitish. Ears small, rounded, behind dark brown. Rump and backs of the hams uniform with body, except that just at the base of the tail on each side, and on the top of the proximal half of the tail itself, the colour is rather darker. Rest of tail above brown, beneath whitish; limbs externally like body.

Horns set up at a slight angle above the nasal profile, but not nearly so much as in *C. grimmii*:—

♂. Short (about 50 mm. long), thick at base; their greatest basal diameter going about 2½ times in their length.

♀. Entirely absent in the only specimen available (not fully adult). No traces of horn-cores are to be seen on the skull, and probably the female is always without them.

Skull broad and strong. Muzzle rather narrow. Anteorbital fossæ rather shallow, their bottoms about 14 mm. apart in an adult male. Mesial notch of palate only about 4 or 5 mm. in advance of the lateral ones.

Dimensions.—♂. Height at withers 350; ear 50; hind foot 170. Skull (♂)—basal length 120; greatest breadth 63; anterior edge of orbit to gnathion 69; nasals, length 47, breadth 24·5; muzzle 40·5; upper molar series 41·5.

Hab. W. Africa. Gambia [*Whitfield* (Brit. Mus.)]; Sierra Leone [*Sabine* (Brit. Mus.)]; Liberia [*Büttikofer* (Leyd. Mus.)]; Fantee [*Aubinn* (Brit. Mus.)]; Dabocrom, Gold Coast [*Pel* (Leyd. Mus.)].

This species shows a certain tendency to the peculiar coloration of the rump characteristic of *C. melanorheus*; the colour contrasts of black and white of the latter, however, are only in its case dark brown and light brown respectively.

The entire absence of the horns in the female is a very important character, but merely on the evidence of a single specimen, and that one not fully adult, I hesitate to give it definitely as one of the characteristics of the species.

14. Cephalolophus melanorheus, Gray.

Cephalophus melanorheus, Gray, Ann. Mag. N. H. (1) xviii. p. 167 (1846).

Cephalophus anchietæ, Bocage, P. Z. S. 1878, p. 743.

Similar in all respects to *C. maxwelli*, except that it is rather smaller, and that the brown colour of the back darkens to black on and at each side of the base of the tail, below which there is an abrupt change to white on the backs of the hams. Female with horns.

Horns short, but almost as long in the female as in the male, placed in the same straight line as the nasal profile, slightly incurved:—

♂ about 40 mm. long, basal diameter going about 2½ times in the length.

♀ about 30 or 35 mm. long, basal diameter going about 3 times in the length.

Dimensions.—Height much as in next species. Ear 40; hind foot 155.

Skull (♂)—basal length (c.) 116; greatest breadth 60; anterior edge of orbit to gnathion 63; nasals, length 44, breadth 23; muzzle 40; upper molar series 37.

Hab. Southern half of West-African Forest-region from the Cameroons [*Burton*, *Crossley* (Brit. Mus.); *Preuss & Morgan* (Berl. Mus. *fide* Matschie)] and Fernando Po [*T. Thomson* (Brit. Mus.)] to Angola [*Anchieta* (Lisb. Mus. *fide* Bocage)]. (No doubt also extending across the continent in the Equatorial Forest-region.) Island of Zanzibar [*Kirk* (Brit. Mus.)].

15. Cephalolophus monticola, Thunb.

Antilope monticola, Thunb. K. Vet.-Ak. Handl. xxxii. p. 93 (1811).

Antilope (*Cephalophus*) *cærula*, Ham. Smith, Griff. Cuv. An. K. iv. p. 268 (1827).

Cephalophus bicolor, Gray, P. Z. S. 1862, p. 263, pl. xxxiv. (animal).

Size and characters of horns as in *C. melanorheus*. Colour as in *C. maxwelli*, except that the legs from the elbows and knees downwards are bright rufous.

Dimensions.—♀. Height at withers 320, ear 40, hind foot 154. Skull—basal length 109; greatest breadth 57; anterior edge of orbit to gnathion 61; nasals, length 40[1], breadth 24·3; muzzle 38; upper molar series 34·5.

Hab. South-east Africa. Umgozy Forest, Zululand [*Dunn* (Brit. Mus.)]; Eland's Post [*Atmore* (Brit. Mus.)]; Galgebosch[2], Uitenhage [*Dr. Burchell* (Brit. Mus.)].

This and the last species, and, if the female is not always hornless, *C. maxwelli* also, might be considered to be merely geographical races of one single species. To settle the question, however, we must wait until the opening up of the interior of Africa shows what are the characters of any representative forms that may be found there.

16. Cephalolophus coronatus, Gray.

C. coronatus, Gray, Ann. Mag. N. H. (1) x. p. 266 (1842).

Size probably, in adult animals, about equal to that of *C. abyssinicus*; form slender. Colour uniformly light yellow all over, except a small streak on the nasal region, the tip of the tail, and the metacarpus and metatarsus, all of which are black. The yellow hairs of the body finely grizzled with black.

Horns, skull, and teeth of adult not yet known. In the type skull, that of a half-grown animal, the anteorbital fossæ are of moderate depth, and the mesial notch on the palate is about 10 mm. in advance of the lateral ones.

Dimensions of type, immature ♂.—Height at withers 410; ear 75; hind foot 206.

Hab. W. Africa. Gambia [*Whitfield* (Brit. Mus.)].

Of this pretty species there are only in the Museum immature and young specimens, and from this material I am unable to come to a definite conclusion as to its relationship. In its general appearance, however, it has a certain amount of resemblance to the Duiker group, of which it may be the West-African representative, and I have therefore in the synopsis included it provisionally in the same section as *C. grimmii* and *abyssinicus*. I should, however, feel no surprise if the examination of adult skulls and horns proves this conclusion to be wrong.

17. Cephalolophus abyssinicus, sp. n.

Size about one-third smaller than that of *C. grimmii*. Ears elongate,

[1] From another specimen.

[2] Collected in February, 1814. Type of *A. cærulea*.

about equal to the distance between the anterior canthus and the rhinarium. Colour grizzled yellowish grey, with rufous face, brown nasal mark, and brown feet, just as in the grizzled varieties of *C. grimmii*, of which it is obviously the Abyssinian representative.

Horns (♂) set up at an angle above the line of the nasal profile, but not so markedly as in *C. grimmii*. 74 mm. long, evenly tapering, their basal diameter going nearly 5 times in their length.

Skull, besides being actually smaller, shorter and broader in proportion than in *C. grimmii*. Distance between orbit and gnathion only just about equal to the zygomatic breadth. Anteorbital fossæ of medium depth, defined above by a well-marked ridge, their bottoms about 14 mm. apart. Mesial notch of palate about 9 mm. in advance of the lateral ones.

Dimensions.— ♂. Height at withers 455; ear 90; hind foot 220. Skull—basal length 131; greatest breadth 73·5; anterior rim of orbit to gnathion 74; nasals, length 51, breadth 30; muzzle 45; upper molar series 46·5.

Hab. Abyssinia (Brit. Mus.).

This species is no doubt the *Antilope madoqua* of Rüppell [1], but not the earlier described *A. madoka* of Hamilton Smith [2], which is Salt's Antelope (*Nanotragus saltianus*, Blainv.). Both names are founded on the native name Madoqua or Madoka assigned by different authors to one or other of the two species, and probably used indiscriminately for either.

Hamilton Smith's name being happily antedated by De Blainville's "*A. saltiana*," and Rüppell's incapable of adoption, as having been used before, we are fortunately able to rescue both these beautiful little species from the clutches of this barbarous and doubtful native name.

18. CEPHALOLOPHUS GRIMMII, L.

Capra sylvestris africana, Grimm, Misc. Cur. Ac. Nat. Cur. Decas ii., Ann. iv. 1685, p. 131 (1686).

Capra grimmia, Linn. Syst. Nat. (10) i. p. 70 (1758), *ex* Grimm.

Antilope nictitans, Thunb. Mém. Ac. Pétersb. iii. p. 312 (1811).

Antilope (*Cervicapra*) *mergens*, Desm. N. Dict. d'H. N. ii. p. 193 (1816).

Antilope (*Cephalophus*) *platous*, *burchellii*, and *ptoox*, Ham. Sm., Griff. Cuv. An. K. iv. pp. 260–265 (1827).

Cephalophus campbelliæ, Gray, Ann. Mag. N. H. (1) xviii. p. 164 (1846).

Antilope ocularis and *albifrons*, Peters, Säug. Mossamb. pp. 184 & 186, pls. xxxvii.–xxxix., pl. xli. fig. 1, pl. xlii. fig. 1 (animal and skull) (1852).

Grimmia splendidula and *irrorata*, Gray, P. Z. S. 1871, p. 590.

Size medium; form much more delicate and slender than in any

[1] N. Wirb. Abyss., Säug. p. 22, pl. vii. fig. 2 (animal) (1835).
[2] Griff. Cuv. An. K. iv. p. 271 (1827).

of the species hitherto considered. Ears long, longer than the distance from the anterior canthus to the tip of the nose, their tip narrow and pointed. General colour of body pale greyish brown, sometimes with a yellowish tinge, but very variable in tone; more or less grizzled, owing to the hairs being annulated with yellowish and brown. Face rufous or yellowish, with a deep brown longitudinal patch on the nasal region, rarely extending upwards to the bases of the horns. Throat and belly like back. Chin, inner sides of fore arms and of thighs, and underside of tail whitish or pure white. Front of fore legs with a brownish line running down them to the hoofs. Metapodials brown. Tail black above and white below, but the base above is commonly coloured like the back.

Horns present only in ♂[1]. These set up at a considerable angle to the line of the nasal profile; slender, tapering, their bases roughened but not markedly thickened, their greatest basal diameter going about 6 or 7 times in their length.

Skull long and narrow. Anteorbital fossæ of medium depth, their border above generally rounded, not sharply ridged; their bottoms about 20 mm. apart in a fine male. Muzzle long, the distance from the anterior edge of the orbit to the gnathion much exceeding the greatest zygomatic breadth. Mesial notch of palate extending some way in front of the lateral ones.

Dimensions.—♂. Height at withers 575; ear 110; hind foot 263.

Skull—basal length 183; greatest breadth 85; anterior rim of orbit to gnathion 112; nasals, length 71, breadth 35; muzzle 64; length of molar series 61.

Hab. Southern Africa, from the Cape northwards on the west to Angola [*Gabriel* (Brit. Mus.); *Anchieta* (Lisb. Mus.)], and on the east to Taita [*Wray* (Brit. Mus.)] and Mount Kilima-njaro [*Hunter* (Brit. Mus.)].

This common and widely spread species has been made the basis of a large number of untenable species, mostly without any really valid excuse. Certainly the species is rather variable in coloration, especially as to the tone of the general body-colour and the extent of the dark patch on the face; but the differences are all obviously of little essential importance, and I have no hesitation in assigning all the names above given to one single species.

C. grimmii and *C. abyssinicus* together form a little group somewhat apart from the other species, but I do not think this group, to which Gray gave the name of *Grimmia*, is worthy of generic or even of subgeneric rank. The character of the female being hornless, on which some stress has been laid, is neither constant in *C. grimmii* nor non-existent in other species[2], and the other characters are all rather of degree than of kind, and all very difficult of definition. Other species seem also to lead up towards the group, as for example *C. coronatus*, which, when adult specimens are obtained, may prove to be quite closely allied to *C. abyssinicus*.

[1] Mr. Selous, however, says (P. Z. S. 1881, p. 763) "although the females are almost always hornless, I have met with three examples bearing horns."

[2] See *C. maxwelli*, supra p. 426.

The Duikers appear to be inhabitants of open or merely brush-covered regions, while the other *Cephalolophi* are for the most part inhabitants of dense forest, as may be judged from their extreme abundance in the West-African forest-region.

4. On the Characters and Variations of *Pontaster tenuispinis*. By F. Jeffrey Bell, M.A., Sec.R.M.S.

[Received May 2, 1892.]

(Plate XXVI.)

In the year 1846 Düben and Koren published their invaluable catalogue of the Echinoderms of Scandinavia, and since that time the species which they called *Astropecten tenuispinus* has been mentioned and more or less fully described by succeeding writers, such as Sars, Lütken, Koren and Danielssen.

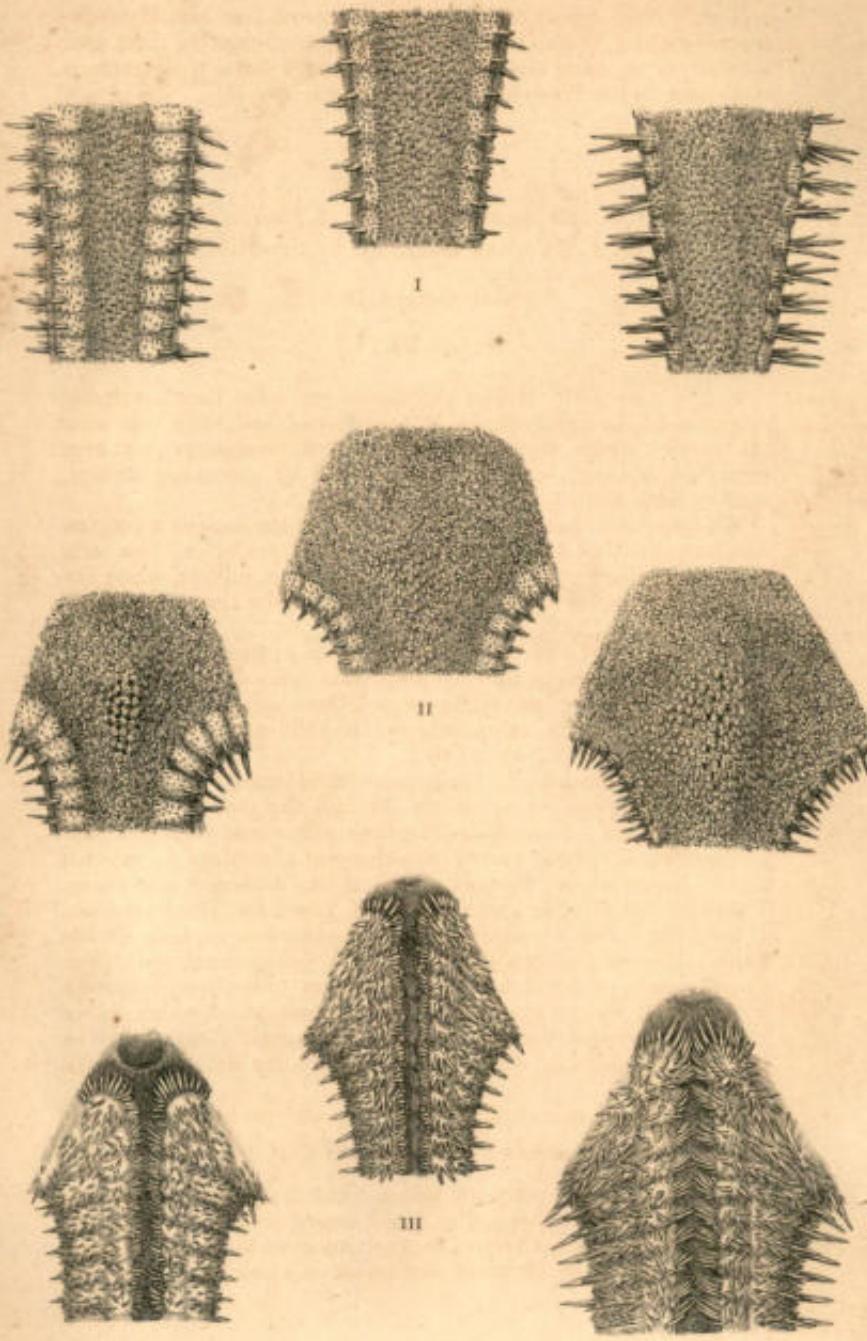
We know now that the specimens seen by the famous zoologists who first described this species were all small examples; two were quite small, having R equal only to 12 or 18 millim., while the third, with R equal to 45 millim., is much smaller than many specimens now known to us.

The ratio of R to r is given by them as 4=1; but as r=9 millim., when R=45, it is clear that the proportion varies from 4 or 5 to 1. The specimens described by Koren and Danielssen in 1884 were as much as 260 millim. in spread, and R=130 and r=23; or the proportion was as $5\frac{3}{4}$ (nearly) to 1.

With the variations in these proportions there must be some variation in the relative size of the disc and the general appearance of the specimen. Notwithstanding these differences, there has been a consensus of opinion among Scandinavian naturalists as to what should be called, as most of them call it, *Archaster tenuispinus*. Thanks to the obliging kindness of Prof. Lovén and Dr. Danielssen, I have been able to receive (and in most cases to keep for the British Museum) various specimens from various localities. Prof. Quennerstedt, of Lund, has been so kind as to compare specimens which I sent him for examination with the example on which Düben and Koren founded their species, not daring, rightly enough, to let the valuable specimen under his charge run any risk through the post.

Having thus a considerable series of specimens before me, I find that the range of variation of $\frac{r}{R}$ is greater than we have yet supposed, for r may be only 10 millim., and R=74 millim., or the proportion instead of being 4 or 5 to 1 comes to be $7\frac{2}{5}$ to 1.

Mr. Sladen does not inform us what his ideas are as to *Pontaster tenuispinis*; but he obviously looks on it as a small species, for he



Bergan & Ridley del. et lith. Hanhart imp.

VARIATIONS OF PONTASTER TENUISPINIS.

says of a variety that its "habit" is much larger than that of "any examples which I have seen of the type-form." The largest of his varieties appear to have R=66, but Koren and Danielssen had examples of *P. tenuispinis* in which R=130. However, it is useless for anyone who has not, like myself, access to the collection which Mr. Sladen describes, to hope to discuss with him any question which is based on measurements, for of these no writer is so chary.

The proportions of R to r in this variety of Mr. Sladen's vary from $3\frac{7}{8}$, through $3\frac{10}{13}$ and 4 to $4\frac{7}{10}$ and $4\frac{4}{7}$; as the variability is so great, I consider the relation of R to r should be put aside as a reason for distinguishing a variety of a form which itself shows a variation between 4 and $7\frac{3}{5}$.

The original diagnosis of the species begins with the words "radiis attenuatis"; but in this point I observe some differences among the specimens, some of which have arms a good deal stouter than others. But on this point it is necessary to be precise, for Mr. Sladen's variety, which he calls "*platynota*"[1] (a mispriut, I presume, for

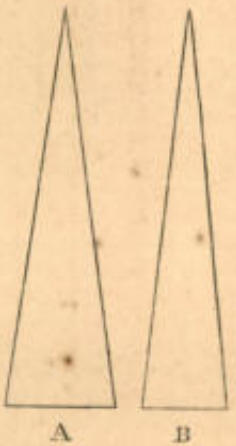


Diagram showing the relative proportions of the arms of (A) *P. tenuispinis* and (B) *P. platynotos*.

platynotos), is said to be marked by a "rapid attenuation" of the rays at a short distance above their base. If figures can be made to prove anything, words may be taken to mean anything; and a "rapid attenuation" may mean anything between the loss of weight which follows a few days' hard exercise or the result of a ten-weeks' bout of fever. When we bring this vague expression to the test of measurement, we find that one example of the variety has an arm

[1] Chall. Rep. Asteroidea (1889), p. 29.

15 millim. wide at its base, and 7 millim. wide midway between the base and the tip, while an example of "*A. tenuispinus*," named by the authorities of the Bergen Museum, gives with a base of 15 millim., a width at the middle of the arm of 5·5 millim., or ·35 millim. more than would keep the proportions of width of base to width at middle equal in the two specimens.

A reference to the diagrams A and B (p. 431), in which the proportions above given are plotted out, will show that in A the "attenuation" is *more* marked than in B, but the difference is so slight that I submit it is not of the least importance.

The original diagnosis goes on "margine alto"; these words at first presented some difficulty, as several of the specimens before me are remarkable for their flatness; but the matter was quite cleared up when I sent two specimens to Prof. Quennerstedt, in order to have them compared with the type in the University of Lund.

These specimens, which I marked A and B, had respectively R=76 and 51, while the depth of the body at the angles was 3·3 and 4·3 millim. each. In A the supero-marginals merely formed a fringe to the upper surface of the arm, while in B they formed a distinct line on the upper surface.

In Prof. Quennerstedt's opinion A cannot be *A. tenuispinis*, while B is certainly very close to it. In other words, *A. tenuispinis*, as represented by its type, by the figure given by its describers, and by the sketch sent me by the learned Professor of Lund, has the supero-marginals "forming a well-defined border on the abactinal surface." But this is the chief character by which *P. limbatus*, Sladen, is distinguished from *P. tenuispinus*, Sladen (D. & K., sp.). As a matter of fact, however, this is a point in which specimens brought from the same locality vary very greatly, and every stage may be found between that in which the supero-marginal is a mere line on the upper surface, and that in which it forms a distinct band.

If, however, there are to be specific distinctions made, it is clear that *P. limbatus* of Sladen must be regarded as the equivalent of *P. tenuispinis*, D. & K.; and *P. tenuispinus*, Sladen, must receive a new name. For this, however, I see no real need.

Recent observers have been struck by the presence at the base of the arm, on the upper surface, of a perforated area, which it has been proposed to call a "papularium," as the tubes which project through the holes are "papular" or respiratory tubes. At times these "papularia" are so distinct that one wonders how it is that they can have escaped the notice of earlier observers; but the truth is that sometimes the papularia are very indistinct, and at times they cannot be seen at all. This is another very remarkable instance of variation.

If the views which I hold are justly derived from the facts which I have cited—facts, I may point out, which any worker during the last ten years might have acquired for himself without any overdue call upon his time—the synonymy of this species may briefly be cited thus:—

PONTASTER TENUISPINIS. (Plate XXVI.)

Astropecten tenuispinus, Düben & Koren, Wet. Akad. Hdlgr. 1844 (1846), p. 251, pl. viii. figs. 20–22.

Archaster tenuispinus, Sars, Norges Echin. (1861), p. 38, pl. 3. figs. 5–7.

Pontaster tenuispinus, Sladen, 'Challenger' Rep. Ast. (1889), p. 28.

Pontaster tenuispinis, Bell, Ann. & Mag. N. H. iv. (1889), p. 433.

Pontaster tenuispinus, var. *platynota*, Sladen, op. cit. p. 29.

Pontaster hebitus, id. op. cit. p. 33.

Pontaster limbatus, id. op. cit. p. 35.

Distribution. Both sides of North Atlantic, Arctic Ocean, Kara Sea. Largest within the Arctic circle; the Irish forms often very stout. 85–600 fathoms.

The following diagnosis of this very variable form may be offered:—

The proportion of R (greater diameter) to *r* (diameter of disc) varies between $3\frac{1}{2}$ and $7\frac{2}{3}$. A very variable species in many characters.

Disc and arms flat, but the depth of the side at the angles of the disc varying somewhat; the arms taper regularly, and end in rather fine points as a rule. The bases of the arms on the dorsal surface sometimes, but not always, marked by a perforated area (the papularium) of an elongate lens-like form containing from ten to twenty holes. The sides of the arms above bounded by a pretty stout supero-marginal, which may, however, be so thin as to be merely a line on the upper surface. There may be as many as 40 supero-marginals, and they pretty constantly each carry a well-developed spine, the base of which is surrounded by a number of spinelets. A similar, or sometimes rather stouter, spine is borne by each inferomarginal, and one or more of the surrounding spinelets may be prominent on account of their length. The intermediate plates on the lower surface are, as a rule, thickly covered with spines, but in these there are, at times, reductions. The spines on the ambulacral plates vary considerably in number and disposition, but the most usual arrangement appears to be a row of about six small spines along the groove with one, two, or three larger spines set transversely. Pedicellariæ present or absent. Delicate spines may sometimes be seen rising from the dorsal paxilliform plates.

EXPLANATION OF PLATE XXVI.

Figures illustrative of the variations exhibited in the size of (I.) the supero-marginal plates, (II.) the characters of the papularia, and (III.) the disposition of spines on the actinal surface and along the ambulacral groove.

5. A List of the *Lycænidæ* of the South Pacific Islands east of the Solomon Group, with Descriptions of several new Species. By Hamilton H. Druce, F.E.S.

[Received May 3, 1892.]

(Plate XXVII.)

In 1891 I published a list of the Lycænidæ of the Solomon Islands in the 'Proceedings' of the Society. The present paper is an attempt to bring together the species of this family which have been described as inhabiting the South Sea Islands to the east of the Solomon Group. Our knowledge of the whole is, at present, very small, as large numbers of important islands remain to be explored. Mr. Butler published lists in the 'Proceedings' of this Society for 1874 and 1875, and has since described a number of species, principally from the New Hebrides Islands. Out of 31 species here enumerated, I have described 7 as new.

Several important genera, such as *Catochrysops*, *Arhopala*, and *Deudorix*, seem to end their range quite on the western extremity of the group.

Thanks to the kindness of Messrs. Godman and Salvin, I have been able to examine their collection, which contains good series of most of the species, which were obtained principally by Messrs. C. M. Woodford and G. F. Mathew.

The types of the species described as new are in their collection.

The following table is intended to show at a glance the several localities from which each species has been recorded:—

	N. Hebrides Is.	N. Caledonia.	Loyalty Is.	Fiji Is.	Tonga Is.	Samoa Is.	Cook Is.	Society Is.	Australia.
Zizera									
labradus	*	*	...	*	*	*	...	...	*
gaika	*	...	...	...	...	...	...	...	*
lulu	*	...	...	*	*	*	...	...	*
Talicada									
excellens	*								
Nacaduba									
vitiensis	...	...	...	*					
dyopa	...	...	...	*					
samoensis	...	...	...	...	...	*			
novæ-hebridensis	*								
florinda	...	...	*	...	...	...	...	...	*
malliscollo	*								
dion	*	...	...	...	...	...	...	...	*
nebulosa	*								
biocellata	*	...	...	...	...	...	...	...	*



1.



2.



3.



6.



5.



4.



7.



9.



8.



10.



11.



12.



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15.



16.



18.



17.

Lycænidæ from South Pacific.

W. Purkiss, ad. nat. lith.

West, Newman, imp.

TABLE (*continued*).

	N. Hebrides Is.	N. Caledonia.	Loyalty Is.	Fiji Is.	Tonga Is.	Samoa Is.	Cook Is.	Society Is.	Australia.
Nacaduba (*continued*)									
deplorans	...	...	*						
catochloris	...	...	...	...	...	...	...	*	
Thysonotis									
caledonica	...	*				*			
Jamides									
candrena	...	...	...	*					
pulcherrima	*								
morphoides	*	...	...	...	*				
goodenovii	*								
woodfordi	*	...	...	*	*				
petunia	...	...	...	*					
kava	*	...	...	*					
carissima	*	...	...	*	*	*			
walkeri	...	...	...	...	...	...	*		
Lampides									
evanescens	*								
Catochrysops									
cnejus	*	...	...	*	...	...	...	...	*
platissa	*	*	...	*	...	*	...	...	*
Tarucus									
plinius	*	...	...	...	...	...	...	...	*
Polyommatus									
bæticus	*	...	...	...	...	...	...	*	*
Deudorix									
mathewi	*								

ZIZERA, Moore.

Three species of this genus occur in these islands: ***Z. labradus*** and ***Z. lulu***, which are generally distributed, and ***Z. gaika***, which I have seen only from the New Hebrides.

ZIZERA LABRADUS. (Plate XXVII. fig. 1.)

Polyommatus labradus, Godt. Enc. Méth. ix. p. 680 (1819).

Lycæna alsulus, Herr.-Schäff. Stett. ent. Zeit. 1869, p. 75; Butl. P. Z. S. 1874, p. 285[1].

Lycæna communis, Herr.-Schäff. Stett. ent. Zeit. 1869, p. 72 (undescribed).

Lycæna phœbe, Murray, Ent. Mo. Mag. x. p. 107 (1873); Butl. P. Z. S. 1874, p. 285; id. 1875, p. 616.

Zizera phœbe, H. H. Druce, P. Z. S. 1891, p. 358.

Lycæna mangoensis, Butl. Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 347 (1884)[2].

Lycæna caduca, Butl. P. Z. S. 1875, p. 616[3].

New Hebrides (*Mathew*). Espiritu Santo I., Mallicollo I.,

and Pentecost I., New Hebrides (*Woodford*). Sandwich I. and Erromango I., New Hebrides[1]. Fiji Is. (*Mathew*). Suva, Viti Levu, Fiji Is. (*Woodford*). Mango, Fiji Is.[2] Tonga Is. and Samoa Is. (*Mathew*). Upolu I., Samoa Is. (*Herr.-Schäff.*). Tutuila I., Samoa Is. (*Butler*). New Caledonia[3]. Australia.

I have carefully examined two specimens in the British Museum which were received from the Godeffroy Museum—one of which, a male, is labelled *L. communis*, the other, a female, *L. alsulus*—and I am quite satisfied that, as pointed out by Mr. Butler (P. Z. S. 1875, p. 616), they represent the same species, as does also *L. phœbe*, Murray. *Lycæna mangoensis*, Butl., is nothing but a rather more strongly marked form, and we have in our collection specimens from Fiji Islands quite as typical *L. alsulus*. *Lycæna caduca*, Butl., again is, in my opinion, a variety, as although I have, in the large series before me, no specimen agreeing exactly with the type, there are several very close to it.

Mr. Miskin has lately pointed out that *labradus* is the oldest name for this species (Ann. Queensland Museum, no. 1, p. 62, 1891), and is doubtless quite correct in so identifying it.

ZIZERA GAIKA.

Lycæna gaika, Trimen, Trans. Ent. Soc. 1862, p. 403.
Lycæna pygmæa, Snell. Tijds. Ent. xix. t. 7. f. 3 (1876).

Pentecost I., Mallicollo I., New Hebrides (*Woodford*). New Hebrides (*Mathew*).

So far as I am able to ascertain, this insect does not occur eastwards from the New Hebrides.

ZIZERA LULU. (Plate XXVII. fig. 2.)

Lycæna lulu, Mathew, Trans. Ent. Soc. p. 312 (1889).
Lycæna conjungens, Lucas, T. P., P. R. S. Queensl. p. 160, ff. 11 & 12 (1889), *vide* Miskin.

New Hebrides (*Mathew*). Tonga Is. (*Mathew*) (types, Tongatabu I.). Fiji Is. (*Mathew*). Samoa Is. (*Mathew*).

If I had not seen the specimen in the British Museum before referred to, I should have considered Herrich-Schäffer's description of *L. alsulus* to have referred to this species, as he speaks of the underside being without markings, save a few angular marks.

In the large series before me, I can detect no variation but the absence or presence of the black anal-angular spot on the underside of secondaries.

Mr. Mathew's types are now in Messrs. Godman and Salvin's collection.

TALICADA, Moore.

T. cleotas and *T. excellens* are distinguished at once from their congeners *T. nyseus*, *T. mindora*, and *T. arruana* by having a distinct spot in the centre of the cell of the fore wing below, also by the darker ground-colour of both wings. The genus has not yet been

recorded as occurring east of the New Hebrides Islands, and no representative of it is found in Australia.

TALICADA EXCELLENS.

Scolitantides excellens, Butl. P. Z. S. 1875, p. 616, t. 67. f. 12[1].

Mallicollo I., Pentecost I., New Hebrides (*C. M. Woodford*). New Hebrides (*Mathew*). Erromango I., New Hebrides[1].

Mr. Butler was evidently mistaken in describing his species as differing from *T. cleotas*, Guér., by the male having the purple colour spread over the primaries and the centre of the secondaries. As a matter of fact *T. cleotas* ♂ has the purple of a lighter and more brilliant hue, and much more extensively spread over both wings, leaving the margins only narrowly black. Mr. Butler has doubtless taken Guérin's figure for a male, whereas it is a female with somewhat more blue than usual. All females I have seen from New Ireland have this blue to a greater or lesser extent, but I note that females of *T. cleotas* from the Solomon Islands are without it, also all females of *T. excellens*.

I think *T. excellens* can be distinguished by having the veins black, and by the outer margin of primaries having a considerably broader black border.

NACADUBA, Moore.

NACADUBA VITIENSIS. (Plate XXVII. figs. 3, 4.)

Catochrysops vitiensis, Butl. Ann. & Mag. Nat. Hist. (5) xii. p. 389 (1883).

Nacaduba gemmata, H. H. Druce, Ent. Mo. Mag. vol. xxiii. p. 204 (1887).

Fiji Is. (*Mus. D.*). Suva, Viti Levu (*C. M. Woodford*). Fiji Is. (*Mathew*) (*Mus. G. & S.*). Viti I. (*Butler*).

A common insect in these islands, and showing a good deal of variation in the size of the ocelli below and also in the expanse of wings, varying from $1\frac{1}{8}$–$1\frac{4}{8}$ inch.

When I described this insect in 1887, examples stood in the British Museum collection unnamed, as, although Mr. Butler described it in 1883, the types were not incorporated and he had forgotten that he had named it.

NACADUBA DYOPA.

Lycæna dyopa, Herr.-Schäff. Stett. ent. Zeit. p. 75 (1869).

Lampides dyopa, Butl. P. Z. S. 1874, p. 285.

Ovalau I., Fiji Is. (*Herr.-Schäff.*).

This species probably equals *N. vitiensis*, as it is described as having on the hind wing large verdigris-coloured bordered round spots of equal size, which at once distinguish it from *Jamides candrena* and its allies.

NACADUBA SAMOENSIS, sp. n. (Plate XXVII. figs. 5, 6.)

Allied to *N. vitiensis*, Butl.; rather larger.

♂. Upperside more slaty blue and somewhat darker. Underside

(with the markings much the same) of a decided grey, not greyish brown as in *N. vitiensis*, and with two large black spots on the hind wing, placed as in that species and encircled with light metallic cærulean blue (greenish in *N. vitiensis*), but without the yellow outer rings. A few blue scales at the anal angle.

♀. Upperside: allied to *N. vitiensis*, but the blue on the disk darker and much restricted, not appearing on the hind wing, and the large anal spots not showing through as they do in that species.

Underside as male.

Head, thorax, and abdomen concolorous with wings. Legs greyish; antennæ brown, spotted with white.

Expanse, ♂ $1\frac{3}{16}$ in., ♀ $1\frac{1}{8}$ in.

Samoa Is. (*Mathew*) (*Mus. G. & S.*).

A pair of this insect in Messrs. Godman and Salvin's collection are the only specimens I have seen. Although allied to *N. vitiensis*, it has several points of distinction.

NACADUBA NOVÆ-HEBRIDENSIS, sp. n. (Plate XXVII. figs. 7, 8.)

Allied to *N. vitiensis*, Butl.

♂. Upperside a somewhat lighter and more silvery shade of violaceous blue. Underside pale ashen grey, with the markings, which are arranged much as in *N. vitiensis*, less distinctly prominent, and having on the margin of the hind wing one large black spot only; which is placed between the two lower median nervules, and which has its outer edge only bordered with metallic blue, and is not encircled with bright yellow as in *N. vitiensis*. A few blue scales at the anal angle.

♀. Upperside much like that sex of *N. vitiensis*, but the blue area rather more extensive and considerably lighter in colour, and having on the hind wing a marginal row of pale grey crescent-shaped lunules. Underside as male.

A very short black tail on the lower median nervule, which is occasionally tipped with white. There is very little trace of the greenish scales at the base of the wings below.

Head, thorax, and abdomen concolorous with wings. Legs greyish; antennæ brown, spotted with white.

Expanse as *N. vitiensis*.

Pentecost I., Mallicollo I., New Hebrides (*Woodford*). Vaté I., New Hebrides (*Mathew*) (*Mus. G. & S.*). New Hebrides (*B. M.*).

A male from Vaté Island, obtained by Mr. Mathew, has the black spot on the hind wing quite small; otherwise I notice no variation in the good series before me.

This insect is distinguished at once from *N. vitiensis* and also from *N. samoensis* by having a short linear tail.

NACADUBA FLORINDA. (Plate XXVII. fig. 12.)

Lampides florinda, Butl. Ann. & Mag. Nat. Hist. (4) xx. p. 354.

Lifu I., Loyalty Is. (*B. M.*). N. Australia (*Mus. D.*).

The type in the British Museum and a single specimen in our own collection, which agrees exactly with it, are the only two I have

seen. Mr. Miskin does not refer to it, so that probably it is known under another name in Australia.

NACADUBA MALLICOLLO, sp. n. (Plate XXVII. fig. 18.)

Lampides argentina, Butl. (*nec* Pritt.), P. Z. S. 1875, p. 616.

♂. Upperside. Fore wing light violaceous blue, whitish in the cell and towards the outer margin, which, together with the costa, is rather broadly uniform blackish brown, the border extending into the middle of the cell. Hind wing greyish brown, darker towards the costal margin, and violaceous towards the base. A marginal row of distinct black spots extending from the apex to the anal angle, bordered inwardly with a row of indistinct grey crescent-shaped lunules, and outwardly with a clear white line interrupted by the nervules; beyond this a blackish marginal line. Cilia greyish, darker at each nervule.

Underside pale ashen grey, with the white-bordered markings distinct and slightly darker than the ground-colour. Having much the appearance of *N. euretes*, ♀ (P. Z. S. 1891, pl. xxxi. f. 7), but with the submarginal row of lunules on both wings less distinct, smaller, and more triangular. Head, thorax, and abdomen concolorous with wings. Antennæ black with white spots.

A short black tail tipped with white on the lower median nervule.

Expanse 1¼ inch.

Mallicollo I., New Hebrides (*Woodford*) (*Mus. G. & S.*). Tanna I., New Hebrides (*B. M.*).

The male of this insect in the British Museum is a uniform violaceous blue, with very narrow linear brown borders.

This species does not appear to me very closely allied to any other, but is perhaps nearest to *N. dion* on the upperside of male and female.

Mr. Butler has identified this insect with *Acrop.? argentina*, Prittwitz, from the Samoa Islands, but I feel confident that that species is a *Jamides*, which is also Mr. Miskin's opinion, as he places it as a variety of *L.* (= *J.*) *astraptes*, Feld.

NACADUBA DION.

Polyommatus dion, Godt. Enc. Méth. ix. p. 679. n. 191 (1823).

Lampides perasia, Butl. P. Z. S. 1875, p. 616.

New Hebrides (*G. F. Mathew*) (*Mus. G. & S.*). Tanna I., New Hebrides (*B. M.*).

Both sexes of this insect agreeing well with Australian specimens; two females, however, have slightly narrower black borders and consequently a larger area of white, whilst another is quite normal.

Lycæna perasia, auct. (*nec* Felder), from Australia, in my opinion equals *N. dion*. I have not seen a specimen from Amboina, whence Felder's type was obtained, but his figure seems to point to a form which has the brown borders on the underside much broader than any Australian specimens I have seen, and consequently a less extent of white.

NACADUBA NEBULOSA, sp. n. (Plate XXVII. figs. 10, 11.)

Allied to *N. keiria*, mihi, but without the tails.

♂. Upperside: colour the same; hind wing without the black spots at the anal angle. Underside greyish creamy white, with markings and spots arranged as in *N. keiria*, but very faint and indistinct.

♀. Upperside as *N. keiria*, ♀; underside as male. Head, thorax, and abdomen concolorous with wings. Antennæ and legs brown, spotted with white.

Expanse as *N. keiria*.

Espiritu Santo I., Mallicollo I., New Hebrides (*Woodford*). New Hebrides (*Mathew*) (*Mus. G. & S.*).

A form distinct from anything I have seen.

NACADUBA BIOCELLATA.

Lycæna biocellata, Feld. Reise, Nov., Lep. ii. p. 280. n. 352, t. 35. f. 14 (1865).

Lampides armillata, Butl. P. Z. S. 1875, p. 614. n. 22.

New Hebrides (*Mathew*).

I have before me a male and two females of this pretty little species, which agree exactly with two in the Hewitson collection from Swan River; also with Felder's figure.

Mr. Butler, in describing his species, evidently overlooked Felder's insect, at least he makes no mention of it.

The male is much like the female, but has the violaceous extending almost to the margins of both wings.

I am unable to state positively whether this species should be placed in *Nacaduba* or in *Prosotas*, as I have no specimen for dissection.

NACADUBA DEPLORANS.

Lampides deplorans, Butl. P. Z. S. 1875, p. 614. n. 23.

Maré I., Loyalty Is. (*B. M.*).

The type in the British Museum is the only example I have seen. It certainly is not the female of *N. biocellata*, as both sexes of that insect are in Messrs. Godman and Salvin's collection.

NACADUBA? CATOCHLORIS.

Lycæna? catochloris, Boisd. Voy. Astr., Lep. p. 78 (1832); Butl. P. Z. S. 1874, p. 286.

Taiti, Society Is. (*Boisd.*).

I have not been able to identify this species. Mr. Butler in 1874 suspected it to be a *Danis*, but as that genus is not known to occur amongst these islands I think it will probably turn out to be a *Nacaduba*.

THYSONOTIS, Hübn.

One species only of this genus has been discovered in these islands, examples of which are contained in the British Museum and also in our own collection.

THYSONOTIS CALEDONICA.

Lycæna caledonica, Feld. Reise Nov., Lep. ii. p. 267, t. 33. f. 7 (1865).

New Caledonia (*Feld.*) (*Mus. D.*).

Mr. Kirby, in his catalogue (p. 346), places *T. caledonica* as a synonym of *T. schaeffera*, but the whole upperside of the male, with the exception of the anal angle of hind wings, is of a rich dark blue, in that respect resembling *T. cepheis* from the Solomon Islands, but darker. The underside of hind wing is a most brilliant rich dark gold.

The uppersides of the females of *T. schaeffera*, *T. cepheis*, and *T. caledonica* are practically all the same.

JAMIDES, Hübn.

The species of this genus from the South Sea Islands have been supposed to occur only in their typical localities, but the numbers obtained by Mr. Mathew and Mr. Woodford prove that this is not the case—*J. woodfordi* having been received from Fiji, the New Hebrides, and Tonga Islands.

All the species are very nearly alike on the undersides, but although I have before me a good series of most of the species I am unable to say that the colours merge one into another.

JAMIDES CANDRENA.

Lycæna candrena, Herr.-Schäff. Stett. ent. Zeit. 1869, p. 74.

Lampides candrena, Butl. P. Z. S. 1874, p. 285.

Viti Levu I., Ovalau I., Vanua Valava I., Fiji Is. (*Herr.-Schäff.*).

The only specimen I have seen is one in the British Museum which Mr. Butler informs me was sent by Herrich-Schäffer under his name. The wings appear to be exactly the same shade of blue as in *J. pulcherrima*, but the spots on the hind margin of secondaries seem to be absent, and the blue extends to the apex of the wing.

Judging from Herrich-Schäffer's description I should have identified the insect which stands under the name *J. woodfordi* as his species, because, first, he states that it is near *L. kankena*, Feld., which, according to Dr. Felder, is similar to his *L. nemea* in the coloration of the upperside, and, secondly, no black borders are mentioned in the male; now in the series of *J. woodfordi* before me several specimens have the borders so narrow as to be almost imperceptible, and until some one is able to compare the museum example with the actual type it is impossible to be certain what *J. candrena* really is.

Mr. Miskin, Ann. Queensland Museum, no. 1, p. 51 (1891), states that *L. candrena* is a synonym of *L.* (=*Jamides*) *astraptes*, Feld., and on p. 54 gives N. Hebrides as a locality for *L. bochus*, Cr. There are specimens in Messrs. Godman and Salvin's collection of *J. astraptes* from Amboina, Ceram, and Philippine Islands; all these have the costal portion of the hind wings of a lighter and more shining blue than the rest of the wings, in that respect differing from all the island forms noted in this paper and resembling the Indian *L. bochus*, from which they principally differ in having narrower black apical borders.

JAMIDES PULCHERRIMA. (Plate XXVII. fig. 16.)

Jamides pulcherrima, Butl. Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 347 (1884)[1].

Tanna I.[1] Mallicollo I., New Hebrides (*Woodford*). New Hebrides (*Mathew*).

Two specimens in Messrs. Godman and Salvin's collection, agreeing exactly with the type in the British Museum.

JAMIDES MORPHOIDES.

Jamides morphoides, Butl. Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 347 (1884)[1].

Lampides candrena, Butl. P. Z. S. 1876, p. 252[2].

Espiritu Santo I., Pentecost I., Mallicollo I., New Hebrides (*Woodford*). Montagu I., New Hebrides[1 2]. Tonga Is. (*Mathew*).

The single male from Tonga Is. in Messrs. Godman and Salvin's collection has the blue on the hind wing extending almost to the margin.

JAMIDES GOODENOVII.

Lampides goodenovii, Butl. P. Z. S. 1876, p. 252; Waterh. Aid, pl. 165. f. 6 (1886).

Espiritu Santo I., New Hebrides (*Woodford*).

Four specimens of this insect in Messrs. Godman and Salvin's collection are all from Espiritu Santo Island. Mr. Butler describes the type as a female; it is a male, and a female before me is without the metallic gloss and has the borders considerably browner and also broader, especially in the hind wing.

JAMIDES WOODFORDI.

Jamides woodfordii, Butl. Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 346 (1884).

Jamides campanulata, Butl. ibid. p. 346 (1884).

Jamides lobelia, Butl. ibid. p. 347 (1884).

New Hebrides (*Mathew*). Tonga Is. (*Mathew*). Viti Levu I., Mango I., Fiji Is. (*Woodford*). Vanua Levu I., Fiji Is. (*B. M.*). Fiji Is. (*Mathew*).

There are before me a large number of this insect from the Fiji Islands, which varies a good deal in the width of the black borders and also in the colour of the underside.

I have before noted (P. Z. S. 1891, p. 367) that *J. campanulata* cannot be separated from *J. woodfordi*, and after carefully examining the type of *J. lobelia* I cannot admit it as anything but a dwarf specimen of *J. woodfordi*.

JAMIDES PETUNIA.

Jamides petunia, H. H. Druce, Ent. Mo. Mag. vol. xxiii. p. 203 (1887).

Fiji Is. (*Mus. Druce*).

It has been suggested to me that the specimens which I described

are only *J. woodfordi* subjected to the action of damp. They are dark bluish bronze and have a very distinct appearance, and for the present I think it better to keep them separate. There are no specimens in any other collection that I have seen which are anything like them.

JAMIDES KAVA, sp. n. (Plate XXVII. fig. 15.)

♂. Brilliant morpho blue; general appearance of typical *J. woodfordi*, but hind wing without bluish-white borders to black spots on outer margin; colour of *J. morphoides*. Underside as in *J. morphoides*.

Expanse $1\frac{1}{10}$ inch.

New Hebrides (*Mathew*). Fiji Is. (*Mathew*).

The type in Messrs. Godman and Salvin's collection and a specimen in our own from Fiji Islands are identical. This may prove to be a variety of *J. morphoides*, but a good series of that species from the New Hebrides does not show any variation.

JAMIDES CARISSIMA. (Plate XXVII. fig. 17.)

Lampides carissima, Butl. P. Z. S. 1875, p. 615, pl. lxvii. ff. 3, 4; Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 417 (1883).

? *Acrop.*? *argentina*, Pritt. Stett. ent. Zeit. p. 274. no. 32 (1867).

Erromango I., New Hebrides (*Butl.*). Espiritu Santo I., Pentecost I., New Hebrides (*Woodford*). New Hebrides (*Mathew*). Tonga Is., Fiji Is. (*Mathew*). Samoa Is. (*B. M.*). Tongatabu ('Challenger' Exped.).

A good series of specimens not varying to any appreciable extent, and distinguished at once from *J. woodfordi* by their much darker and richer blue. *Lampides* (=*Jamides*) *phaseli*, Mathew (the types of which are now in Messrs. Godman and Salvin's collection), from the Claremont Islands, and which we have also from N. Australia, is allied to this species, but is much more plumbeous on the upperside and on the underside the white lines appear much more distinct. Mr. Miskin, in the Annals of the Queensland Museum, no. 1, p. 59 (1891), places this species in the genus *Lycænesthes*, which is certainly an error, as its hind wing possessing one tail only immediately shows. It will be observed that in the same paper Mr. Miskin places 17 species in *Lampides*, referred to "Hübn., Moore, Dist., and De Nicéville," but none of these authors use this name for any of the species he places under it.

It is, I think, possible that the insect described by von Prittwitz may prove to be the same as Mr. Butler's *J. carissima*, but without examining the type I fear it is impossible to be certain.

JAMIDES WALKERI, sp. n. (Plate XXVII. figs. 13, 14.)

♂. Allied to *J. carissima*, but slightly darker blue and with the borders blacker, more distinct, even, and not widening out at the apex as in that species. Underside rather greyer and the white lines less distinct.

♀. Close to *J. carissima*, ♀, but less blue on the disks and the

borders dull black, not brownish black as in that species. Underside as male.

Hind wings without linear tails.

Expanse, ♂ 1–1⅛, ♀ 1 1/10–1⅛ inch.

Aitutaki I. (*J. J. Walker*). Rarotonga I. (*Walker & Mathew*). Cook Is.

Although a species of *Nacaduba* (*ardates*) is known to have tailed and tailless forms, I think it is impossible to consider this insect the same as *J. carissima*, as they do not occur together. The other distinctions, though slight, seem constant. There are two pairs, including the types, in Messrs. Godman and Salvin's collection, and one in our own. This is the only species in the genus without the usual tail. The species is also in the British Museum.

Lampides, Hübn.

Lampides evanescens.

Lampides evanescens, Butl. P. Z. S. 1875, p. 615.

Mallicollo I., Pentecost I., New Hebrides (*Woodford*).

This is a common insect in the New Hebrides, and also in the Solomon Islands, but I have not seen it or any representative of the genus from any of the islands further eastward.

Catochrysops, Boisd.

Catochrysops cnejus.

Hesperia cnejus, Fabr. Ent. Syst. Supp. p. 430 (1798).

Lycæna samoa, Herr.-Schäff. Stett. ent. Zeit. 1869, p. 73. n. 30

Catochrysops patala, Butl. (*nec* Kollar) Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 346 (1884)[1].

New Hebrides (*Mathew*). Erromango I., New Hebrides[1]. Suva, Viti Levu I., and Mango I., Fiji Is. (*Woodford*). Levuka, Ovalau I., Fiji Is. (*Mus. D.*).

Two females in Messrs. Godman and Salvin's collection from New Hebrides have the hind wings on the upperside greyish white, excepting the costal margin, which is light brown.

Catochrysops platissa.

Lycæna platissa, Herr.-Schäff. Stett. ent. Zeit. vol. xxx. p. 74, pl. iv. f. 20, ♀ (1869).

Lycæna kandarpa, var. *caledonica*, Feld. Verh. zool.-bot. Ges. xii. p. 495 (1862).

Mallicollo I., New Hebrides (*Woodford & Mathew*). N. Caledonia. Rotumah I. (*Mathew*). Levuka, Ovalau I., Fiji Is. (*Mus. D.*). Samoa Is. (*Mathew*) (*Mus. G. & S.*).

I am still of the opinion that the species inhabiting these islands should be separated from *C. strabo*, Fabr., but not having seen Herrich-Schäffer's type it is impossible to say whether the insects before me represent his species. Felder's *Lyc. kandarpa*, var. *caledonica*, from New Caledonia is an older name for the same insect,

but as it is well known under the name *C. platissa* I do not care to suggest another alteration in its synonymy.

The specimens I have examined show considerable variation in size (some specimens from Samoa Islands being little more than half that of others from the New Hebrides) and also in coloration, some which I consider typical having a greyish-black outer marginal line only, whilst others have the apex and outer margin broadly greyish. The undersides also show considerable differences—some having the spots and bands brownish and distinct, in others, again, they are almost concolorous with the ground-colour of the wings. These variations cannot be traced to any particular locality, as a series from each shows all intermediates and extremes.

Tarucus, Moore.

Tarucus plinius.

Hesperia plinius, Fabr. Ent. Syst. vol. iii. pt. 1, p. 284 (1793).

Vaté I., New Hebrides (*Mathew*) (*Mus. G. & S.*).

Mr. Miskin considers that the Australian insect should stand under the name *pseudocassius*, Murray. Such being the case, he must admit that *T. plinius* and *T. pseudocassius* occur together, as we possess specimens from India and Africa agreeing exactly with others from Australia. Mr. Mathew obtained a number of this insect in the New Hebrides, but I have seen it from none of the islands eastwards.

There is in Messrs. Godman and Salvin's collection a single female, formerly in Mr. Mathew's collection, labelled New Britain.

Polyommatus, Latr.

Polyommatus bæticus.

Papilio bæticus, Linn. Syst. Nat. i. 2, p. 789 (1767).
Lycæna taitensis, Boisd. Voy. Astr., Lép. p. 77 (1832).
Lampides taitensis, Butl. P. Z. S. 1876, p. 252.

Espiritu Santo I., New Hebrides (*Woodford*). New Hebrides (*Mathew*). Tahiti, Society Is. (*Boisduval*).

The specimens before me agree exactly with some in our collection from W. and S. Africa, but are smaller and less densely covered with coarse scales than is usual in European examples. There can, I think, be no doubt that Boisduval's name is a synonym.

Arhopala, Boisd.

This genus apparently ends its range in the Solomon Islands, as no species of it has been recorded to the eastward.

Deudorix, Hew.

This genus, although well known to inhabit N. Australia and New Guinea with its adjacent islands, is, so far as I am aware, recorded

here for the first time from these islands. The species must either be very rare or very local, or we should have seen specimens before this.

DEUDORIX MATHEWI, sp. n. (Plate XXVII. fig. 9.)

♀. Upperside. Fore wing rich dark brown, darker in the cell, with a confined disk of brownish orange; hind wing a uniform cupreous olivaceous brown, lobe with a black centre bordered inwardly with orange-red, outwardly with a few metallic-blue scales.

Underside pale ashen grey, with rather darker white-bordered bands arranged much as in *D. epijarbas*, Moore, but that on the fore wing extending nearer to the inner margin, and those on the hind wing being more compact and placed altogether nearer to the base. The black spot between the lower median nervules broadly bordered inwardly with light metallic blue; a large metallic-blue patch between this spot and the lobe and a metallic-blue line along the anal margin as in *D. epijarbas*.

Head whitish; thorax above greenish; below, together with legs, concolorous with wings. Abdomen pale buff below, greyish brown above. Cilia of fore wing above and below yellowish brown; of hind wing paler white towards anal angle. Antennæ black, spotted with white and tipped with red. Palpi whitish, tipped with black. Tail black, lower edge and tip white: half as long as in *D. epijarbas*, or any other true *Deudorix*, and considerably broader.

Expanse $1\frac{7}{10}$ inch.

New Hebrides (*G. F. Mathew*) (*Mus. G. & S.*).

Mr. Mathew only obtained one specimen of this interesting species, a female, and, judging from its bright coloration, the male should turn out to be an insect of exceptional brilliancy. It is quite distinct from every other species of the group.

EXPLANATION OF PLATE XXVII.

Fig. 1. *Zizera labradus*, Godt., ♂, p. 435.
2. „ *lulu*, Mathew, ♂, p. 436.
3. *Nacaduba vitiensis*, Butl., ♂, p. 437.
4. „ „ „ ♀, p. 437.
5. „ *samoensis*, sp. n., ♂, p. 437.
6. „ „ „ ♀, p. 437.
7. „ *novæ-hebridensis*, sp. n., ♂, p. 438.
8. „ „ „ „ ♀, p. 438.
9. *Deudorix mathewi*, sp n., ♀, p. 446.
10. *Nacaduba nebulosa*, sp. n., ♂, p. 440.
11. „ „ „ ♀, p. 440.
12. „ *florinda*, Butl., ♀, p. 438.
13. *Jamides walkeri*, sp. n., ♂, p. 443.
14. „ „ „ ♀, p. 443.
15. „ *kaea*, sp. n., ♂, p. 443.
16. „ *pulcherrima*, Butl., ♂, p. 442.
17. „ *carissima*, Butl., ♂, p. 443.
18. *Nacaduba mallicollo*, sp. n., ♀, p. 439.

6. On the Geographical Distribution of the Land-Mollusca of the Philippine Islands, and their Relations to the Mollusca of the neighbouring Groups. By the Rev. A. H. Cooke, M.A., F.Z.S., Fellow and Assistant-Tutor of King's College, Cambridge.

[Received April 20, 1892.]

The Land-Mollusca of the Philippines may be regarded as consisting of two classes, those belonging to peculiar genera or subgenera developed after the final separation of the group, and those belonging to genera or subgenera common to the neighbouring islands. These latter may again be subdivided into (1) Indo-Malay and (2) Moluccan and Polynesian genera, according as the metropolis of their development lies to the S.W. or the S.E. of the Philippine group.

The object of the first part of this paper is to examine the distribution of the genus *Cochlostyla* amongst the different islands of the Philippine group. The Philippines are distinguished from every other group throughout the Pacific, except the Sandwich Islands, by the possession of an almost wholly peculiar and very conspicuous genus of Land-Mollusca, of striking beauty in form and ornamentation, and exceedingly rich in species [1]. The genus falls into 15 subgenera, the majority of which are on the whole fairly well marked, although the distinction between several of them is somewhat arbitrary. Not a single island is without its representative of the genus, and the species and even the subgenera are frequently much restricted in the area of their distribution. The whole genus thus forms an interesting clue by which to examine the problem of the ancient relationship of the different islands to one another.

Preliminary Remarks on the Subgenera of Cochlostyla.

I have followed Semper [2] in regarding *Axina* and *Corasia* as true *Cochlostylæ*, and von Möllendorff in adding [3] *Chloræa* and [4] *Ptychostyla* and excluding [5] *Phœnicobius*. Semper admits that the only distinction between *Cochlostyla* and *Chloræa* is that the latter exhibits some small anatomical difference in the genital apparatus, and this, as von Möllendorff justly remarks, is hardly sufficient reason for keeping it separate. The division of subgenera adopted by Semper

[1] About 240 are enumerated by Hidalgo, 'Journ. de Conch.' 3e sér. xxvii. 1887, pp. 111–192; but the list might be considerably narrowed by the reduction of many "species" to the rank of varieties, and the exclusion of several which are not true *Cochlostylæ*.

[2] 'Reisen,' II. iii. pp. 190, 166.

[3] Nachr. mal. Gesell. xx. 1888, p. 99.

[4] *Ibid.* p. 65.

[5] *Ibid.* xxiii. 1891, p. 200.

in the 'Reisen'[1] is admitted, even by its author, to be hardly satisfactory. But there is practically a general agreement between Semper and Pfeiffer[2], since both agree in the limitations represented by about 10 of the subgenera, the chief points of difference arising with regard to the respective limits of *Calocochlea* and *Helicostyla*, of *Helicobulimus* and *Orthostylus*, of *Orthostylus* and *Canistrum*, and the restriction of *Canistrum* proper. The distinction, if any, between some of these groups is, unless and until some definite anatomical difference is established, at best arbitrary. After careful consideration I have decided to abolish *Helicobulimus* altogether, merging it in *Orthostylus*. The species are in any case few (Pfeiffer enumerates only 5, and one of these, *grandis*, Pfr., is better classified as *Calocochlea*), and different authorities are much at issue with regard to referring specific forms to one group or the other. This seems sufficient reason for refusing to draw a line between them. With regard to *Orthostylus* and *Canistrum* (Pfr.), there is a very long series of forms ultimately connecting such typical *Orthostyli* as, e. g., *daphnis*, Brod., and *rufogaster*, Fér., with elongated shells like *camelopardalis*, Brod., and *nympha*, Pfr. But the extremes are so wide apart that it may be worth while to try to separate them, and I do so by regarding *pictor*, Brod., as a sort of border-line form, removing it from *Orthostylus*, and considering it and all the more elongated forms as belonging to a separate group (*Hypselostyla*, Mts.). This group is practically identical with Semper's '*Elongatæ*,' for there is strong ground for restricting, with Semper, the group *Canistrum* to a peculiar section of shells[3], the type of which is *ovoidea*, Lam. (=*luzonica*, Mörch, =*euryzona*, Pfr.).

The localities given in each case have been most carefully considered, and no species has been taken into account whose locality is not regarded as authoritative. Thus the locality 'Philippines,' so often given by the older writers, is useless for the present purpose, and species not further localized (a considerable number) have been neglected altogether. Recent investigation has been more exact in its record of localities, and in the present paper 180 species in all are brought to account. Further, it has been found necessary to neglect Cuming's authority as establishing any locality whatsoever. Those familiar with his method of preserving localities will understand this, and it need only be added that Semper and von Möllendorff are continually at issue with him. He may be taken as confirming, but

[1] (1) *Corasia*, (2) *Callicochlias*, (3) *Globosæ*, (4) *Hypomelanæ*, (5) *Cinereæ*, (6) *Axina*, (7) *Helicostyla*, (8) *Orustia*, (9) *Sphæricæ*, (10) *Cochlodryas*, (11) *Orthostylus*, (12) *Elongatæ*, (13) *Phengus*, (14) *Eudoxus*, (15) *Canistrum*, (16) *Prochilus*, (17) *Chrysallis*, (18) *Phœnicobius*.

[2] Nomencl. Hel. Viv. pp. 202–212. Von Möllendorff's paper on the subgeneric classification of *Cochlostyla* (Jahrb. deutsch. mal. Gesell. xii. p. 72) places the divergence at its maximum.

[3] Semper, 'Reisen,' II. iii. p. 219, places in this section the following species:—*stabilis*, Sby., *euryzona*, Sby., *ovoidea*, Lam., *belcheri*, Pfr., *balanoides*, Jon., *breviculus*, Pfr., *cinerosa*, Pfr., *dilatata*, Pfr. I should agree with him with regard to the first five; *cinerosa* is probably a var. of *satyrus*, Brod., which is a *Hypselostyla*; the remaining two appear doubtful.

never as establishing, a locality. The main authorities are the two authors just mentioned, Hidalgo, von Martens, and Dohrn. Hidalgo's work requires special watchfulness, but on the whole his localities are trustworthy. No locality from Pfeiffer has been accepted unconfirmed.

No especial care has been taken to weed out synonymous species. This would involve another heavy piece of work, and would not materially affect the results arrived at.

Distribution of the Subgenera of Cochlostyla [1].

1. Chloræa.

Luzon, 6: benguetensis, Semp., geotrochus, Möllf., hanleyi, Pfr., gmeliniana, Pfr., antonii, Semp., hügeli, Pfr. (all N. Luzon except hügeli, which occurs also in Central Luzon).
Marinduque, 2: amœna, Pfr., [2] *fibula*, Brod.
Mindoro, 2: thersites, Brod., constricta, Pfr.
Cebu, 2: *fibula*, Brod., *sirena*, Brod.
Mindanao, 1: *sirena*, Brod.
Tablas, 1: *dryope*, Brod.
Sibuyan, 1: *dryope*, Brod.
Luban, 1: *fibula*, Brod.

This subgenus is widely distributed without being specially characteristic of any island. It is not recorded from the large islands of Leyte and Samar, nor from S. Luzon, which is closely related to them. The true position of the so-called *Chloræa pelewana*, Mouss., from the Pelew Islands, cannot be said to be ascertained as yet.

2. Axina.

Luzon, 3: garibaldiana, D. & S., kobelti, Möllf., schadenbergi, Möllf.
Cebu, 6: magistra, Pfr., zebuensis, Brod., cumingi, Pfr., moreleti, Pfr., carbonaria, Sby., phloiodes, Pfr.
Siquijor, 1: siquijorensis, Brod.

The distribution of this subgenus is remarkably broken. It appears to replace *Calocochlea* in Cebu, and to be replaced by it in all the other islands except Luzon.

3. Corasia.

[3] *Babuyanes*, 3: [4] elisabethæ, O. Semp., [4] *albaiensis*, Sby., [4] halichlora, O. Semp.
Luzon, 8: [4] *albaiensis*, Sby., psittacina, Desh., erubescens, Semp., pudibunda, Semp., livido-cincta, Semp., aurata, Sby., irosinensis, Hid., cærulea, Möllf.

[1] A very small island, lying quite close to a large one, with but little depth of water between, is regarded, for the present purpose, as forming part of the larger island.
[2] Species *italicized* are found on more than one island.
[3] *Elisabethæ* and *halichlora* from Calayan I., *albaiensis* from Camiguin de Luzon.
[4] These species may possibly be classified as *Calocochlea*.

Mindoro, 2 : *papyracea*, Brod., *ægrota*, Rve.
Catanduanes, 2 : reginæ, Brod., *papyracea*, Brod.
Marinduque, 1 : *filaris*, Val.
Tablas, 2 : *intorta*, Sby., *ægrota*, Rve.
Negros, 2 : *virgo*, Brod., *intorta*, Sby.
Cebu, 5 : *ægrota*, Rve., *virgo*, Brod., *papyracea*, Brod., *intorta*, Sby., magtanensis, Semp.
Limansana, 1 : limansanensis, Semp.
Bohol, 3 : valenciensii, Eyd., æruginosa, Pfr., *intorta*, Sby.
Panay, 1 : *intorta*, Sby.
Siquijor, 3 ; broderipii, Pfr., *papyracea*, Brod., *intorta*, Sby.
Mindanao, 8 : puella, Brod., cromyodes, Pfr., *filaris*, Val., *virgo*, Brod., *lais*, Pfr., *zamboangæ*, H. & J., *intorta*, Sby., saranganica, Möllf.
Basilan, 1 : *zamboangæ*, H. & J.
Soo-loo, 1 : *lais*, Pfr.

This appears to be the only subgenus of *Cochlostyla* not peculiar to the Philippines, if the species referred to it be correctly assigned. It occurs also in Tukan Bessi (off S.E. Celebes), perhaps in the Tular Islands (between Gilolo and the southern point of Mindanao), in Amboyna, in New Guinea, and in the Solomon Islands. It may be doubted whether any of these extra-Philippine species are really *Cochlostyla*[1].

4. Calocochlea.

Babuyanes, 3 : [2] *pulcherrima*, Sby., damahoyi, Pfr., chrysochila, Sby.
Luzon, 8 : festiva, Don., dataensis, O. Semp., *zonifera*, Sby., caillaudi, Desh., dubiosa, Pfr. (also in Alabat), *pulcherrima*, Sby., ponderosa, Pfr., erythrospira, Möllf.
Catanduanes, 2 : *coronadoi*, Hid., *norrisii*, Sby.
Mindoro, 4 : melanochila, Val., roissyana, Fér., dimera, Jon.
Tablas, 1 : *cocomelos*, Sby.
Sibuyan, 2 : *cocomelos*, Sby., *samarensis*, Semp.
Samar, 5 : *zonifera*, Sby., *norrisii*, Sby., speciosa, Jay, *samarensis*, Semp., *cryptica*, Brod.
Leyte, 6 : *zonifera*, Sby., *norrisii*, Sby., *coronadoi*, Hid., *sphærion*, Sby., cretata, Brod., fragilis, Sby.
Surigao, 1 : *latitans*, Brod.
Panaon, 1 : panaensis, Semp.
Bohol, 3 : *sphærion*, Sby., *latitans*, Brod., pan, Brod.
Mindanao, 11 : [3] chlorochroa, Sby., [3] mindanaensis, Sby., *zonifera*, Sby., *cryptica*, Brod., *sphærion*, Sby., circe, Pfr., depressa, Semp., cineracea, Semp., lignicolor, Möllf., retusa, Pfr.

[1] Fischer and Crosse (Miss. Scient. Mex. p. 296) actually describe as *Corasia* a shell from Mexico.
[2] All three species from Calayan I., *pulcherrima* also from Babuyan I.
[3] Caniguin only.

Evenly distributed over almost all the group, except where replaced by *Axina* (Cebu, Siquijor). One species (*zonifera*) is common to Luzon, Leyte, Samar, and Mindanao. A group within this group (Semper's *cinereæ*), consisting of *cryptica*, *latitans*, *cretata*, *panaensis*, and *cineracea*, occurs in the contiguous islands of Samar, Leyte, Surigao, Panaon, Bohol, and Mindanao, but not in Luzon.

5. HELICOSTYLA.

Luzon, 14: curta, Sby., monticula, Sby., annulata, Sby., libata, Rve., *mirabilis*, Fér. (also in Alabat), montana, Semp., fenestrata, Sby., fumigata, Mts., balteata, Sby., sphærica, Sby., boettgeriana, Möllf., *metaformis*, Fér. (also in Alabat), [1] iloconensis, Sby., hindsi, Pfr.
Marinduque, 1: *mirabilis*, Fér.
Mindoro, 4: orbitula, Sby., tenera, Sby., fulgens, Sby., hydrophana, Sby.
Cuyos, 1: ignobilis, Sby.
Tablas, 3: crossei, Hid., bruguieriana, Pfr., turbo, Pfr.
Romblon, 2: *effusa*, Pfr., bembicodes, Pfr.
Sibuyan, 1: *effusa*, Pfr.
Cebu, 1: [2] *collodes*, Pfr.
[*Bohol*, 1: [3] *metaformis*, Fér.].

One of the few subgenera well represented in Mindoro in common with other islands. It occurs on the Tablas-Romblon-Sibuyan group, but is not recorded from any other of the central islands except Cebu (and *collodes* is a remarkably aberrant form), or from Leyte and Samar. The species are remarkably peculiar to the separate islands.

6. COCHLODRYAS.

Mindoro, 1: florida, Sby.
Burias, 1: polychroa, Sby.

A subgenus of very restricted and apparently broken distribution. Possibly 'Burias' may turn out to be incorrect.

7. EUDOXUS.

Luzon, 1?: [4] *chloroleuca*, Mts.
Catanduanes, 3?: [1] *chloroleuca*, Mts., leopardus, Pfr., bustoi, Hid.
Mindanao, 6: smaragdina, Rve., straminea, Semp., ægle, Brod., cumingi, Pfr., paradoxa, Semp., oviformis, Semp.

[1] Given in error by Hidalgo from Mindanao: Semper especially records it as peculiar to Ylocos, a couple of provinces in N. Luzon.
[2] Wrongly given by Hidalgo from Zamboanga, S. Mindanao.
[3] The locality is due to Hidalgo, but he does not state his authority, and there can be little doubt that it is incorrect. Von Möllendorff, who collected in Bohol, does not mention it.
[4] The classification of this species, and its assignment to Luzon, are matters of doubt.

8. ORTHOSTYLUS.

Luzon, 20: leucophæa, Sby., woodiana, Lea (also Alabat), porteri, Pfr. (also Polillo), lignaria, Pfr., rufogaster, Less., macrostoma, Pfr., vidali, Hid., *bicolorata*, Lea (also Alabat), polillensis, Pfr. (Polillo only), supra-badia, Semp., juglans, Pfr., nux, Semp., monozona, Pfr., concinna, Sby., flammula, Semp., turris, Semp., grandis, Pfr., *turbinoides*, Brod., amaliæ, Möllf., *pithogaster*, Fér. (also Alabat).
Catanduanes, 3: imperator, Pfr., codonensis, Hid., turbinoides, Brod.
Marinduque, 4: marinduquensis, Hid., *bicolorata*, Lea, *philippinensis*, Rve., villari, Hid.
Samar, 2: *philippinensis*, Rve., *pithogaster*, Fér.
Leyte, 1: *turbinoides*, Brod.
Panay, 3: turgens, Desh., *bicolorata*, Lea, *sarcinosa*, Fér.
Cebu, 4: *pithogaster*, Fér., *faunus*, Brod., *sarcinosa*, Fér., *daphnis*, Brod.
Bohol, 2: gilva, Sby., *daphnis*, Brod.
Masbate, 3: *pithogaster*, Fér., *faunus*, Brod., ticaonica, Brod.
Siquijor, 1: *daphnis*, Brod.

This subgenus is largely developed in Luzon and the central islands, but entirely absent from Mindoro and Mindanao. Several species are of wide distribution, e. g., *pithogaster* (Luzon, Samar, Cebu, Masbate), *daphnis* (Cebu, Bohol, Siquijor), *turbinoides* (Luzon, Catanduanes, Leyte). *Cochl. rustica*, Mouss., from Java, must be an *Amphidromus*: *C. viridis*, Desh., from Madagascar, is a *Helix*.

9. PHENGUS.

Luzon, 2: *romblonensis*, Pfr. (Calaguas only), opalina, Sby.
Marinduque, 7: *romblonensis*, Pfr., quadrasi, Hid., cossmanniana, Cr., *simplex*, Jon., eburnea, Rve., möllendorffi, Hid., subcarinata, Pfr.
Romblon, 1: *simplex*, Jon.
[1] *Burias*, 1: concinna, Sby.

This subgenus has its headquarters in Marinduque, and appears to have spread only to the islands in the immediate vicinity.

10. CANISTRUM.

Burias, 2: *ovoidea*, Lam., stabilis, Sby.
[2] *Masbate*, 1: *ovoidea*, Lam.

A small but well-marked subgenus of correspondingly well-marked distribution. Its true limitations have been indicated above.

[1] To these should perhaps be added *cinciniformis*, Sby., Luban, on the authority of a private collector, but I do not feel justified in placing it in the text. Pfeiffer strangely classifies the species in *Cochlodryas*.
[2] Ilocos Sur (N. Luzon) is given as a habitat for *balanoides*, Sby., by a private collector, but the authority is hardly sufficient.

11. HYPSELOSTYLA.

Luzon, 2: *dactylus*, Brod., *nympha*, Brod.
Catanduanes, 1: *dactylus*, Brod.
Marinduque, 1: *nympha*, Brod.
Leyte, 1: *camelopardalis*, Brod.
Panay, 3: [1] fulgetrum, Brod., nobilis, Rve., pictor, Brod.
Cebu, 1: *camelopardalis*, Brod.
Bohol, 2: boholensis, Brod., *camelopardalis*, Brod.
Busuanga, *Palawan*, and *Balabac*, 1: satyrus, Brod.

Characteristic of the central group, this subgenus just reaches Luzon and its southern attendant islands, but is entirely absent from Mindoro and Mindanao. Its appearance in Palawan and the Calamianes Islands is remarkable, no other subgenus being represented there.

12. CHRYSALIS.

Mindoro, 5: aspersa, Grat., mindoroensis, Brod., chrysalidiformis, Sby., electrica, Rve., antonii, Semp.

Entirely peculiar to Mindoro.

13. PROCHILUS.

Mindoro, 7: fictilis, Brod., virgata, Jay, porracea, Jay, calobapta, Jon., dryas, Brod., larvata, Brod., sylvanoides, Semp.
[2] *Cuyos*, 1: cuyoensis.

Not found out of Mindoro and (possibly) the Cuyos Is.

14. PTYCHOSTYLA.

Luban, 1: [3] cepoides, Lea.

Peculiar to Luban; one species only known.

15. PFEIFFERIA.

Luzon, 1: micans, Pfr.

Characteristics of the separate Islands.

Babuyanes.—This group, which may at a remote time have been connected with Luzon, but now is separated from it by a deep

[1] These three species from Panay, together with *satyrus*, form almost a group within a group, which is confined to Panay, the Calamianes, Palawan, and Balabac, in none of which islands do the more elongated *Hypselostylæ* occur.

[2] There is no authority but Cuming's for assigning this sp. to the Cuyos Is.; but as it does not appear to have been discovered anywhere else, there is considerable probability that the locality may be correct.

[3] Möllendorff, Nachr. mal. Gesell. xx. 1888, p. 65. A tablet in the Brit. Mus. has on the back, in Cuming's hand, "Island of Luban, leaves of trees." This locality had never been confirmed until one of von Möllendorff's collectors found the species living on Luban. Pfeiffer classified it as *Stylodonta*, Tryon as *Nanina*! Semper (Reisen, II. iii. p. 181) was the first to regard the species as *Cochlostyla*. He placed it in *Calococlea*, suggesting, however, that a special group should be formed for so remarkable a shell.

channel, contains representatives of no subgenera which do not occur in Luzon. Only two subgenera (*Corasia* and *Calocochlea*) appear to be found there.

Luzon.—The great size of this island, exceeding as it does in area all the other islands, excepting Mindanao, taken together, and its wide extension to the S. and E., cause it, besides developing a rich fauna of its own, to receive immigrants from subgenera not indigenous to it. Thus there is no group which is not represented on Luzon, with the exception of those peculiar to Mindoro and Luban, but, on the other hand, there is no group (except *Pfeifferia*) peculiar to it. It is characterized by a rich development of the four subgenera *Corasia*, *Calocochlea*, *Helicostyla*, and *Orthostylus*; its neighbourhood to Marinduque gives it its 2 species of *Phengus*, to the central group its 2 species of *Hypselostyla*. Catanduanes, Polillo, and Alabat, the three islands on its eastern side, the fauna of which is well known, present no peculiar features; the channels separating them from Luzon are shallow, and they are practically a part of the main island.

Marinduque.—This island, although in other respects closely related to Luzon, stands out distinct from it in several respects, and is by no means so closely related to it as the islands just mentioned. The channel separating it from Luzon is deep, and apparently only just fails to exceed 100 fathoms in depth throughout its length. It is the metropolis of the subg. *Phengus*, 7 out of the 9 known species being found there. No species of *Calocochlea*, so abundant in Luzon, appears to occur. *Orthostylus* is abundant, and *Hypselostyla* is represented by one species.

Leyte and *Samar*.—These two islands, which are separated from one another by a very narrow and shallow channel, are closely related. The San Bernardino channel, which separates Samar from Luzon, is not of great depth, and accordingly no subgenus occurs on these two islands which does not also occur on Luzon. On the other hand, the Surigao passage, which separates Leyte from Mindanao, is, at least in part, of considerable depth, and we find accordingly that two out of the three subgenera hitherto recorded from Leyte do not occur in Mindanao. Neither of the islands can be said to be well explored. Only *Calocochlea* and *Orthostylus* are recorded from Samar, and the same two, together with *Hypselostyla*, from Leyte.

Burias and *Masbate*.—The subgenus *Canistrum*, so far as our information goes, appears to be peculiar to these two islands. This is the more strange, because the channel separating them from Luzon and from Samar is of no great depth, and the stretch of sea between Masbate and the N. coasts of Negros and Cebu is the largest piece of shallow water in the Philippines, scarcely exceeding 30 fathoms at any point. Eastward of Burias and Masbate the depths are considerable, and completely separate these islands from the Tablas-Romblon-Sibuyan group. Ticao does not appear to have been explored. *Orthostylus* is abundant on Masbate.

Tablas, *Romblon*, *Sibuyan*.—These three islands, which are separated by very deep water from all their neighbours, are closely


MAP
illustrating
the Geographical Distribution
OF
THE LAND-MOLLUSCA
OF
THE PHILIPPINE ISLANDS.
Water under 100 fathoms
Depths in fathoms
FORMOSA
BASHEE OR BATAN I.
BABUYANES I.
POLILLO
LUBAN
CATANDUANES
BUSUANGA
CALAMIANES
PANAY
DINAGAT
PALAWAN PASSAGE
PALAWAN
BALABAC STRAIT
BALABAC
SULU SEA
MINDANAO
BASILAN
SULU
SULU ARCHIPELAGO
SIBUTU PASSAGE
SABANGANI I.
TULAR I.
TALAUTSE I.
CELEBES SEA
CELEBES
GILOLO
BORNEO

related to one another. They have no subgenus peculiar, but their general relations are rather with Luzon than with the central islands. One species of *Phengus* indicates relations with Marinduque, while the complete absence of *Hypselostyla*, so common in Panay, separates them from the central group.

Cebu and *Bohol*.—These islands, with Panay, are the metropolis of *Hypselostyla*, which has spread northward to Luzon. Both are sharply separated from Mindanao, since neither *Orthostylus*, which is abundant in Cebu and Bohol, nor *Hypselostyla* is represented in that island, while on the other hand *Eudoxus*, which is abundant in Mindanao, is entirely absent from Cebu and Bohol. *Corasia* is abundant in both islands; *Axina* is not recorded from Bohol, while it is abundant in Cebu, which indeed contains 6 out of the 10 existing species. *Calocochlea*, on the contrary, which is entirely absent from Cebu, occurs freely in Bohol [1].

Panay.—This island appears, on a consideration of its fauna, to be rather isolated; but perhaps this may be accounted for by the fact that its nearest neighbour, Negros, has been scarcely explored. Its relations are with the central group, *Hypselostyla* being abundant and all its species peculiar to Panay. *Orthostylus* is the only other subgenus known to occur. Thus no connection is indicated with the Tablas-Romblon-Sibuyan group or with Mindoro.

Mindanao (including *Surigao* and *Camiguin*).—This great island presents some remarkable features. *Axina* is entirely absent, while *Calocochlea* is exceedingly abundant. *Corasia* appears to be confined to the extreme S., where it is abundant. *Phengus*, *Helicostyla*, and *Cochlodryas* are absent, and, what is more remarkable, *Orthostylus* and *Hypselostyla*, so abundant on Cebu and Bohol, do not occur, thus indicating a very considerable severance between Mindanao and the central islands. The channel immediately north of Mindanao is not well surveyed, but appears undoubtedly to be of very considerable depth, 185 fathoms having been recorded by the 'Challenger' close under the N. coast of Camiguin. The Surigao strait appears to be rather shallow on its eastern side, but as it opens out towards the west the depth appears rapidly to increase. A special feature of Mindanao is the development of *Eudoxus*, found elsewhere only in Luzon (?) and Catanduanes [2]. So far as we can at present make out the relations of Mindanao are rather with Luzon than with the islands immediately contiguous.

There seems every probability that the western part of Mindanao was once for a considerable time a separate island, completely disconnected from the central and eastern portions. The low and narrow neck of land, scarcely 20 miles across, lying between Iligan

[1] Hidalgo (Journ. de Conch. 3e sér. xxvii. p. 175) gives Cebu as a habitat for *calobapta*, Jon. This must be a mistake, as the species is a *Prochilus*, which is confined to Mindoro and, perhaps, the Cuyos.

[2] Hidalgo (Journ. de Conch. *ut sup.* p. 146) gives *C. roissyana* from "Surigao, dans l'île de Mindanao." I do not know any other authority for believing that *roissyana* is not peculiar to Mindoro. There is probably a misidentification of *C. sphærion*, Sowb.

Bay in the N. and Illana Bay in the S., appears to me to represent the original channel of separation [1]. *Corasia* occurs all over the island; its appearance and development must therefore have preceded the separating of the western portion. But *Calocochlea* and *Eudoxus*, the latter of which is almost peculiar to Mindanao, occur only in the N. and E. (e. g. *smaragdina* is found from Mainit in the extreme N. to Davao on the S.E. coast), and are not recorded from any point west of the narrow isthmus. Again, the section of *Chloritis* of which *H. spinosissima*, Semp., *quieta*, Reeve, and *sanziana*, H. & J., are well known examples, is almost peculiar to Mindanao, but is only found in the district to the W. of this peninsula, and does not appear to have penetrated the main portion of the island.

One species of *Corasia* (*zamboangæ*, H. & J.) is recorded from the island of Basilan (S. of Mindanao); the species is not peculiar, and occurs also on Mindanao.

Mindoro.—The general relations of this island are very remarkable, and cause it to stand out as by far the most isolated of the whole Philippine group. A glance at the map might incline us to regard it as a link between Luzon and Panay, with close relations to the former island, and with no cause for especial individuality. Mindoro, however, is incomparably the most isolated of all the Philippines. It contains one, possibly two, absolutely peculiar subgenera, which are very well marked, and of which the nearest relations appear to be with *Hypselostyla*. In other words, the relations of Mindoro, are, so far, but only very remotely, with Panay. At the same time, however, no existing subgenus appears to be common to the two islands. Probably further exploration may detect *Chlorœa*, *Corasia*, and *Calocochlea* on Panay; but that would not bring its relationship to Mindoro at all closer, since these subgenera are known from almost every island. With Luzon Mindoro has, excluding the three subgenera universally prevalent, only one subgenus (*Helicostyla*) in common. All the species, however, are peculiar to Mindoro. Through this subgenus Mindoro appears also related to the Tablas-Romblon-Sibuyan group, and also to the Cuyos Is., but not to Panay. *Axina*, *Eudoxus*, *Orthostylus*, *Phengus*, *Canistrum*, and *Hypselostyla* are completely absent. *Cochlodryas*, however, is common to Mindoro and Burias only.

Cuyos Is.—These islands are very imperfectly known, but what little information we have tends to relate them with Mindoro, and not with Panay or Palawan. If Cuming's authority is to be trusted, the only two subgenera which occur in the Cuyos (*Helicostyla* and *Prochilus*) are common to Mindoro, but do not occur either on Panay or Palawan.

Luban.—This little island, lying almost between Luzon and Mindoro, must have been, in all probability, isolated for a long time. It contains one well-marked subgenus, *Ptychostyla*, which is quite peculiar. Deep water surrounds the island on every side.

[1] Most atlases, even the most recent, erroneously represent this isthmus as traversed by a lofty range of mountains.

Conclusions with regard to the Development of Cochlostyla.

It is probable that the distribution of *Cochlostyla*, above indicated, is due primarily to the union and separation of the various islands, perhaps more than once repeated. It can hardly be an accident which excludes *Orthostylus*, *Hypselostyla*, and *Helicostyla* from Mindanao, while *Corasia* and *Calocochlea* are not excluded, or which so sharply separates Mindoro from its near neighbour Luzon. The accompanying map (p. 455) shows that an elevation of the sea-bottom, of not more than 100 fathoms, would be sufficient to unite together all the great islands of Luzon, Leyte, Samar, Burias, Masbate, Bohol, Cebu, Negros, and Panay, not one of which is specially characterized by any one particular group, but all of which have a great many groups in common. The islands which would still remain isolated would be Luban, Mindoro, the Tablas-Romblon-Sibuyan group, Siquijor, and, possibly, Mindanao, all of which are characterized by the prominent absence or presence of marked subgenera[1]. When we know that the whole of the adjacent island of Borneo has been submerged for a depth of probably twice this amount, the probability that similar oscillations of level have occurred in the Philippines is largely increased, and, as a matter of fact, comparatively fresh coralline limestone occurs in many places in the islands at a height of at least 2000 feet above the sea[2]. There is no need to assume that the elevation and submergence affected all the islands simultaneously, or that it has not been several times repeated.

The conclusions that we arrive at by a study of the genus *Cochlostyla* are not illustrated, to any very considerable extent, by the distribution of other genera of Land-Mollusca occurring in the Philippines[3]. The natural inference is, that the genus *Cochlostyla*, as a whole, is of comparatively recent development, dating, in all probability, from a time much posterior to the introduction of the bulk of the Indo-Malay genera, and subsequent to the final separation of the group from Borneo and possibly from Celebes. The oldest of the subgenera appear to be *Chlorœa*, *Corasia*, and *Calocochlea*, which are universally distributed, being common alike to Luzon, Mindoro, Mindanao, and the central group. *Orthostylus* and *Hypselostyla* were probably developed in the central group after the final separation of Mindanao. Mindoro and Luban (the only possessors of peculiar subgenera) must have been isolated very early, although perhaps the union of Mindoro with the Cuyos Is. continued after the separation of the former from Luzon and from Panay.

[1] The soundings in the Surigao Strait are, even in the most recent charts, very infrequent, and the extent of shallow water between Mindanao, Leyte, and Samar is probably exaggerated on the accompanying map.

[2] Mr. Everett writes to me as follows:—"Cebu, Siquijor, part of Bohol, almost all Leyte, N.E. Mindanao, Tablas, Romblon, and parts of Samar and Luzon are covered with thick caps of recent coral-limestone. There is a good deal of limestone in Palawan and the Calamianes. The island of Mindoro is . . . not overlaid (at least as seen from the sea) by recent coral-limestone, as so many of the Philippine group are."

[3] E. g. *Euplecta*, *Hemitrichia*, *Obbina*, which are almost peculiar to the group.

Relations of the Philippines to the neighbouring Islands.

The Philippines are connected with Borneo, and through Borneo with Java, Sumatra, and the mainland of S.E. Asia, by two distinct ridges or banks of elevation, which enclose between them the Soo-loo or Mindoro Sea. The first, or westernmost, of these, which stretches from a point S.W. of Mindoro to the northern Cape of Borneo, consists of the islands of Busuanga, Calamian, and Limicapan, of the great island Palawan or Paragua, and the smaller islands Balabac, Balambangan, and Banguey. The entire length of this ridge is somewhat over 400 miles, not including the channel (about 50 miles wide at its narrowest point) between Busuanga and Mindoro. Of this, about 350 miles is land, and about 50 miles water of less than 50 fathoms in depth. The easternmost bridge, which stretches from Zamboanga, the extreme western point of Mindanao, to the N.E. corner of Borneo, consists of a continuous chain of small islands, the Basilan group, and the Soo-loo Archipelago. This ridge is only about 225 miles in length, but the largest island of the chain is scarcely 40 miles long, as compared with Palawan, which is over 250.

On either side of both ridges the depth of the sea is profound. A deep submarine valley[1], with soundings of 670 fathoms to 1200 fathoms (the so-called 'Palawan passage'), runs in a N.E. and S.W. direction immediately west of and parallel to Palawan. The Soo-loo Sea is still deeper, soundings of 2225 fathoms and 2550 fathoms having been obtained off the S.W. coast of Mindanao, while profounder depths still have been fathomed in the Celebes Sea. A curious point about these ridges is, that a chasm occurs in each of them, and in each of them at one end, but not at the same end in both. The Palawan ridge is interrupted at its extreme northern end, between Busuanga and Mindoro, by a channel 50 miles broad and about 600 fathoms in depth (the Mindoro Strait). The Soo-loo ridge is interrupted at its extreme southern end by a channel only about 20 miles in width, but in parts over 500 fathoms in depth (the Silutu passage). Were it not for these channels, a rise of 100 fathoms in elevation of the sea-bottom would make a double direct communication by land between the Philippines and Borneo.

There can be no doubt that Indo-Malay species of Mollusca have penetrated into the Philippines, in very early times, by both these ridges. Thus we find abundant in the Philippines the great *Naninæ* and *Cyclophori* so characteristic of the larger Sunda Islands. Four[2]

[1] It is important to notice this, since the 'Palawan passage' might be expected to mean the strait between Palawan and Borneo, whereas it means the fairway between Palawan and the dangerous ground to the west. Occasionally we find 'Palawan passage' given by inexact writers as a locality for Land-Mollusca, which is much as if 'Mozambique Channel' were given as a locality for a Madagascar *Cyclostoma*, or 'Bass' Strait' for a Tasmanian *Helix*. Pfeiffer (Mon. Hel. iv. 362) gives 'Palawan passage' for his *Bulimus trailli*, and Tenison-Woods (Proc. Linn. Soc. N. S. Wales, ser. 2, iii. p. 1003) gives the same locality for *Camæna trailli* and *palawanica*.

[2] *Amphidromus jayanus*, Lea, is probably not Philippine, and certainly not a *Cochlostyla*. Godwin-Austen records it (as a *Cochlostyla*) from Borneo (P. Z. S. 1891, p. 45).

species of *Amphidromus* are known from the Philippines (Sumatra 5, Java 15, Borneo 6); of these two get no farther north than Balabac, another occurs on Palawan, while two others are met with in Mindanao, and one of these has penetrated as far as Bohol and S. Leyte[1]. A detailed survey of some of the principal genera common to the Philippines and the neighbouring islands will be given below.

It would seem as if the connection which probably at one time existed between Palawan, Busuanga, and Mindoro was not directly across the present Mindoro Strait, where the depth is extreme. The Cuyos Is. appear to have shallow water to the W., and decidedly deeper water to the E.; thus their connection is with Palawan now. Again, the water shallows rapidly towards the S.E. end of Mindoro Strait, and is broken by islets and submarine banks, which extend from the S. point of Mindoro towards Panay and also towards Busuanga; the water, however, between these banks and islets is deep, being generally over 100 fathoms, and often more. The water off the N. and W. sides of Panay has not been very accurately surveyed, but is in all probability extremely deep. It would thus seem probable that any connection which may have existed between Mindoro and Busuanga (and a consideration of the very remarkable Helicidæ of both islands makes such a connection extremely probable) followed the line of shallower water at the E. end of the Mindoro Strait, and possibly extended some distance eastward towards Panay.

It will now be interesting to examine the Land-Mollusca of these two ridges, with a view of discovering whether or not they belong to the Philippine fauna.

Unfortunately, our knowledge of the Land-Mollusca of the Soo-loo ridge is meagre in the extreme. We know that Basilan, Lampinigan, and Malanipa are, by their *Cochlostylæ*, closely related to Mindanao. We know also that one species of *Cochlostyla* (*lais*, Pfr.) occurs on Soo-loo Is. Tawi-tawi[2] is quite unexplored. The Mollusca of Bongao, the last island at the Borneo end of the chain, are known. Eleven species in all are enumerated, five of which show distinct relations with Borneo.

The following species are known to occur on Basilan:—

Cochlostyla zamboangæ, H. & J.	Also occurs in	Mindanao.
Xesta mindanaensis, Semp.	,,	Mindanao.
Chloritis sanziana, H. & J.	,,	Mindanao.
Obbina rota, Brod.	,,	Bohol, Siquijor, &c.
Rhysota semiglobosa, Pfr.	,,	Philippines generally.
Macrochlamys crebristriata, Semp.	Also occurs in	Mindanao.
Microcystis myops, Semp. & Dhrn.	,,	Philippines [generally.
Trochomorpha metcalfei, Pfr.	Also occurs in	Philippines generally.
Stenogyra panayensis, Pfr.	,,	Philippines generally.
Pupina ottonis, Dohrn.	,,	Mindanao.

[1] *Amph. maculiferus*, Sowb.; *see* Semper, Reisen, II. iii. p. 148.
[2] The 'Samarang' anchored off the island, but did not make a landing.

Thus Basilan is, as might be expected, thoroughly Philippine, not possessing even one peculiar species.

The Mollusca known from Malanipa are :—

Xesta mindanaensis, Semp.	Also occurs in	Mindanao.
Chloritis sanziana, H. & J.	„	Mindanao.
Obbina bigonia, Fér.	„	Mindanao, Leyte, Samar.
Leptopoma vitreum, Less.	„	Philippines generally.

The only Mollusca which appear to be known from Soo-loo are:—

Trochomorpha metcalfei, Pfr.
Cochlostyla lais, Pfr.
Melania soolooensis, Brot.
[1] *Cyclotus suluanus*, Möllf., MS.

According to Hidalgo [2], *Cochl. lais* occurs in N. Mindanao. The species is probably only a variety of *puella*, Brod. Pfeiffer originally described it from the Philippines generally; in the 'Novitates,' iv. tab. 126. ff. 6, 7, p. 114, he figures a var. said to be from Tukan Bessi, a locality which I greatly doubt.

In the absence of any information as to Tawi-tawi, it is impossible to say how far Philippine influence extends along this ridge.

The Mollusca known [3] from Bongao are :—

Plectotropis squamulifera, Möllf. Peculiar.
Macrochlamys angulata, Möllf. Peculiar.
Trochonanina conicoides, Metc. Peculiar.
Opeas, two species not identified.
Opisthoporus, sp. (possibly a *Cyclotus*).
Leptopoma, sp.
Lagochilus quinqueliratus, Möllf. Peculiar.
Alycæus excisus, Möllf. Peculiar.
Diplommatina roebelini, Möllf. Peculiar.
Pupina ottonis, Dohrn. Also occurs in Philippines.
Helicina martensi, Issel. „ Borneo.

Thus six out of the eight known species are peculiar, while of the remaining two, one occurs in the Philippines and one in Borneo. As to genera, no exclusively Philippine genus occurs, while *Plectotropis*, *Macrochlamys*, *Trochonanina*, *Opisthoporus*, *Lagochilus*, and *Alycæus* are Indo-Malay. In spite, then, of the deep intervening channel, Bongao is distinctly Bornean, and, in spite of the chain of islands with shallow water between them, distinctly non-Philippine.

Coming to the western ridge, the Mollusca known from Balabac [4] are as follows :—

Amphidromus [5] ? *entobaptus*, Dohrn. Also occurs in Palawan.

[1] In the Brit. Mus., from the Hungerford collection.
[2] Journ. de Conch. 3e sér. xxxv. p. 113.
[3] Von Möllendorff, Jahrb. deutsch. malak. Gesell. xiv. p. 286.
[4] From the island of Balambangan, on the Bornean side of Balabac Strait, are recorded *Ariophanta regalis*, Bens., and *Cyclophorus tenebricosus*, Ad. and Rve., and from an islet between Banguey and Balambangan, *Amphidromus adamsii*, Reeve.
[5] This is the species called by Hidalgo *contrarius*, Müll., which occurs in Timor.

Amphidromus quadrasi, Hid. Peculiar.
Lamprocystis goniogyra, Möllf. Also occurs in Philippines generally.
—— *myops*, Semp. & Dhrn. ,, Philippines generally.
—— *succinea*, Pfr. ,, Philippines generally.
Trochonanina labuanensis, Pfr. ,, Borneo.
Hadra[1] *monochroa*, Sby. Also occurs in Palawan and Busuanga.
Cochlostyla[2] *satyrus*, Brod. ,, Palawan and Busuanga.
Cyclophorus triliratus, Pfr. ,, Borneo.
Opisthoporus quadrasi, Cr. Peculiar.
Leptopoma insigne, Sby. Also occurs in Mindoro.
—— *maculatum*, Lea. ,, Luzon.
—— *vitreum*, Less. Also occurs in Java, Philippines, Moluccas.
Quadrasia hidalgoi, Cr. Peculiar.

Thus we find, even at the extreme Bornean end of this ridge, Philippine influence of considerable importance. The Bornean *Amphidromi* are counterbalanced by the *Hadra*, which belongs to the remarkable group of which the metropolis is Palawan, and by the single *Cochlostyla*. *Opisthoporus*, again, is Indo-Malay, while in the genus *Leptopoma* the preponderance, in species at any rate, is towards the Philippines. *Quadrasia* is a remarkable freshwater form, apparently allied to *Planaxis*, and quite peculiar to Balabac.

The Mollusca known from Palawan are as follows:—

Hemiplecta schumacheriana, Pfr. Also occurs in Borneo.
Hemitrichia (?) *plateni*, Dohrn. Peculiar.
Euplecta cebuensis, Möllf. Also occurs in Philippines.
Lamprocystis goniogyra, Möllf. ,, Philippines.
—— *succinea*, Pfr. ,, Philippines.
Trochonanina conicoides, Metc. ,, Borneo, Bongao.
Trochomorpha loocensis, Hid. ,, Philippines.
—— *metcalfei*, Pfr. ,, Philippines, Borneo.
—— *splendens*, Semp. ,, Philippines.
Amphidromus entobaptus, Dohrn. Peculiar, with Balabac.
Hadra trailli, Pfr. Peculiar.
—— [3] *monochroa*, Sby. Peculiar to Palawan, Balabac, and Busuanga.
Eulotella (?) *inquieta*, Dohrn. Peculiar.
—— *fodiens*, Pfr. Also occurs in Philippines.
Cochlostyla[4] *satyrus*, Brod. Peculiar.
Cyclotus euzonus, Dohrn. Peculiar.
—— *sordidus*, Pfr. Said to occur in China and Cochin China.
Opisthoporus quadrasi, Hid. Peculiar.

[1] As *lagunæ*, Hid. This variable species appears to be confined to Balabac, Palawan, and Busuanga; Hidalgo (Journ. de Conch. sér. 3, xxvii. p. 109) cites it also from Luzon, but I think this must be a mistake.
[2] As the var. *graellsi*, Hid.
[3] Including the varieties *palawanica*, Pfr., *lagunæ*, Hid., *doriæ*, Dohrn, and *palumba*, Souv. Cuming gives *monochroa* from Tablas, which I think is a mistake. Dohrn considers the occurrence of *doriæ* in Borneo very doubtful.
[4] Including the varieties *graellsi*, Hid., *palawanensis*, Pfr., and *librosa*, Pfr.

Cyclophorus acutimarginatus, Sby. (?). Also occurs in Philippines.
—— *plateni*, Dohrn. Peculiar.
—— *quadrasi*, Hid. Peculiar.
—— *woodianus*, Les. Also occurs in Philippines.
Leptopoma acuminatum, Sby. ,, Philippines.
—— *atricapillum*, Sby. ,, Philippines.
—— *distinguendum*, Dohrn. ,, Philippines.
—— *insigne*, Sby. ,, Philippines.
—— *luteostoma*, Sby. ,, Philippines.
—— *superbum*, Dohrn. Peculiar.
—— *vitreum*, Less. Also occurs in Java, Philippines, Moluccas.
Helicina martensi, Issel. ,, Borneo.

Of the 30 species above enumerated, 11 are peculiar to Palawan and the adjacent islands, while, of the remaining 19, 13 occur also in the Philippines only, 3 in Borneo, 2 are common to the Philippines and Sunda Islands, while one is assigned, perhaps wrongly, to China. If, however, we take the genera concerned, we find that 3 (*Cochlostyla*, *Hemitrichia*, *Euplecta*) are Philippine; 6 (*Hemiplecta*, *Trochonanina*, *Amphidromus*, *Eulotella*, *Opisthoporus*, *Cyclophorus*) are Indo-Malay; while the remainder are Moluccan and Polynesian genera which have spread into the Philippines and Sunda Islands. Palawan, therefore, affords a link between the Philippines and the Indo-Malay islands, without being very markedly allied with either group. Of Indo-Malay genera which do not appear to reach to the Philippines proper, it has *Opisthoporus*, while *Amphidromus* and *Eulotella* are but scantily represented there. Again, of genera peculiarly Philippine, it has the three above mentioned, so that the balance is fairly even. It is in its operculates, *Leptopoma* and *Cyclophorus*, that Palawan shows its closest relation to the Philippines.

The Mollusca known from Busuanga are as follows:—

Ennea (*Diaphora*) *möllendorffi*, Hid. Peculiar.
—— (——) *morleti*, Hid. Peculiar.
Kaliella doliolum, Pfr. Also occurs in Philippines.
Macrochlamys gemma, Pfr. ,, Philippines.
Lamprocystis glaberrima, Semp. ,, Philippines.
—— *globulus*, Möllf. ,, Philippines.
—— *goniogyra*, Möllf. ,, Philippines.
—— *myops*, Semp. & Dhrn. ,, Philippines.
Patula aperta (?). ,, Philippines.
Trochomorpha metcalfei, Pfr. ,, Philippines and Borneo.
—— *bintuanensis*, Hid. Peculiar.
—— *crossei*, Hid. Peculiar.
Trochomorphoides (?) *fernandezi*, Hid. Peculiar.
—— *planasi*, Hid. Peculiar.
Aulacospira azpeitiæ, Hid. Peculiar.
Trachia malbatensis, Hid. Peculiar.
Hadra[1] *polychroa*, Sby. Palawan and Balabac.

[1] As the var. *palumba*, Souv.

Phœnicobius bintuanensis, Hid. Peculiar.
—— *campanula*, Pfr. Peculiar.
Eulotella (?) *fodiens*, Pfr. Also occurs in Philippines.
Cochlostyla [1] *satyrus*, Brod. Palawan and Balabac.
Cyclophorus smithi, Hid. Peculiar.
Coptochilus quadrasi, Hid. Peculiar.

It is evident from this list that, as would be expected, Philippine influence is preponderant in Busuanga. Of the 23 species known, 12 are peculiar, and, of the remaining 11, 2 are also peculiar to Palawan and Balabac, 8 are common to the Philippines, and only 1 appears to occur in Borneo. *Amphidromus*, which occurred in Palawan, is not represented, but relationship with Palawan is sufficiently attested by the one *Cochlostyla* and by *Hadra polychroa*. The Indo-Malay *Opisthoporus* which reached Palawan appears to reach no farther. The occurrence of the *Diaphora* section of *Ennea*, which is only found elsewhere in Luzon, is a markedly Philippine element. *Kaliella* is a thoroughly Indo-Malay genus, which occurs sparingly in Java, Borneo, and the Philippines. The two species classified as *Trochomorphoides* are of doubtful generic position. Originally described as *Trochomorpha*, they were afterwards placed by their author in *Geotrochus*. In seems better to assign them to the genus in which Von Martens has placed several other Geotrochoid species (e. g. *bantamensis*, Smith, from Bantam I., off Java, and *niahensis*, Godw.-Aust., from N. Borneo), until their anatomy has become definitely known.

By far the most interesting part of the molluscan fauna of Busuanga are its Helices. Only three are known, viz. *campanula*, Pfr., *bintuanensis*, Hid., *polychroa*, Sby. These three species belong to two groups closely related to one another. One of these groups is represented in Palawan, the other in Mindoro, Busuanga uniting the two by possessing both. There can be little doubt of the very close relationship of *campanula* and *bintuanensis* (together with *ceres*, Pfr., probably from this same locality) with the species so long regarded as a group of *Cochlostyla* (*Phœnicobius*), but now separated off by von Möllendorff as a group of Helices of the Camœna family. The curiously stumpy form, thick and roughly toothed lip, and often wrinkled sculpture are marked points of similarity throughout. The other group, that of *polychroa*, is more of the normal helicoid type, but is linked with *Phœnicobius* by the form *trailli*, Pfr., which presents points of analogy with both groups.

This occurrence of a number of large Helices of very restricted distribution (*Phœnicobius* being peculiar to Busuanga and Mindoro, and the *polychroa* group to Busuanga, Palawan, Balabac, and perhaps N.E. Borneo) is exceedingly remarkable. The evidence that the *polychroa* group extends to Borneo is not strong. *H. trailli* and *H. palawanica* are given from Borneo in the Brit. Mus. on the authority of Mr. Ussher, Consul at Labuan about 15 years ago. Issel, however, in his monograph of Bornean Mollusca, gives these same species, not from Borneo, but from 'Stretto di Palawan,' which probably means

[1] As the var. *fischeri*, Hid.

Balabac. The mistake about "Palawan passage," alluded to above, has perhaps induced collectors to assign to both sides of the supposed "passage" species that really came from one side only. The only form that appears to have any real authority as coming from Borneo is *H. doriæ*, Dohrn, and I do not feel absolutely certain even about it, while Dohrn himself is very doubtful. But, whether the group be represented in Borneo or not, it is interesting to consider the relationship of these two very isolated groups of Helices, which, it may be remarked, afford very strong evidence for a land connection at some point between Mindoro and the Calamianes. It appears to me that both of these groups find their nearest relations in an easterly and not in a westerly direction—the *Phœnicobius* group being nearly akin to the well-known forms *mamilla* and *papilla*, from N. Celebes, and these to *concisa*, Fér., from Waigiou, and *quoyi*, Desh., from Celebes; the *polychroa* group to shells of the type of *rehsei*, Mart., from N. Guinea, and *dupuyana*, Cpr., from N.E. Australia. It is certain that, as far as these regions are concerned, it is only in N. Guinea and N. Australia that Helices are found of the size and general texture of those under consideration. And it is perhaps worth while pointing out other affinities of the same kind. The remarkable *H. antiqua*, Ad. & Rve., from N. Borneo, appears closely allied to no other shell but *leonardi*, Tapp.-Can., from N. Guinea. The unique *H. plurizonata*, Ad. & Rve., found during the 'Samarang' voyage in Mindanao, is very nearly related to *lacteolota*, Sm., and *agnocheilus*, Sm., both from N. Guinea[1]. The *Corasiæ* of the Philippines are closely related to a group of shells which attain their maximum development in the Solomon Islands. The section of *Chloritis* which includes such Helices as *quieta*, Rve., *brevidens*, Sby., *spinosissima*, Semp., *sauliæ*, Pfr., *sanziana*, H. & J., *caliginosa*, Ad. & Rve., and *philippinensis*, Semp., has its nearest relations in N. Guinea, Torres Str., and N. Australia. And it is perhaps worth noticing that the Philippine *Chlorites* just mentioned appear to be restricted to the two islands of Mindanao and Mindoro, *i. e.* just where the two ridges of connection impinge upon the Philippine group.

These facts seem to point to a land connection, no doubt of extreme antiquity, which admitted of Land-Shells of a Papuan and N. Australian type finding their way in a westerly direction. I am therefore inclined to regard *Phœnicobius* and the *polychroa* group, as now occurring in Palawan, Mindoro, and the adjacent islands, as a sort of survival of a fauna which perhaps had once a much more extended range. It is a significant fact that almost the only other *Helix* from the E. Indies generally which in shape at all approaches the smaller forms of the *Phœnicobius* group is *H. codonodes*, Pfr., from the Nicobars. It is possible that eventually fossil or subfossil forms may be discovered in Sumatra and Java which will place this at present isolated form in continuous geographical connection with the apparently related fauna of Busuanga and Mindoro.

[1] Had the 'Samarang' been anywhere near N. Guinea, one might have been disposed to believe that the locality for *plurizonata* was erroneous; its facies is so strongly Papuan.

A word may be added with regard to three groups of islands which link the Philippines with other points of geographical interest. These are the Tular Islands, the Talautse Islands, and the Bashee or Batan Islands.

The Tular Islands are situated between Mindanao and Gilolo, in Lat. 4° N., Long. 127° E. The only Mollusca which appear to be known from them are [1] *Helix physalis*, Pfr., and *Partula newcombiana*, Hartm. Ancey [2] doubts the correctness of the locality for the latter (Salisbaboe Island, one of the group). It is certainly, if correct, the most westerly *Partula* known, the few species from the Pelew Islands coming next. The Tular Islands are known to be volcanic, and a more thorough knowledge of their fauna, as illustrating the relations between Mindanao and Gilolo, would be most interesting. The depth of water, both to the north and south of the group, is extreme.

From Sanghir, the largest of the Talautse Islands (situated in Lat. 3° N., Long. 125° E.), the only Mollusca known are *Cyclophorus sericatus*, Anc., and *Obba linnæana*, Pfr. The latter is a very interesting shell, and approximates closely to the Celebesian forms *mamilla*, Fér., and *quoyi*, Desh. In the Brit. Mus. there is a tablet of *Corasia leucophthalma*, Pfr., from Sanghir Island, but I do not feel confident of the authority.

The Bashee or Batan Islands, lying midway between Luzon and Formosa in Lat. 21° N., Long. 122° E., appear not to have been visited by a naturalist since the voyage of the 'Samarang.' They are a continuation of the volcanic chain which runs through the Philippines, Formosa, and the Loo-Choo Islands to Japan and Kamtschatka. The depth of water all round them is profound, 1000 fathoms being recorded immediately off the S. point of Formosa, while the Ballintang Channel, which separates the Bashee Islands from the Babuyanes, is certainly of great depth. The only Mollusca known from these islands are *Helix batanica*, Ad. & Rve., *Cochlostyla ? speciosa*, Jay, and *Bulimus kochii*, all from the island of Ibugos ('Samarang,' Zoology *Preface*, Narrative, vol. i. p. 72). *Helix batanica*, a sinistral species, appears to be of a thoroughly Chinese or Formosan type, belonging to the same section as *peliomphala*, Pfr., *formosensis*, Pfr., and *bacca*, Pfr. The *Cochlostyla*, on the other hand, is of course Philippine, and it is very remarkable that the species should occur on an island separated by such great depths from the Philippines proper. What the exact species may be is uncertain. Adams originally considered it to be *C. speciosa*. Reeve afterwards described it (Conch. Ic., Helix, pl. ix. f. 2) as *batanica*, afterwards altered to *volubilis*. Pfeiffer regarded it as either his *dubiosa* or as *decipiens*, Sowb. Hidalgo thinks it a variety of *damahoyi*, Pfr. (Journ. de Conch. 1887, p. 129). What '*Bulimus kochii*' may be (Adams says it occurred in three varieties,

[1] Described in Mal. Blätt. xviii. 1871, p. 123, from Mr. J. H. Thomson's collection. In the Nomenclator Hel. Viv. it is classified as a *Cochlostyla*. An examination of specimens in Mr. J. H. Ponsonby's collection, received from Mr. Thomson, makes me very doubtful on this point.

[2] Le Nat. 1889, p. 266.

but he does not figure any) I am quite unable to suggest. If an *Amphidromus*, the balance of connection would be, on the whole, with Formosa. The further investigation of the Mollusca of this interesting group is very desirable.

In the following table (pp. 468, 469) are examples of Indo-Malayan genera which reach the Philippines.

The following Indo-Malayan genera occur in the Philippines, but have not yet been detected in Sumatra, Java, or Borneo, viz.:—*Hypselostoma* (*philippinicum*), *Plectopylis* (*polyptychia*, *trochospira*), *Ditropis* (*mira*, *cebuana*, *quadrasi*), *Cyathopoma* (*cornu*, *meridionale*, *aries*).

Of Moluccan and Polynesian genera occurring in the Philippines, and gradually diminishing through the Sunda Islands westward, the following may be mentioned:—*Trochomorpha*: Philippines 9, Borneo 8, Java 8, Sumatra 4; *Helicina*: Philippines 16, Borneo[1] 3, Java 1, Sumatra 0; *Leptopoma*: Philippines 31, Borneo 11, Java 2, Sumatra 1; *Cyclotus*: Philippines 18, Borneo 6, Java 2, Sumatra 1; *Pupina*: Philippines 5, Borneo 3, Java 5, Sumatra 3. Two species of *Tornatellina* (*manillensis*, *ringens*) occur in the Philippines, but not farther westward, one of *Endodonta* (*philippinensis*), and one of the *Leucochilus* section of *Pupa* (the pan-Polynesian *pediculus*).

There seems to be a good deal of misunderstanding with regard to the island Tukan Bessi (variously spelled Toekang Besi, Toukang basi, Tukang Bessie, Toekun Bessi). It originally came into notice as the habitat of three supposed *Cochlostylæ* (*thomsoni*, Pfr., *indusiata*, Pfr., *tukanensis*, Pfr.), described (as *Helices*) by Pfeiffer in Malak. Blätt. xviii. 1871, p. 120, f., from the collection of Mr. J. H. Thomson; the same locality is repeated in each case in the 'Novitates,' vol. iv. pp. 71–73. Kobelt, in his papers on geographical distribution, quotes Issel (Monogr. Bornean Mollusca) as referring one of these species to "the small islands north of Borneo," and in his list gives *Cochlostyla lais*, *tukanensis*, and *physalis* all from "Toekun Bessi." Von Möllendorff (Jahrb. deutsch. malak. Gesell. xiv. p. 285) remarks that this island, as well as Tular and New Beland, lies between the S. point of Mindanao and the Moluccas. The only Tukan Bessi with which I am acquainted is off the S.E. point of Celebes, in Lat. 4° S., Long. 124° E., and therefore well away from the Sulu Sea or the Celebes Sea proper. No island of such a name, or of a name anything approaching it, appears on the chart of the seas north of Borneo. Either, therefore, the original locality of Mr. Thomson's shells was incorrect, which there seems no reason to believe, or the island has been wrongly located by succeeding writers. What the island of "New Beland" is, to which Möllendorff refers, and from which Von Martens describes[2] his *Cyclotus angulatus*, I am quite unable to conjecture.

[1] Lieut.-Col. Godwin-Austen (P. Z. S. 1889, p. 352) adds *crossei*, Semp., to the Bornean fauna, on the authority of the Brit. Mus., which has specimens from "Palawan." I suspect this is an error. Semper's original locality was Palauan in Luzon.

[2] Jahrb. deutsch. malak. Gesell. i. 1874, p. 56.

EXAMPLES OF INDO-MALAYAN GENERA OF LAND-MOLLUSCA WHICH REACH THE PHILIPPINES.

	SUMATRA.	JAVA.	BORNEO.	CELEBES.	PHILIPPINES.
Sitala	.....	bandongensis.	angulata. everetti. singularis. kusana. orchis.	.....	philippinarum. lineolata.
Amphidromus	inversus. sumatranus. jayanus. adamsi. porcellanus.	appressus. purus. galericulum. bataviæ. loricatus. sultanus. interruptus. emaciatus. porcellanus. leucoxanthus. perversus. palaceus. winteri. furcillatus. fllozonatus.	melanomma. interruptus. perversus (?). chloris. maculiferus. adamsi.	sinistralis. perversus. interruptus. sultanus. beccarii. annæ.	chloris. maculiferus. entobaptus (Palawan). quadrasi (Balabac).
Clausilia	sumatrana. excurrens. obesa. alticola.	javana. heldii. corticina. cornea. junghuhni. moritzii. orientalis. salacana.	bornensis. schwaneri. dohertyi.	moluccensis.	cumingiana.
Kaliella	.....	javana.	pulvisculum.	.....	pseudositala. pusilla. stenopleuris. luzonica. doliolum.

Glessula	sumatrana.	cornea. javanica.	wallacei.	.....	philippinensis.
Plectotropis	sumatrana.	winteriana. sumatrana. squamulosa.	.....	.....	visayana.
Lagochilus	garreli.	grandipilum. ciliferum. trochulus. ciliocinctum.	dido. keppeli. mundyanum. triliratum.	ciliocinctum. bellum.	boettgeri. subcarinatum. tigrinulum. mucronatum. grande. parvum. omphalotropis. quadrasi. stenomphalus.
Opisthoporus	sumatranus. rostellatus. javanus.	corniculum. biciliatus. javanus.	biciliatus. euryomphalus. latistrigus. rostellatus. birostris. pterocycloides. pertusus.	.....	quadrasi (not farther than Palawan).
Alycaeus	longituba.	hochstetteri. jagori.	hochstetteri. globosus. spiracellum. broti. galbanus. hosei. everetti. specus.	jagori. celebensis.	caroli. tomotrema.
Coptochilus	sectilabrum. sumatranum.	.....	anostoma. doriæ.	.....	altum.

June 14, 1892.

Prof. Flower, 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 1892:—

The total number of registered additions to the Society's Menagerie during the month of May was 136, of which 80 were by presentation, 20 by birth, 22 by purchase, and 14 on deposit. The total number of departures during the same period, by death and removals, was 75.



Hypocolius ampelinus, ♂ et ♀.

Amongst the additions I may invite special attention to a pair of the rare and beautiful Passerine bird the Grey Coly-Shrike (*Hypocolius*

ampelinus) from Fao, Persian Gulf, presented by W. D. Cumming, Esq., and received May 6th. We had previously received from the same donor a male of this bird, which is still alive and in splendid condition. The drawing by Mr. Keulemans which I exhibit (see p. 470) shows the attitude taken by the male of this species when courting.

Mr. Sclater made some remarks on the Zoological Gardens at Rotterdam, the Hague, Amsterdam, and Antwerp, which he had visited since the last meeting, and on the principal animals he had noticed in each of them.

At Rotterdam was an example of an Antelope lately received from the Congo, a male of *Cephalolophus sylvicultor* or of a nearly allied species, believed to be the first example of this fine animal brought to Europe. Besides this, the specimens of *Tragelaphus gratus* and *Cephalolophus badius* (*cf.* P. Z. S. 1891, p. 327) were still living. In the Monkey-house were examples of *Macacus ocreatus*, *M. speciosus* of Japan, and *Semnopithecus pruinosus* of Java. The Zebras were represented by a pair of *Equus burchelli chapmanni*. Amongst the birds, Mr. Sclater had noticed examples of *Gyps rueppelli*, *Ketupa javanensis*, a fine series of six Snowy Owls (*Nyctea nivea*), *Squatarola helvetica* in full summer plumage, *Trichoglossus forsteni* of Sumbawa, *Ardetta sinensis* from Java, *Plotus anhinga* (a fine adult bird), and *Gallinula orientalis* from Java.

The Heronry in the Rotterdam Gardens (of wild herons, see P. Z. S. 1891, p. 327) was in full vigour, there being 28 nests this year, and a pair of Black Storks (*Ciconia nigra*) were nesting inside the adjacent Night-Herons' Aviary.

At the Hague Zoological Gardens the greatest attraction was the large series of caged European Passeres, many Sylviidæ (e. g. *Ruticilla phœnicurus*, *R. titys*, *Sylvia cinerea* and *S. curruca*) being amongst the number.

At Amsterdam the principal Antelopes noted were a pair of *Hippotragus equinus* and a female of *H. niger*; a pair of *Cobus ellipsiprymnus* and 3 males and a female of *C. defassa*[1]; also examples of *Gazella dama*, of both species of Gnu, and of *Bubalis albifrons*. The herd of *Tragelaphus gratus* was still flourishing, and consisted of two males, two females, and a young male lately born. A *Cephalophus* lately received from Western Africa appeared to be *C. nigrifrons*. The Giraffes had become reduced in number to a single female, but there were a fine pair of Mountain Zebras (*Equus zebra*) and a young one.

From the Zoological Gardens at Antwerp a number of desirable acquisitions had been obtained for the Society's Collection, amongst which were examples of *Casuarius uniappendiculatus*, a male Ostrich, and a pair of Victoria Crown-Pigeons (*Goura victoriæ*). A young male Hippopotamus, born on the 6th September, 1891, the fourth of the offspring of the adult pair now for several years in these Gardens, seemed to be in splendid health and condition. It was hoped that this animal might be acquired later on for the Society's Collection.

[1] *Cobus sing-sing* (Bennett), Cat. Vert. 1883, p. 144.

Mr. Sclater had also visited the private Menagerie of the Society's Corresponding Member, Mr. F. E. Blaauw, of Westerveld, s'Graveland, Hilversum, and admired the beautiful herd of White-tailed Gnus, and the flocks of Rheas of both species (*Rhea americana* and *R. darwini*) and the fine series of Water-fowl to be seen there. A pair of Mantchurian Cranes (*Grus viridirostris*) were found engaged on the duties of incubation, and both *Bernicla poliocephala* and *B. rubidiceps* with young birds lately hatched[1].

A communication was read from Mr. T. D. A. Cockerell, F.Z.S., of the Institute of Jamaica, containing an account of the occurrence of a specimen of the Jacana (*Jacana spinosa*[2], Cory, B. W. I. p. 252) in Jamaica.

On April 20, 1892, Dr. Alex. G. McCatty, of Montego Bay, Jamaica, had sent a specimen of this bird to Mr. F. Cundall, Secretary of the Jamaica Institute, stating that it was quite new to him and had been shot by his friend Mr. Dillon at Savanna-la-Mar, where it is known to the people as the "Banana or Plantain Coot." This was, so far as Mr. Cockerell knew, the first certain record of the Jacana in Jamaica. There was, however, in the Museum of the Institute of Jamaica, a skin of a Jacana presented by Mr. H. O. Vickers in 1886, which was said to have been shot by that gentleman in Westmoreland Parish, Jamaica.

In a subsequent letter (dated May 14th) Mr. Cockerell had written as follows:—

"Since writing on this subject I have learned, from Mr. R. A. Walcott, Resident Magistrate for Westmoreland, that the Jacana is certainly resident in Jamaica. It was first observed by a party of gentlemen, of whom Mr. Walcott was one, in 1874, on the Cabaritta River. Since then it has occurred regularly, being observed in the Meylersfield Morasses, between Savanna-la-Mar and Little London, along the banks of the Cabaritta, and at the ponds at Hodges, near Black River, in St. Elizabeth. Although there is no history of its importation, it seems probable that it must have been brought to Jamaica from the mainland about 1873, as the rather numerous sportsmen of Westmoreland and St. Elizabeth would surely have observed it, had it existed there earlier. Its arrival by natural means seems out of the question, as Mr. Walcott informs me that it cannot fly long distances."

Dr. J. Anderson, F.R.S., F.Z.S., read the following notes on the occurrence of *Spalax typhlus* in Africa:—

"Towards the end of last April, while in Lower Egypt, I found in the district of Mariut, to the west of the great lake of the same name, and about eight miles from Alexandria, the rodent exhibited to-night.

"I may mention, in order to convey to you some idea of the character of the Egyptian habitat of this animal, that unlike the delta

[1] For a report on Heer Blaauw's collection, see "Educations d'Animaux faites à s'Graveland (Hollande) en 1891," Rev. Sc. Nat. Appl. 1892, p. 449.

[2] Melius *Parra gymnostoma*, Wagl.

proper the Mariut district consists of low rounded hills, that form a barrier between the lake and the sea. They are, however, of no great height, as the highest eminence does not rise probably more than 80 feet above the sea-level. On the gentle slopes rising from the lake, on the small plains, and in the hollows in the undulations, the Bedouins who form the greater part of the sparse population sow their crops, chiefly barley, trusting to the very meagre and uncertain rainfall of winter and spring for the irrigation of the land. If there is a moderate rainfall, the entire area, I am informed, presents in spring a beautifully green and comparatively luxuriant appearance, being covered with various flowering plants, among which Asphodels and Hyacinths abound, and by the crops of the Bedouins, which afford these people a fair return under such conditions. However, I was not favoured with such a pleasing scene during my visits, as everything was dried up, the rainfall of the past winter and of this spring being remarkedly deficient.

"On my excursion we met an Arab working in his stunted barley-field, and on questioning him about the different kinds of animals found in the district, he mentioned one which he said was completely blind and that burrowed on the higher ground and threw up mounds of earth, the character of which he illustrated by taking a handful of soil and dropping it into little heaps resembling mole-hills. I was at first incredulous and told him that in order to convince me of its presence it would be necessary for him to show me one, and I promised him 10 francs for the first he should bring alive to Alexandria. Two days afterwards he appeared at Abbatts Hotel with one in a strong canvas bag, which when opened was found to contain an animal certainly blind, as no external trace of eyes could be detected, the area which the eye should have occupied being entirely covered with skin and fur.

"I appointed a day on which to return to Mariut, and arranged with him that he should meet me near his village, and that we should dig out the animal together, he having previously sought out a place in which he had satisfied himself the animal was to be found.

"On meeting him on the day appointed, he led me to a little level flat, on the upper margin of a barley-field, and approaching it carefully he stopped short and pointed out a small hole he had dug and in which fresh earth had recently been thrown up, as if by a mole. In making the hole he had cut through two of the passages of the burrower, and he knew that in leaving them exposed the animal, if it were in either of them, would close the one in which it happened to be by throwing out earth, that would be more moist than the surrounding soil and thus indicate its presence. Having thus satisfied me that an animal was in this spot, he led me higher up to another and still larger level expanse covered with little mounds and with the dried stalks of Asphodels. Here, again, he had taken the same precaution to find out the whereabouts of the burrower. Selecting one passage we commenced to dig, but we had not proceeded far when we found that it gave off secondary tunnels, which had to be dug up to their blind extremities. As some of these passages were nearly 30 to 40 yards long, the work of

opening them up occupied some time; but as the soil was not hard and the tunnels not more than 18 inches, as a rule, below the surface, the work was accomplished more quickly than it would have been had the conditions been less favourable to digging. When a secondary tunnel was encountered its opening was closed while the main run was traced to its end, and then the secondary one was taken up, and so on until at last all the runs were searched from the points at which they had been cut across, and then the other sections in the opposite directions were taken in hand. We followed some of these to a depth of four feet, and there the passages were numerous and some of them very short and running above others below them. In one place, three runs were observed side by side, but all ultimately diverged from each other. In following one of these to the depth just mentioned we came upon a domical chamber packed full of bulbs, some of which are exhibited. My wife counted them as they were handed out and they reached the number of 68. Adjoining this chamber was another, quite empty, and which the Arabs said was the sleeping apartment. A passage leading off from these chambers was followed up for a short distance, when we came upon the animal moving backwards in it, retreating as we gradually shortened its burrow, which proving to be a *cul-de-sac* rendered the capture of the rodent an easy matter. All the passages dug up seemed to radiate outwards from these chambers; but we did not see any other store chambers, as the two other animals we captured were found in runs near the surface. However, in following up one animal we came upon a chamber the floor of which was covered with a nest of leaves. The digging out of these three animals occupied us four hours.

"The tunnels are perfectly smooth and cylindrical, and in digging through the soil above them numerous bulbs of the same kind as those found in the store-house were observed. The runs are therefore tunnels made by the animal in search of its food.

"I kept the three animals beside me for some time before sending them off by steamer for London, placing each in a large tin box half filled with earth and sand. I observed that when a number of bulbs were given to them they manifested their hoarding instinct by carrying them between their powerful teeth to one spot, where they deposited them—a very striking performance in an animal devoid of sight. The probability is that, in actions of this kind, it is guided by the sense of smell, the other sense which is most developed being that of hearing, even although there is no external ear, this part of the acoustic organ being reduced to a tube beginning on a level with the external skin, but of considerable capacity. The animal is endowed with wonderful activity and is very restless at night, thus still retaining a habit of life which, although probably of no use to it now, is generally characteristic of its close allies. It would be very interesting to know whether it ever comes above ground, as the Arabs assert that males and females are never found in the same burrows. The area, however, which I examined was so cut up by runs from various centres that it is easy to conceive that the burrows of different sexes occasionally intersect and communicate with one another.

As an illustration of the energy of this animal and of the strength resident in its neck-muscles and head, I may mention that one of them forced open, during the night, one end of the overlapping lid of the tin box in which it was confined, and escaped, even although the lid was firmly tied down in the middle and was weighted above. It achieved this feat by standing on its hind legs and by inserting its broad spatulate head between the lid and the box. In the morning it was found concealed between the folds of the cover of a dressing-bag.

"The chief object of this note, however, is not to record the habits of this remarkable animal, but to place on record its occurrence in Egypt. It was known to Aristotle, and during the last two centuries it has been described and figured by many naturalists. It is the only representative of the genus *Spalax*, if these Egyptian individuals prove to be the same as the European animal, which is found in Poland, Southern Hungary, and Eastern Russia, indeed over nearly the whole of South-eastern Europe, extending, as pointed out by Olivier in the beginning of the present century, to Syria, Mesopotamia, and Persia, and of late years found by Canon Tristram in Palestine as far south as the neighbourhood of Jerusalem, and by Mr. H. C. Hart at Gaza. If I have not overlooked any of the literature of this subject, it is now recorded for the first time from the African Continent.

"The Arabs know it as the *Abu-amma*. *Abu* means father, and *amma* blind; and I am informed that the two may be translated as meaning the truly or essentially blind. In the specimens sent round, the one in alcohol has the head intact, while in the other semi-dried specimen the skin has been reflected to exhibit the small eye, a mere black speck among the muscles, which Olivier states is perfectly organized, but I have not as yet examined it myself. It will be observed that the under surface of the reflected skin exhibits no trace of the remains of an eye-opening, and that the eye is separated from the skin proper by a thick layer of the skin-muscle, which I have partially dissected out. The presence of this muscular layer must exclude even the faintest sensation of light, so that, in time, all trace of an eye will probably be lost if the animal retains its present habit of using its head in burrowing, which is doubtless the cause of the disappearance externally of the delicate organ of sight. Of course its seemingly thoroughly underground habit of life also contributed its influence in dwarfing the eye. The first instinct of the animal when it is taken from its burrow and is let loose on the surface soil is to dig its head into the earth, the transverse ridge on the bare hard nose and the vibrissal ridge on the side of the head being special modifications of structure depending on this habit of life. This action of the large broad head is of course materially aided by the fore feet; but these structures are scarcely more developed than those of a common rat of the dimensions of itself, and the claws are only of moderate size.

"*Spalax* moves backwards in its burrows with remarkable ease, as I observed in one of the specimens captured; the reversible character of the fur and the reduction of the tail to a mere rudiment facilitate this movement.

"I had hoped to have shown to-night the animals I sent off alive from Egypt, but they all died on the way home, the last off the Isle of Wight. The person who was in charge of them informs me that they would probably all have reached this country alive had not the sandy earth that had been sent with them been impregnated with salt, which began to deliquesce as soon as the ship got into the moist atmosphere of the Mediterranean."

Prof. Romanes gave an account of some results recently obtained from the cross-breeding of Rats and Rabbits, and showed that according to these experiments it did not follow that a blending of the characters of the parents was always the result of crossing two different varieties.

Prof. Howes exhibited and made remarks on some photographs received from Prof. Parker, of Otago, New Zealand, illustrative of Sea-Lions, Penguins, and Albatrosses in their native haunts.

Dr. Dawson made some remarks on the Fur-Seal of Alaska, and exhibited a series of photographs illustrating the attitudes and mode of life of these animals.

Mr. Sclater called attention to the habits of a South-African Snake (*Dasypeltis scabra*), as exhibited by an example of this snake presented to the Society's Menagerie by Messrs. Herbert M. and Claude Beddington, of Port Elizabeth, and received September 15, 1891, which was placed on the table.

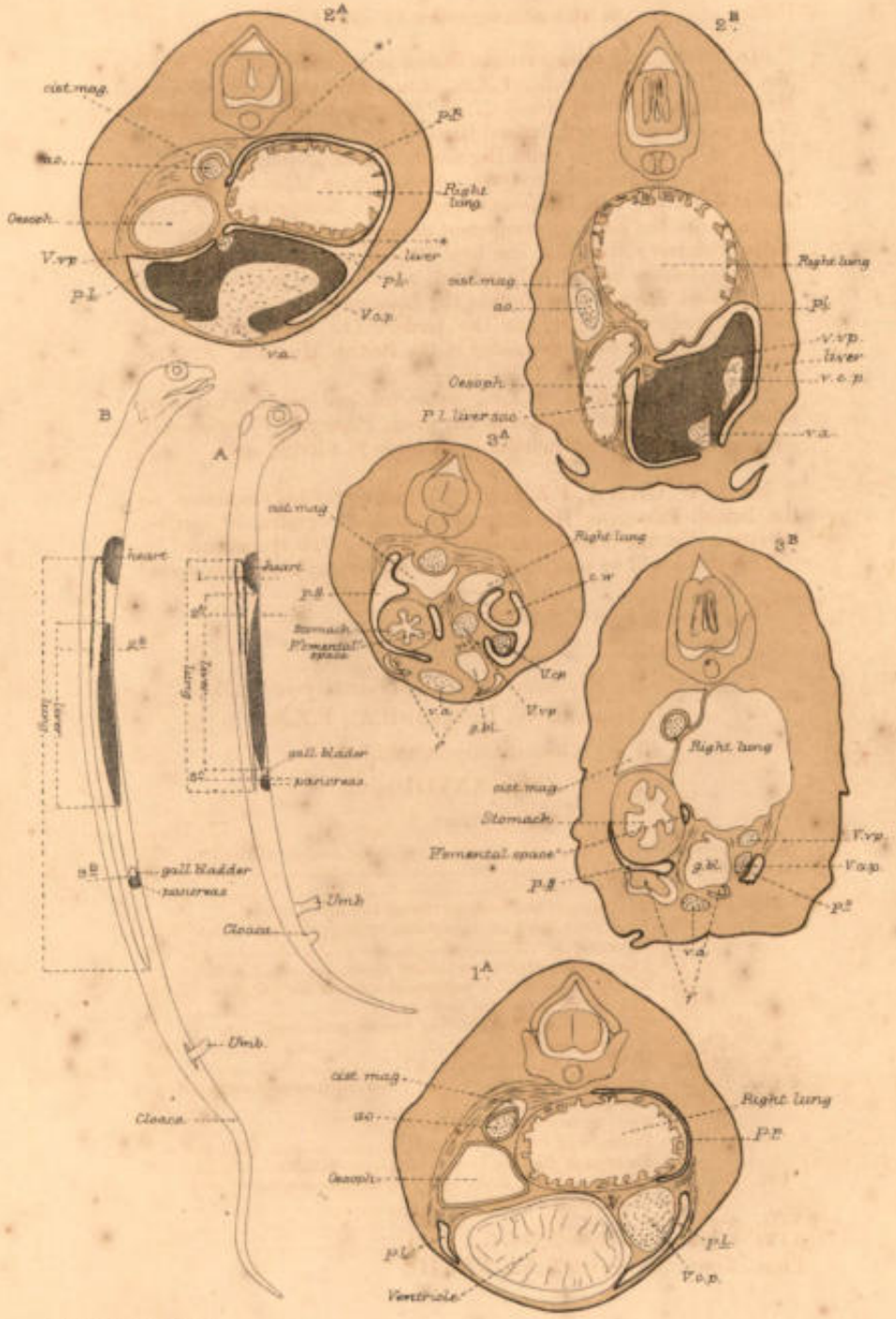
As was well known, this snake fed exclusively on eggs; and since it had been in the Society's Gardens it had occasionally eaten pigeons' eggs. These were, no doubt, pierced by the gular teeth which this peculiar snake possesses, and their contents emptied into the stomach.

A short time after the egg had been swallowed, the shell of the egg was rejected from the mouth in the form of a pellet.

Specimens of these pellets were exhibited [1].

[1] Dr. Andrew Smith writes as follows:—

"The paucity and smallness of the teeth in the mouth are favourable to the passage of the egg, and permit it to progress without injury, whereas were they otherwise, many eggs, which have very thin shells, would be broken before they entered the gullet, and the animal in consequence would be deprived of its natural food when within its reach. Having observed that living specimens which I kept in confinement always retained the egg stationary about two inches behind the head, and while in that position used great efforts to crush it, I killed one, and found the gular teeth at about the place where the egg ceases to descend. Those teeth, I am satisfied from many observations, assist in fixing the egg, and also in breaking the shell when the former reaches them, and is subjected to compression by the muscular action of the parts surrounding it. The instant the egg is broken by the exertions of the animal, the shell is ejected from the mouth, and the fluid contents are conveyed onwards to the stomach." ('Illustrations of Zoology of S. Africa,' text to plate 73.)



G.W. Butler ad nat. delt.
M.P. Parker chr. lith.

West, Newman imp.

Body-cavity of Snakes

Mr. Sclater read some extracts from a letter addressed to him by Mr. H. H. Johnston, C.B., F.Z.S., dated the Residency, Zomba, British Central Africa, March 27th, 1892, announcing the despatch of a large consignment of Natural History specimens illustrative of the Fauna and Flora of the Shiré Highlands, a good proportion of which were from altitudes of from 4000 to 8000 feet on Mount Zomba and Mount Milanji. Mr. Johnston requested Mr. Sclater to place these specimens in the hands of competent naturalists for examination.

Mr. Sclater stated that one box containing 150 bird-skins and 6 mammal-skins had already arrived, and that he proposed to ask Mr. Oldfield Thomas to undertake the examination of the latter and Captain Shelley to determine the birds. The first complete set of everything was to be deposited in the British Museum.

Mr. W. Saville Kent, F.Z.S., exhibited and made remarks on some photographs of a species of the genus *Podargus* (*P. strigoides*), showing the strange attitudes of these birds in a living state.

Mr. J. W. Gregory, F.Z.S., gave an account of his researches on the British Paleogene Bryozoa, of which he recognized 30 species, represented in the National Collection by about 750 specimens.

This paper will be published entire in the Society's 'Transactions.'

The following papers were read:—

1. On the Subdivision of the Body-cavity in Snakes.

By Gerard W. Butler, B.A., F.Z.S.

[Received May 14, 1892.]

(Plate XXVIII.)

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§ I. *Introductory.*

This paper is a continuation of my previous one "On the Subdivision of the Body-cavity in Lizards, Crocodiles, and Birds" (Proc. Zool. Soc. 1889, p. 452). Probably most persons will admit that the comparative study of any structure is more or less useful, since any such study may at any time suggest or confirm relationships between different types, or may throw light on physiology. But whether there be much or little interest in the relations (in the different groups of the Amniota) of the pleuroperitoneal cavity, with its more or less complete subdivision into different spaces, by longitudinal, transverse, or oblique membranes or "diaphragms," the fact remains, that any departure from that which embryology shows to be the simplest arrangement (viz. that seen in Lizards) at once arrests the attention of the anatomist; and, accordingly, much is from time to time written on the subject.

Therefore, as the matter is one which cannot be satisfactorily discussed except after somewhat laborious work in embryology and comparative anatomy, I have thought it well, having once gone some length in the matter, to continue my investigations.

I have to thank the "British Association," the occupation of whose "table" at the Zoological Station at Naples in 1890 gave me facilities for the collection of various Reptilian material, embryological and otherwise, and also my former teacher Prof. G. B. Howes, of the Royal College of Science, South Kensington, who generously placed at my disposal a large variety of Snakes, with permission to work at them in his laboratory. I am also indebted to Mr. G. A. Boulenger, who has kindly identified many of my specimens.

§ II. *Bibliography.*

The writer in Bronn's 'Klassen u. Ordnungen des Thierreichs' (Band vi. Abth. 3, p. 1544) says:—"The peritoneum of the Python, and apparently of many exotic Snakes, exhibits peculiarities not known in any other vertebrates. These peculiarities have been often described, and always as something quite 'new'"; and he goes on to give references. It would appear, however, from the way he speaks, and the references he gives, that the "peculiarities" of which he is thinking consist simply in the relation of the peritoneum to the stomach and intestine, the individual coils of which latter it does not follow. And, such being the case, he is quite right in saying that they have often been described (at any rate from Meckel[1] downwards). But this is only one point about the peritoneum of Snakes, and not the most interesting one. While one of the authors to whom he refers us [namely Retzius, (1) & (2)] has noted all the other peculiarities, Duvernoy confines himself to the one point above mentioned, and Herring, who is quoted without adverse

[1] Deutsches Archiv für die Physiologie (Halle), Band iii. 1817, p. 219.

criticism, is absolutely incorrect and misleading when he says of the Boa constrictor, "*es ist kein Cavum* thoracis oder *abdominis vorhanden*. . . ."; for the peritoneal cavity ("cavum abdominis") with its various subdivisions, judging by a young specimen in the British Museum, which, by the courtesy of Mr. Boulenger, I was permitted to examine, is better seen in *Boa constrictor* than in most Snakes. It is, however, hardly surprising that anyone, not forewarned by allied studies, should err as to the peritoneum of these animals.

I shall notice the paper by Lataste and Blanchard presently.

We are also referred to F. Leydig ["Ueber die einheimischen Schlangen," Senckenberg. naturf. Gesellschaft, Band xiii. 1883–4]. Leydig, however, like the writer in the 'Thierreichs,' who is perhaps following him, quotes indiscriminately Herring, who is wrong, and Retzius who is right; and the conclusion which (*loc. cit.* p. 214) he says we may draw from the various descriptions (as to the coexistence of a peritoneal cavity and a subdivided lymph-space) is, as might be expected, vague, and does not convey a correct idea of the actual facts.

To one who has elsewhere found nothing but incomplete and usually very meagre and general, if not incorrect, accounts of the Ophidian peritoneum, it is a pleasure to turn to the account of Retzius (1) & (2).

This author in 1830 described the state of things in the *Python*, overlooking no division of the peritoneal cavity; though in the case of two of the smaller spaces he simply calls them "serous canals." His description of the peritoneum appears to be as complete as it is possible for such a description of the anatomical features of any one animal to be, without the light thrown by comparative anatomy and development. One small division of the peritoneal cavity, which embryology shows to be a remnant of the "omental" space, I did not myself discover in any adult Snake until after reading Retzius' account of the Python. But although this careful "old master" seems to have seen more than any one else since, I nevertheless hope that there will be something "new" in the following paper, in so far as a study of their mode of origin furnishes material for the discussion of the true nature and the homologies of the various peritoneal spaces, and in so far as a comparative study of examples of nearly all the families of Snakes enables me to state it as probable that most, if not all Snakes, while differing considerably in other respects, are essentially alike in their peritoneal cavities[1].

We come now to the papers by Lataste and Blanchard (3) and Blanchard (4). The statement on p. 95 of (3), to the effect that the peritoneum does not extend anteriorly to the gall-bladder, is qualified by one on p. 106, to the effect that there are two serous

[1] For instance, *Tupinambis* (*Tejus*) differs strikingly from other Lizards in the possession of a most distinct transverse septum behind the liver (see Proc. Zool. Soc. 1889, plate xlviii. and text). I have recently discovered a previous mention of this structure by Meckel [Deutsches Archiv für die Physiologie (Halle), Band iii. 1817, p. 218]. However, Meckel gave no figure or detailed description of this septum.

sacs in the region of the liver. These authors are chiefly concerned with details as to the most posterior of the spaces described in this paper, especially as to its tapering forward and backward extensions. Some of their statements were in 1880 questioned by S. Jourdain [1]; and in 1882 Blanchard, in the light of new material, published a second paper (4) in which he modifies the account given in the former (3) [2].

These authors refer us to Cuvier (1835), Duméril and Bibron (1844), Siebold and Stannius (1848), and Milne-Edwards. I have of course carefully consulted these and also Owen, Hunter ('Essays and Observations,' edited by Owen), and various modern text-books; but I have not found anything on this subject to which it is worth while to refer the reader. Anatomists have as a rule kept clear of it; and one feels that it would be often mere impertinence to criticise in detail the little that has been said. So far as my search has gone, while here and there we find details of truth often mixed with more or less error, it may be said, speaking generally, that those authors who are not betrayed into including Snakes under their description of other reptiles, keep safe, by confining themselves to the most meagre details or to the most vague and general statements. For instance, Cuvier (Leçons d'Anat. Comp. 2nd ed. 1835, tom. iv. 2e part. pp. 670, 671) describes the relations of the pleuro-peritoneum in the Slowworm (*Anguis fragilis*), where we have the typical Lacertilian condition, and adds that in the true Snakes things are similar, *but more complicated*. In the paper above referred to (3) Lataste and Blanchard do an injustice to Cuvier by quoting this passage without the last "saving clause."

List of Titles.

[Snakes.]

(1) Retzius.—"Anatomisk untersöckning öfver nägra delar af *Python bivittatus*." Kon. Vet.-Akad. Handl. Stockholm, 1830, pp. 81–116.

(2) Retzius.—[German version of the above]. "Isis," Leipzig, 1832, pp. 511–531.

(3) F. Lataste et R. Blanchard.—"Le Péritoine du Python de Seba." Bull. Soc. Zool. de France, 1879, pp. 95–112.

(4) R. Blanchard.—"Nouvelles recherches sur le Péritoine du Python de Seba." Bull. Soc. Zool. de France, 1882.

[1] Revue Internationale des Sciences, 1880, p. 267.

[2] What chiefly interests these writers is a *macroscopic* connection which they find between the hinder division of the peritoneal cavity and the connective tissue in that region, and so possibly with the "cisterna magna" (grande citerne rétro-péritonale), and they add suggestive remarks as to the relations of cœlom, lymph-spaces, and connective tissue in general, and the interchangeability of the two latter. There is, as they say, nothing essentially new involved, but it would be interesting, if their account be correct (but this is disputed), to see with the naked eye what is in other animals only to be seen with the microscope.

[Lizards, Crocodiles, and Birds.]

(5) "On the Subdivision of the Body-cavity in Lizards, Crocodiles, and Birds."[1] Proc. Zool. Soc. London, 1889, pp. 452–474, plates xlvi.–xlix.

I quote this paper here because, as explained, the present one is really a continuation of it, and I shall have occasion to refer back to it. Some other references will be found in it.

§ III. *List of Snakes examined*[2].

Suborder I. **OPOTERODONTA.**				
Fam. CATODONTA.		.....	...	
Fam. EPANODONTA.		*Typhlops lumbricalis* ...	*a*	1
Suborder II. **COLUBRIFORMIA.**				
Fam. UROPELTIDÆ.		*Rhinophis blythii*	*c*	
Fam. TORTRICIDÆ.		*Cylindrophis rufa*	*c*	
Fam. XENOPELTIDÆ.		*Xenopeltis unicolor*.....	*a*	
Fam. PYTHONIDÆ.	Erycinæ.	*Eryx johnii*	*a*	
	Boinæ.	*Enygrus carinatus*	*a*	
		Boa constrictor	*a*	
	Pythoninæ.	*Python molurus*	*a*	
Fam. CALAMARIDÆ.		*Aspidura trachyprocta* .	*b*	
Fam. COLUBRIDÆ.	Coronellinæ.	*Liophis meremii*	*a*	
	Natricinæ.	*Tropidonotus natrix* ...	*b*	‡
		Heterodon d'orbignii ...	*b*	
	Colubrinæ.	*Elaphis quadrilineatus* .	*b*	‡
		Composoma melanurum.	*a*	
		Zamenis gemonensis ...	*b*	*
		Pituophis catenifer ...	*b*	*

[1] I take this opportunity to make the following corrections and additions:—

P. 464, l. 14, for "*Vitelline*" read *Allantoic*.

P. 473, l. 14, for "*mesentery and ligaments*" read *mesentery and median ligaments*.

Fig. 7, erase *v.om*, *v.om'*.

Fig. 33, for 4 read 3.

Fig. 46, the space on the right side of the figure into which the spleen and œsophagus project should be marked 2' and similarly

Fig. 47, for 2 and 3 read 2' and 3 (on the left side of the figure).

With regard to figs. 42 and 43 see below, § VII. (iii.) note.

Further, since the description of the Crocodile was written, I have, thanks to the generosity of Mr. S. F. Clark, of Williams College, Mass., been able to cut sections of a considerably younger stage (viz. a 35-days Alligator). This, while confirming the other opinions expressed in the previous paper, makes it clear that there is originally a "Foramen of Winslow" in the normal position, so that from the 7th to the 18th lines inclusive on page 470 of (5) should be struck out.

Lastly, since p. 465 of that paper was written, I have found that certain Scincoid Lizards are as to the relations of their right lungs and liver intermediate between the Teiidæ and other Lizards; while *Acontias meleagris* agrees with most Lizards, *Anguis fragilis*, *Chalcides mionecton*, and apparently *Acontias monodactyla* have their "pulmohepatic recess" not extending into the region of the lungs. So that a section through the lungs resembles fig. B on that page, and one behind the lungs shows the right lobe of the liver attached as in fig. A.

[2] For explanation see § V.

Suborder **COLUBRIFORMIA** *(continued)*.			
	Dryadinæ	.....	...	
Fam.	DENDROPHIDÆ.	*Dendrophis picta*	*a*	
Fam.	DRYOPHIDÆ.	*Dryophis prasina*	*c*	2
Fam.	PSAMMOPHIDÆ.	*Calopeltis lacertina* ...	*b*	
Fam.	DIPSADIDÆ.	*Dipsas ceylonensis*	*c*	†
		Leptodeira rufescens ...	*c*	
Fam.	SCYTALIDÆ.	.....	...	
Fam.	LYCODONTIDÆ.	*Lamprophis rufescens*...	*b*	3*
Fam.	ACROCHORDIDÆ.	.....	...	
Suborder III. **PROTEROGLYPHA**.				
Fam.	ELAPIDÆ.	*Elaps fulvius*	*b*	
Fam.	HYDROPHIDÆ.	*Hydrophis fasciata*	*c*	††
		Pelamis bicolor	*c*	
Suborder IV. **SOLENOGLYPHA**.				
Fam.	VIPERIDÆ.	*Vipera berus*	*b*	
		,, *aspis*	*b*	
		,, *arietans*	*b*	*
		,, *nasicornis*	*b*	4
Fam.	CROTALIDÆ.	*Crotalus durissus*.....	*b*	

§ IV. *On the Subdivision of the Body-cavity in the Adult Snake.*

(0). *Preliminary, and as to certain Extra-peritoneal Lymph-spaces.*

Once one knows what to look for and where to find it, it is not difficult to make out the relations of the peritoneum in Snakes of ordinary size, such as the Common Grass-Snake (*Tropidonotus natrix*) or the Common Viper (*Vipera berus*). But without such knowledge it is, judging by my own experience, not so easy.

I may perhaps be excused then if, in describing what is seen, I explain how to find it. I have spoken simply of the peritoneum, because, as may with advantage be stated here, the pleural cavity or cavities appear to be obliterated in all the Snakes I have examined [this will be discussed later, § VI.]. All my specimens have been more or less hardened in spirits, and it would seem that sometimes specimens which on the outside appear unduly soft are well adapted to our present purpose.

To dissect a Snake, insert scissors between the skin and the ribs, and cut all along the body from the region of the heart to the cloaca, keeping rather to one side of the mid-ventral line, with the scissor-points close under the skin. Having then turned back the skin from the ventral side of the animal, nothing is simpler than to ease away outwards on each side the ribs and the muscles of the body-wall, so far as they close in the ventral side. We then see, stretching from about the hinder end of the liver to not far from the cloaca, the well-known *fat-bodies*, sheathed ventrally by membranous tissue, which laterally wraps round outside all the viscera including the kidneys.

Now, first, as to these fat-bodies. If the Snake under examination be a *Python* or a *Cylindrophis rufa* (and I think I might add the

water-snakes *Hydrophis* and *Pelamis*), one possible source of error is eliminated, for in these there is no space round the fat, such as is present in the great majority of Snakes. In *Python* the fat occurs as a number of small separate lobules, quilted between membranous tissue, and the condition is somewhat similar in *Cylindrophis*, though anteriorly the fat-lobules tend to run together.

On the other hand, in most Snakes the fat occurs as a continuous, but often much folded band on either side, each of which hangs in a well-marked lymph-cavity [1] which might perhaps be taken, as it has been taken in certain other Reptiles, for a part of the cœlom proper. Development, however, shows that this is not the case. The fat and the space round it become differentiated at a comparatively late embryonic stage, and the space probably arises in the same way as, and should be placed in the same category with, the "cisterna magna," in which runs the aorta [2]. This latter is, like the circumadiposal lymph-spaces, well developed in Snakes. Besides these there may be a more or less distinct lymph-space round the kidneys.

It would have been impossible, in discussing the body-cavity proper of Snakes, to omit a reference to these *extra*-peritoneal lymph-spaces, for they are certain to strike the observer, and may be in some cases more conspicuous than the peritoneal cavity itself; and he might possibly take them for part of this and wonder why no reference had been made to them. For further remarks on these spaces, and figures showing their relations in adult *Tropidonotus* and *Vipera* and advanced embryo of *Tropidonotus*, see paper "On the Relations of the Fat-bodies of the Sauropsida." [3]

After opening the ventral body-wall of the Snake as described above, it will be best, before further dissecting, to ascertain the position of the right and most anteriorly situated kidney. If, then, we cut through the membrane ventrad of the fat a little to the right side of the animal, we, as explained above, in nearly all Snakes cut into the right circumadiposal space; this can be followed forwards and backwards, as a continuous space from one end of the fat to the other. If we next, turning up the fat, cut through the inner membranous wall of this space at a point just anterior to the right kidney [4] we shall have cut into:—

§ IV. (i.). *The Single Posterior Peritoneal Space.*

This is described by Retzius, (1) p. 91, (2) p. 517, and Lataste

[1] In certain other Snakes we see a condition of things intermediate between this and what obtains in Pythons—in fact, we have an interesting and possibly suggestive series, which need not, however, be discussed here.

[2] Thus in advanced *Elaphis* embryos (Plate XXVIII. figs. A, B) the allantoic arteries run forwards from the aorta to the umbilical stalk in the posterior part of these circumadiposal lymph-spaces, as the aorta runs in the cisterna magna, but there does not appear to be any communication between these spaces.

[3] Proc. Zool. Soc. London, 1889, plate lix. figs. 8, 9, 10. [N.B. *g* in fig. 9 and *re* in figs. 5 and 6 should be *c.w.*]

[4] If we cut at random we shall possibly miss the peritoneal cavity altogether, and may perhaps cut either into the "cisterna magna," or a lymph-space that may surround the kidney.

and Blanchard (3). If we carefully, with the aid of a seeker and pair of scissors, open up the ventral wall of this space, we shall find that it tapers off posteriorly on the ventral side of the rectum and appears to end at a small distance in front of the cloaca (varying in different species). On the other hand, we find that it ends anteriorly in front of the reproductive glands. It is in fact, like the corresponding space in Birds, Crocodiles, and *Tupinambis*, an *intestinogenital* cavity.

As the right reproductive gland lies, in Snakes, in advance of the left, this posterior peritoneal space extends forwards farther on the right side than on the other.

In the male we shall probably have no difficulty in making out the anterior limits of this space, just in front of the anteriorly rounded testes.

But in the female it may not be always easy to say exactly where this space does end anteriorly. If we follow the oviduct of either side forwards, we find the anterior end of its funnel continued as a thread into a narrow, forwardly directed, funnel of peritoneum. On the right side [*cf.* (3) pp. 100, 101] this narrow peritoneal funnel or tube runs forwards just externally to the portal and postcaval veins, and is the remnant, as will be explained later, of the right half of the peritoneal cavity in this region, which, down to a comparatively late embryonic stage, persists as a narrow tube (fig. 3^B, P^o) placing the posterior peritoneal space now described in communication with that in which the right lobe of the liver lies. Similarly with the small funnel on the left side. We can frequently tell approximately where these peritoneal tubes or funnels end, and this was especially clear in a specimen of *Heterodon d'orbignii*. While sometimes it is hard to say this, it is not very important to know the exact point at which such tapering tubes end, especially as it is, in nearly all cases, perfectly clear that the anterior peritoneal spaces into which they might be expected to lead are closed behind [1]. The wonder is not that where, as in the females, these forwardly directed peritoneal funnels occur they should vary as to their extension forwards, but that the original embryonic continuity of the peritoneal cavity on either side is, so far as I can ascertain, never maintained in the adult.

Before leaving this hindmost division of the peritoneal cavity, which, as stated, extends in the male (and except for insignificant tubular processes in the female also) from the anterior border of the reproductive organs to a point on the rectum usually not far from the cloaca, it may be well to say a few words as to the viscera which project into it.

As stated in § II., the relations of the peritoneum to the alimentary canal have been repeatedly noticed by writers on Snakes, from Meckel (*loc. cit.*) to the present day (*cf.* for instance Rolleston,

[1] It is only rarely that the right half of the liver tapers off backwards along the course of the posterior vena cava. When this is so, it may be sometimes difficult to say exactly where the tapering liver-ase ends. [*Liophis merremii, Vipera aricianus, V. nasicornis, Crotalus durissus.*]

'Forms of Animal Life,' 2nd ed. p. 69). From my tabulated notes I find that the straight terminal portion of the intestine seldom projects at all into the body-cavity, and that the less folded portion, immediately preceding this, seldom (as in *Cœlopeltis lacertina*, *Crotalus durissus*, *Compsosoma melanurum*, and *Python*) has anything that can be called a mesentery. As to the zigzag part of the intestine that follows the stomach, the peritoneum (as so often noticed) does not follow the individual bends, but merely covers the zigzag as a whole. In fact *the intestine of Snakes, as a rule, intrudes upon the peritoneal cavity less than in any other Vertebrates.*

Secondly, as to the kidneys [1]. With rare exceptions, the permanent kidneys in Sauropsida (unlike the Wolffian bodies of the embryo, and the kidneys of certain Mammalia) do not project freely into the body-cavity, but are in great part, if not entirely, situated outside it [2]. Snakes are no exception to this rule. In *Boa constrictor*, it is true, I have found the kidneys hanging freely in the body-cavity, as in certain Amphisbænidæ, but this is the only case I have found among Snakes. The only other Snakes in which I have found any part of the kidneys projecting into the body-cavity are *Typhlops*, *Cœlopeltis*, and the *Pythonidæ*, and in these cases the intrusion is but slight. In all the other forms examined (see list § III.) [3] *the kidneys lie entirely outside the peritoneal cavity, and do not project at all into it.* It is interesting to note that this exclusion of the kidneys from the body-cavity in Snakes is, like the absence of this cavity round parts of the alimentary canal, not primary. That is to say, when, at a comparatively late embryonic stage, the permanent kidneys first begin to develop, they in part project into the peritoneal cavity, as is the case in the adults of some (and perhaps most) Lizards.

Thirdly, the only other organs whose relations to this hinder peritoneal space we have to consider are the reproductive ones: and these in both sexes (and as I believe to be the case in all Vertebrates) project freely into the body-cavity.

Bearing, then, in mind that the kidneys of Snakes are with rare exceptions wholly outside the peritoneal cavity [4], and that the intestine commonly has no mesentery and bulges but little into the body-cavity, so as in individuals of some species (*Liophis meremii*) to appear to have almost entirely receded from it, it will be readily understood that *this hinder peritoneal space may occasionally be reduced in Snakes to little more than a tube containing the*

[1] I add these remarks as to the kidneys because those organs are usually referred to in discussing the relations of the peritoneum, and the impression is sometimes conveyed that there is something unusual in the exclusion of the kidneys from the body-cavity.

[2] The Amphisbænidæ [e. g. *A. darwinii*, *Lepidosternon scutigerum*, and to a rather less extent *A. alba* and *Pachyalaimus brevis*] are the only marked exceptions I know of besides the *Boa constrictor*.

[3] I could not ascertain the relations in *Lamprophys*, *Hydrophis*, and *Crotalus*, but have no reason to suspect them to be exceptional.

[4] The lymph-space mentioned above which may occur round them must not be mistaken for part of the peritoneal cavity.

reproductive glands and their ducts. From this it is not surprising to find that it terminates anteriorly in front of the reproductive organs, the body-cavity of either side being obliterated over a longer or shorter area.

§ IV. (ii.). *The Unpaired* "Gastric" *Peritoneal Space of the Left Side.*

Between the hinder end of the right liver-lobe and the anterior end of the right reproductive gland the main[1] *right* half of the peritoneal cavity is unrepresented in the male; and in the female it is only represented (as described above) by a narrow peritoneal funnel or tube which sometimes extends but little in advance of the ovary.

On the other hand, on the *left* side there is, with few exceptions, a distinct peritoneal space to be made out in the pyloric region. Retzius [(1) p. 89, and (2) p. 515], describing *Python bivittatus*, notices both this and the space which will be later referred to [§ IV. (iv.)] as the omental one.

To find this *gastric space* in any Snake, we, after the preliminary easing away of the body-wall described above (§ IV. (0)), mark the point at the end of the stomach where, about opposite the hind end of the gall-bladder, it is often slightly bent (just where its thick-walled part ends). Then, carefully lifting up and cutting through the membranous tissue that wraps round the left and ventral sides of the posterior end of the stomach, we shall in nearly all cases (*see* § III. and § V.) find a distinct serous space, which, in the region described, wraps round the stomach on its ventral and left sides (the "blind sac" of Retzius); when, as sometimes happens, this is continued forwards by a narrow canal ("left serous canal" of Retzius), this latter, as a rule, lies more ventrally than laterally to the stomach itself.

This *gastric sac* was, among the forms I examined, best developed in a specimen of *Cœlopeltis lacertina*, where it extended from a point 1½ inches behind the gall-bladder forwards, so as to slightly overlap the left liver-lobe. It is, however, here, as apparently in all Snakes, divided off from the peritoneal sac that surrounds that liver-lobe. It is also well developed in some specimens of *Zamenis gemonensis* (a common Italian Snake) and in the various types of Pythonidæ examined (viz. *Eryx*, *Enygrus*, *Python*). It was also distinct in *Compsosoma* and *Lamprophis*; and in fact I ascertained its presence in all the species examined, with the exception of a few marked (c) on the list in § III., and it not improbably occurs in some of these also.

However, it is developed to a very different degree in different species and in different individuals of the same species. Thus *it will very likely not be found in many specimens of* Tropidonotus natrix, *while it would appear* (Elaphis, Zamenis) *that it may be larger in the male than in the female.*

[1] There is, however, in many cases, a more or less marked "omental" space traceable (*cf.* § IV.).

As might be expected, when this "gastric" sac is reduced in extent, what remains of it will be found at the point where it is most expanded in other cases: that is, at that point approximate to the posterior end of the stomach, where I have suggested above that search for it should be made.

§ IV. (iii.). *The Paired Peritoneal Liver-sacs.*

Some writers make a point of the liver of Snakes being unilobular. This is in a sense true, in so far as, with the exception of the oft-quoted liver of *Typhlops* [in which animal there are some three principal, besides minor, lobulations of the liver on each side], and the trifling lobulation that may be seen in some other cases (*Vipera berus* and *arietans*), the liver of Snakes presents at first sight the appearance of one elongated body.

However, *morphologically, no animal has a more obviously bilobed liver.* And it is most certainly incorrect to say, in the language of one of our text-books, that the liver of Snakes corresponds only to the right liver-lobe of other Reptiles.

As Retzius remarks of the Python [(1) p. 96, (2) p. 520], *the liver is divided "into a right and left half . . . each lateral half of the liver is enclosed in a serous capsule of its own."*

It need perhaps hardly be added that the dorsal and ventral lines of demarcation between the two halves of the liver really represent the lines along which that organ meets the median longitudinal septum, which in its dorsal part supports the œsophagus and which, in all air-breathers, divides the pulmohepatic part of the pleuroperitoneal cavity into right and left halves[1]. We shall return later, § VII., to these liver-sacs, so that little need be said of them here. They fit the liver-lobes pretty closely, and therefore cannot possibly be missed even in the smallest Snakes.

In the rare cases in which the right liver-lobe tapers off along the course of the posterior vena cava (*Liophis meremii*, *Vipera arietans* and *nasicornis*, and *Crotalus durissus*), the liver-sac of that side necessarily does so too, wherefore it is hard to ascertain exactly where it ends.

§ IV. (iv.). *The Unpaired "Omental" or "Lesser Peritoneal" Space of the Right Side*[2].

This space is practically the most difficult of any of the peritoneal spaces to find. Moreover, I do not think that it is present in the

[1] Owing to the marked tilting of the liver over to the right side in Snakes, while the right, and usually only, lung often takes up a position in the mid-dorsal line, what is morphologically the median sagittal plane of the Snake, so far as the colom and viscera are concerned, usually, in the region of the liver, makes an angle (varying from 45° [*cf.* Plate XXVIII. fig. 2*] to 90°) with the plane joining the vertebral column with the middle of the ventral scales.

[2] The space referred to occurs apparently in all the Amniota, and it is, I

adults of all Snakes; and this, not merely because I have not in a number of cases been able to satisfy myself as to its presence by dissection, but also because in *Elaphis quadrilineatus*, of which I obtained some advanced embryos, I find, by serial sections, that it is almost totally obliterated while still within the egg.

If this space is present, one may expect to find it as a small one immediately on the right side of the stomach, and especially of the hinder part thereof—in fact, *lying between the gall-bladder and the stomach and bounded behind by the pancreas*. It will not in any case extend caudad of the pancreas, and it may not reach quite so far back as the anterior end of that organ in the adult. Anteriorly it may, when specially well developed, extend forwards as a narrow space on the right side of the stomach to a point a little anterior to the posterior end of the right liver-lobe (*Typhlops lumbricalis*). This omental space, in the Snakes which I have examined, is best seen in *Typhlops*, *Xenopeltis*, and the Pythonidæ; it is also well marked, though in a less degree conspicuous, in *Compsosoma*, *Dendrophis*, and others. I could not distinctly make it out in the forms marked (*b*) and (*c*) in the list (p. 489).

This "omental" space must not be confused with the "gastric" space above described, which runs close to it but more to the left side; that, in its hinder region, usually distinctly wraps round the left side of the pyloric part of the stomach, while this omental space is on its right side.

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believe, disguised, by the fenestration of the mesogastric and gastrohepatic ligaments, in the Amphibia also.

The word "*omental*" is somewhat ambiguous, and "*lesser peritoneal cavity*," though excellent for the Mammalia, is unsatisfactory in the case of Birds, Crocodiles, and Snakes, where there is more than one such cavity present.

It may be explained, then, that the term "omental space" is here used to include the whole space that corresponds to (*a*) the "Saccus omenti" of Mammals (the sac enclosed by the recurved stomach and its attached membranes), and (*b*) the "Recessus superior sacci omenti" of His, which in embryos of Mammals extends forwards into the pulmonary region, and is the *right* "pulmohepatic recess" of my previous paper (5). In Lizards, Crocodiles, and Birds this "recess" may be more important than the "saccus" itself.

In the adults of most Lizards, of certain Chelonians (*Thalassochelys*), and at any rate of certain Mammals, and in the embryonic stages of Crocodiles, Snakes, and Birds, we find that this "omental space" communicates with the right side of the peritoneal cavity by an aperture (very wide in many Lizards) which is the "Foramen of Winslow." This "Foramen of Winslow" is bounded postero-ventrally by the pancreas and the hepatic ducts, which run in the hinder margin of the gastro-hepatic ligament, and antero-dorsally by the posterior vena cava, which, in its course from the kidneys (or in an embryo from the Wolffian bodies) to the liver, runs in what either is, or once was, the posterior margin of a ligament attaching the right half of the liver to the dorsal body-wall.

This "Foramen of Winslow" may persist as described, as in most Lizards and some Chelonians (*Thalassochelys*) and Mammals; or it may become obliterated, as in Amphisbænians, certain Chelonians (*Testudo* and *Emys*), Snakes, Crocodiles, and Birds (*Gallus*).

In the latter case we have, as a result, an entirely closed peritoneal sac.

§ V. *Explanation of the List of Snakes given in* § III.

a—signifies a Snake in which I have clearly found the full complement of peritoneal spaces as described above, § IV., viz.:—

α. The posterior peritoneal space.
β. The paired liver-sacs.
γ. The gastric sac of left side.
δ. The "omental" space.

b—signifies a Snake in which I have not clearly made out the "omental" space, though all the others occur;

but * indicates that this *probably* is present.
" ‡ " " *possibly* "

c—signifies a Snake in which I have not clearly made out either of the smaller peritoneal spaces, *i. e.* either the "gastric" or the "omental," though the principal sacs, viz. the two liver-sacs and the posterior peritoneal space, occur.

† indicates that a Snake *probably* has a "gastric" sac.
†† " " " *possibly* " " "

1—*Typhlops*.—In this the anterior and posterior boundaries of the gastric sac were not clearly made out.

2—*Dryophis* (one of the long "Whip Snakes").—I cannot pretend to have seen the posterior boundary of the liver-sacs, but have no reason to believe that they are not closed as in all other cases.

3—*Lamprophis*.—It is possible that the right testis is enclosed in a separate peritoneal sac apart from the posterior peritoneal space. If so, this would be a peculiarity of this Snake.

4—*Vipera nasicornis*.—I am not sure that the gastric sac does not communicate with the posterior peritoneal space. If it does, we merely have a persistence of a condition of things which (*see* § VI.) certainly does persist to a comparatively late embryonic stage.

The list in § III. in part speaks for itself. I may point out, however, that *Snakes marked* b *and* c *are essentially similar as to the relations of their peritoneum to those marked* a. The "gastric" and still more the "omental" space is as a rule small, and anyone who did not know exactly where to look for either would in most cases not find them. Where there was no clear indication of one or both, I have marked the Snakes *b* or *c* as explained; and it is quite possible that one or both of them may be found in Snakes so marked. Moreover, even if they are absent this does not indicate any hard-and-fast dissimilarity between the Snakes marked *b* and *c* and those marked *a*, for development (§ VI.) shows that both the "gastric" and the "omental" spaces are, with rare exceptions, but reduced remnants of original more extensive ones; and a comparative study of the Snakes on the list shows that when these spaces are present, the amount of reduction of either varies very greatly, not only in different species but in different individuals of the same species. It is not then surprising, but, rather, just what we should expect, that in some cases one or both of these spaces should have become obliterated altogether.

§ VI. *The Developmental History of the Pleuroperitoneal Cavity of Snakes.*

At first sight the aspect of a Snake embryo is perhaps forbidding to the embryologist [1]. During much of its early existence great part of such a Snake is coiled round its allantoic stalk in such a way that it cannot be uncoiled, and one may have to do with the same embryo cut through nine times in one section. On the other hand, in later stages, when the embryo can be straightened out, it is apt to be desperately long. However, the part of the animal which chiefly concerns us in the earlier stages is not affected by the coiling, and though the modifications which produce the characteristic relations of the peritoneum of the adult Snake only arise at a comparatively late embryonic stage, one comes to the end of even a six-inch Snake sooner than might be expected, especially when, as in the present case, it is not necessary that the sections should be very thin.

§ VI. (i.). *Early Embryos of* Tropidonotus, Zamenis, *and* Vipera (with gill-slits).

For the earlier stages (about period II. of Rathke [2]), I obtained a series of embryos of *Tropidonotus natrix*, and a less complete one of *Zamenis gemonensis* and *Vipera aspis*. These stages extend from (i) a time, soon after the first appearance of the allantois, when there were traces of but one or two postoral clefts and the spiral coiling had not begun, to (ii) a time when there were 4 complete coils in the abdomino-caudal region, and when, though the gills were hardly so apparent as in a stage with only 3 coils, sections showed that there were here, as in that stage, 4 pairs of postoral gill-pouches, the first two of which communicated with the exterior.

In the most advanced of these earlier stages the pleuroperitoneal cavity presents a condition of things similar to that which we find in Lizards. That is to say, besides the main pleuroperitoneal cavity continuous throughout its whole extent, we have to the right of the stomach a "lesser peritoneal" or "omental" cavity, communicating with the right half of the main pleuroperitoneal one by a "Foramen of Winslow."

The omental sac proper is, however, very small. Its anterior recess ["Recessus superior sacci omenti" of His—my "pulmo-hepatic recess" (5)], which, in Birds, Crocodiles, Chelonia, and most Lizards, runs forwards between, and is bounded by, the œsophagus and the lung and liver-lobe of the right side, and their connecting ligaments), in these Snake embryos, as in certain Scincoid Lizards [3],

[1] On the supposition that he desires to obtain a complete series of sections. Doubtless much can be done without this, but in dealing with a subject like that before us, when microscopic spaces have to be traced and it is often desirable to be able to prove a negative—to prove, for instance, that two small spaces do *not* communicate—no other method is equally satisfactory.

[2] Rathke, 'Entwick. d. Natter,' Königsberg, 1839.

[3] *Anguis fragilis*, *Chalcides mionecton*, and apparently *Acontias monodactyla*. However, *Acontias meleagris* presents the condition of things that is usual in

does not extend forwards into the region of the lung [1]; it is confined to the hepatic region—the pancreas, which forms the posterior wall of the space, being, together with the gall-bladder, at this stage and for some time longer in contact with the liver. But as development proceeds, and as the lung extends back to and beyond the hinder end of the liver, and as the pancreas and gall-bladder come to lie, as they almost invariably do in Snakes, a considerable distance behind the liver [2], this space (if not obliterated) comes to be, with rare exceptions, entirely posthepatic in position.

§ VI. (ii.). *Embryos of* Elaphis quadrilineatus, 11 *cm. long.*

The next stage that I have, an *Elaphis* embryo 11 cm. long (Plate XXVIII. fig. A), (all allowance being made for *Elaphis* being a larger Snake than *Tropidonotus* or *Zamenis*, with larger eggs), is considerably more advanced than the stage just described, and yet for our present purpose there is no important gap between them. There is in fact, as far as the pleuroperitoneal cavity is concerned, at first sight as yet nothing to suggest the characteristic Ophidian condition. The liver-lobe of either side and the lung for the greater part of its length project freely into the common pleuroperitoneal cavity.

The only definite change that we have to note is the closing of the "Foramen of Winslow"; this, however, not only occurs in Birds (*Gallus*), Crocodiles, and many Chelonians, but also in the snake-like but truly lacertilian Amphisbænidæ. In fact *an Elaphis embryo of* 11 *cm. long is still lacertilian as to its pleuroperitoneal cavity; but, nevertheless, the changes that are shortly to supervene are foreshadowed.*

Lizards, and perhaps little importance is to be attached to the difference. Whichever is the more primitive state of things, the one may easily be derived from the other. The condition in Snakes and the Scincoids first mentioned is probably associated with the elongation of form, and with the origin of the liver at some distance behind the point of origin of the lungs. In fact, in these Lizards, as in all the Snakes I have examined (with the exception of the species of *Vipera*, *Hydrophis*, *Pelamis*, and less markedly of *Typhlops*), there is even in the adult a distinct gap between the anterior end of the liver and the heart.

[1] Some of the Snakes examined (*see* list, p. 481), viz. the Pythonidæ (*Eryx*, *Enygrus*, *Python*) and *Xenopeltis*, have two well-developed lungs, the right, however, being the larger. Others, viz. *Rhinophis*, *Cylindrophis*, *Aspidura*, *Elaps*, have a more or less distinct rudiment of a left lung. Others again—*Tropidonotus*, *Elaphis*, *Dipsas*—have the merest trace of this, only to be found by careful search near the posterior corner of the heart. In some, again, *Vipera* (*berus* and *aspis*), *Crotalus*, *Lamprophis*, and others, I did not find any trace of a left lung. In *Vipera aspis* I find no trace of a left lung even in early embryos. Though I have no embryonic stages of the Pythonidæ or Xenopeltidæ, a comparison of their anatomy with that of the more usual one-lunged forms seems to assure us that, for our present purpose, there is no noteworthy difference between them. The left lung, when present, lies between the dorso-lateral wall of the left liver-sac and the œsophagus, in a position, in fact, corresponding to that of the right lung of the other side, and has not, any more than its fellow, any trace of pleural cavity round it.

[2] However, in *Rhinophis* and certain specimens of *Aspidura* the gall-bladder is close to the liver, and it is not far removed in the Common Viper (*Vipera berus*).

Thus, considering the relations of the lung to the body-cavity, we find that in the region anterior to the liver the cavity is reduced; and, *tracing our sections backwards*, we find that the anterior part of the lung is surrounded on all sides by connective tissue. Then (still in the region of the heart) a small cavity appears on the outer side of the lung, which (P^p in fig. 1^A), as we approach the apex of the heart and the anterior border of the liver, extends round dorsad of that organ. In sections that pass through the anterior apex of the liver, the lung is bounded ventrally by a sort of incipient fibrous-tissue "diaphragm," referable in part to a latero-anterior ligament of the liver, and in part to a proliferation of connective tissue that occurs on the ventral side of the lung, which we can trace extending backwards over the ventral surface of its at present free portion (* in fig. 2^A).

As remarked above, transverse sections taken anywhere else through the liver show the lung projecting freely into the common pleuro-peritoneal cavity, which wraps round it dorsally and ventrally, in fact all round it, except on its left or mesial side where it is attached (fig. 2^A). When, however, we follow the sections still farther back, behind the liver, we find that the posterior part of the lung burrows as it were into the connective tissue dorsad of the body-cavity, a little to the right of the aorta (fig. 3^A).

We see, then, that at both ends there is a tendency to exclude the lung from the general body-cavity, and at the same time to obliterate the pleural cavity. Similarly, if, leaving the lung, we turn to the left side of this embryo and follow the sections backwards, we find that it is not till we reach about the middle of the liver that we see the œsophagus projecting into the peritoneal cavity. For the anterior part of its course it is for the most part surrounded by connective tissue (figs. 1^A and 2^A).

Again; on the same left side of the body, just posterior to the left lobe of the liver, we find a foreshadowing of the "posthepatic septum," which later closes the liver-sacs posteriorly. This foreshadowing consists in a broadening and leftward extension over the stomach of the median ventral ligament. We note also that behind the liver the body-cavity of either side is somewhat circumscribed (fig. 3^A).

§ VI. (iii.). *Embryo of* Elaphis quadrilineatus, 15 *cm. long*.

My next stage is an *Elaphis* embryo 15 cm. long (Plate XXVIII. fig. B). I regret not having a stage intermediate between this and the preceding, or any embryo of another species of equivalent age. Still, I think that a careful comparison of the 11 cm. and 15 cm. stages leaves but little uncertainty as to how we ought to regard these peritoneal spaces of Snakes.

Comparing the general features of the two embryos, we see that the head has now a less embryonic appearance, the lower jaw, for instance, being better developed. The umbilicus is further removed from the cloaca, and sections show us that the gall-bladder and

pancreas have become separated from the liver, and that the lung has grown a considerable distance backwards. In fact, an embryo of this stage, but for its comparative stoutness and the persistence of the Wolffian bodies in front of the kidneys, is very similar to the adult in the proportion of its parts and the position of the viscera. It is curious that the liver does not seem to have grown in length proportionate to the rest of the body.

Turning now to the condition of the body-cavity, we find that in the *Elaphis* embryo, 15 cm. long, the lung has become entirely excluded from that cavity, or, rather, *that part of the body-cavity which in the* 11 *cm. stage extended round the outer and dorsal walls of the lung has been entirely obliterated* (figs. 2^B, 3^B). Remembering, however, that in the 11 cm. stage it was only the part of the lung in the region of the liver (at that time the greater part of the lung) which projected freely into the body-cavity, it will not surprise us so much as it might otherwise do to find that no part of the lung is now surrounded by that space.

It will be remembered that, anterior to the liver, the pleural portion of the cœlom was in the preceding stage already in great part obliterated (fig. 1^A); and, judging by the relations of the posterior end of the lung at that time (fig. 3^A), it is but natural to conclude that the great length of lung which now extends behind the liver (*cf.* figs. B and 3^B) has developed where we find it, by burrowing backwards as it were in the fibrous tissue dorsad of the peritoneal cavity. We have, then, only to account for the exclusion from the body-cavity of that part of the lung which lies in the hepatic region (compare figs. 2^A and 2^B).

Now, in the 11 cm. stage there was as described a considerable development of fibrous connective tissue, both on the ventral and dorsal free surfaces of the lung (fig. 2^A, $**'$); and the idea naturally suggests itself that, as far as that part of the lung which lies in the region of the liver is concerned, the fibrous tissue ventral to the lung [working backwards and forwards from the points opposite the anterior and posterior ends of the liver (*cf.* figs. 1^A and 3^A), where we saw the lung in the 11 cm. stage excluded from the peritoneal cavity] has formed a "diaphragm," similar in its relation to the lung, though perhaps not otherwise homologous, to the "diaphragm" of Birds; and that almost synchronously the fibrous tissue dorsad of the lung (fig. 2^A, $*'$) has obliterated the pleural cavity, thus produced, as the pleural cavity *is* obliterated in Birds.

But of course, in the absence of an intermediate stage, one cannot be absolutely certain of what happens; and it is possible that the changes which have taken place may be in part comparable to those which lead to the formation of the "diaphragm" in Mammals. With regard to the other divisions of the body-cavity, the left half of the liver now lies in a closed sac (*the left liver-sac*) (fig. 2^B, *P.l-liver-sac*). The closing of this sac has resulted, firstly from an extension backwards of that obliteration of the peritoneal space on the left of the œsophagus which was seen taking place in the previous stage, and secondly from the connection with the lateral body-wall of the fibrous

posthepatic septum, which was also seen forming out of the ventral ligament of the stomach.

The liver-sac of the right side (fig. 2^B, P^s) is still continuous, by a long and very narrow peritoneal tubule (fig. 3^B, P^s), with the main posterior peritoneal space.

Following this narrow tube backwards from the liver-sac, we find that it runs externally to (on the right side of) the postcaval and vitelline (or portal) veins, and that it contains a minute forward continuation of the funnel of the oviduct, represented by a raised groove on the wall of this small space. As this tube of communication is now so small, and has no apparent use, it is not surprising that it should be obliterated in the adult.

In the figure (3^B) we see, cut through, a very small cavity, on the right side of the stomach, in the corner between it and the lung. This must be the remains of the "*omental space*," as to the persistence of which in the adult of this species I am not certain (see list).

Lastly, as to the *gastric space*. This is also seen in section in fig. 3^B (P^g). Following the sections backwards, we find that it is still freely continuous with the posterior portion of the peritoneal cavity.

Finally, at this stage, sections through the region of the pancreas show that the ventral ligamentous attachment of the alimentary canal to the adjacent body-wall becomes here very broad; so that we can easily understand how, when the alimentary canal comes to be bent and folded on itself, as it here does later on, the *gastric* sac might become closed posteriorly, in somewhat the same way as did the left liver-sac. The permanent kidneys (which in the preceding stage were only just making their appearance, and then had the peritoneum extending as a backwardly directed pocket external to each and covering their mesial surface) are now fairly developed, and it is found that the posterior part of each lies completely outside the body-cavity. In the adult they come to lie entirely outside it.

§ VII. *The Subdivisions of the Body-cavity in Snakes compared with those in other Sauropsida.*

[I here refer to the figures illustrating my previous paper (5).]

(i.) The *posterior peritoneal space* seems to have its exact homologue in Crocodiles [(5) figs. 42, and 43, 3], and it is very similar to the posthepatic cavity in the Lizard *Tupinambis* [(5) fig. 31, 3] or a Bird [(5) figs. 14–18, 3); but in the Bird there is on the left side and in *Tupinambis* on both sides [(5) fig. 32, o, o'] a connection with the anterior part of the body-cavity. In fact:—

(ii.) Snakes agree with Birds (e. g. *Gallus*, *Anas*), Crocodiles, and the Lizard *Tupinambis* in having a septum across the body-cavity behind the liver (*posthepatic septum*). In Birds and *Tupinambis* this septum is incomplete.

(iii.) The *gastric space* seems to have an almost exact homologue

in Crocodiles [*cf.* (5) figs. 42 and 43, in which a small unpaired space is seen in the region of the stomach [1]].

(iv.) The *omental space* is, as described above [§ IV. (iv.) note], well represented in all the other groups of Sauropsida.

(v.) As to the *liver-sacs*, the task of comparison is not so simple. The ventral liver-sacs of Crocodiles are no more comparable with those of Snakes than with those of Birds. We also soon see that there is a considerable difference between the body-cavity in the pulmohepatic region of Snakes and that in the corresponding region of the Bird. Thus, if we start from the median ventral ligament of the liver and proceed outwards, we find in the case of the Fowl [(5) fig. 45] that the spaces 1, 1 are bounded laterally by the body-wall, or rather by the "oblique septum"; but in Snakes (fig. 3^B) we pass all round the liver and reach the median dorsal attachment of that organ. This difference is clearly correlated with the fact that while in Snakes the "pulmohepatic recesses" are totally or almost totally absent [see above, § VI. (i.)], in Birds they are remarkably well developed [(5) fig. 45, 2, 2'].

In short, the "avian diaphragm" is developed out of fibrous tissue on the ventro-mesial face of the lungs, which tissue bounds these spaces (2, 2') externally. But while the fibrous tissue, which forms a sort of diaphragm ventral to the lung in Snakes, and bounds the right liver-sac dorsally, appears to have a somewhat similar relation to the lung, its other relations are different. In fact, but for its adherence to the lung, one might, from its topographical relations, rather compare the diaphragmatic tissue in Snakes with that in Mammals.

It would seem hardly more possible to closely homologize the "diaphragm" and liver-sacs of Snakes with those of Birds than the diaphragm of Mammals with that of Birds. In the case of animals which have descended from common ancestors along more or less divergent lines, we ought not of course to expect to be always able to compare *directly* corresponding parts, but rather to have to content ourselves sometimes with tracing the condition of things in each back to their common origin.

It may be remarked that the lungs of *Varanus* (*Monitor*) are excluded from the peritoneal cavity by a sort of "membranous diaphragm" [2], and this is less markedly the case with the lungs of certain Chelonia. It may well be, therefore, that the relations of the lung in Snakes can be explained by a reference to one or both of these groups; but this embryology alone can decide.

[1] It is marked in these figures with a number 1, like the paired ventral liver-sacs, because I was led to regard both the ventral part of the posthepatic septum (β) which closes the liver-sacs posteriorly, and the fibrous tissue (δ) which closes this gastric sac posteriorly, as but lateral expansions of the median ventral attachment of the stomach and liver, from which point of view the sac in the region of the stomach and the paired ventral liver-sacs might be grouped together. The embryology of Snakes seems to be in favour of the essential similarity between the septa $\beta\beta$ (*see* § VI.); but as in Snakes this gastric space is so distinctly posterior to the two liver-sacs, it may with advantage be considered apart from them in both those animals and Crocodiles.

[2] Martin, P. Z. S. 1831, p. 138. See also P. Z. S. 1889, p. 608.

(vi.) Besides the definite subdivision of the body-cavity described above, there are found in Snakes a number of modifications which tend to obliterate the pleuroperitoneal cavity.

Consideration, however, shows us that these modifications of the simple primitive condition (like those which lead to the definite subdivision of the body-cavity) take place along lines which are followed to a greater or less extent in other groups of Sauropsida. And Snakes differ in this respect, to some extent, among themselves.

Thus, the obliteration of the pleural cavity may be compared with what we find in Birds (and possibly also in Monitor Lizards, if not in Chelonia).

Again, the complete exclusion of the kidneys from the body-cavity, although the rule with the Snakes, is, we see, not confined to this order. A partial exclusion is rather usual [*ante* § IV. (i.) and notes.]

Thirdly, the remarkable development of extra-peritoneal lymph-cavities in Snakes, which still further reduces the space available for the body-cavity proper—is but an exaggeration of what we find in other Reptiles (e. g. *Monitor* and Amphisbænidæ) [*ante* § IV. (0)].

Lastly, the relation of the alimentary canal to the peritoneum, so often described, certainly does appear to be a peculiarity of Snakes; concerning this, Snakes differ among themselves, some departing less than others from the common type (in which the intestine hangs by a mesentery into the peritoneal cavity). The firm attachment of the stomach in Crocodiles seems essentially similiar to that in Snakes.

§ VIII. *Conclusions.*

(1) In Snakes, as in Crocodiles, the pleuroperitoneal cavity is, for great part of their embryonic period, very similar to that of adult Lizards; and the same is true of the earlier stages of Birds and Mammals.

(2) In Snakes the simple, primitive, lacertilian condition becomes during the later stages of development modified, in the following ways:—

(*a*) The pleural part of the body-cavity becomes obliterated.
(*b*) The peritoneal part of the body-cavity becomes subdivided into a definite number of closed spaces, viz.:
  (i.) A posterior, or intestino-genital space.
  (ii.) A gastric space on the left side.
  (iii.) An "omental" space.
  (iv.) Two paired liver-sacs.

(3) An examination of representatives of nearly all types of Snake (see list) shows that however much they may differ, in actual size, in the proportion of their parts, in various anatomical characters, and in their habit of life, they all agree in the plan on which their peritoneal cavity is subdivided.

(4) The subdivision of the body-cavity of Snakes proceeds in

large measure along lines followed in effecting a similar subdivision in other groups of Sauropsida. Thus:—

(i.) The *omental space* corresponds in all Sauropsida and it is a closed space, as in Snakes, in at any rate certain Birds, Crocodiles, and Chelonians.

(ii.) We may find in Sauropsida either a complete (Snakes, Crocodiles) or partial (Birds and *Tupinambis*) *posthepatic septum* across the body-cavity behind the liver.

(iii.) In Crocodiles, as well as in Snakes, we get the left, anterior, portion of the posthepatic peritoneal cavity shut off as a *gastric* space, leaving the remainder as a closed *intestino-genital* space.

As to each of the above-mentioned points, then, there seems to be a fairly close homology between Snakes and one or more of the other groups of Sauropsida.

(5) On the other hand, while there are points about the obliteration of the pleural cavity and the relations of the liver-sacs in Snakes which remind us of what occurs in Birds, there is perhaps no closer similarity in these respects between the two groups than between the "diaphragm" of Mammals and that of Birds.

§ IX.—EXPLANATION OF PLATE XXVIII.

ao.	Dorsal aorta.
cist. mag.	Cisterna magna.
c.w.	Wölffian body.
f.	Developing fat-body projecting into circumadiposal lymph-space.
g.bl.	Gall-bladder.
œsoph.	Œsophagus.
P	Signifies a part of the pleuroperitoneal cavity, thus:—
P^g	That part of peritoneal cavity which later forms the closed *gastric* space.
P^l	That part which will form a *liver-sac*.
P.l-liver-sac	Is the already closed left liver-sac.
P^p	The pleural part of pleuroperitoneal cavity—destined to be obliterated.
P^v (in fig. 3)	Narrow peritoneal tube connecting the right liver-sac and the posterior peritoneal cavity—destined to be obliterated.
Umb.	Umbilical stalk.
v.a.	Allantoic, or anterior abdominal vein.
v.c.p.	Vena cava posterior.
v.vp.	Vitelline-portal vein.
**	Connective tissue on free surface of lung.

Fig. A. Embryo (♂) of *Elaphis quadrilineatus*, 11 cm. long. Nat. size. Outline sketch, to show the relations and proportional development of the lung, liver, and other parts indicated. [The embryos were curled round in the eggs, and at this stage it would probably not be possible to straighten one to this degree. This is a rectified sketch of a partially straightened embryo.]

Fig. B. Embryo (♀) of *Elaphis quadrilineatus*, 15 cm. long. Nat. size. Outline sketch of an artificially straightened embryo for comparison with A.

Fig. 1^A. Transverse section of *Elaphis* embryo, of the same size as fig. A, through the ventricle of the heart (×14).

Fig. 2^A. Transverse section of same embryo, through anterior part of liver (×14).
Fig. 3^A. Transverse section of same embryo, through the gall-bladder (×14).
Fig. 2^B. Transverse section of embryo of same stage as fig. B, through a region as nearly as may be corresponding to that in fig. 2^A (×14).
Fig. 3^B. Transverse section of same embryo, through a region as nearly as may be corresponding to that in fig. 3^A (×14).

2. On a Collection of Birds from the Island of Anguilla, West Indies. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received May 18, 1892.]

Mr. W. R. Elliott, one of the Collectors employed by the Committee of the Royal Society and British Association for the exploration of the Lesser Antilles, paid a short visit to Anguilla [1] in March last, and made a small collection of birds, which I have now the pleasure of exhibiting. It contains 27 skins, which are referable to 16 species. There is nothing new or even rare amongst them, but as, so far as I know, no ornithological collector has previously been in Anguilla, and its Ornis is entirely unknown, it will be of interest to record the names of the species represented in the Collection and to add a few remarks.

Besides the species now mentioned Mr. Elliott writes that two other birds were seen—a "Chicken-hawk" (perhaps *Falco columbarius*) and a Bittern (probably *Butorides virescens*). The former was common, but the latter "rather scarce at this time of year."

Mr. Elliott was told that during the wet season a large number of other birds visit the island. When he was there in March, every thing was burned up by a three months' drought. The birds obtained are therefore "undoubtedly permanent inhabitants." Amongst the visitors during rainy season he hears of "plovers, ducks, and snipes in large flocks."

In the following list I have given references to Mr. Cory's most useful 'Birds of the West Indies' (Boston, 1889), in which all the species are mentioned.

1. Margarops fuscatus (Vieill.).

Cichlerminia fuscata, Sharpe, Cat. B. vi. p. 329.
Margarops fuscatus, Cory, B. of W. I. p. 28.

A single male specimen. "*Thrush*, scarce now, but as a rule common; seems to have left the island in search of food."—W. R. E.

[1] "Anguilla, or Snake Island, the most northerly of the British Caribbee Islands, lies north of St. Martin's, from which it is distant about 5 miles. It is about 20 miles long and 6 broad, but is so low and flat that it cannot be seen from a greater distance than 10 or 12 miles. The soil is calcareous and not very productive. A little sugar, cotton, tobacco, and maize are grown on it, but it is deficient both in wood and water. In the centre of the island is a saline lake which yields a large quantity of salt, the greater part of which is exported to America. The climate is healthy. The chief occupations of the inhabitants are breeding cattle and gathering salt."—*Imp. Gazetteer*, i. p. 158.

2. Dendrœca ruficapilla (Gm.).

Dendrœca ruficapilla, Sharpe, Cat. B. x. p. 275.
Dendrœca petechia ruficapilla, Cory, B. W. I. p. 45.

A pair. "*Yellow Finch*, common."

3. Certhiola bartolemica (Sparrm.).

Certhiola bartolemica, Scl. Cat. B. xi. p. 42; Cory, B. W. I. p. 64.

A pair. "*Yellow-breast*, fairly common."

This form is probably the same as that of the neighbouring island of St. Bartholomew, but there are no specimens available for comparison.

4. Loxigilla noctis (Linn.).

Loxigilla noctis, Sharpe, Cat. B. xii. p. 84; Cory, B. W. I. p. 91.

A pair of this species. "*Red-breasted Sparrow*, very scarce at this time of year."

5. Phonipara bicolor (Linn.).

Phonipara bicolor, Sharpe, Cat. B. xii. p. 149.
Euetheia bicolor, Cory, B. W. I. p. 96.

One ex. ♂. "*Green Sparrow*, fairly common."

6. Elainea martinica (Linn.).

Elainea martinica, Scl. Cat. B. xiv. p. 141; Cory, B. W. I. p. 117.

Two males. "*Whistler*, scarce."

7. Tyrannus rostratus, Scl.

Tyrannus rostratus, Scl. Cat. B. xiv. p. 273; Cory, B. W. I. p. 129.

Two males and a female. "*Chincherry*, common."

8. Eulampis holosericeus (Linn.).

Eulampis holosericeus, Cory, B. W. I. p. 146.

One male. "*Humming-bird*, fairly common."

9. Orthorhynchus exilis (Gm.).

One female. "*Humming-bird*, fairly common."

10. Tinnunculus caribbæarum (Gm.).

Tinnunculus caribbæarum, Gurney, List of B. of Prey, p. 99.
Falco caribbæarum, Cory, B. W. I. p. 204.

A pair. "*Killy-killy*, common."

11. Zenaida martinicana, Bp.

Zenaida martinicana, Cory, B. W. I. p. 215.

A female. "*Turtle-dove*, scarce now, said to be common in the rainy season."

12. Chamæpelia passerina (Linn.).

Columbigallina passerina, Cory, B. W. I. p. 217.

A pair. "*Ground-dove*, common."

13. Gallinula galeata (Licht.).

Gallinula galeata, Cory, B. W. I. p. 257.

A pair. "*Coot*, common near brackish ponds."

14. Strepsilas interpres (Linn.).

Arenaria interpres, Cory, B. W. I. p. 231.

A female, in immature plumage. "Very rarely seen—in fact never observed before. The Rev. Mr. Schouten, who takes great interest in Natural History, and has resided in Anguilla twenty-eight years, told me it was quite new to him."—W. R. E.

15. Totanus flavipes (Gm.).

Totanus flavipes, Cory, B. W. I. p. 238.

Two females. "*Yellow-legs*, common near brackish ponds.'

16. Phaëthon æthereus, Linn.

Phaëthon æthereus, Cory, B. W. I. p. 275.

Two males. "*Tropic-bird*: nests in holes among the cliffs on the sea-side."

3. On the Insectivorous Genus *Echinops*, Martin, with Notes on the Dentition of the allied Genera. By Oldfield Thomas.

[Received June 3, 1892.]

At the Meeting of this Society on Feb. 13, 1838[1], Mr. W. Martin exhibited and described an Insectivore belonging to the group known as "Madagascar hedgehogs," but much smaller than the common *Ericulus setosus*, and gave it the new generic and specific name of *Echinops telfairi*, in honour of its donor, Mr. C. Telfair. A fuller description, with accurate figures both of the animal and its skull, was given by the same naturalist a little later[2], and from these it might have been easily seen that the animal was fully adult. This specimen has remained unique almost up to the present time[3], and on this account, the species not being known, the name *Ericulus telfairi* has been of late years wrongly assigned to *Ericulus setosus*.

The genus *Echinops* was properly recognized by Wagner[4] (who

[1] P. Z. S. 1838, p. 17.

[2] Trans. Z. S. ii. p. 249, pl. 46 (1840).

[3] The young individual, 17 days old, also sent by Mr. Telfair, and mentioned P. Z. S. 1833, p. 81, proves on examination to be the ordinary larger form *Ericulus setosus*.

[4] Schreb. Säug. Suppl. ii. p. 29 (1840).

unnecessarily renamed it *Echinogale*), by Peters[1], by Mivart[2], and by Grandidier[3]; but unfortunately Dr. Jentink, in an exhaustive and otherwise most useful paper on the group, deceived by the small size of the type, put it down[4] as a young specimen of *Ericulus setosus*, an example followed by Trouessart[5] and Dobson[6]. The latter no doubt overlooked the type now in the British Museum, and the two former had not of course the opportunity of examining it.

Of this type specimen the cranium, figured by Mr. Martin, was unfortunately lost before the Museum of the Zoological Society was transferred to the British Museum, but the skin, the lower jaw, and the bones of the trunk are still preserved. These confirm in every way the accuracy of Mr. Martin's description and figures.

The Museum has now received several specimens of this group collected by Mr. J. T. Last at Manumbu, S. Madagascar, which clearly belong to two different species, a larger and a smaller, also differing from one another by the number of their teeth.

The former of these is clearly *Ericulus setosus*, and the latter is by its dentition an *Echinops*, a genus which I now propose to reinstate, but on the description of which by Martin and Mivart I shall not try to improve, except with regard to the homologies of its cheek-teeth, which will be referred to later. It may, however, be noted that, apart from the general size, not always easily determinable in these animals, the two forms may be readily distinguished externally by the great difference in the size of the claws, those of *Ericulus* attaining a length in front of about 6 mm., and behind of about 7 mm., while those of *Echinops* scarcely exceed 3 in front and 4 behind, with a proportionate reduction in thickness.

As to the species to which Mr. Last's *Echinops* belongs I am more doubtful. Firstly, it appears to be smaller than *E. telfairi*, and to have smaller teeth, but the difference is very slight. Secondly, the type of the older known species has the spines all quite black-tipped and becoming gradually paler to the roots. On the other hand, Mr. Last's specimens, four in number, all have white-tipped spines, the white extending over the terminal 2 or 2½ mm. of the spine[7]. In view of the great variability of *Ericulus setosus* in the colour of the spines, this character must be looked upon with great hesitation; but at the same time the difference in appearance is so very great that I think it should be recognized by name, and I propose to call Mr. Last's *Echinops* a new subspecies, giving it the name of *E. telfairi pallescens*.

The following are the measurements of the typical skull of the new form, the largest of five:—

Basal length 34·1; greatest breadth (between points of maxillary

[1] MB. Ak. Berl. 1865, p. 286.
[2] P. Z. S. 1871, p. 73.
[3] Rev. Mag. Zool. (2) xxi. p. 338 (1869).
[4] N. L. M. i. p. 140 (1879).
[5] Le Nat. 1880, p. 178.
[6] Mon. Insectiv. p. 70 (1882).
[7] M. Grandidier (*l. c.*) describes as "*E. mivarti*" an animal which is "noirâtre et plus foncé que *E. telfairi*"; but the latter being superficially quite black, it is probable that he has mistaken the form to which the name *E. telfairi* belongs, and that his *mivarti* is really *telfairi*, and his *telfairi* the one now described.

zygomatic processes) 16·7; interorbital breadth 9·1; palate, length 19·1, breadth outside p^4 12·2, inside p^4 4·7; length of lower jaw from condyle (bone only) 27; height from coronoid to angle 13·4.

Of the five specimens examined, two others are of almost precisely the same size as the type, and two, of similar age, are rather smaller, the difference being, I presume, sexual. Unfortunately the skins and skulls are not identified with each other, so that I cannot say for certain whether in this form the male or the female is the larger.

Now with regard to the homologies of the teeth of *Echinops*, the five cheek-teeth of which have been supposed to be two premolars and three molars, the reduction from the 3–3 of *Ericulus* being therefore in the premolars,—I find on comparison that this is not the case, but that the reduction is in the molars, of which there are only two, while the premolars number three. These three premolars all have milk predecessors, as is also the case in *Centetes* and *Ericulus*, and therefore the missing premolar of the full set of four may be presumed to be p^1, which is as yet not known to change in any member of the Linnean group of Feræ. The incisors are two, above and below, both in the permanent and milk series.

The full dental formula of *Echinops* is therefore

$$\text{I.}\begin{Bmatrix}1\ 2\ 0\\ \overline{1\ 2}\\ 1\ 2\ 0\end{Bmatrix}\ \text{C.}\begin{Bmatrix}1\\ \overline{1}\\ 1\end{Bmatrix}\ \text{P.}\begin{Bmatrix}0\ 2\ 3\ 4\\ \overline{2\ 3\ 4}\\ 0\ 2\ 3\ 4\end{Bmatrix}\ \text{M.}\begin{Bmatrix}1\ 2\\ \overline{\quad}\\ 1\ 2\end{Bmatrix}=24.\,32^{1}.$$

Comparing this with the formulæ of some of the allied genera, we find that *Ericulus* is in all respects the same except that it has M. $\frac{1.2.3}{1.2.3}$, the totals therefore being 24. 36.

Two points about the milk-change of *Ericulus* may be specially noticed, both of them showing a very low and unspecialized condition. The first is the extraordinary resemblance existing between the milk-teeth and their respective successors, a resemblance so great that it is extremely difficult to say whether any given set of teeth belongs to the milk or permanent series. And this difficulty is increased by the second point, namely the fact that the molars come up with and stand perfectly in series with the milk premolars, the last molar being fully up and in use some time before these commence to fall. This fact, in so lowly an animal, is decidedly confirmatory of the recent suggestion that the molars even of the Placentals really belong to the milk rather than to the permanent series[2].

[1] This ingenious method of so writing the dental formulæ as to show clearly both the milk and permanent teeth and their relations to one another is copied from Dr. Winge's paper "Om Pattedyrenes Tandskifte" (Vid. Medd. 1882, p. 15). The method is so clear that no explanation is needed.

[2] *Cf.* (for Marsupials) Kükenthal, Anat. Anz. vi. pp. 369 & 658 (1891), and (for Placentals) Thomas, Ann. Mag. N. H. (6) ix. p. 310 (1892).

Passing now to the dentition of *Centetes*[1], besides the known increase by one each in the number of the upper milk and the lower milk and permanent incisors, we find a most remarkable and noteworthy character in the number of the molars.

When writing his invaluable Monograph of the Insectivora, Dr. Dobson stated[2] *en passant*, and merely as a question of specific difference or identity, that certain specimens of *Centetes ecaudatus* in the British Museum were much larger than usual, and had an additional upper molar. Now remembering the continual and unending discussion that the presence of four true molars in *Otocyon* has given rise to, it is evident that the occurrence of a fourth upper molar in *Centetes* is an exceedingly interesting fact, and one that deserves to be brought into much greater prominence.

A renewed examination of the specimens shows that the presence of four molars is not a merely accidental variation in one or two individuals, *but is a normal character of the species*, although the fourth molar only comes up very late in life—so late, in fact, that the great majority of Museum specimens do not possess it. This is proved by my finding the minute calcified germ of m^4 behind the m^3 of what is, apart from the three unusually large individuals referred to by Dobson, the largest skull in the Museum collection, and one that, in the absence of these three, would have been put down as a remarkably fine and well-grown one. Judging, therefore, by the specimens in the Museum, it appears probable that the species seldom attains to the great age necessary to obtain the fourth molar, but that when it does, it normally has the additional tooth.

Curiously, however, not only is m^4, like our own "wisdom tooth," long behind m^3 in its date of appearance, but owing to the fact that it projects further into the mouth and is rather feebly attached, it is the *first* of the molars to disappear. For in one extremely aged specimen, in which the molars and premolars are worn down to the roots[3], m^4 has again entirely disappeared, and has evidently been worn down and dropped out in the natural course of existence.

[1] Thanks to the kindness of Prof. A. Milne-Edwards, who has sent me a complete copy of the chapter referring to the Tanrecs in Geoffroy's rare 'Catalogue du Musée,' I am most fortunately able to state that the name *Setiger*, Geoffr. (1803), need not displace *Centetes*, Ill. (1811), a change which appeared to be imperative on reading Trouessart's paper, already quoted.

In this paper, while stating that *Setiger* was absolutely synonymous with *Centetes*, the author exercised in favour of the latter that fancied right of selection which has been so disastrous throughout the history of zoological nomenclature. However, the copy now before me of Geoffroy's words shows that the typical and first mentioned species of his genus "*Setiger*" is "*S. inauris*," whose characters are largely mixed up in the generic diagnosis; and this animal, as we know from p. 22 of Isidore Geoffroy's paper on the group (Guérin, Mag. Zool. Mamm. (2) 1839, Art. 1), was neither more nor less than a common Hedgehog which had lost its ears. This being the case, *Setiger* becomes a synonym of *Erinaceus*, Linn., and happily remains in its time-honoured obscurity.

[2] Mon. Insectiv. p. 69, pl. vii. fig. 7.

[3] This specimen presents an example of that mechanical wearing down, and consequent increase in the number of "teeth," on which Dr. Kükenthal in the case of a Seal has laid such stress (*t. c.* p. 367); for its p^2 has formed two, and its p^3 three minute "teeth," these being of course merely the roots of the proper teeth (see my own remarks, *t. c.* p. 311).

None of the specimens show any trace of a lower m^4.

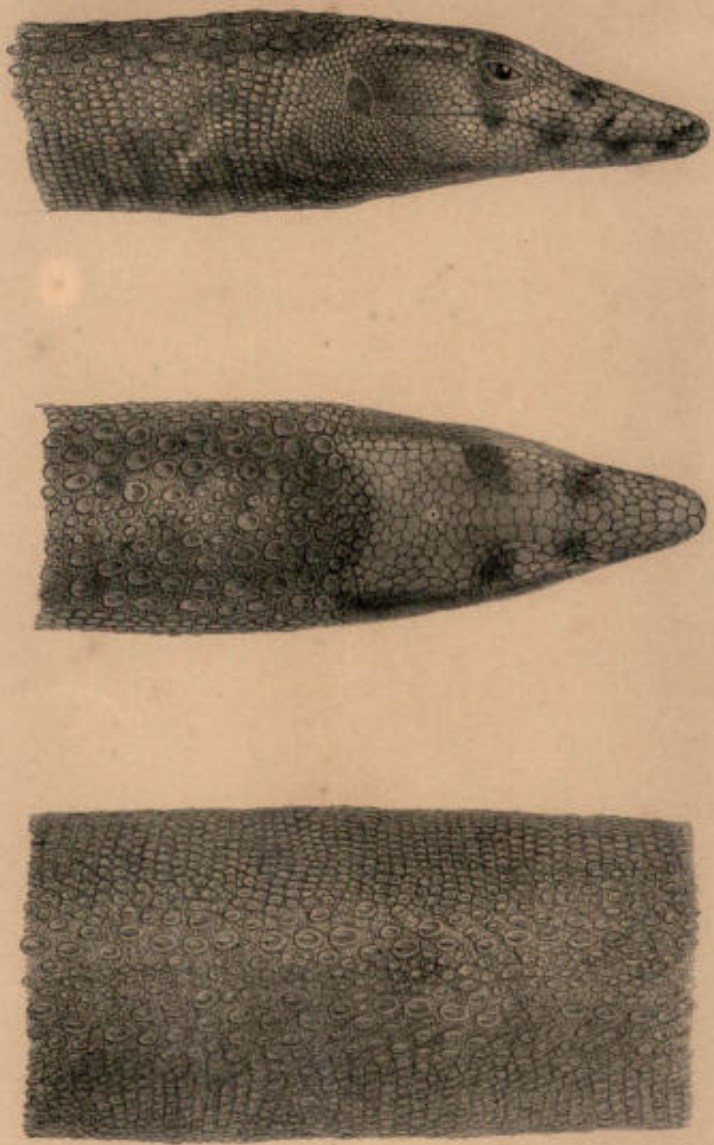
In these three genera of *Centetidæ* and, so far as I can make out from the published figures, in *Potamogale*, we have a premolar formula of $\frac{0\ 2\ 3\ 4}{1\ 2\ 3\ 4}$; the p^4 (both milk and permanent) is absolutely molariform, while p^3 (again both milk and permanent) is functionally a "carnassial"—characters all in contrast to those of *Solenodon*, on whose close relationship to the *Centetidæ* so much has been written.

In this animal there are, it is true, three premolars as in *Centetes* and the others, but of these *the first does not change*, a fact which seems to show that it is homologous with the non-changing p^1 of other Feræ, and not with the changing p^2. If this be the case, and the two posterior changing premolars be still looked upon as p^3 and p^4, we get the formula $P.\frac{1\ 0\ 3\ 4}{3\ 4}$, while as a further difference p^3 is absolutely premolariform, and it is p^4 that is functionally "carnassial" or semi-molariform, no premolar being truly molariform; and finally there is neither that striking resemblance between the milk and permanent teeth, nor the unusually early development of the true molars, characteristic of the *Centetidæ*.

It appears to me therefore that not only was Dr. Dobson perfectly justified in separating the *Solenodontidæ* as a distinct family from the *Centetidæ*, with which Peters had placed them, but I would go further and suggest that their main connecting link—their common trituberculism—may be merely in each case a remnant of a time when, as the American zoologists have shown, trituberculism was a far more common character than at present, and that they have really no very close relationship to each other whatever. The proper solution of this problem will probably rest with the palæontologists of North America, on which continent the ancestors of *Solenodon* may be expected to have lived; and in consideration of its great general and geographical interest, I would specially commend it to the notice of any of them who may have the opportunity of examining remains referable to early Insectivora.

The following is a tabular arrangement of the formulæ above described, with the addition of that of *Gymnura*, put in for comparison with the rest. Numbers in italics represent teeth which, although present, are minute and apparently functionless. No definite suggestions as to the serial homologies of p^1 or of the molars are intended to be conveyed by the type in which their respective numbers are printed.

	I.	C.	P.	M.
Centetes ...	1 2 0	1	0 2 3 4	1 2 3 4
	1 2 3	1	2 3 4	
	1 2 3	1	2 3 4	
	1 2 3	1	0 2 3 4	1 2 3
Ericulus .	1 2 0	1	0 2 3 4	1 2 3
	1 2 0	1	2 3 4	
	1 2 0	1	2 3 4	
	1 2 0	1	0 2 3 4	1 2 3



Peter Smit del. et lith. Mintern Bros. imp.

VARANUS HETEROPHOLIS.



Peter Smit. del. et lith. Mintern Bros. imp

1. RHACOPHORUS DULITENSIS 2. NECTOPHRYNE HOSII

Echinops...	1 2 0	1	0 2 3 4	1 2
	1 2 0	1	2 3 4	
	1 2 0	1	2 3 4	
	1 2 0	1	0 2 3 4	1 2
Solenodon ..	1 2 3	1	1 0 3 4	1 2 3
	1 2 3	1	3 4	
	1 2 3	1	4	
	1 2 3	1	1 0 3 4	1 2 3
Gymnura[1]..	1 2 3	1	1 2 3 4	1 2 3
	1 2 3	1	2 3 4	
	1 2 3	1	0 3 4	
	1 2 3	1	1 2 3 4	1 2 3

4. An Account of the Reptiles and Batrachians collected by Mr. C. Hose on Mt. Dulit, Borneo. By G. A. Boulenger.

[Received June 7, 1892.]

(Plates XXIX. & XXX.)

Two small sets of Reptiles and Batrachians from Mt. Dulit[2], Sarawak, have been received from Mr. Hose and are now incorporated in the British Museum collection. The first, received in August 1891, contained examples of a single new species (*Rana hosii*, Boulenger, Ann. & Mag. N. H. [6] viii. 1891, p. 290). The second, received a few days ago, is much more valuable, as it adds three new species to the fauna of Borneo, among which is a remarkable form of *Varanus*.

I now proceed to give a complete list of the species represented in Mr. Hose's collection.

REPTILES.

1. Gymnodactylus marmoratus, Kuhl.

2. Gecko stentor, Cantor.

3. Gecko monarchus, Schleg.

4. Ptychozoon horsfieldii, Gray.

Dr. F. Müller will shortly show that this species, established and then withdrawn by Gray, is distinct from *P. homalocephalum*, Crev. A single specimen, a male, is in Mr. Hose's collection.

5. Draco quinquefasciatus, Gray.

6. Gonyocephalus grandis, Gray.

[1] *Hylomys* is similar to *Gymnura*, except that $\underline{mi}^3$ is absent and $\underline{mp}^3$ is functional.

[2] For information as to the exact position of this mountain we refer the reader to p. 221 of the present volume.

7. VARANUS HETEROPHOLIS, sp. n. (Plate XXIX.)

Teeth acute, compressed. Snout depressed, obtusely pointed, as long as the distance between the anterior corner of the eye and the ear; canthus rostralis indistinct. Nostril an oblique slit, its distance from the end of the snout thrice as great as from the orbit. Digits rather elongate. Tail compressed, keeled above. Scales on head rather large, flat, polygonal, subequal; ten across the snout, from nostril to nostril, four across supraocular region and three across interorbital region; the middle supraocular series somewhat enlarged transversely; temporal scales very small. Nuchal scales very large, round, flat, mostly with a short faint keel, widely separated from each other by finely granular interspaces. Dorsal scales feebly keeled, of very unequal sizes, those on the middle line smallest, with two or three alternating series of very large oval ones on each side; a series of slightly enlarged scales on each side. Ventral scales keeled, in about 80 transverse series. Caudal scales keeled, those on the lower half twice as large as the others; caudal keel with a very low doubly toothed crest. Dark brown above; a black streak along each side of the anterior half of the nape, followed by two crescentic black cross-bands on the nape and a third on the back between the fore limbs: reddish brown beneath, throat variegated with black.

Total length 1040 millim.; tail 610.

A single specimen was received of this most remarkable new species, which, though nearly allied to *V. dumerilii*, differs from all its congeners in the singular dorsal lepidosis, which somewhat recalls that of another Bornean Reptile, *Lanthanotus borneensis*, described some 15 years ago from a single specimen obtained at Sarawak, and as to the systematic position of which we are still much in the dark owing to the imperfection of Dr. Steindachner's description. Some time ago I pointed out the singular fact that the Frog and the Toad with the longest legs known (*Rana jerboa* and *Bufo jerboa*) are both from Borneo. A parallel case of superficial resemblance is now offered by the similitude in scaling between *Varanus heteropholis* and *Lanthanotus borneensis*.

8. VARANUS SALVATOR, Laur.

9. TROPIDOPHORUS BROOKII, Gray.

10. CYLINDROPHIS RUFUS, Laur.

11. SIMOTES OCTOLINEATUS, Schn.

12. GONYOPHIS MARGARITATUS, Ptrs.

A single young specimen, with 233 ventrals and 108 subcaudals. Three black streaks on the back of the head, one on each side behind the eye, the third along the suture between the parietals.

13. TROPIDONOTUS CONSPICILLATUS, Gthr.

14. Tropidonotus saravacensis, Gthr.

One of the specimens is black, with bright orange spots on the anterior half of the body, which is chequered black and yellow below; posterior half of body and tail, above and below, uniform black.

15. Tropidonotus chrysargus, Boie.

16. Tropidonotus maculatus, Edling.

17. Tropidonotus rhodomelas, Boie.

18. Psammodynastes pictus, Gthr.

19. Dryophis prasinus, Boie.

20. Chrysopelea ornata, Shaw.

21. Adeniophis intestinalis, Daud., var. nigrotæniatus, Peters.

22. Amblycephalus malaccanus, Peters.

A single specimen, agreeing very closely with the one figured by van Lidth de Jeude (M. Weber's Zool. Ergebn. i. pl. xv. figs. 4–6), and which is stated to have been compared with the type of *Astenodipsas malaccana*. Ventrals 169; subcaudals 55.

23. Atropophis borneensis, Peters.

24. Trimeresurus gramineus, Shaw.

25. Trimeresurus subannulatus, Gray.

BATRACHIANS.

1. Rana macrodon, Kuhl.

2. Rana hosii, Blgr.

3. Rana jerboa, Gthr.

A single female specimen, measuring 85 millim. from snout to vent. Vomerine teeth in two short, straight, transverse series on a line with the posterior borders of the large choanæ. Tibia three fourths length of head and body.

4. Rana natatrix, Gthr. (*guttata*, Gthr.).

5. Rhacophorus appendiculatus, Gthr.

6. Rhacophorus dulitensis, sp. n. (Plate XXX. fig. 1.)

Vomerine teeth in two slightly oblique series touching the inner front edge of the choanæ. Snout rounded, as long as the diameter of the orbit; loreal region vertical, concave; nostril slightly nearer the end of the snout than the eye; interorbital space broader than the upper eyelid; tympanum close to the eye and three-fourths its diameter.

Fingers entirely webbed, the disks smaller than the tympanum; toes webbed to the disks, which are smaller than those of the fingers; subarticular tubercles feebly developed. Tibio-tarsal articulation reaching the tip of the snout. Skin smooth, feebly granulate on the belly; a slight dermal fringe along forearm and tarsus; a dermal flap above anus and at heel. Yellowish, with a few purplish dots on head and back; a purplish line round the snout, from eye to eye, passing through the nostrils.

From snout to vent 43 millim.

A single specimen.

7. Ixalus aurifasciatus, Schleg.

8. Calophrynus pleurostigma, Tsch.

9. Callula baleata, S. Müll.

10. Nectophryne hosii, sp. n. (Plate XXX. fig. 2.)

Head broader than long; snout short, obliquely truncate; canthus rostralis strong; loreal region nearly vertical, concave; interorbital space broader than upper eyelid, slightly concave; tympanum distinct, vertically oval, half the diameter of the eye. Fore limb long and strong; fingers webbed at the base, ending in rather large subtriangular expansions, first much shorter than second; toes short, with small distal expansions, extensively webbed, but the three distal phalanges of the fourth toe free; subarticular tubercles well developed; two small, flat metatarsal tubercles; a tarsal fold. Tarso-metatarsal articulation reaching between eye and end of snout. Above with small scattered warts, beneath finely granulate; a short and narrow, but very prominent parotoid gland. Brown; throat blackish. Male with an internal subgular vocal sac.

From snout to vent 60 millim.

A single male specimen.

11. Bufo quadriporcatus, Blgr.

12. Bufo asper, Gravh.

Besides several small and perfectly typical examples, the collection contains a large female, measuring 215 millim. from snout to vent, which agrees in every respect with *B. asper* except in the much greater development of the parotoid glands, the length of which equals their distance from the end of the snout and twice and a half their width; they are disposed very obliquely, diverging behind. I have felt tempted to describe this specimen as a distinct species; if I abstain from doing so it is because I can detect no other ground for such a separation than the size and form of the parotoids, a character which varies so much in certain other species of this genus—*B. marinus*, *B. regularis*, and *B. viridis*, for instance.

13. Megalophrys nasuta, Schleg.

14. Ichthyophis monochrous, Blkr.

5. On new Species and Varieties of the Land-Molluscan Genus *Diplommatina* from the Garo, Naga, and Munipur Hill-ranges, Assam.

By Lieut.-Col. H. H. Godwin-Austen, F.R.S., F.Z.S., &c.

[Received June 14, 1892.]

The arrival of a large collection of Land-Shells sent me by Mr. T. H. Aldrich, of Cincinnati, U.S.A., and made by Mr. W. Doherty in 1889 in different parts of the Naga Hills and Munipur, has led me to take up and work out those belonging to the genus *Diplommatina*; for I had also in my own collection a number of undescribed species of the same genus which I had found when surveying that country in 1872. I had also specimens collected by the late Mr. Chennell in the Lhota Naga Hills and by Mr. Robert in Munipur and the Garo Hills, making up a fine series for examination. Mr. Doherty made Kohimah in the Naga Hills his headquarters, and was there during the summer months; he also collected in the Eastern Naga Hills, south of Margarita, which is the terminus of the Railway from Debrughur to the coal-workings and about 50 miles distant. In this neighbourhood he was, being in quite unexplored ground, very successful as regards novelties, while at the same time he extended the range of other species. Mr. Doherty collected the minute specimens himself, while his men were looking after Lepidoptera and Coleoptera; some of the larger shells were brought to him by the Nagas, but he could not get them to search for the small forms.

Although I was in the Naga Hills in the winter and spring only, the driest time of the year, I got a fine series of the Land-Shells; the season does not make much difference on the high peaks, which are so often covered with cloud for a part of the day, and the sun does not penetrate into the damp northern ravines. I trained several men of my party to collect, both Khasis and Ghoorkhas, and they became most expert in finding the minute forms in the decaying vegetation, and four annas for every new species or for a good number of specimens was quite sufficient as an inducement to work hard. I found them very keen of sight, and they very soon knew the different genera and those I most wanted. Mr. Doherty was far too liberal in giving the Nagas two rupees for shells. In the forests and noisome jungly ravines, at times swarming with leeches, this work is not over pleasant, and it is only the interest and excitement of finding some beautiful new form at any moment that leads one on this lowly chase, as it has me for many an hour. To the native collector it is far less exciting, and he credits his master with making some wonderful curative out of the animals.

In 1875 I published descriptions of three new species of this genus in the J. A. S. B.; and under *D. tumida*, var., I then referred to the great differences to be noticed in the shells from different parts of the Burrail range, and urged that a careful examination should be made of them all. I have now been able to better

this, aided by the additional material sent me by Mr. Aldrich, to whom my very sincere thanks are due and also to Mr. Doherty who collected them. This gentleman has extended the area of country now collected in much farther to the east, up to Margarita, as I mentioned before; and these Naga Hills, inhabited by the most Eastern representatives of this race, must not be confounded with the Naga Hills inhabited by the Anghamis, which are 150 miles to the westward. Thus one box containing a number of only partly sorted tubes sent me by Mr. Aldrich had simply Naga Hills attached to it. As Mr. Doherty's letter, also enclosed, was dated from Kohima in the Anghami Naga Hills, I naturally at first concluded they were from that part. Fortunately, I afterwards found series of the same species in tubes in another box, marked "Margarita." It shows how very carefully labelling should be done in the field.

Looking over a large series of the species of this genus, it is of interest to note the much larger size of so many of the species from the Naga Hill-ranges, as compared with those in the Khasi and Garo Hills and the Himalayas. The change commences with the rise of the Burrail Tertiary range, near Asalu. None of the Khasi Hill species approach them in size.

D. scalaria, from the Garo side, is one of the largest, and that is only 3·5 millim. in height of spire; while *D. pachycheilus*, 4·8, or say 5 millim., is the single large species from Darjiling. At Asalu we find *D. insignis* 6·5 millim., *D. tumida* 5 millim., *D. convoluta* 6·25 millim., and, as will be seen in the new forms described in this paper, six are 5 millim. in height and over, two of them reaching 6 millim.

Of *D. janitiaca*, G.-A., one example was sent from Margarita.

Constriction in front, above the peristome; sculptured throughout.

DIPLOMMATINA DECOROSA, n. sp.

Loc. Anghami, Naga Hills (*W. Doherty*, in coll. T. H. Aldrich).

Shell elongately fusiform, not rimate; sculpture, fine, close, regular costulation on all the whorls; colour pale whitish horny; spire, sides somewhat flat, apex rather acuminate, rapidly diminishing; suture moderately impressed; whorls 8, sides flatly convex, penultimate and antepenultimate equal; constriction above the aperture, towards the outer margin; aperture ovate, rounded below; peristome thickened; columellar tooth small, in front.

Size: maj. diam. 2·5; alt. axis 5·5 millim.

There was one solitary specimen in my collection of this species from north of the Burrail, and 6 specimens, but smaller in size (4·5 millim. in height of spire), from the peak of Shiroifurar, in the Lahupa Naga Hills, north of Munipur. Mr. Aldrich's collection contains a large number, and I have selected the type out of these.

On the boss of trap rock near the village of Phunggam I found a number of a small variety, 4·5 millim. in height of spire, but differing in no respect, except in size, from the typical species, only that they are all of a pale sea-green tint.

The same form occurred on Kopamedza Peak, with this difference,

that the constriction was more to the right, directly over the outer margin of the peristome. From Prowi, specimens were still smaller in size, 3·8 millim.

Constriction in front, above the peristome; last whorls smooth.

DIPLOMMATINA GAROENSIS, n. sp.

Loc. Garo Hills; exact locality unknown (*W. Robert*).

Shell dextral, globosely fusiform, solid; sculpture, distant, very fine ribbing on the 3 apical whorls, the rest smooth and shiny; colour pale ochraceous; spire high, side very convex; apex acuminate, and when viewed from the side the axis is curved; suture impressed; whorls 6½, all tumid, the antepenultimate much swollen and by far the largest; constriction above the aperture; aperture vertical, oval; peristome very much thickened and double; columellar tooth moderately large.

Size: maj. diam. 2·3; alt. axis 3·5 millim.

This species may be known by its very large antepenultimate whorl and the curved axis of the spire, and its strongly developed peristome and smooth lower whorls. It formed part of a collection of shells made by Mr. W. Robert, of the Khasi Hills Survey party, in the Garo Hills, during the military expedition into them in 1872–73. Ten specimens were found.

DIPLOMMATINA ELONGATA, n. sp.

The typical shells of my *D. tumida* (J. A. S. B. xxxix. pt. 2, p. 6, pl. ii. f. 2) came from Neuglo in the North Cachar Hills, not far from Asalu. As I collected eastward the form changed, so that in Munipur it does not correspond with the original type. Thus on Nougmaiching Peak, 5135 ft., which is a conspicuous point seen from Imphal, the capital of Munipur, and lying to the east of the valley, a small form occurred, with the peristome less circular, the form less tumid, and quite smooth on the last whorls.

On Laisen Peak, 5173 ft., in the mountains to the north of Munipur, occurred another variety, which I describe below.

At Kezakenomih I found examples of a species which I described and figured in 1875 (J. A. S. B. vol. xliv. pt. 2, pl. iv. fig. 7) as *D. tumida*, var. This, however, seems so very distinct, now that we have a much larger series to look over, that it must stand under another specific title, and I have named it D. ELONGATA, n. sp.: this was the original description:—

"Shell elongately fusiform, thin, pale yellowish green; sculpture very faint above, quite smooth on the three last whorls; spire attenuate, sides flat; suture moderate; whorls 8½ to 9, the antepenultimate the largest; constriction in front above the aperture; last whorl ascends slightly; aperture oval, vertical; peristome double, thickened, slightly reflected; columellar tooth small and remote. Alt. 0·22; diam. 0·13 inch.

"*Hab.* Kézákenomih, Naga Hills."

DIPLOMMATINA TUMIDA, var.

Loc. Laisen Peak and Trigonometrical Station, Munipur.

Shell dextral, elongately fusiform, not rimate; sculpture, fine costulation on the 5 apical whorls, the last smooth; colour pale greenish; spire with convex sides, apex acuminate; suture well impressed; whorls 7½, penultimate and antepenultimate equal; constriction above the aperture, but towards the right-hand side; aperture oval, vertical; peristome thickened, double; columellar margin straight and angulate below, the tooth in front, moderately large.

Size: maj. diam. 2·4; alt. axis 5·0 millim.

DIPLOMMATINA CHENNELLI, n. sp.

Loc. Lhota Naga Hills (*Chennell*).

Shell dextral, of solid form; sculpture, very fine, rather distinct ribbing, with scarcely any relief; colour pale ochraceous and sienna-brown; spire flat-sided, apex acuminate; suture rather shallow; whorls 8½ to 9, sides flatly convex, constriction in front, the last two whorls equal in size; aperture oval, vertical; peristome thickened, strong; the columellar margin vertical and angulate below.

Size: (1st sp.) maj. diam. 2·9; alt. axis 5·9 millim.

Size: (2nd sp.) maj. diam. 2·9; alt. axis 5·0 millim.

This has close affinities to *D. labiosa* from the Khasi and Garo Hills; but, although far larger (nearly double), the columellar tooth is much smaller, the spire more attenuate, and the general shape differs. I name it after the late Mr. A. Chennell, an Assistant in the Indian Survey Department.

DIPLOMMATINA BUTLERI, n. sp.

Loc. Laisen Peak, Munipur (*Godwin-Austen*).

Shell dextral, tumidly fusiform; sculpture, none on the last 3 whorls, very distant, strong costulation on all above; colour pale sienna-brown, fresh shells glassy and polished; spire conic, rapidly diminishing, apex small; suture well impressed; whorls 7½, penultimate and antepenultimate about equal, sides very convex, constriction above the aperture; aperture nearly circular, vertical; peristome double, strong, continuous; columellar margin vertical, angulate below, the tooth large, in front.

Size: maj. diam. 2·0; alt. axis 4·4 millim.

Six specimens were obtained, together with those of *D. tumida*, var., previously alluded to. This well-marked species was also found by me at Prowi, in the Lahupa Naga Hills, at the head of the Lanier River, which drains into the Kyengdwen of Burmah, and was abundant there. I have also two specimens from Kezakenomih.

Two specimens from Klang Sing, Naga Hills, are rather more tumid.

I name this after Capt. John Butler, who was the Political Agent accompanying the Survey party on our exploring work, and who unfortunately lost his life in an ambuscade laid by a hostile clan, when the Survey work was again being prosecuted further east under

Lt. Woodthorpe, R.E. Butler was a splendid officer for such a frontier, and the Survey owed much to his untiring aid and to the interest he took in its proper extension.

DIPLOMMATINA AMBIGUA, n. sp.

Loc. South of Burrail Range, Munipur (*Godwin-Austen*).

Shell dextral, large, solid; sculpture fine, rather close costulation on all the whorls; colour horny white; spire high, sides rather flat above, apex rather acuminate; suture impressed; whorls 8, flatly convex; constriction in front, above the aperture; aperture oval, vertical; peristome strong, closely double, reflected; columellar tooth small for size of the shell, situated well in front and directed downwards.

Size: maj. diam. 3·0; alt. axis 5·5 millim.

This is one of the largest species from these mountains. I also got it at Kezakenomih; one specimen measuring 6·5 millim. in height of spire.

DIPLOMMATINA COMMUTATA, n. sp.

Loc. Prowi, Lahupa Naga Hills (*Godwin-Austen*).

Shell dextral, elongately fusiform; sculpture, 4 apical whorls finely costulated, the last whorls nearly smooth; colour pale sienna; spire with convex sides; suture moderately impressed; whorls 7½, sides convex, antepenultimate rather the largest; constriction in front, above the aperture, but to the right side; aperture oval, vertical; peristome double; columellar tooth sharp, well developed, directed downwards and well in front.

Size: maj. diam. 1·75; alt. axis 3·0 millim.

A large form of this I found at Tellizo Peak, Anghami Naga Hills, on the North Munipur frontier line.

Constriction on side, behind the peristome; sculptured throughout.

DIPLOMMATINA DOHERTYI, n. sp.

Loc. Margarita, Upper Assam (*W. Doherty*, in coll. T. H. Aldrich).

Shell dextral, very tumidly fusiform, strong, not rimate; sculpture fine rather distant costulation on all the whorls; colour very pale, with a pinkish tint or ochraceous; spire, sides flat, rapidly diminishing, apex acuminate; suture impressed; whorls 8, last 3 whorls with convex sides, the penultimate the largest; constriction on side, well behind the aperture; the last whorl rises near peristome; aperture nearly circular, subvertical, rounded below; peristome double, outer somewhat reflected, and sinuous on margin; columellar tooth small, blunt, situated within the aperture, in many specimens it is not seen when viewed directly in front.

Size: maj. diam. 3·0; alt. axis 6·4 millim.

This shell is from the Eastern Naga country; there were two lots in Mr. Doherty's collection—one with a few specimens labelled "Margarita," another, a numerous lot, marked only "Naga."

DIPLOMMATINA THOMSONI, n. sp.

Loc. South Burrail (*Godwin-Austen*).

Shell dextral, elongately fusiform; sculpture, 3 apical whorls smooth, all the rest with very fine regular, rather close ribbing: colour whitish; spire rather high, sides flattened; apex rather blunt: suture moderately impressed; whorls 7½, sides convex, the antepenultimate the largest, last whorl ascending near the aperture; constriction lies directly behind and adjacent to the peristome; aperture oval; columellar tooth small for size of shell and lying within the aperture; peristome as usual.

Size: maj. diam. 2·4; alt. axis 5·0 millim.

I have named this species after Col. Mowbray Thomson, who, at the time it was collected, accompanied our camp in his capacity of Political Agent of Munipur, while the boundary of that State was being surveyed by me in 1872–73; in carrying out this work he rendered us great assistance, although much thwarted by the unfriendly action of the Munipur Durbar.

In general form this shell is like *D. pachycheilus*, Bs., a Darjiling species, but the columellar tooth is never so large as in that species.

DIPLOMMATINA NENGLOENSIS, n. sp.

Loc. Nenglo, North Cachar Hills (*Godwin-Austen*).

Shell dextral, elongately fusiform, large, solid; sculpture very fine, moderately distant ribbing; colour pale ochraceous; spire high, with flat sides, apex acuminate; suture shallow; whorls 8½, sides flatly convex; constriction some distance behind the aperture, on side; aperture widely ovate, expanded towards the outer margin; peristome double, not thickened; columellar margin subvertical, the tooth very small and remotely situated.

Size: maj. diam. 2·9; alt. axis 5·0 millim.

This is a very distinct shell; in its very ovate aperture and small columellar process or tooth it is unlike any other I have in my collection.

DIPLOMMATINA DISTINCTA, n. sp.

Loc. North of Burrail Range, Naga Hills (*Godwin-Austen*).

Shell dextral, small, rather depressedly fusiform; sculpture very fine close ribbing; colour pale horny; spire conoid; apex blunt; suture impressed; whorls 7, sides convex, the antepenultimate the largest; constriction on the side, well behind the aperture; aperture vertical, irregularly ovate; peristome thin; columellar tooth very large for size and in front.

Size: maj. diam. 2·0; alt. axis 3·4 millim.

There is only one specimen of this species, but it is very different from any of the smaller forms in having the constriction behind the aperture, and, for so small a shell, in having the columellar tooth so large.

Constriction on the side, behind the peristome; last whorls smooth.

DIPLOMMATINA KHUNHOENSIS, n. sp.

Loc. Khunho Peak and Trigonometrical Station, 8809 ft. above the Mao villages, Naga Hills (*in coll. H. H. G.-A.*).

Shell dextral, ovately fusiform, not rimate; sculpture, fine regular costulation on the 3rd, 4th, and 5th whorls, the 2 apical smooth, the last whorls polished and glassy; colour pale sienna; spire, side flattened near the apex, which is somewhat acuminate; suture impressed; whorls 8, the antepenultimate the largest; constriction behind the aperture on the penultimate whorl; aperture oval and vertical; peristome double, strong, continuous; columellar tooth well developed, rather remote.

Size: maj. diam. 2·2; alt. axis 4·8 to 5·2 millim.

Six specimens were found.

A form rather longer and less swollen occurs in the same range; about 30 specimens were obtained at Gnameh Peak (5585 feet), near the Barak River.

There is another form much smaller, being only 3·5 in length, with the same glassy last whorls and the constriction rather further back, behind the aperture. Examples of this were also found at Sikhamih, in the Lahupa Naga Hills. I distinguish this variety as *khunhoensis*, var. *minor*.

DIPLOMMATINA LAPILLUS, n. sp.

Loc. Kopamedza Peak, Lahupa Naga Hills, 8375 ft. (*Godw.-Aust.*).

Shell dextral, elongately fusiform, tumid below, not rimate; sculpture fine, regular, close costulation, which is often much worn down; colour (bleached); spire with sides flattened, apex acuminate; suture shallow; whorls 8, sides flatly convex, the antepenultimate the largest; constriction of the penultimate whorl on the side, well behind the aperture; aperture oval, subvertical; peristome thickened, double, rounded below; columellar tooth small and far back within the aperture.

Size: maj. diam. 3·0; alt. axis 6·0 millim.

Three specimens, marked from the "north of the Burrail Range." Two are from the typical locality given above.

DIPLOMMATINA COMPACTA, n. sp.

Loc. South of Barak in Munipur (*Godwin-Austen*).

Shell dextral, small, tumidly fusiform; sculpture, the two apical whorls smooth, two next with fine close ribbing, the last three whorls smooth or glassy; colour pale ochraceous white; spire, sides rather flat, apex moderately blunt; suture slightly impressed; whorls 7½, the antepenultimate the largest and tumid; constriction on the side, well behind the aperture, at about 1 millim. distant; aperture oval, vertical; peristome double; columellar tooth large in front, and directed downwards.

Size: maj. diam. 1·8; alt. axis 3·5 millim.

A larger shell, with rather a different shaped spire 4 millim. in height, was found at Asalu, with the constriction in same position.

It is an allied form of *D. jatingana*, from the North Cachar Hills, which is a larger, more tumid species with the constriction farther behind the aperture.

A single specimen, only 3 millim. in height, was sorted out of the box containing *D. chennelli*, from the Lhota Naga Hills.

Small species, with columellar process.

DIPLOMMATINA UNICRENATA, n. sp.

Loc. Eastern Naga Hills (*W. Doherty*, in coll. T. H. Aldrich).

Shell dextral, ovately fusiform, subrimate, rather thin; sculpture, distant strong costulation on all the whorls; colour white, with a pale lemon-yellow tint in fresh shells; spire with sides convex, apex somewhat blunt; suture well impressed; whorls 7½, antepenultimate the largest, sides convex, the constriction above the aperture, in front; aperture circular, vertical; peristome double, outer wavy in outline, with one very marked and decided crenulation on the upper outer margin, and a slight sinuation on the left lower margin; columellar tooth large and directed downwards.

Size: alt. axis 4·0 millim.

A very large number of this new shell are in Mr. Doherty's collection, four from Margarita in a tube, the remainder marked as from the Naga Hills. This is a very beautiful new species, the only shell approaching it that I know from this region being *D. angulata* of Moulmain.

DIPLOMMATINA JAPVOENSIS, n. sp.

Loc. Japvo Peak, Anghami Naga Hills, 10,000 ft. (*Godwin-Austen*).

Shell dextral, fusiform, thin texture; sculpture, close rather fine ribbing; colour pale ochraceous; spire conic, apex blunt; suture moderately impressed; whorls 7½, sides convex, swollen below; constriction in front, towards the outer margin of the peristome; aperture oval, vertical; columellar tooth fairly developed, blunt; peristome closely double, of weak structure.

Size: maj. diam. 2·4; alt. axis 3·8 millim.

This is larger than the other species from this peak and elevation; and is the species described as *D. sherfaiensis*, var., J. A. S. B. 1875, p. 9, pl. iv. fig. 5; but as it is sufficiently distinct from the form found on Sherfaisip Peak, far to the west, and also from another found on Shiroifurar Peak, I think it better to give it a distinctive title.

DIPLOMMATINA ANIMULA, n. sp.

Loc. Prowi, Lahupa Naga Hills, Munipur (*Godwin-Austen*).

Shell dextral, ovately fusiform, thin and delicate, and glassy texture; sculpture, rather distant well-marked costulation; colour whitish grey; spire moderately high, sides convex, apex blunt; suture impressed; whorls 6, tumid, sides very convex, antepenultimate

the largest [illegible] constriction in centre, above the aperture; aperture widely ovate, vertical, angulate on the lower margin of the columella; the tooth large and well developed; peristome very strong.

Size: maj. diam. 1·3; alt. axis 2·0 millim.

This is another minute shell, differing from all others I have seen in the strong peristome and large columellar tooth. *D. delicata* is its nearest ally.

DIPLOMMATINA SUBRUBELLA, n. sp.

Loc. Japvo Peak (*Godwin-Austen*).

Shell dextral, small, fusiform; sculpture, fine, regular, rather close costulation; colour pale reddish; spire high, sides convex, apex blunt; suture impressed; whorls 6½, sides convex, penultimate and antepenultimate equal; constriction in front, above the peristome; aperture circular, nearly vertical; columellar tooth very small and internal; peristome closely double, not thickened.

Size: maj. diam. 1·4; alt. axis 2·6 millim.

This is a close ally of *D. sherfaiensis*, but is much smaller and has a coarser sculpture.

DIPLOMMATINA SUBTILIS, n. sp.

Loc. Margarita (*W. Doherty*, in coll. T. H. Aldrich).

Shell dextral, elongately ovate, thickened; sculpture, fine, close, regular costulation throughout; colour pale sienna-brown; spire with convex sides, apex blunt; suture impressed; whorls 6, sides convex, penultimate slightly the largest, the last does not rise much upon the penultimate; constriction in front, but not well marked; aperture circular, suboblique; columellar tooth well developed for the size of the shell; peristome double, strong.

Size: maj. diam. 1·0; alt. axis 1·5 millim.

This is a good species, one of the smallest; its elongated form separates it at once from *D. parvula*, the finer costulation and larger size from *D. minuta*.

DIPLOMMATINA DELICATA, n. sp.

Loc. E. Naga Hills? (*W. Doherty*, in coll. T. H. Aldrich).

Shell dextral, very small, tumidly fusiform; sculpture, very distant, strong costulation; colour pale horny; spire rather depressed, sides convex, apex blunt; suture well impressed; whorls 6, sides convex, swollen, antepenultimate the largest; constriction above the aperture; aperture ovate, vertical; columellar tooth well marked; peristome as usual.

Size: alt. axis 1·75 millim.

There are only two specimens in the collection among those merely labelled Naga Hills, but I have every reason to think they were from near Margarita.

Small species, with very minute or no columellar plait or tooth.

These should eventually be brought into a subgenus of their own.

DIPLOMMATINA MUNIPURENSIS, n. sp.

Loc. South of the Barak River, between the Mao village and Munipur (*Godwin-Austen*).

Shell dextral, elongately fusiform; sculpture minute, close costulation; colour very pale greenish grey; spire symmetrical, sides slightly convex; suture well impressed; whorls 6½, sides convex; constriction in front and immediately above the aperture; no columellar tooth, its position indicated by a slight sinuosity on the columellar margin; aperture nearly circular, subvertical; peristome closely double, very slight in form, the inner does not spread much upward on the penultimate whorl.

Size: maj. diam. 1·5; alt. axis 2·7 millim.

From the number of specimens found, this appears a very abundant species; I never got anything like it in the Khasi Hills to the west.

DIPLOMMATINA VENUSTULA, n. sp.

Loc. Japvo Peak, Anghami Naga Hills (*Godwin-Austen*).

Shell dextral, elongately fusiform, thin; sculpture, fine, regular, close costulation throughout; colour pale amber; spire high, sides flattish, apex acuminate; suture impressed; whorls 7½, sides convex, the penultimate the largest; constriction in front above the aperture; aperture widely ovate, suboblique; peristome but slightly developed, narrowly double, expanded into a small wing on the upper and outer margin, giving it a very sinuated margin; no columellar tooth.

Size: maj. diam. 2·1; alt. axis 4·0 millim.

This species, of which I only obtained 3 specimens, is quite distinct, as shown in the form of the spire and particularly the expanded side of the peristome, which is an unusual character.

DIPLOMMATINA DOMUNCULA, n. sp.

Loc. Margarita, Naga Hills (*W. Doherty*, in coll. T. H. Aldrich).

Shell dextral, fusiform; sculpture, strong, regular, distant costulation on all the whorls, much closer near the constriction, first two whorls smooth; colour pale whitish with an ochraceous tint; spire with convex sides, apex blunt; suture well impressed; whorls 7½, sides convex, antepenultimate the largest, last whorl does not rise upon the penultimate; constriction above the aperture; aperture circular, subvertical, curvilinear as seen from the side; peristome double, not very much thickened; columellar tooth very minute, internal.

Size: maj. diam. 1·3; alt. axis 3·0 millim.

This is a very distinct form, quite new to me, and belonging to a group which is not represented, so far as I know, in the Khasi and Jaintia Hills.

DIPLOMMATINA SUCCINEA, n. sp.

Loc. Anghami Naga Hills (*Godwin-Austen*).

Shell dextral, tumidly fusiform, thin and delicate in texture; sculpture, regular, rather close costulation; colour very pale amber, with stronger coloration on the apex; spire somewhat depressed, suture impressed; whorls 6, tumid, with convex sides; constriction above the aperture; aperture oval, vertical; columellar tooth only indicated by a slight swelling; peristome double, strong.

Size: maj. diam. 1·3; alt. axis 2·0 millim.

This minute species may be compared with *D. parvula* from the N. Khasi Hills, from which it differs in being larger, and in having a greater number of whorls and a much more tumid shape.

DIPLOMMATINA CONCINNA, n. sp.

Loc. Naga Hills, probably south of Margarita (*Doherty*, in coll. T. H. Aldrich).

Shell dextral, solid, fusiform; sculpture, very strong, rather distant costulation; spire tapering rapidly, apex acuminate; suture impressed; whorls 7, sides convex, penultimate and antepenultimate about equal in size; constriction hardly apparent, just above the aperture; aperture circular, vertical; columellar tooth quite minute, only an indication of it; peristome double, strongly developed.

Size: alt. axis 1·6 millim.

This is very distinct from any of the minute species I have hitherto examined from this part of India; it is distinguished by its thick shell and strong costulation.

Sinistral species.

DIPLOMMATINA GIBBEROSA, n. sp.

Loc. South of the Barak River between Munipur and Imphal (*Godwin-Austen*).

Shell sinistral, ovately fusiform; sculpture, very distant fine costulation, 9 ribs on the antepenultimate whorl when viewed from the front; colour very pale greenish; spire low, sides rounded, apex blunt; suture very impressed; whorls 4½, very swollen, sides very convex, penultimate much the largest; constriction on penultimate in centre above the aperture; aperture oval, subvertical; peristome double, strong; columellar tooth small, internal.

Size: maj. diam. 1·5; alt. axis 2·2 millim.

The nearest ally of this species is *D. jaintiaca*, G.-A., figured in the J. A. S. B. vol. xxxviii. pl. iii.; it differs, however, much in form, particularly in the expanded penultimate whorl and in its very distant sculpture. A very large number of it were collected in the above-named locality, and a single example at Prowi in the Lahupa Naga country.

In the collection sent me by Mr. Aldrich in a box marked Naga Hills were about 40 specimens of this shell. The exact locality

was not recorded, but I take it they were from some part of the Anghami Naga hills.

List of New Species and Varieties.

Constriction in front.
Sculptured throughout.
D. decorus, p. 510.
Last whorls smooth.
D. garoensis, p. 511.
D. elongata, p. 511.
D. tumida, var., p. 512.
D. chennelli, p. 512.
D. butleri, p. 512.
D. ambigua, p. 513.
D. commutata, p. 513.

Constriction behind the peristome.
Sculptured throughout.
D. doherty, p. 513.
D. thomsoni, p. 514.
D. nengloensis, p. 514.
D. distincta, p. 514.
Last whorls smooth.
D. khunhoensis, p. 515.
D. lapillus, p. 515.
D. compacta, p. 515.

Small species, with columellar tooth.
D. unicrenata, p. 516.
D. japvoensis, p. 516.
D. animula, p. 516.
D. subrubella, p. 517.
D. subtilis, p. 517.
D. delicata, p. 517.

Small species, with very minute or no columellar process.
D. manipurensis, p. 518.
D. venustula, p. 518.
D. domuncula, p. 518.
D. succinea, p. 519.
D. concinna, p. 519.

Sinistral species.
D. gibberosa, p. 519.

6. On the Brain and Muscular Anatomy of *Aulacodus*. By Frank E. Beddard, M.A., F.Z.S., Prosector to the Society.

[Received May 3, 1892.]

The visceral anatomy of this Rodent has been described in the 'Proceedings' of this Society[1] by Mr. Garrod. The death of a specimen recently deposited in the Menagerie enables me to supplement that paper by a few notes upon the brain and the musculature which were not investigated by my predecessor.

I. Muscular Anatomy.

The *Pectoralis major* may be said to be composed of four more or less distinct portions; the attachments of these were at any rate separate: the first part of the complex muscle is inserted on to the deltoid ridge and is 16 mm. across at the insertion; immediately below this is a slip of the extensive *Panniculus carnosus*. Above this the second part of the pectoral is inserted on to the head of the humerus and for a certain distance down the shaft; the insertion is only slightly narrower than that of the first part, measuring 15 mm.; two smaller slips are inserted just below the second part

[1] "On the Visceral Anatomy of the Ground-Rat (*Aulacodus swinderianus*)," P. Z. S. 1873, pp. 786–789.

of the sterno-scapular; these may possibly be regarded as being collectively the equivalent of the *pectoralis minor* of other animals.

Both *Sterno-mastoid* and *Cleido-mastoid* are present; the latter is of about half the size of the former and arises from the middle of the clavicle.

The *Omohyoid* is present and is large.

The *Levator claviculæ* is continuous with part of the *panniculus carnosus*.

The *Latissimus dorsi* is a large muscle and gives off a good-sized *dorso-epitrochlear* slip to the elbow; the latter is 8 mm. across; the *latissimus dorsi* is inserted in common with the *teres*.

The *Trapezius* is extensive; it is continuous with part of the *panniculus*, but its strong tendon can be seen to be separate.

The *Rhomboideus* is attached along the whole length of the vertebral border of the scapula and also ventrally to the fascia covering the *supra-spinatus* and to the spine of the scapula itself, just at the point where the spine ends in the vertebral border of the scapula.

The *Sterno-scapular* is in two parts: the shorter and narrower part arises from the sternum and from the cartilage of the first rib; it is about 5 mm. across near to its origin; at the insertion it splits into two parts—one entirely muscular, the other nearly entirely tendinous; the former joins the fourth part of the *pectoralis*, the latter becomes continuous with the second and larger half of the *sterno-scapular*.

The *Deltoid* is a double muscle: one part arises from the clavicle, the other from the metacromion; they are inserted together above and to the outside of the insertion of the *pectoralis* to the deltoid ridge.

The *Biceps* is double-headed; the short head arises in common with the *coraco-brachialis*.

The *Coraco-brachialis* is a single muscle; its insertion extends 7 mm. beyond the insertion of the *teres*.

The *Brachialis anticus* has two heads of origin.

The *Triceps* is, as usual, a very massive muscle; the scapular head is the largest, and arises also partly from the fascia covering the *infra-spinatus*.

The *Teres major* ends in a flat tendon, 9 mm. across, which is, as has already been mentioned, inserted in common with the *latissimus dorsi*.

The *Subscapularis* commences about 12 mm. away from the vertebral border of the scapula.

The *Pronator radii teres* is inserted on to the middle of the shaft of the radius; the half nearest to the insertion has a glistening tendinous surface.

The *Flexor carpi radialis* arises from the flexor condyle of the humerus; its tendon begins 30 mm. from the origin.

The *Flexor carpi ulnaris* is a large muscle; the tendon, which is broad and strap-shaped, is the widest of all the flexor tendons.

The *Flexor sublimis* arises from the flexor condyle and from the septum between itself and the *flexor profundus*; it receives an excessively

delicate tendon (18 mm. long) from the ulnar head of the *flexor profundus*; it splits into three delicate nearly equi-sized tendons of insertion; of these the two outer are the thickest.

The *Flexor profundus digitorum* is composed of four parts: the largest arises from the flexor condyle; this gives off a branch about 15 mm. from its origin, which ends in a thin tendon apparently inserted into the palmar cartilage; the main muscle passes into a thick yellowish tendon which immediately joins that formed by the other divisions: the second head of the muscle arises from the middle of the shaft of the ulna; it becomes tendinous on the lower surface just before joining the others; there is also another smaller condylar head, which is soon joined by a head arising from the shaft of the radius; these divide into four tendons.

The *Extensores carpi radialis brevior and longior* are precisely as described by Messrs. Murie and Mivart in the Agouti; so, too, the *Extensor ossis metacarpi pollicis*.

There were no traces that I could discover of the *Extensor primi* or *secundi internodii pollicis*.

The *Pronator quadratus* is extensive, occupying nearly the whole of the shaft of the arm-bones.

The *Extensor carpi ulnaris* arises from the extensor condyle by a strong tendon on one surface and by a few fibres from the ulna; its strong tendon of insertion, which is 15 mm. long, is rounded.

The *Extensor indicis* is a small muscle; it arises from the middle of the ulna, and then becomes fused with the extensor mass.

The *Extensor minimi digiti* supplies digits IV. and V.

The *Extensor communis digitorum* divides early into three muscular bellies: two of these pass into tendons, which supply digits IV. and V. respectively; the tendon of the third splits into two, which go to digits II. and III.

The outside of the thigh is covered by a thick muscular mass, composed of several elements which are not to be very easily distinguished; a tendinous line separates the *Biceps* from the rest; the latter mass probably represents the *Tensor vaginæ femoris*, the *Glutæus maximus*, and the *Sartorius*. It is largely tendinous at its origin from the vertebral spines; the compound muscle is partly inserted on to the fascia covering the knee-joint; it is also inserted by a strong tendon on to the lower margin of the femur, just in front of the insertion of the *Glutæus medius*: I consider that this part of the compound muscle is undoubtedly the *Glutæus maximus*.

The *Biceps* is an enormous fleshy mass; it has the usual double origin and is inserted along the whole of the leg chiefly to the fascia covering the leg, but also in front by a short tendon to the patella.

The *Gracilis* is a double muscle; the two parts run side by side, arising from the symphysis pubis close together; they are also inserted close together on to the fascia covering the leg.

The *Semimembranosus* is composed of two distinct parts: the first part has a strong tendinous attachment to the inner condyle of the femur; the second part is a long thin muscle from the caudal vertebræ and is inserted just between the two heads of the

Gastrocnemius by a muscular insertion; it recalls the femoro-caudal of Birds.

The *Semitendinosus* arises by two heads; its flat strap-shaped tendinous insertion on to the tibia commences just after that of the *gracilis*.

The *Glutæus medius* is a powerful muscle hardly to be distinguished at its origin from the *Glutæus minimus*; it is inserted along the lower margin of the femur in front of the great trochanter for a distance of 30 mm.; the insertion is partly muscular and partly tendinous; the tendinous part of the insertion is divided up into a number of more or less distinct tendinous insertions.

The *Glutæus minimus* is a powerful muscle difficult to distinguish from the last at its origin; it arises from the greater part of the ilium; it becomes quite separate from the *Glutæus medius* a little before the insertion on to the great trochanter.

There was no trace that I could discover of a *Scansorius*, whose presence is mentioned in several Rodents.

The *Adductor magnus* is not by any means a large muscle; it is quite distinct from the other adductors; it is long and thinnish, and arises from the symphysis pubis by a tendinous origin; the upper surface of the muscle is glistening for a considerable distance after the origin.

The other two *Adductors* form a large fleshy mass and are not readily distinguishable from each other.

The *Iliacus* is a large muscle divided into two portions; it is inserted together with the *Psoas* on to the lesser trochanter.

The *Psoas magnus* is a large muscle, also divisible into two parts; the part which arises most anteriorly becomes tendinous on one side a couple of inches from its insertion.

The *Pyriformis* is present.

Both *Obturators* were present.

The *Rectus femoris* originates by two well-defined heads, which are tendinous, though overlaid by muscular fibres; the muscle is covered anteriorly by the *Vastus externus*.

The *Gastrocnemius* has the usual two heads, which take origin from two sesamoids; the inner head is the smaller of the two.

The *Plantaris* arises in common with the outer head of the last, and is fused with it for some way; it splits into three tendons on the sole of the foot.

The *Soleus* is fleshy with a tendinous origin from the head of the fibula; its exposed surface is glistening; it is inserted on to the os calcis.

The tendons of the *Flexores tibialis* and *fibularis* join before the latter splits into its four tendons of insertion: the tendon of the *Flexor tibialis* seems to be mainly concerned with the supply of the inner of the four tendons; the fourth of the four tendons of the *Flexor fibularis* is very much smaller than the rest, which is of course in relation to the comparatively rudimentary fifth toe; this tendon arises from the lower surface of the conjoined tendons and not from the outer edge.

The *Tibialis posticus* is covered by the *Flexor tibialis*; it becomes tendinous halfway down the leg.

The *Tibialis anticus* appears to be quite normal in size and attachments. So, too, the *Extensor digitorum longus* and the *Extensor hallucis* (which is inserted on to the second digit, the first being absent).

There are four *Peroneal* muscles; that supplying the fifth digit is very slender, both muscle and tendon, and is inserted on to the last phalanx.

The *Peroneus quarti digiti* is the outermost of the peroneal muscles; it is strong and has an insertion corresponding to the last muscle upon the fourth digit.

The *Peroneus brevis* is inserted on to the outermost metatarsal.

The *Peroneus longus* is the most superficial of the peroneals in origin; its tendon crosses the sole of the foot, as has often been described in Rodents.

The musculature of this Rodent is clearly more like that of the Hystricine genera than other forms; the arrangement of the long flexor tendons of the foot conform to the type met with in the Porcupines, Chinchillas, &c., and differs from the arrangement characterizing the Sciuromorpha and Myomorpha[1]. As *Aulacodus* is usually associated with *Capromys* it might be expected that the agreement in structure would be closer with that animal than with the Porcupines: I mention *Capromys* particularly since it is one of the few genera of the Octodontidæ of which the muscular anatomy has been described; its anatomy has lately formed the subject of an article in these 'Proceedings' by Dr. G. E. Dobson[2]. There is, in fact, a close similarity between the Rodent which forms the subject of the present communication and *Capromys*; the principal differences appear to be the following:—

(1) The *Deltoid* in *Capromys* arises partly from the spine of the scapula.

(2) The *Latissimus dorsi* has a double insertion, one part being connected with the *Pectoralis*.

(3) There is no tendon (?) connecting the *Flexor profundus digitorum* with the *Flexor sublimis*.

(4) The *Glutæus medius* is inserted by two thick tendons on to the great trochanter.

(5) The *Glutæus minimus* is "a narrow long muscle"; its insertion is between the two tendons of the last.

(6) The *Obturator internus* is absent.

(7) The *Semimembranosus* has only one part.

In some of these points where *Aulacodus* differs from *Capromys* it agrees with *Erethizon*[3]: the *Deltoid* is like that of *Erethizon*;

[1] "On the Homologies of the long Flexor Muscles, &c.," Journ. Anat. 1883, p. 142.

[2] "On the Myology and Visceral Anatomy of *Capromys melanurus*, with a Description of the Species," P. Z. S. 1884, p. 233.

[3] Mivart, "Notes on the Anatomy of *Erethizon dorsatus*," P. Z. S. 1882, p. 271.

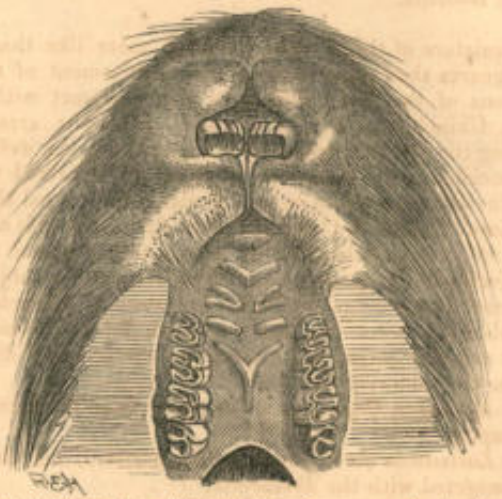
so, too, is the *Semi-membranosus* in having two distinct parts; there is, however, too little known at present about the musculature of the Rodentia to allow of any detailed comparisons of *Aulacodus* with other types. I content myself therefore with pointing out the above-mentioned differences from its near ally *Capromys*.

II. Visceral Anatomy.

As I have already mentioned, Prof. Garrod has described the main points in the visceral anatomy of this Rodent; I may, however, call attention to a few matters which he did not specially dwell upon.

The accompanying drawing (fig. 1) illustrates the *ridges* upon

Fig. 1.



Palate of *Aulacodus*, to illustrate the ridges upon the hard palate.

the *hard palate*; these ridges, as will be seen from the figure, are symmetrical, and at the same time few in number; they are for the most part in front of the molars. An inspection of the figure will save the necessity for any further description.

The *Spleen* is of a triangular form; its longest diameter measures 2¼ inches, the shorter diameter 1¾ inches. The *Cæcum* has been very fully treated of by Garrod; but he was in error, as I have already pointed out in a previous paper, in ascribing a unique character to the structure of this part of the alimentary canal; in *Dolichotis* there are a series of folds in the interior of the cæcum which bear not a little resemblance to those of *Aulacodus*. Garrod has also said nothing about the folds of mesentery which support the cæcum; near to the cæcum the small intestine has a mesentery

on both sides; about half an inch away from the intestine a fold arises from the mesentery supporting the intestine, which crosses over the intestine itself and is attached to the cæcum; a deep pocket is thus formed which is of course floored by the cæcum; on the opposite side there is a corresponding fold, arising, however, rather further away from the intestine; this also crosses the intestine and becomes fused with the fold running directly from the intestine to the cæcum. The cæcum is thus supported by three distinct folds, of which the median one, that arising from the intestine, is practically anangious; the two lateral folds which arise from the mesentery on the side furthest away from cæcum bear blood-vessels.

III. Brain.

The brain showed, after preservation in alcohol, the following proportions:—

Total length (to end of cerebellum) 37 mm.
Length of hemispheres 24 mm.
Greatest breadth 24 mm.
Vertical diameter 16 mm.

The outline of the brain as seen from above is shown in the accompanying drawing (woodcut, fig. 2). The two hemispheres

Fig. 2.



Brain of *Aulacodus*, viewed from above.
Sy, Sylvian fissure; *a*, longitudinal furrow.

are broader behind than in front; up to the Sylvian fissure the outer borders of the two hemispheres are approximately parallel to each other, though their outline is, of course, curved; from the Sylvian fissure to the anterior extremity of the brain these margins converge slightly, the diameter of the anterior extremity of the brain being 11 mm. The form of the hemispheres is in fact more like that of *Octodon* and *Myopotamus* among the immediate allies of *Aulacodus*: there is less similarity in the general shape of the

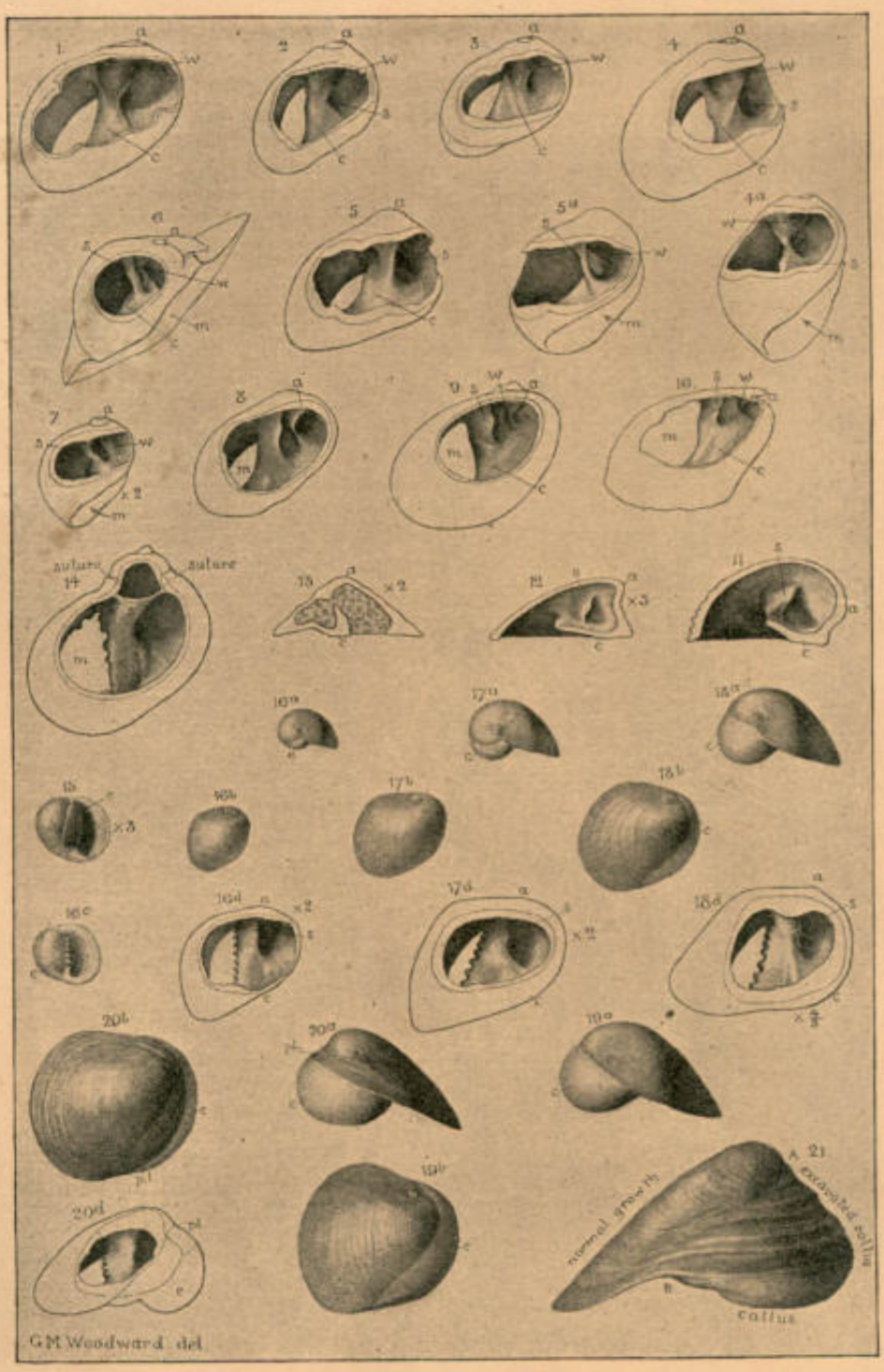
hemispheres to *Capromys*; this latter Rodent has the peculiar rounded hemispheres that characterize the Porcupines. As in most Rodents (and many of the lower Mammalia) the optic lobes are largely exposed: the degree to which the corpora quadrigemina are exposed in *Aulacodus* differs from that of any Rodent with which I have been able to compare its brain: the difference chiefly depends upon the form of the posterior margin of the hemispheres; these are very closely approximated in the middle line, and diverge posteriorly at a very wide angle; the posterior boundaries of the hemispheres, indeed, meet almost in the same straight line; there is no widening out of the median sulcus to form a triangular space, such as is evident, for example, in *Dolichotis patagonica*[1] and all other Rodents whose brains I have examined. As, however, the hemispheres do not come into contact with the cerebellum in the middle part above, there is a space left which is occupied by the two posterior lobes of the corpora quadrigemina. These two only are visible and they are raised almost to the level of the hemispheres themselves. As a rule, when the brain of a Rodent is viewed in profile, the corpora quadrigemina are seen upon the floor of a deep depression. Compare, for example, the accompanying drawing and fig. 4 A of my paper upon *Dolichotis* quoted below.

The cerebral hemispheres of *Aulacodus* are but faintly fissured.

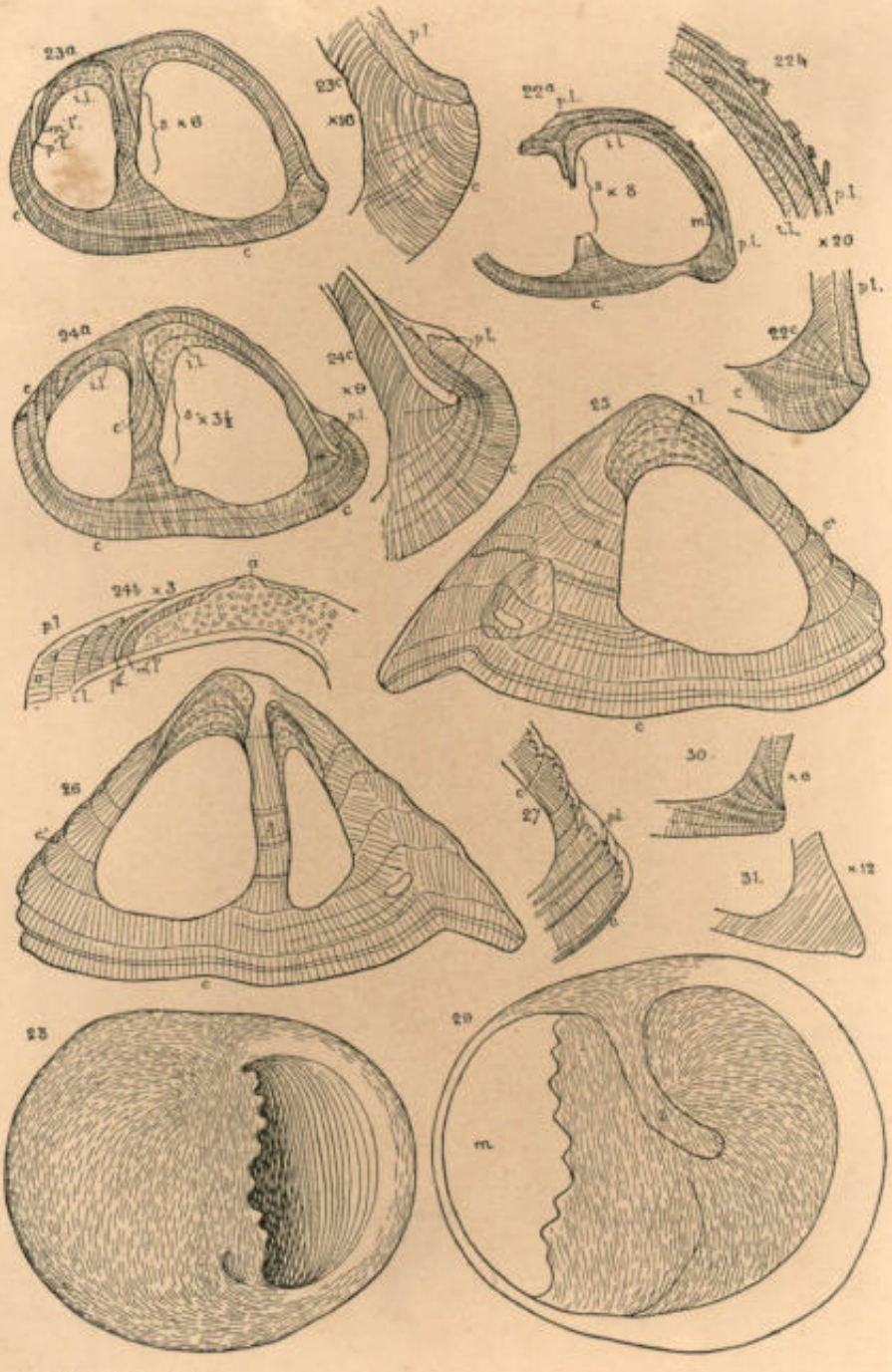
The Sylvian fissure is, however, well marked, though short in extent; it runs on each side almost vertically upwards, its direction being, indeed, rather forwards at first and then curving backwards. Just in front of the Sylvian fissure at its origin is a short backwardly-directed furrow, which joins the Sylvian fissure, thus cutting off a small triangular piece of brain about 2 mm. in length; this perhaps represents the Island of Reil. The Sylvian fissure of *Aulacodus* is much better marked than it is in either *Myopotamus* or *Capromys*, in both of which the fissure is barely discernible.

The upper surface of the brain is but little marked by sulci; I have already pointed out that there is not an obvious relation between the size of the animal and the complexity of its brain-convolutions in the Rodentia. The Beaver with its nearly smooth brain is perhaps the most striking instance; and this example is additionally remarkable from the fact that aquatic mammalia seem, as a general rule, to have more richly convoluted brains than their purely terrestrial relations. The only fissure is the longitudinal fissure corresponding, I imagine, to that termed by Sir Richard Owen "lambdoidal"; the only fissures upon the brains of *Myopotamus* and *Capromys* were the same, which is so strongly developed in *Dolichotis*, *Cœlogenys*, and *Dasyprocta*. In *Aulacodus* this fissure does not run, as it does in *Dolichotis*, continuously from one end of the hemisphere to the other. There is a short fissure on each side, 7 mm. in length (*a*, in fig. 2); separated from this by a space of about 5 mm. is the anterior part of it, which is even less extensive.

[1] "Notes on the Anatomy of *Dolichotis patagonica*," P. Z. S. 1891, p. 226.



STRUCTURE OF NERITINA, VELATES, ETC.



G.M. Woodward del.

STRUCTURE OF NERITINA, VELATES, ETC.

Where the free edge is thickened and pillar-like, as in *N. intermedia*, *N. punctulata*, *N. fluviatilis*, and, to a lesser degree, in *N. latissima*, the angle it makes with the septiform columellar lip approaches the perpendicular; where, however, the septum is widely separated from the paries, as in *N. canalis* and the species that follow in the series quoted above, its free edge is thin, sharp, and inclined more out of the perpendicular, the whole septum sloping back from the aperture.

Towards the middle in *N. canalis* the free edge of the septum has a somewhat acuminate projection corresponding to that noted above on the columella-edge in *N. cornea*, &c.

Viewed through the aperture of the shell only a very small portion of the septum can in these latter cases be seen; in its earlier stages in the other species cited it is of course quite out of sight. The shifting of the septum away from the parietal wall is due to a purely mechanical cause. Just in proportion as the whorls of the shell increase more rapidly and the spire at the same time becomes more depressed, so the latter approximates the posterior angle of the aperture, and consequently the inner wall of the last whorl becomes smaller and smaller and less and less adapted to serve as a myophore. Moreover, as the shell becomes flattened and the septiform columellar lip extends further and further outwards from the axis, the angle at which the retractor muscle would have to act in order to withdraw the extended animal, were its fixed point still the remnant of the paries, would be one of great disadvantage from a mechanical point of view, and hence a fresh attachment, as near to and as much above the aperture as possible, becomes of great importance and is obtained by the forward movement of the septum already described. The manner of this forward growth will be best dealt with later on when the growth of the shell of *Velates conoideus* is under consideration.

In all cases, too, the scars of the anterior and posterior retractor muscles are pronounced in proportion to the strength of the muscles that were attached thereto, and, in consequence, to the thickness of the shell and the septum. It must also be borne in mind that the flattened columellar lip characteristic of *Neritina* and *Nerita* is formed by the callus, as likewise is the "shelf" in *Septaria* [= *Navicella*].

In *Nerita* the myophore at first sight appears as if it were a remnant of the paries; but a closer inspection, if one may judge from such typical forms as *N. peloronta*, Linn. (fig. 14), *N. polita*, Linn., and *N. plexa*, Chemn., reveals the fact that it is merely the septum, all trace of the inner walls and columella having been removed.

Velates, so far as at present known, is represented by but two species—*V. conoideus*, Lamk., and *V. equinus*, Bez., which occur together in the Lower and Middle Eocene of the Paris Basin. The shell of the latter attains to close upon 4 whorls when full-grown, and at that age corresponds in size with specimens of *V. conoideus* that have only completed about 3 whorls. The internal construction of the two at these respective periods is so similar that the description

of one of them is sufficient, and no further reference need be made to the growth of the shell in *V. equinus* since it is perfectly normal. During the early stages of its growth, *i. e.* up to about 3 or 3½ whorls, the myophore in the young *Velates* shell (fig. 16) is formed of the remnant of the parietal wall strengthened by shelly deposit much in the same way and degree as it is in *Neritina virginea*. No trace of a prominence is perceptible at first on the thin and sharp columella-edge, but by the time 3½ whorls are finished it is plainly discernible, and with the completion of the fourth whorl it attains its maximum development (fig. 17 *d*). The angle the columella-edge makes with the columellar lip scarcely if at all exceeds 45° and is less in the earlier stages, whilst the whole myophore rakes back from the aperture and is not visible from without. After the completion of the fourth whorl the growth of the septum is comparatively rapid and increase takes place especially along that portion of its free margin which is furthest from the callus. By the time 4¼ whorls are complete the free margin is almost perpendicular to the callus and has become thickened and pillar-like, a slight fold on it marking the position of the late prominence (fig. 18 *d*). The appearance of the septum at this stage is most like that of *Neritina punctulata* amongst recent species. Shortly after the completion of 4½ whorls (fig. 20 *d*) the septum alone constitutes the myophore, the columella and paries having been absorbed, and occupies the relative position it retains throughout the remaining period of growth: its free and thickened edge is quite perpendicular to the callus, and the greater portion becomes visible through the aperture, although the whole septum curves inwards as it projects into the chamber of the shell. So far, therefore, as the myophore is concerned the shell of *Velates conoideus* offers in the growth of the individual a series of conditions which in the recent forms find their parallel in distinct species:—in its earlier stages the paries and the incipient septum go to form the myophore, as in the instances quoted; in the later period the septum alone plays that part, as in *Neritina crepidularia*.

The scars of the retractor muscles, both anterior and posterior, become more marked as the individual grows, the former especially deepening with age, and there is a well-marked anterior palatal apophysis which gradually becomes fainter as the shell grows and finally almost entirely disappears. The callus which in the young shell does not extend very far over the adjacent portion of the body-whorl (fig. 15) gradually spreads further and further (figs. 16, 17), till by the time 4¼ whorls have been completed (fig. 18) it has covered nearly one half of the body-whorl and its line of demarcation is in one plane with that of the margin of the outer lip. The rate of increase of the third and following whorl is, moreover, proportionately greater than that of the preceding ones.

It is at this point that the great change in the manner of growth of the shell begins. First of all the callus is greatly thickened till it becomes in proportion to the shell itself larger and thicker than at any subsequent period (fig. 19). In the next place, further increase of the shell begins to be effected by the addition of fresh material

not merely to the outer lip and columella alone as in normal growth, but all the way round in the plane of the outer lip, as first evinced by the deposition of periostracal layer along and over the outer margin of the enlarged callus (fig. 20), the lines of deposition, or growth, being continuous with those of the outer lip. In other words, were it not for the overlap of the callus the peristome would be complete, as in *Neritina crepidularia* and *Tomostoma neritoides*. Deposition also takes place over the whole surface of the callus. The direction of growth is in this manner completely changed. Instead of developing spirally, round an axis of which the protoconch forms the apex, the shell enlarges radially, the new axis being the pillar-like margin of the septum and its apex the point, on the exterior of the body-whorl, situated immediately over the junction of these two. In this new condition of affairs the callus, which is at right angles to the new axis, lies of course completely athwart the direction of growth and decidedly in the way of further extension, so that the animal must have found itself much in the same predicament that a limpet would do were it to be suddenly half-decked when its period of growth was still far from complete.

A grave problem in its domestic architecture was thus raised, and the solution forms the most interesting feature in the life-history of this species; for layer by layer, as deposition of fresh shelly matter took place without, a corresponding amount of material was removed on the inner side of the callus, and the additional room required thus obtained. Put in homely phraseology, this mode of enlarging a tenement reminds one of nothing so much as of the Irishman, who raised his roof by digging out the floor of his cabin.

The ultimate outcome of this novel mode of increase is that, in the adult *Velates*, that portion of the shell included between the margin of the outer lip and a line (A B, fig. 21) joining its extremities and passing round and a little below the apex on the further side is normal, whereas the remainder is formed out of callus past and present. This comes out very clearly in the various sections of the shell presently to be described. Of course the walls around the apex which require to be thickened as the shell increases in size, to make them as durable as the rest, are strengthened in the usual way by the deposition of fresh shelly matter within, so that, in an old shell, what was once the cavity inhabited by the young animal has become solid shell.

The changes which take place in the external form of the test of *Velates*, as was to be expected, find their reflection in the intimate structure of the shell itself. An axial section whose plane passes close to and almost parallel with the edge of the columellar lip, but just misses the apex itself, has been made in each of three young shells of different ages, and the sections stained with picro-carmine to bring out the structure more clearly. In the first, a specimen of about 3 whorls (Plate XXXII. fig. 22 *a*), the shell-wall near the apex shows three readily distinguishable layers:—the outermost, or periostracal layer, the crystalline, and the innermost layer, which in this case consists of the material laid down not merely as a lining to

the shell, but to fill up the space no longer occupied by the animal and to thicken the shell where, having been formed when the animal was young, it was too thin for the present requirement of its occupant.

The periostracal layer, which shows a tendency to divide into two zones (fig. 22 *b*), is translucent and presents to the eye a fibrous structure, the fibres being arranged at right angles to the surface in the region of the apex; but as the layer is followed down towards the anterior end of the columellar lip they change their direction gradually till they assume the feather-like appearance familiar in shell-structure and are arranged in a direction approximately parallel with the layer itself (fig. 22 *c*).

The second principal layer also exhibits a fibrous appearance consequent on the arrangement of its crystalline plates, which near the apex are nearly but not quite at right angles to the surface. As the columellar lip is approached these become more inclined, till on joining those of the columellar lip itself they unite with them and sweep through an arc of more than a quarter of a circle (fig. 24 *c*).

The layers of growth can in places be clearly seen (figs. 22 *a*, *b*). The innermost deposit is confined to the neighbourhood of the apex and thins out as it recedes therefrom: it shows in section the cross-hatched structure so common in sections of shell and due to the especial arrangement of its component plates.

That the myophore at this stage is still formed in its upper part of the parietal wall is evident from its structure and its continuity with the outer wall next the apex (fig. 22 *a*). The middle portion of the myophore and the posterior wall have unfortunately been broken away in grinding this section. Nevertheless sufficient of the base of the former and of the callus out of which that base has been formed is left to show that even at this early age a considerable enlargement of the interior by absorption has taken place.

In the next older specimen, one of about three and a half whorls (fig. 23 *a*), the remnant of the parietal wall can be traced, the section being perfect, for quite two-thirds of the length of the myophore, whilst in the outer wall on the posterior side of the section the remnant of another original wall is present. A portion of the periostracal layer, about halfway down that side, curves inwards, traverses the shell-wall, and abruptly terminates on the inner side (*p'.l'.*): it is overlain by the edge of the callus which comes up to this point and which is in its turn covered by a fresh deposit of periostracal layer that joins on to the first one. This junction is not a true suture, since it does not mark the union of two whorls. The extent to which the callus has been absorbed on its inner side is clearly shown, as also the vertical arrangement of its component plates. This structure, however, is still better seen in more advanced stages of growth.

The third section (fig. 24 *a*) has been taken of the young shell at the stage when its four and a half whorls have been completed and the period of radial growth entered on, just at the time when the callus having attained its maximum development begins to be covered all round its margin by the periostracal layer. The myophore is still in part formed of an old outer wall of the test, but that portion

was callus (*c'*), as shown by the structure, and has been shaped to suit its present position, as the transverse direction of its lines of growth testify. The wall on the posterior side of the section is built up of an old whorl, of callus, and of infilling material. The absolute apex of each of these two last specimens appears in the succeeding section of the respective shells, and here may be seen the remains of the true spire, such as it is, and the overlapping sutures (fig. 24 *b*).

These remnants exist in the adult shell, unless indeed it be a worn specimen; all other traces of former walls have disappeared. A section taken through a full-grown specimen as nearly as possible in the plane of the septum (fig. 25), and stained with picro-carmine, clearly reveals the intimate relationship between the myophore and the neighbouring walls of the test and demonstrates beyond doubt the way in which they have been carved out of successive layers of callus, for the lines of growth can be traced right across the septum to its inner margin and reappear in the wall of the shell on the opposite side of the cavity (see also fig. 26). They may also be distinctly seen running round the walls on the interior surface of the shell[1].

The composition and intimate microscopical structure of the *Velates* shell likewise call for some remark, since further points of interest are presented by them.

The term *periostracal layer* has been employed throughout, instead of *periostracum*, for the external layer, the reason being that it differs so widely in its composition from the chitinous substance which coats most shells, and which usually is known by the latter term, that its application in this instance might have been misleading.

This layer is remarkably hard and extremely difficult to cut through; it does not stain like the rest of the shell, but remains translucent with a cloudy fibrous appearance when seen in the microsections already described. It retains probably to a very high degree (especially in the young shell) the coloration and mottled markings which adorned the shell when living. Its line of junction with the underlying crystalline layer in the young shell and that portion of the adult where the growth is normal is even; but where it overlies callus the several layers of the two inosculate and the line of junction is extremely ragged and irregular (figs. 24 and 27). In the one case the mantle-edge that secreted it was advancing over a given area followed in regular order by the portion that furnished the material for the second layer; in the other the mantle was retreating from the area of deposition as the shell increased in size and so gave rise to overlapping of the two series of deposits, the irregularities that thus arose being further complicated by the fluctuations in the growth of the animal and its shell.

Under the delusion that this periostracal layer might, like the molluscan radula, prove to be very dense chitine, a portion was placed in Mr. G. T. Prior's hands for examination. He most kindly made a careful investigation of it, with the result that it

[1] These lines of growth were noted by Schmidel.

appears in the main to consist of calcic carbonate, since it dissolves with effervescence in dilute hydrochloric acid, leaving, however, an appreciable residue. This residue subjected to the usual tests, both with acids and under the blowpipe, proved to consist of silica, having a specific gravity which is nearer that of the crystalline than the amorphous state. Naturally it was at first thought that this silica might be a product of fossilization, but since the callus, which was equally exposed to the same influence, yields no appreciable residue, this does not appear to be a tenable supposition; at the same time without further and more extended inquiries one hardly likes to look upon it as an original product of the animal[1].

The crystalline layer which forms the principal thickness of the shell-wall is composed of a single stratum of laminæ, the component fibres of which in each successive lamina run in a reverse direction to those of the preceding one, as originally described by Count Bournon[2] and subsequently by all writers on molluscan shell-structure.

The direction these plates take, however, in the present example is peculiar. In that part where the growth is normal (see fig. 21) their direction coincides with that of the lines of growth, their planes being perpendicular to the outer surface of the shell, just as seemingly obtains in an ordinary *Neritina* (e. g. *N. gagates*). In the remaining portion of the shell-wall beneath the periostracal layer the plates follow the curve of the shell, their planes radiating from the new apex and consequently being approximately parallel with the outer surface—approximately, because the sections show that in each major group of layers they 'feather' somewhat (figs. 25, 26, 27).

These walls being, as already mentioned, hewn out of successive margins of former callus, it follows naturally that in the outer margin of the callus itself the plates follow the same course—that is to say, are disposed in a crescent, at the extremities of which, their planes of inclination twisting to suit, they unite with those of the outer lip to form a continuous circle. Along the dentate columellar lip they also run parallel with the margin, and here, as elsewhere over the callus, their planes are at right angles to the exterior surface.

On reaching the posterior angle of the aperture this series of lamellæ (viewed from the exterior) abruptly bifurcates, one set curving sharply towards the outer lip, the other in the opposite direction, and both commingling with, and becoming lost in, the marginal plates; the point of junction of the two series thus forms a centre whence they stream off in three directions (fig. 28).

At the anterior angle the whole series curves towards the outer lip, becoming lost, as before, in the marginal set. Across the central portion of the callus they run in an oblique direction, radiating from

[1] Schmidel noted that this layer did not appear to be entirely composed of lime.

[2] 'Traité complet de la Chaux carbonatée,' etc. tom. i. (1808) p. 310. See also Gray (J. E.), Phil. Trans. cxxiv. (1833) p. 789; Bowerbank (J. S.), Trans. Micro. Soc. i. (1844) p. 128, pl. xv. fig. 1; and Rose (G.), Abhandl. k. Akad. Wissensch. Berlin, 1858 (1859), p. 89. pl. iii.

a point situated a little way in from the posterior angle, their course as they approach the margin becoming uniformly deflected to the left, *i. e.* in the direction of the anterior angle of the aperture. The nature of this arrangement is, however, more easily gathered from the figure than realized from a mere description. Seen from the inner aspect the relationship of the internal septum to this structure becomes apparent (fig. 29). The point by the posterior angle of the aperture whence the plates radiate in three directions marks the junction of the septum with the outer wall; the centre of radiation a little further in falls just beside the septum in the middle of its curved inner side, so that the direction of the plates in the septum itself very nearly corresponds with the curvature of its walls, or, to put it in another way, the 'graining' of the septum is but slightly 'on the cross.' The whole system of construction of the callus, therefore, would appear to foreshadow the future requirements of the animal, and its component plates to be so arranged that when by erosion in the course of growth its unabsorbed portions form part and parcel of the walls and septum of the shell these plates shall be in the right position to impart the greatest strength and durability to the whole that is possible under the circumstances, for the lines of growth in the callus-formed portion are of necessity lines of weakness.

Mr. H. A. Miers was so good as to investigate a portion of the crystalline layer from the callus, testing its specific gravity by means of density fluids. It floated in a liquid in which aragonite and tourmaline sank; but foundered in one which would support beryl and calcite. On account of its porous nature, the observed specific gravity of the material must in reality be too low and the crystalline callus is therefore more likely to be aragonite than calcite.

Mr. Miers further reports:—"By taking some of the very finest powder and examining it with a twelfth oil immersion, I am able to find some specks which are undoubtedly calcite (by cleavage and opt. char.). In section it is impossible to determine the substance—because the use of the same objective with polarized light shows that it consists of very minute overlapping fibres even where it appears homogeneous under the quarter. Some of the powder looks to me more like aragonite—little ragged fibres with straight extinction, no cleavage, and the double refraction of aragonite.

"The final result is then—an extremely fine fibrous structure; the presence of calcite proved; the presence of aragonite highly probable."

The manner in which the myophore and the callus shift forward with the growth of the shell in *Neritina* can now be readily understood. Fresh shelly matter is added to the outer and a corresponding quantity removed from the inner side. No section can well be taken to prove this to demonstration in the majority of the species of the genus, but in *N. crepidularia* it can be shown that the callus does thus change its position and move through a segment of a circle, keeping pace in this way with the growth of the rest of the shell (fig. 30); and the same is true of *Septaria* [=*Navicella*]. In

both, however, there is no change in the direction of growth, and though the peristome is complete in the mature individual it does not increase equally all round as in *Velates conoideus*, but develops most rapidly at its peripheral point, the diametrically opposite edge of the callus scarcely being added to at all and thus constituting the axis on which the direction of growth pivots. A section taken in the plane of the direction of growth displays the successive layers of former callus spread out like a fan at this point (fig. 30). Judging from external appearances there are but three forms which at first sight would seem likely to exhibit the same structure and mode of growth as *Velates conoideus*, viz.: *Tomostoma neritoides*, Desh., from the Eocene, the Oolitic genus *Pileolus*, and *Velatella carditoides* from the American Cretaceous: all three are, so to speak, like half-decked limpets in form and increase radially by the addition of fresh material to the continuous peristome; but in neither the first nor last-named, certainly, does the callus in any way overlap the lateral walls of the test, nor is there any but the slightest change in the direction of growth and that at a very early stage. A rough section of the first, however (fig. 31), shows that whilst the callus moves forward in the manner indicated above, the adjacent portion of the wall of the test though continuous with it is probably normal in its growth. Unfortunately the species is a small one and material is scarce, whilst the shell is so fragile that the micro-section which was being prepared crumbled in the final process, and Mr. Riley, to whose skilful manipulation is due the successful series of interesting sections on which this paper is in part founded, was too disheartened by the failure to essay any further attempts. With regard to *Pileolus* it is much to be regretted that no definite opinion can be formed, since the specimens are so completely mineralized that all intimate structure is lost. Sowerby speaks of breaking open one and discovering its internal spire[1]; but though Dr. Woodward most kindly had two specimens cut, no such trace of any spire is visible in them, the only peculiarity being a thickening of the columellar lip on its inner margin. It was impossible even to make out if there is a septum or not, and it is necessary to await the discovery of better preserved specimens before attempting to pronounce further upon this genus[2].

As for *Velatella*, neither the original description[3] nor Tryon's figure[4] enables one to form any conjecture as to its probable mode of growth.

[1] 'Genera of Recent and Fossil Shells.'

[2] Since the foregoing paragraphs were written, Mr. W. H. Hudleston, F.R.S., the President of the Geological Society, has most obligingly lent me a section of *Pileolus* which he possesses and which comes from the Lower Oolite. It shows distinctly that in this genus there most clearly is a septum, as in *Neritina crepidularia* and *Tomostoma*. The Museum sections must have passed just through the spreading base of this septum at its inner margin where it joins the callus. There is no true internal spire as stated by Sowerby. The shell in this specimen was, as usual, far too altered to exhibit any trace of structure.

[3] Ann. Rept. U. S. Geol. and Geog. Surv. 1872 (1873), p. 499.

[4] Struct. and Syst. Conch. pl. lxxviii. fig. 85.

So far, therefore, as our present knowledge extends *Velates conoideus* is absolutely unique in its method of building up its shell.

In conclusion it is the writer's pleasing task to tender his sincerest thanks to the many kind friends to whom he is indebted for assistance and advice in the course of the preparation of this paper. Beside those gentlemen already named he has to especially thank Mr. G. F. Harris for the loan of specimens, and his friend and colleague Mr. E. A. Smith for much assistance and advice.

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1780. Schmidel (C. C.). Vorstellung einiger merkwürdigen Versteinerungen mit kurzen Anmerkungen. [Pt. ii.] p. 41, pl. xxiii. figs. 1–3.

[This edition has not been seen by the writer: the 1793 edition, however, contains at the same page the following:—

"Da ich zwei dergleichen besitze, so habe ich eine darzu angewendet, sie öffnen zu lassen, um nicht nur die Beschaffenheit der einzigen inneren Windung, als auch die Stärke der Schaale, die aus vielen über einander gelegten Schichten besteht, und den Gipfel der Schnecke ganz allein macht, in der 3ten Figur vor Augen zu legen. Dass sie eine achtmal ausgezackte Lippe hat, und mit einer bräunlichen, dem Ansehen noch nicht ganz verkalchten Schaale aussen versehen ist, wird durch diese Vorstellungen deutlich sein, ohne dass wir nöthig haben, mit der weiteren Beschreibung aufzuhalten, die man am angeführten Orte nachsehen kann."]

1786. *Nerita schmideliana sinistrorsa, fossilis*, CHEMNITZ: Mart. u. Chem. Conch.-Cab. ix. Abth. i. p. 130, pl. 114. ff. 975–6.
["... habe ich sie Neritam Schmidelianam genant."]
1789. *Nerita perversa*, GMELIN: Linn. Syst. Nat. ed. xiii. tom. i. p. 3686.
1804. *Nerita conoidea*, LAMARCK: Ann. Mus. Hist. Nat. Paris, v. p. 93.
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EXPLANATION OF THE PLATES.

(Unless otherwise stated the figures are of the natural size.)

PLATE XXXI.

Figs. 1–10. A series of specimens of *Neritina*, with the outer wall of the body-whorl cut away to show the successive stages in the formation of the shelly septum (*s*), which ultimately supplants the inner wall of the whorl, or paries (*w*), in its function of myophore, and exhibiting their relation to each other and the callus (*c*). The approximate position of the apex is marked *a*.

Fig. 1. *Neritina cornea*, Linn., in which there is only a small amount of shelly deposit at the junction of *w* with *s*, and possibly, very faintly, along the basal portion of the columella-edge of *w*.
2. *N. gagates*, Lamk., in which the shelly deposit is slightly more pronounced and begins to form a spur (*s*) up the columella-edge of *w*.
3. *N. dubia*, Chemn., exhibiting a further thickening of the shelly deposit and a strengthening of *s*.
4. *N. bicolor*, Réc.: *s* is yet more developed and begins to project beyond *w*, and form a septum, as seen in 4 *a*, which is a view taken more from the inner side.
5. *N. punctulata*, Lamk.: the septum *s* stands well away from *w*, and its free margin is seen to be greatly thickened when it is viewed from behind, as shown in 5 *a*.
6. *N. latissima*, Brod.: *s* and *w* begin to separate.
7. *N. fluviatilis*, Linn.: × 2, *s* and *w* stand apart.
8. *Neritina*, sp. ?
9. *N. canalis*, Sow.
10. *N. granosa*, Sow.
s and *w* are successively more widely separated from each other, and *c* more and more developed.
11. *N. crepidularia*, Lamk. Section in the plane of the direction of growth: *w* is entirely absorbed and *s* is placed near the margin of *c*.
12. *Tomostoma neritoides*, Desh., × 3. Section as in fig. 11, with which it closely agrees.
13. *Pileolus plicatus*, Sow., × 2. Section as in fig. 11.
14. *Nerita peloronta*, Linn. Section to show septum *s* and total removal

of *w*. The cavity extends behind *s* to the point marked +, and therefore far beyond the sutural line (*suture*); the outer wall at this point is very thin.

Figs. 15–20. *Velates conoideus*, Lamk. *a*, apex; *c*, callus; *s*, myophore, which at first is formed by a portion of the paries, but subsequently consists solely of the septum.

Fig. 15. Young shell of about 2 whorls, to show the small extent of the callus. × 3.

16. Young shell of about 3¼ whorls
17. " " 4 "
18. " " 4½ "
19. " " 4⅔ "
20. " " over 4⅔ "

in which fresh periostracal layer begins to be deposited over the callus.

a. Apical view, showing proportion of callus.
b. Dorsal view.
c. Ventral view.
d. Section to show interior.

(Fig. 16 *d* × 2; Fig. 17 *d* × 2; Fig. 18 *d* × ⅔.)

21. Adult shell from the anterior side (⅓ nat. size), to show the relative proportion of shell in which the growth is normal to that formed of callus and excavated callus.

Plate XXXII.[1]

Fig. 22 *a*. Axial section of young shell of about 3 whorls: ×8. *p.l.*, periostracal layer; *m.l.*, middle or crystalline layer; *i.l.*, infilling layer; *c.*, callus. The portions of pre-existing layers belonging to the young shell and included in the present walls are marked by the same letters with the addition of accents.

22 *b*. Portion of the anterior wall further magnified, to show the structure *p.l.* and the lines of growth in *m.l.*

22 *c*. Junction of the outer wall and callus on the anterior side of the same section.

23 *a*. Axial section of a specimen of about 3¼ whorls: ×6.

23 *b*. Junction of the callus and outer wall on the anterior side, further magnified.

24 *a*. Axial section of a specimen of 4½ whorls: ×3⅔.

24 *b*. Following section of the same, showing actual apex.

24 *c*. Junction of callus and outer wall on the anterior side, further magnified.

25. Section through adult shell in the plane of the septum, to show the connection of the latter with the outer wall.

26. Section parallel with the preceding a little further in from the aperture and viewed in the opposite direction.

27. Radial section of an adult specimen taken on the side away from the aperture and showing the junction of the callus and the outer wall, which consists of layers of former callus.

28. External ventral surface of adult specimen with the course of the component plates of the callus marked out. [From two specimens.]

29. Internal ventral surface from a specimen in the British Museum (Natural History) [Reg. 31977], showing the course of the component plates and their relation to the septum.

30. Section of a portion of *Neritina crepidularia*, Lamk., in the plane of the direction of growth, showing the junction of the callus and outer wall of the shell on the side furthest from the aperture (considerably enlarged).

31. Similar section of *Tomostoma neritoides*, Desh. (considerably enlarged).

[1] The microstructure of the sections is filled in diagrammatically.

November 1, 1892.

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, 1892:—

The registered additions to the Society's Menagerie during the month of June were 132, of which 49 were acquired by presentation, 43 by purchase, 21 by birth, 9 were received in exchange, and 10 on deposit. The number of departures during the same period by death and removals was 90.

The registered additions to the Society's Menagerie during the month of July were 165; of these 92 were acquired by presentation, 27 by purchase, 2 by exchange, 34 by birth, and 10 were received on deposit. The number of departures during the same period by death and removals was 73.

The most noticeable acquisition during the month was a young Gibbon from Hainan, South China, of a uniform black colour, belonging to the species recently described (Ann. Nat. Hist. ser. 6, ix. p. 145, 1892) by Mr. Oldfield Thomas as *Hylobates hainanus*. The Society are indebted to Mr. Julius Neumann, of Hoihow, Hainan, China, for this interesting animal, which is new to the Collection.

The registered additions to the Society's Menagerie during the month of August were 151; of these 57 were acquired by presentation, 34 by purchase, 5 by birth, 8 by exchange, and 47 were received on deposit. The number of departures during the same period by death and removals was 71.

The registered additions to the Society's Menagerie during the month of September were 99; of these 49 were acquired by presentation, 27 by purchase, 12 were bred in the Gardens, and 11 were received on deposit. The number of departures during the same period by death and removals was 108.

The most noticeable addition during the month was a young male Malayan Tapir (*Tapirus indicus*) from Tavoy, Burmah, presented by Col. F. M. Jenkins. The general colour of this animal is that of the adult, but the spots of immaturity are still visible on the legs.

Mr. E. Hartert exhibited examples of two new Mammals from Dutch New Guinea (*Proechidna nigro-aculeata* and *Acrobates pulchellus*[1]), and a stuffed specimen of *Apteryx maxima*, belonging to the Tring Museum.

[1] See below, p. 545.

The following letter, addressed to the Secretary by Lord Lilford, F.Z.S., was read:—

"Sir,

I think that it may interest some Members of the Society to hear that a pair of Demidoff's Galagos (*Galago demidoffi*), purchased by me from Mr. A. E. Jamrach on October 9, 1891, *produced a young one* on April 28 ult., in a cage here. The infant was blind for several days: its fur was very short and of a lighter colour than that of its parents, which were both most careful and very jealous of their offspring. I am glad to be able to add that we have succeeded in keeping these three very interesting little animals alive and in excellent health to the date of this writing on a diet composed principally of cockroaches, mealworms, bread and milk, with occasionally a little fruit.

"I remain,

"Yours &c.,

"LILFORD."

"Lilford Hall, Oundle,
October 19, 1892."

Prof. F. Jeffrey Bell stated that Mr. Carruthers, Keeper of the Botanical Department of the British Museum, had handed him a fine specimen of *Bipalium kewense*, found in one of the warm houses at Straffan House, Kildare. So far as Prof. Bell knew, this was the first occasion on which this now widely-spread species had been recorded from Ireland.

Prof. Newton, M.A., F.R.S., Vice-President, on exhibiting (on behalf of Mr. John Cordeaux) the skin of an immature *Sylvia nisoria*, shot at Easington, near Spurn Point in Yorkshire, on the 19th ult., remarked as follows:—"When on the 4th March, 1879 (Proc. Zool. Soc. 1879, p. 219), I had the privilege of calling the notice of the Society to what I believed to be the remains of the first example of *Sylvia nisoria* obtained in England, some of my friends thought me rather rash in placing confidence in a specimen which had remained unrecognized for about forty years, and had in the meanwhile changed owners more than once. My conduct on that occasion has been in some way justified by the recognition since that time of the occurrence of this species in various parts of the United Kingdom, and I have now to lay before the Society an example which has been killed in Yorkshire within the last fortnight, and sent to me by Mr. Cordeaux for examination. The skin is that of a young bird of the present year, and I may add that no doubt can be entertained of its having been shot, as he informs me, at Easington, on the 19th October, 1892, by Mr. Jalland.

"I have long wished to refer to this species the 'East Woodhay Warbler,' *Sylvia bidehensis*, described and figured by the late Hon. and Rev. W. H. Herbert in the edition (published in 1833, anonymously, but commonly associated with his name) of White's 'Natural History of Selborne' (pp. 129, 130 note, and titlepage); and despite some manifest discrepancies, due perhaps to his having only seen and not procured the birds, I cannot but think that those

which he observed, and possibly those seen by Mr. Sweet near Bristol, may have belonged to *Sylvia nisoria*—a species with which British ornithologists had at that time little or no acquaintance."

Mr. F. Finn, F.Z.S., gave an account of his recent zoological excursion to Zanzibar, and of the principal animals observed at Lamu, Zanzibar, and Mombasa.

Prof. F. Jeffrey Bell, F.Z.S., read a description of a remarkable new Echinoderm of the genus *Cidaris* from Mauritius, taken from a specimen recently transmitted to the British Museum by M. de Robillard. Prof. Bell proposed to call this species *Cidaris curvati-spinis*.

This paper will be published in the Society's 'Transactions.'

A communication was read from Sir Edward Newton, K.C.M.G., C.M.Z.S., and Hans Gadow, Ph.D., M.A., F.R.S., F.Z.S., containing an account of some of the bones of the Dodo and other extinct birds of Mauritius, recently obtained by Mr. Theodore Sauzier, of which the following is an abstract:—

In 1889 the Government of Mauritius appointed a Commission to enquire into the "Souvenirs Historiques" of that island; and in furtherance of their object, at the instance of and under the able direction of their President, Mr. Theodore Sauzier, they continued the exploration of the Mare aux Songes—the marsh in which the late Mr. George Clark, upwards of five-and-twenty years ago, made the discovery of a vast deposit of bones of the Dodo[1] and other animals, mostly now extinct, and the only locality in Mauritius, except Riche Mare, in the district of Flacq, where remains of the Dodo have been found[2].

This exploration has been very successful, for not only have many Dodos' bones, some of them new and others represented only by imperfect specimens, been recovered, but also a considerable number of the bones of other birds, materially adding to our knowledge of those that had been but partially described, and proving the former existence in Mauritius of species either vaguely indicated by old voyagers or wholly unsuspected to have been members of its fauna. Beside these there have been found many remains of the large extinct Lizard, *Didosaurus mauritianus*[3], and several carapaces, plastrons, and skulls, more or less entire, though none absolutely perfect, belonging to one or other of the extirpated Tortoises.

Nearly the whole of these specimens have been sent by Mr. Sauzier, on behalf of the Commission over which he presided, to the Museum at Cambridge, with a view to their determination and to the description of such as are new, and this task has been undertaken by the present writers.

Before proceeding to its execution, it may be as well to recall the

[1] Ibis, 1866, pp. 141 *et seqq.*
[2] Proceedings of the Zoological Society, 1890, pp. 402 *et seqq.*
[3] Günther, Journal of the Linnean Society, Zoology, xiii. pp. 322 *et seqq.*

fact that up to the present time, beside bones of *Didus ineptus*, those of the following birds have been obtained from this marsh and described as under:—

Lophopsittacus mauritianus (Owen).	Lower Jaw. Owen, Ibis, 1866, pp. 168 *et seqq.* Tibia. A. Milne-Edwards, Ann. Sc. Nat. sér. 5, vi. pp. 88 *et seqq.* (1866).
Astur, sp. indet.	Metatarsus. *Id. op. cit.* xix. art. 3 (1874).
Ardea garzetta, Linnæus.	Tibia. *Id. loc. cit.*
Aphanapteryx broecki (Schlegel).	Lower Jaw, Tibia, Metatarsus. *Id. op. cit.* x. pp. 325 *et seqq.* (1868).
Fulica newtoni, A. Milne-Edwards.	Pelvis, Tibia, Metatarsus. *Id. op. cit.* viii. pp. 195 *et seqq.* (1867).

All these are species which no longer occur in the island.

Bones of a species of *Phœnicopterus* have also been found (G. Clark, Ibis, 1866, p. 144, and A. Milne-Edwards, Ann. Sc. Nat. sér. 5, xix. art. 3).

The present collection contains not only bones of the above-named birds, but also those of a Finch (?), an Owl, four other species of Heron or Bittern, a Darter, a Gannet, a Goose, a Duck, a Grebe, two species of Pigeon, one of which is probably the extinct *Funingus* (*Alectorœnas*) *nitidissimus*, a Waterhen, and two Petrels, of which we proceed to describe and characterize as new:—

Strix (?) *sauzieri*,
Astur alphonsi,
Butorides mauritianus,
Plotus nanus,
Sarcidiornis mauritianus, and
Anas theodori.

In naming these species we wish by the first and last to commemorate the services to science of Mr. Sauzier; while the *Astur*, being in all probability identical with that recognized but left unnamed by Professor Milne-Edwards, may be appropriately dedicated to him.

Of birds previously distinguished we have now for the first time the following parts:—

Didus ineptus.—Atlas, Prepelvic or "intermediate" (18th) Vertebra, complete Pubic Bones, and Metacarpals.

Lophopsittacus mauritianus.—Sternum, Femur, Metatarsus, besides Lower Jaw far larger than that first described.

Aphanapteryx broecki.—Skull with Upper Jaw, third Cervical Vertebra, Pelvis, Humerus, Femur[1].

Fulica newtoni.—Cervical Vertebræ (third and ninth or tenth), Sternum, Sacrum, Humerus, Ulna, and Femur[1].

[1] There is a large series of tibiæ (39 right and 50 left), which must belong to one or the other of these two species, but except in a few cases it is impossible to distinguish between them.

One specimen at least of each of the bones now first described has been kindly presented by Mr. Sauzier, on behalf of the Commission of which he is President, to the Museum of the University of Cambridge, as well as a series of other bones in proportion to the extent of the collection. The remainder, including a magnificent skeleton, which has been mounted in that Museum and is doubtless the most complete in the world, of *Didus ineptus*, will be ultimately deposited in the Museum of Mauritius at Port Louis.

This memoir will be published entire in the 'Transactions.'

The following papers were read:—

1. Descriptions of two new Mammals from New Guinea. By the Hon. Walter Rothschild, F.Z.S.

[Received November 1, 1892.]

In the face of the very exhaustive and explicit paper by Mr. Oldfield Thomas in the Proceedings of the Zoological Society for 1885, I should not venture to lay before the Society a description of a new Monotreme of the subfamily Echidnidæ, if I were not backed up by such an eminent zoologist as Dr. Günther. The latter agrees with me that, as we have so little real knowledge of the habits and distribution of the Monotremata, it is advisable to treat each form as a distinct geographical race until such time as we have a complete knowledge of all the forms and their exact geographical distribution.

1. Proechidna nigro-aculeata, sp. nov.

From having had the specimen here described alive I was able to make a much more careful examination of it than if it had been a dried skin.

It differs from *Pr. bruijni* in its much larger size, extremely robust limbs, and much shorter claws. Another great point of difference lies in the hair, for while *Pr. bruijni* is covered with dense woolly brown hair, in which are imbedded the few and scattered spines, in the form before us the hair is long, bristly, and very sparingly sprinkled over the body, the legs being almost bare. In the new form the spines are almost as numerous as in *Echidna aculeata*, but are of great length and thickness and of a horny black colour; while in *Pr. bruijni* they are very few in number, short, thin, and of a pure white colour.

In *Pr. bruijni* the claws are solid and much longer than in *Pr. nigro-aculeata*, the middle claw of the fore foot being $1\frac{1}{4}$ inch long, while that of *Pr. nigro-aculeata* measures only $\frac{3}{4}$ of an inch.

In addition to this, all the claws of *Pr. nigro-aculeata* are much broader and considerably hollowed out on the under surface. Lastly, *Pr. nigro-aculeata* has a much longer and stouter tail than *Pr. bruijni*.

Total length of *Pr. nigro-aculeata*, measured in the flesh, 31 inches, while Gervais gives as the greatest length of *Pr. bruijni* 24 inches.

Hab. Charles Louis Mountains, Dutch New Guinea.

I append here for reference the habitats of the other two described forms of *Proechidna* :—

Pr. bruijni and its varieties *P. villosissima* and *P. leucocephala*: Arfak Mountains, Dutch New Guinea.

Pr. novæ-guineæ: Finisterre Mountains, German New Guinea.

2. ACROBATES PULCHELLUS, sp. nov.

I venture to think that this discovery of the late A. Bruijn's will prove of extreme interest to zoologists as adding a second species to a genus hitherto represented by a single form, and also as proving the much wider geographical distribution of a highly specialized genus.

This species differs from *Acrobates pygmæus* of New South Wales in its more purplish-brown colour, its broader and more robust head, much shorter tail, and comparatively smaller body. On the ventral surface it is much whiter than *A. pygmæus*, and the whole of the throat and sides of the lower jaw are pure white, while in *A. pygmæus* they are yellowish grey. Round the eyes and reaching almost to the nostrils is a blackish-brown patch. Ears rather smaller than in *A. pygmæus*. Tail in *A. pulchellus* 2¼ inches long, while in *A. pygmæus* it is 3⅓.

Hab. One of the small islands in Northern Dutch New Guinea.

2. On Mammals from Nyassaland.

By OLDFIELD THOMAS, F.Z.S.

[Received August 20, 1892.]

By the kindness of Mr. Sclater I have been entrusted with the examination of the fine series of Mammalia sent home to him by Mr. H. H. Johnston, C.B., F.Z.S., Consul-General of Mozambique and H.M. Commissioner for Nyassaland, under whose auspices they were collected by Mr. Alexander Whyte, F.Z.S., a trained naturalist and collector on Mr. Johnston's staff, who is engaged in investigating the fauna and flora of Nyassaland. It is impossible to speak too highly of the scientific energy and public spirit of Mr. Johnston in thus furthering our knowledge of the natural productions of the region which he is called upon to govern—conduct very greatly in contrast to that of many Englishmen in official positions, who, under the name of sport, exterminate the native fauna of many most interesting localities, without a thought either for the needs of science at large or for those of their own National Museum in particular. Of the specimens now sent home a full set is presented by Mr. Johnston to the Museum, as is also the case with the birds, reptiles, and animals of all classes, as well as with the plants which he has been instrumental in getting collected for the benefit of science.

Mr. Whyte, the actual collector, also deserves special mention for the energy with which he has carried out the work entrusted to him and for the care and attention which he has devoted to the preservation of the specimens.

The region from which the present collection is derived is what is called the "Shiré Highlands," some of the specimens coming from Zomba, where the British Consulate is, some 20 miles to the west of Lake Shirwa, at an elevation of 2971 feet above the sea-level; and others, in fact the majority, from the Milanji range of mountains, about the same distance to the south of the lake, and some 40 or 50 miles from Zomba. To this range Mr. Whyte made a special exploring expedition in October and November 1891, and he has given a general account of the physical features of the range, and its fauna and flora, in the Parliamentary report quoted below [1].

As might be expected from a collector of Mr. Whyte's experience, all the skins are carefully labelled with the exact locality, date, and altitude, and the same was the case with the spirit-specimens; but by an unfortunate accident, before these latter came into my hands, the labels became separated from the bottles, so that the exact details about them were lost. All, however, are either from Mt. Zomba or Mt. Milanji.

The species are of course, as a whole, very similar to those obtained by Prof. Peters in his famous exploration of Mozambique, and described by him on his return to Berlin [2]. They are, however, by no means of less value on this account, for the more our knowledge of local variation extends, the more we need to have specimens obtained at or near the localities explored by the earlier collectors. Of actually new species there are none in the present instalment, but there is little doubt that, as Mr. Whyte's knowledge of the locality increases, he will be able to obtain the rarer and more local species, and among these there are certain to be some novelties. One animal, however, in the present collection, the Pallah, is so different from the ordinary specimens as to need a new subspecific name, and the same may prove to be the case with some of the other antelopes of the highlands of Nyassaland.

1. Felis pardus, L.

a. Ad. sk. and skull. ♂. Milanji. 4/11/91.
b. Ad. sk. and skull. ♀. Milanji. 4/11/91.
c. Young skull. Milanji. 1/92. "Young leopard-cub about 2 months old."

a. "Male Leopard, full-grown adult, shot at the base of Milanji mountain, B.C.A., 4 days' march from Zomba, on 4th November, 1891. Dimensions: 6 ft. 10 in. long in flesh, not stretched, and 2 ft. 7 in. at shoulder, and weighing 140 lbs. Colour normal-fulvous with black rosettes and spots. The occipital ridge for attachment

[1] Africa No. 5. Papers relative to the suppression of Slave-raiding in Nyassaland, p. 15 (1892). See also 'Nature,' vol. xlvi. p. 482 (15th Sept. 1892).
[2] Reise nach Mossambique, Säugethiere, 1852.

of muscles of jaw is exceptionally prominent, I think—much more so than is usually the case. This animal killed a donkey (full-grown) by attacking it in *the flank* and disembowelling it. The head and neck did not have a single claw-mark on them. This is a most exceptional case, and I do not think I ever heard before of a Leopard killing its prey otherwise than by springing on the head and neck.

"Another most unusual occurrence in this case was that the Leopard returned to the carcass and was shot dead on the third night, after having been wounded on the chest the second night with a charge of small shot, which was afterwards found under its skin."—*A. Whyte.*

The basal length of the skull of the old male is 207 mm., and its breadth 148 mm. The length of the cub's skull is 87, and of its long $\underline{mp}^3$ 19 mm.

2. Hyæna crocuta, Erxl.

a. Ad. skull. ♀. Milanji. 5/11/91.
b. Imm. sk. and skull. Milanji. 5/11/91.

a. "2 ft. 10 in. in height at shoulder and 150 lbs. in weight. Mangy and sparsely covered with short hair; colours dull. Shot over carcass of donkey killed by Leopard two days previously."

b. "Three parts grown Spotted Hyæna, shot near same carcass. Same species as *a*, but with fine long hair, and colours well defined, looked quite a different species but proved only to differ in being younger and in finer felt."—*A. W.*

Skull *a* is 241 mm. in basal length, and 179 in breadth.

3. Petrodromus tetradactylus, Peters.

a. Zomba. 1/9/91.
b. Zomba.
c. Ad. al. ♂.

4. Vesperus megalurus, Temm.

a. Ad. sk. Milanji Plain, 4000 ft. 18/12/91.
b, *c*. Ad. sks. Zomba. 10/12/91 and 1/2/92.
d–*o*. 3 ad. ♀ and 9 young in al. Forearms of adults 47·3, 47·5, and 48·5 mm.

This rare species was unrepresented in the Museum collection when the Catalogue of Bats was published, but a single specimen of it procured by Dr. Dobson in the Drakenberg Range, Natal, was obtained from that gentleman in 1881.

5. Vesperugo nanus, Peters.

a. Ad. al. ♂.

6. Sciurus mutabilis, Peters.

a, *b*. Milanji Plateau, 6000 ft. 27/10 and 25/11/91.

These two specimens are of considerable interest and value as helping to clear up the confusion which surrounds the relationship of *S. shirensis*, Gray [1], to *S. mutabilis*.

[1] Ann. Mag. N. H. (3) xx. p. 327 (1867).

Firstly, they prove conclusively that the latter species has a seasonal change of colour, the two coats being the one a grizzled rufous and the other a grizzled grey. Peters's type, as figured by him, was a changing specimen with the anterior half of the body grey and the posterior rufous. Specimen *a* is in very much the same state, and in my opinion unquestionably belongs to the same species. From the relative lengths of the two sorts of fur, it is evidently changing from the rufous to the grey phase, and the latter is therefore obviously the summer form. In specimen *b*, killed a month later, the change has gone a little further, the grey fur having become as long as the rufous, while the latter has much decreased in area; the hairs on the centre of the back are deep black to their roots.

Of the three co-types of *S. shirensis*, Gray, one, young, is in the rufous state, except that its extremities are grey, but the two adults are both wholly in their grey coats. They are, however, quite uniform in colour, and have no black patches on their backs. All the specimens examined have one premolar only in the upper jaw, although Peters's type was said to have two, and on this account *S. mutabilis* and *S. shirensis* were kept apart in Dr. Jentink's monographs of the African Squirrels [1].

My own conclusion is that the new Nyassa specimens, with one premolar, are certainly *S. mutabilis*, a determination which destroys the importance of the presence or absence of the extra premolar in this form, and then, this character being gone, that there is nothing to separate the two forms but the black dorsal patches of *mutabilis*, and that as to these we must be content to wait until further specimens prove them to be due either to individual variation, to advanced age, or to genuine specific distinction. But the fact that the types of *S. shirensis* came, as their name implies, actually from the River Shiré is strongly in favour of their specific identity with Mr. Johnston's Nyassa examples.

7. Sciurus palliatus, Peters.

a, *b*. ♂ ♀. Milanji Plateau, 6000 ft. 29/10/91.
c. ♂. Milanji Plateau, 6000 ft. 2/11/91.

8. Otomys irroratus, Brants.

a. Ad. al. ♀.

Like specimens of this species collected by Mr. Jackson in Mianzini [2], Masailand, this individual has a molar lamina-formula of $\frac{3-2-7}{4-2-2}$.

9. Gerbillus (Tatera) afer, Gray (?).

a–*d*. 4 in al.

The South African species of the subgenus *Tatera* are so little

[1] N. L. M. iv. p. 18 (1882). Dr. Jentink, however, implies that some doubt exists as to the skull in Peters's type-skin really belonging to it.
[2] See P. Z. S. 1891, p. 184.

known, and show such extremely slight differential characters, that it is at present almost impossible to say whether *G. afer*, Gray, *G. montanus*, Smith, *G. leucogaster*, Peters, *G. boehmi*, Noack, and *G. validus*, Boc., are all or any of them worthy of specific distinction. Much larger series from different localities will be needed before it is possible accurately to work out this difficult group, and in the meanwhile I use the earliest name available. In any case these Nyassa specimens are so closely allied to the ordinary South African Gerbille that little doubt can exist as to their specific identity with it.

10. Cricetomys gambianus, Waterh.

a, *b*. 2 yg. al. ♀.

11. Mus rattus, var.

a. Ad. sk. Milanji Plain, 4000 ft. 25/10/91.
b–*d*. In al.

One of the numerous brown tropical varieties of the common *Mus rattus*.

12. Mus dolichurus, Smuts.

a, *b*. Ad. and imm. sk. Zomba. 8/8/91.

These specimens represent, of course, Peters's *M. arborarius*, which, as already mentioned[1], I cannot distinguish specifically from *M. dolichurus*. As this long-tailed Tree-Mouse seems to be rare throughout its wide range, these examples are very welcome accessions to the Museum collection.

13. Mus natalensis, A. Sm.

a. Ad. sk. Zomba. 19/1/92.
(?) *b*. Zomba. 17/9/91.
c–*e*. 3 in. al.

This appears to be the *Mus microdon* of Peters.

14. Mus musculus, L.

a, *b*. 2 in al.

The fur of these specimens is rather crisp and spiny, and it may be that when the *musculus* group is worked out in detail the South African form will require a distinct name. One of Sir Andrew Smith's specimens in the Museum is also similarly spiny, and belongs no doubt to the same race. All the essential characters, including the skull and teeth, are quite as in normal *M. musculus*.

15. Mus (Leggada) minutoides, A. Sm.

a–*e*. 10 in al.

These specimens represent, of course, Peters's *Mus minimus*, synonymous, as I believe, with Smith's previously described species.

[1] P. Z. S. 1891, p. 186.

16. Isomys dorsalis, A. Sm.

a. Ad. al. ♀.

It appears on the whole more convenient to recognize *Isomys* as a genus distinct from *Mus*, as it unquestionably is a natural group, and no species really intermediate between the two are known. Trouessart's *Lemniscomys* I include, of course, with *Isomys*, as, apart from the small value of striation as a generic character, certain of the species (e. g. *I. abyssinicus* and *I. variegatus*) are quite intermediate even in this character.

17. Isomys pumilio, Sparrm.

a–*e*. 5 ad. sk. Milanji Plateau, 6000 ft. 27/10/–2/11/91.

"The common Rat of the Milanji Plateau, 6000 feet; has a metallic chirp very similar to the Warblers or Tailor-birds of Ceylon, and I was sure at first that the noise came from a bird."—*A. Whyte*.

These specimens, although rather smaller and more brightly and definitely marked, may be fairly assigned to the typical Cape *I. pumilio*; but the same cannot be said of some other specimens hitherto referred to that form, which these beautiful specimens have enabled me more carefully to examine and compare, and which I now consider to represent two distinct subspecies, and may take this opportunity of describing.

The first is a northern form, based on two specimens taken much further north than the species was otherwise known to occur, namely in Masailand, near Lake Naivasha. It may be called—

Isomys pumilio diminutus, subsp. n.

Size decidedly smaller, and tail shorter, than in typical Cape examples. Ground-colour of body strongly suffused with yellowish orange, especially on the rump. Inner surface of ear rich fulvous, and a tuft of similarly-coloured hairs at the anterior base; anterior margin of outer surface shining black, as usual. Dorsal lines fairly distinct, the lighter ones pale greyish white, the median and the lateral of much the same tone. Tail, as usual, blackish brown above, yellowish white on the sides and below.

Dimensions of the typical skin.—Head and body 94 mm.; tail 62; hind foot 20·2.

Hab. Mianzini, just east of Lake Naivasha, Masailand.

Coll. F. J. Jackson. August, 1889.

The second subspecies is an inhabitant of Bechuanaland, Central South Africa, and its colour peculiarities are those characteristic of the desert representatives of striped forms in all parts of the world:—

Isomys p. bechuanæ, subsp. n.

Size large; feet and tail much elongated; the latter nearly twice as long as in *I. p. diminutus*. General colour sandy or fawn-grey,

the dorsal stripes nearly obsolete, only just distinguishable. Ears partaking of the general pallor, the anterior margin of their outer surface pale rufous instead of shining black, and their inner surfaces pale fawn. Upperside of tail scarcely darker than on the sides and below.

Dimensions of the typical skin (approximate).—Head and body 128 mm.; tail 118; hind foot 26·5.

Hab. Bechuanaland.

18. GOLUNDA FALLAX, Peters.

a. Ad. al. ♂.

This species bears such a close resemblance to the Indian *G. ellioti*, Gr., that it is very difficult to distinguish it. It appears, however, constantly to have only five posterior sole-pads as compared to six in its Asiatic ally.

19. DENDROMYS MESOMELAS, Bts.

a–f. 6 in al.

20. MYOSCALOPS ARGENTEO-CINEREUS, Peters.

a. Ad. sk. Zomba

b–e. 4 yg. sks. Milanji Plain, 4000 ft. 17–19/10/91.

f–n. 9 ad. & yg. al.

While there cannot be the smallest doubt that these specimens really belong to Peters's species, it is an extraordinary fact that not even the largest of them has more than four cheek-teeth in place, the number characteristic of *Georychus* rather than of *Myoscalops*, so that it is difficult to understand under what circumstances the extra teeth are produced. Whether they are only formed in some individuals and not in all, or, as is more probable, are only developed in extreme old age, I am at present unable to decide. Specimens abnormally larger than the general average should be sought for by those having the opportunity, so that this most interesting point may be settled.

The colour of the fur in the adult, or at least nearly adult, skin *b*, confirms my doubtful identification[1] of Emin Pasha's Mandera specimens with Peters's species, for while the present animal is unquestionably, from its locality, *M. argenteo-cinereus*, its colour agrees precisely in tone with that of Emin's specimens, and it is equally different from that of Gray's *G. pallidus*, the peculiar pale colour of which still remains to be explained.

Little variation is presented by the different specimens except in the case of the frontal white spot, which varies from 4 or 5 mm. in diameter to *nil*. The young specimens are, as usual, nearly wholly slaty grey, the buff tips to the hairs being a later product.

[1] P. Z. S. 1890, p. 448.

21. AULACODUS SWINDERENIANUS, Temm.

a. Ad. sk. Milanji Plain, 4000 ft. 29/10/91.

22. PROCAVIA CAPENSIS, Pall.

a. Imm. sk. Milanji Plain, 4000 ft.. 27/10/91.

The present is by far the most northern locality hitherto recorded for this species, as, so far as I know, it has not previously been described as occurring north of Natal. The specimen is unfortunately young, and therefore the determination is to some extent doubtful; but at the same time the rudiments of the dorsal spot, just appearing, are black, and the teeth are decidedly of the hypsodont nature characteristic of *P. capensis* and its allies. Adult specimens of this Nyassa Hyrax would be of value in order to prove whether there is or is not any geographical difference between it and its Cape ally.

23. BUBALIS LICHTENSTEINI, Peters.

a. Ad. sk. and skull. Zomba. 18/1/92.

24. OREOTRAGUS SALTATOR, Bodd.

a. Imm. sk. ♂. Zomba Plateau, 5000 ft. 1/2/92.

A remarkably brilliant yellow-coloured specimen.

25. ÆPYCEROS MELAMPUS JOHNSTONI, subsp. n.

a. Ad. sk. and skull. ♂. Zomba. 15/1/92. *Type* of subspecies.

b. Ad. sk. and skull. ♂. Zomba. 17/1/92.

A local race of the common Pallah distinguished by its slenderer skull and much shorter horns.

Height, judging from the length of the skull, probably nearly equal to that of the typical Pallah, but the build, judging from the form of the same part, probably much lighter and more slender.

Colours apparently precisely as in typical South African *Æ. melampus*; no darker markings on face.

Horns conspicuously shorter than in the typical race, but otherwise very similar to them in structure and curvature, and with about the same number and arrangement of the rings. The amount of the differences in size is brought out in the comparative table of measurements (see p. 554); from it will be seen that the extreme length of the horn in *Æ. m. johnstoni* is barely more than once and a half the basal length of the skull (157 to 100), while in *Æ. m. typicus* the same dimension is considerably more than twice the skull length (219 to 100).

Skull of about the same length as in the typical form, but decidedly narrower (see table), especially in the frontal region, and with the part just in front of the orbits more compressed at the sides, so that the transverse diameter at this point is decidedly less than on the muzzle above the molars, the two diameters being approximately equal in the ordinary race. Palate narrow.

Comparative dimensions of the typical skull and horns of the new race, and of a representative skull, of about the same age, of the true *Æ. melampus*, collected by Burchell at Latakoo, Bechuanaland, in 1812.

Skull.	*Æ. m. typicus.* mm.	*Æ. m. johnstoni.* mm.
Basal length	260	255
Greatest breadth (at back of orbits)	127	113
Interorbital breadth	87	74
Least breadth of muzzle just anterior to orbits	74	60
Greatest breadth of muzzle just above the junction of m^1 and m^2	75	69·5
Palate, least breadth between alveoli of anterior premolars	34	29

Horns.	mm.	in.	mm.	in.
Length round curves behind	569	= 22·5	402	= 15·9
Length in a straight line from base to tip	477	= 18·9 [1]	338	= 13·4
Greatest spread measured on the inner side of each horn	390	= 15·3	250	= 9·85
Distance from tip to tip	315	= 12·4	250	= 9·85

The skull and horns of specimen *b*, rather younger, with the horn-tips less worn, practically agree with the above-given measurements in every way.

The discovery of this interesting animal is somewhat of a surprise, for as the true Pallah is found over nearly the whole of Africa south of the Equator, varying but very slightly in the size of its horns, one would hardly expect to find so distinct a race inhabiting Nyassaland, in the centre of the known range of the species. However, the marked difference in the size of the horns, which must result in a very different general appearance, combined with the great slenderness of the head, appear certainly to necessitate the separation of the Nyassa Pallah as a distinct subspecies, if not as a distinct species, from the true one, and this conclusion is fortified by the entire agreement with each other of the two specimens sent. That chosen as the type is rather aged, with worn teeth and horn-tips, while the second, *b*, although younger, has fully adult horns, as is shown by the character of their basal rings.

I have connected with this beautiful Antelope the name of Consul-General H. H. Johnston, the Governor of the district, and the donor of the magnificent collection of Nyassa animals described in the present series of papers.

26. Cephalolophus grimmi, L.

a. Head. Zomba. 10/1/92.

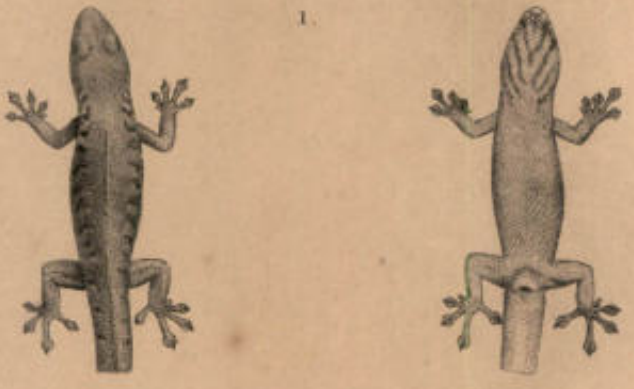
27. Manis temminckii, Smuts.

a. Imm. sk. Blantyre. 1/1/92.

[1] What sportsmen term "good heads" have this measurement 20 or 21 inches (Selous and Willoughby).



1.

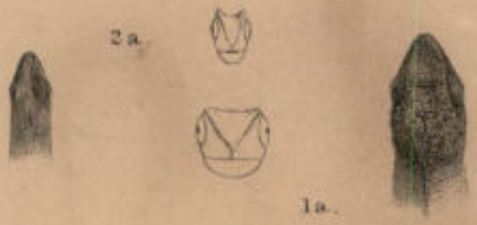




2.

P. Smit. del. et lith. Mintern Bros. imp.

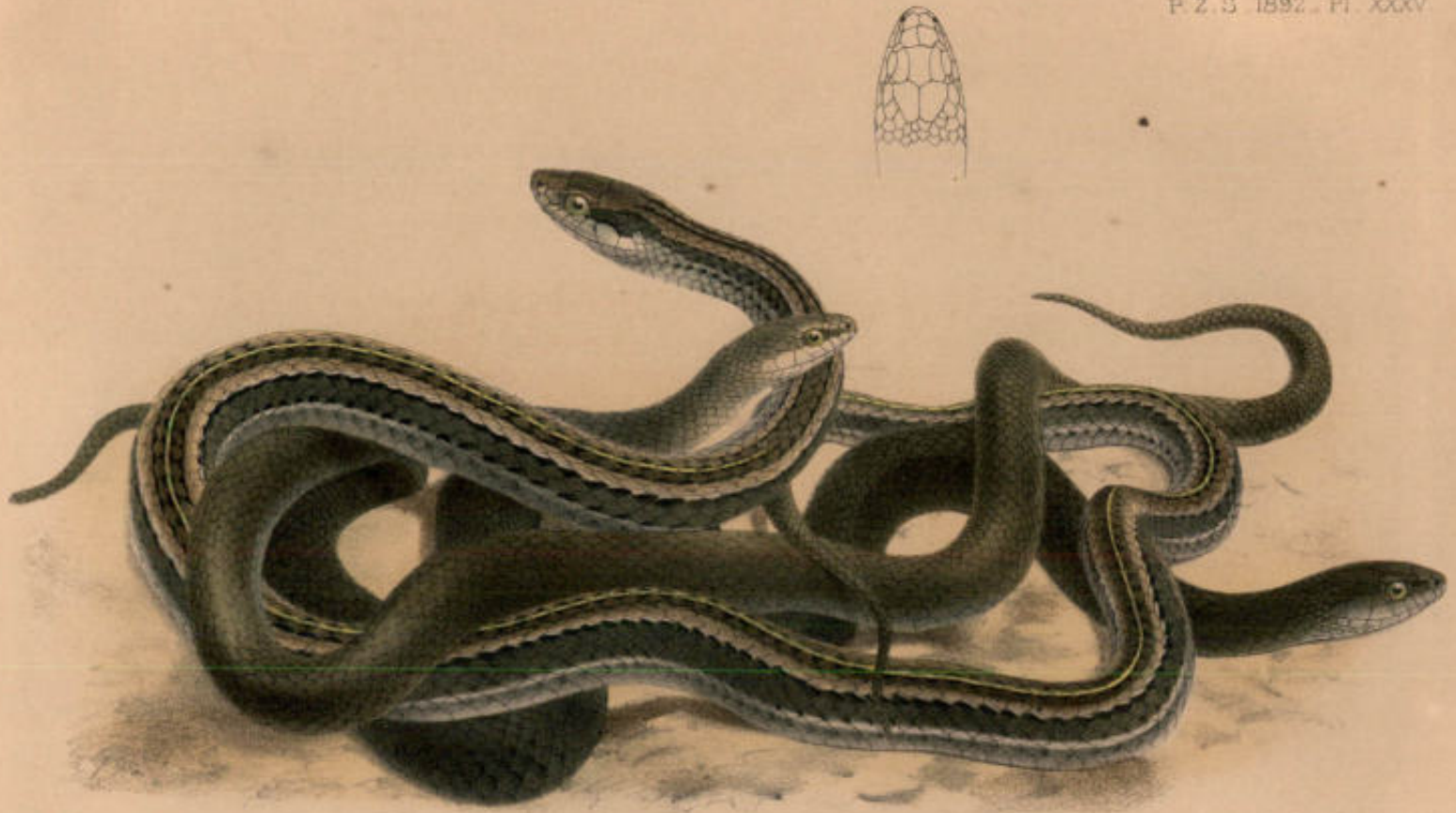
1. LYGODACTYLUS ANGULARIS. 2. CHAMÆLEON ISABELLINUS.





P. Smit. del. et lith. Mintern Bros. imp.

1. RHAMPHOLEON PLATYCEPS. 2. RHAMPHOLEON BRACHYURUS.



Peter Smit. del. et lith.

Mintern Bros. Chromo. Lith.

PSAMMOPHYLAX VARIABILIS.

3. Report on a Collection of Reptiles and Batrachians transmitted by Mr. H. H. Johnston, C.B., from Nyassaland. By Dr. A. Günther, F.R.S., V.P.Z.S.

[Received November 1, 1892.]

(Plates XXXIII.–XXXV.)

Acting under instructions from Mr. H. H. Johnston, C.B., F.Z.S., Mr. Sclater has sent to the British Museum a series of specimens of Reptiles and Batrachians collected by Mr. Alexander Whyte, F.Z.S., the naturalist attached to Mr. Johnston's staff, in the Shiré Highlands south of Lake Nyassa, principally upon Mount Zomba and Mount Milanji.

Mr. Johnston has directed that the first set of these specimens, after they are determined, shall be deposited in the National Collection.

The present consignment consists of 90 specimens. These are referable to 12 species of Lizards, viz.: *Mabouia varia*, Ptrs.; *Mabouia quinquetæniata* (Licht.); *Sepsina tetradactyla* (Ptrs.); *Agama atricollis* (Smith); *Agama mossambica* (Ptrs.); *Agama kirkii* (Blgr.); *Lygodactylus capensis* (Smith); *Lygodactylus angularis* (sp. n.); *Chamæleon dilepis* (var. *Ch. parvilobus*, Blgr.); *Chamæleon isabellinus* (sp. n.); *Rhampholeon platyceps* (sp. n.); *Rhampholeon brachyurus* (sp. n.).

Ten species of Snakes are represented, viz.: *Typhlops obtusus* (Ptrs.); *Uriechis capensis* (Smith), probably = *U. nigriceps* (Ptrs.); *Psammophylax variabilis* (sp. n.); *Homalosoma lutrix* (L.); *Ahætulla irregularis* (Leach); *Leptodira rufescens* (Gm.); *Lycophidium horstockii* (Schleg.); *Boodon lineatus* (D. B.); *Causus rostratus* (Gthr.); *Clotho arietans* (Merr.).

Five species of Batrachians are represented, viz.: *Rana fasciata* (Tschudi); *Rana nyassæ* (sp. n.); *Bufo regularis* (Reuss); *Breviceps mossambicus* (Ptrs.); *Scolecomorphus kirkii* (Blgr.).

The majority of these Reptiles and Batrachians, although previously known from other parts of Central and Eastern Africa, are new to our knowledge of the Reptilian Fauna of the Nyassa district. This knowledge is extremely scanty[1], and embraces, even with the aid of the present consignment, only a small fraction of the actual number of species that must inhabit a district apparently so favourable to the development of Reptilian life. As we may shortly expect further consignments, it would be premature to attempt a comparison of this fauna with those of other parts of Tropical Africa, and I proceed at once to the description of the new forms.

Lygodactylus angularis. (Plate XXXIII. fig. 1.)

Head, body, and particularly the tail depressed; snout obtusely

[1] As will appear from a perusal of three papers, two by the author in Proc. Zool. Soc. 1864, p. 303, and in Ann. & Mag. N. H. ser. 6. i. p. 322 (1888), and one by Mr. Boulenger in Proc. Zool. Soc. 1891, p. 305.

narrowed in front, nearly twice as long as the eye, and longer than the distance between the eye and the small ear-opening. Rostral broad; nostril opposite to the suture between the rostral and first labial; upper labials seven or eight; mental broad, but not extending backwards to the posterior margins of the first pair of lower labials, which are separated from each other by a pair of small scutes. Digits and toes very unequal, free; the first digit and toe very short, but provided with a claw. Seven præanal pores disposed in a chevron-shaped line. Tail with a median series of enlarged scutes below. Brown, above marbled with darker; sides of the thorax with alternate yellow and black spots; white below, throat with three or four concentric V-shaped blue lines, the angles being directed backwards.

Length of body and head	38 millim.
„ head	9 „

Tail mutilated.
One specimen.

CHAMÆLEON ISABELLINUS. (Plate XXXIII. fig. 2.)

This species belongs to the *dilepis*-group of the genus, being distinguished by the large scutes of the occipital flaps and of the occiput.

Casque slightly raised posteriorly; parietal crest low, but distinct; distance between the commissure of the mouth and the extremity of the casque considerably longer than the length of the mouth; lateral crest very distinct. Interorbital space rather concave. Occipital lobes large, elongate, covered with flat scutes in three longitudinal series; also the scutes on the crown are flat, not tubercular. Granules of the body homogeneous; a dorsal and gular-ventral crest. Tail at least as long as the body. Of an isabelline colour, with a white straight band from the axil towards the groin, and with a similar shorter, interrupted band above it.

Total length	6½ in.
Length of tail	3¾ in.
Distance of end of snout from end of parietal crest	1 in.
Width of interorbital space	4½ lines.

RHAMPHOLEON PLATYCEPS. (Plate XXXIV. fig. 1.)

Beside the additional cusp on each claw, neither the fingers nor the toes are provided with a spine. Body finely granular, with scattered slightly enlarged tubercles. The upper side of the head and the interorbital space are flat, granular, with a transverse series of somewhat larger granules crossing the interorbital space, and another crossing the temple; another starts from each side of the crown, and converging and meeting its fellow behind the occiput at a very acute angle is lost on the back; pairs of very small tubercles are placed at regular distances along the vertebral line. Tail (lost by accident) was probably as long as or perhaps shorter than that of

Rh. kerstenii. Colour uniform greyish; anterior half of the head black.

One adult female specimen 2 inches long, without tail.

RHAMPHOLEON BRACHYURUS. (Plate XXXIV. fig. 2.)

Beside the additional cusp on each claw, neither the fingers nor the toes are provided with a spine. Body finely granular, with scattered, slightly enlarged tubercles. The *interorbital space is rather deeply concave*, without transverse series of tubercles; crown of the head compressed, with a raised line on each side, the two lines converging, and meeting at a very acute angle in the vertebral line, where they are lost. A raised line or fold of the skin crosses the temple and is continued along the middle of the side of the body to the root of the tail. Tail very short, not prehensile, shorter than the lower leg with the toes. Light yellowish, with a straight brownish band running along the middle of the side below the raised line; two other, narrower and less dark bands run parallel to the former, above and below it. Upper edge of the tail sharp and of a yellow colour.

Total length	40 millim.
Tail	6 „

Two female specimens, both young, the smaller only 28 millim. long.

PSAMMOPHYLAX VARIABILIS. (Plate XXXV.)

In general habit similar to *Psammophylax rhombeatus*, but with the coloration of a *Psammophis*.

Vertical shield rather elongate, with slightly concave lateral margins, longer than the two frontals together and as long as the occipital. Rostral reaching to the upper surface of the head; loreal square; anteocular single, large, extending to the upper surface of the head, but not, or but barely, reaching the vertical. Two postoculars. Two pairs of chin-shields, the anterior in contact with five lower labials. Eight upper labials, the fourth and fifth entering the orbit. Temporals small, generally one in front and in contact with both postoculars, the succeeding temporals rather irregularly disposed. Scales in 17 rows. Ventrals 157 or 169; anal bifid; subcaudals 57 or 55.

Ground-colour an olive-brown; body with straight bands produced by a somewhat different shade of the ground-colour, and bordered by narrow black or white lines: one of these bands starts from the occiput and occupies the middle of the back, another from behind the eye and runs along the side of the body. The vertebral series of scales is black, each with a yellow central line; the fifth outer series of scales is likewise black, but the yellow line occupies the upper margin of each scale. A greenish-white line runs along the meeting edges of the two outermost series of scales. Upper part of the head uniform brown; upper labials greenish white; lower parts greenish.

This is the coloration of two specimens; a third is uniform greenish olive. This specimen has also two small temporals in front and in contact with the postoculars. Ventrals 163; subcaudals 60.

Another variety, also represented by a single specimen, is uniform black above, lower parts dull greenish. Ventrals 162; subcaudals ca. 44 (tail slightly mutilated).

Total length 24½ in., of which the tail takes 5 and the head ¾ in.

RANA NYASSÆ.

Vomerine teeth in two nearly straight, or slightly oblique series between the hinder part of the small choanæ. Snout moderate, rather pointed; tympanum two thirds of the area of the eye. Fingers slender, the two inner ones subequal; toes very slender, the fourth rather shorter than the distance between the vent and tympanum, two-thirds webbed. Subarticular tubercles almost absent; inner metatarsal tubercle small, short, no outer one. If the hind limb be carried forward along the body, the tibio-tarsal articulation reaches far beyond the snout. Skin of the back with numerous short, irregular, undulated folds, passing into small tubercles behind; abdomens mooth. Upper parts uniform blackish brown; abdomen whitish, largely marbled with dark brown; throat nearly entirely dark brown.

Length of body	.....	27 lines.
„ hind limb	.....	53 „
„ fourth toe	.....	17 „

One specimen.

4. On Zeuglodont and other Cetacean Remains from the Tertiary of the Caucasus. By R. LYDEKKER, B.A., F.Z.S.

[Received September 3, 1892.]

(Plates XXXVI.–XXXVIII.)

The specimens forming the subject of the present communication were brought from Russia by my friend Mr. A. Smith Woodward, to whom they had been lent by Prof. H. Sjögren, of Upsala, for the purpose of examination and description. They were obtained from a Tertiary deposit, in company with a number of fish-remains, in the Caucasus.

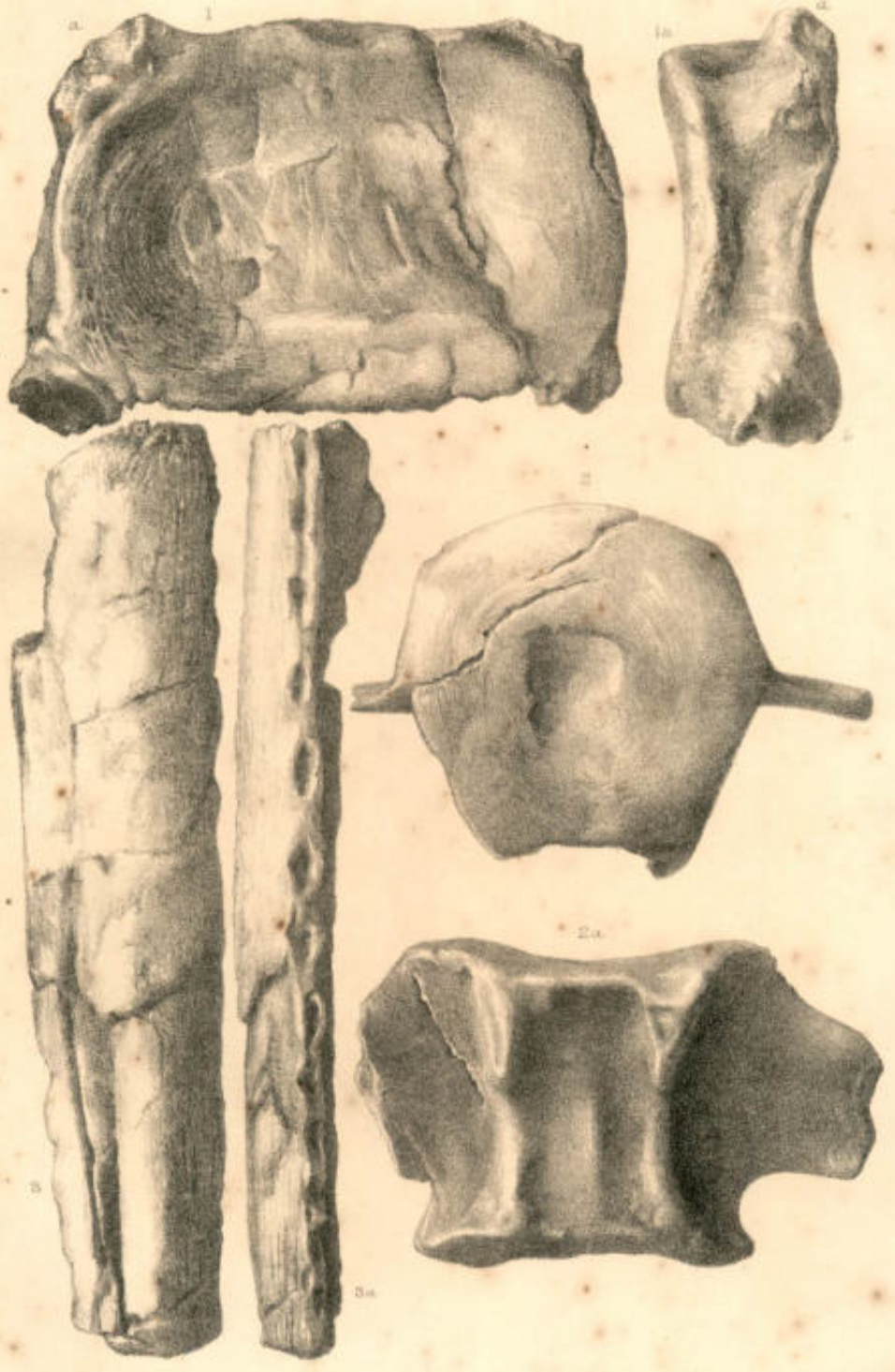
The bones are in a fine state of preservation, and before cleaning were coated with a clayey matrix, among which were numerous plates of selenite; the nature of the matrix thus suggesting a deposit very similar in character to our own London Clay. The specimens comprise several fragments of jaws, numerous more or less imperfect vertebræ, and a single humerus; all evidently belonging to Cetaceans (assuming that the Zeuglodonts are rightly included in that group). The vertebræ and jaws indicate that we have to do with



W.T.A.G.M. Woodward del. et lith.

West, Newman imp.

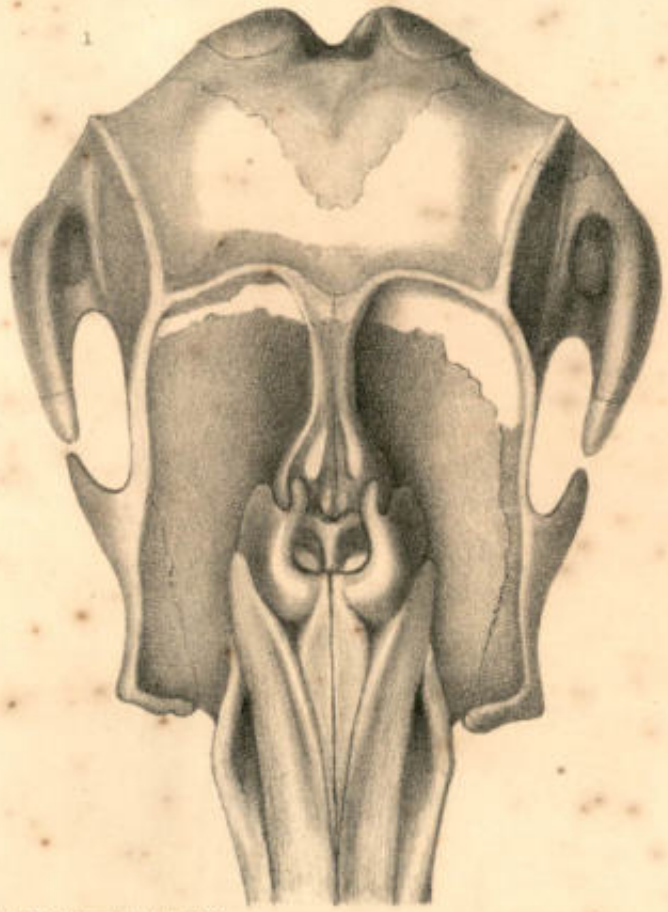
Cetacean Remains from the Caucasus.



E.C.&G.M.Woodward del.et lith.

West,Newman imp.

Cetacean Remains from the Caucasus.





F.C.A.G.M.Woodward del.et lith.

West,Newman imp.

Cetacean Remains from the Caucasus.

three distinct forms, one of which was a Zeuglodont, the second a more typical Cetacean of relatively small size, and the third a still smaller dolphin-like Cetacean. The Zeuglodont remains indicate a very small species.

In regard to the probable age of the deposit, it may be observed that although Zeuglodonts occur in America in the Middle Eocene, and in England in the lower part of the Upper Eocene (Barton beds), in Malta they are found in the Miocene, where one of the forms is of very small size. Moreover, since, with the exception of *Zeuglodon* and *Squalodon*, together with the problematical *Balænoptera* (?) *juddi*, Whales are unknown in the Eocene, while we have two distinct forms in addition to the *Zeuglodon* from these deposits, it might seem that the age of the latter is Miocene rather than Eocene. So far as it goes, the evidence of the *Zeuglodon* might be in favour of the same view, since such a small form as the one before us might well be one of the last waning representatives of its race.

With these preliminary remarks, I proceed to the consideration of the specimens themselves.

I. Zeuglodon caucasicus, sp. nov.

The Zeuglodont remains comprise the hinder part of a left mandibular ramus containing four teeth (Pl. XXXVI. fig. 1), another fragment of a jaw with five broken teeth, a left humerus (Pl. XXXVI. fig. 2), and an imperfect caudal vertebra (Pl. XXXVI. fig. 3).

The Zeuglodont nature of the figured jaw is shown by the teeth, in which the serrations are as fully developed on the anterior as on the posterior border, thus differentiating the specimen from the Squalodonts. The jaw is relatively deeper than in the so-called *Zeuglodon hydrarchus*[1] of North America, but the chief peculiarity of the specimen is its small size, which at once distinguishes it from the American form.

The humerus (Pl. XXXVI. fig. 2) agrees in relative size with the jaw, its total length being only 4·4 inches, whereas the corresponding bone of *Z. hydrarchus* preserved in the Museum at Haarlem measures 8·6 inches[2]. In character both specimens agree very closely, although the European example is distinguished by the greater development of the deltoid crest (*d*), the more oblique form of the head (*h*), and the less upward extension of the great tuberosity (*t*); the upward extension of this tuberosity in the Caucasian specimen is, however, at least partly due to the effect of crush. Both bones are distinguished by the large size of the head, the compressed form of the

[1] Dames and Gaudry regard this form as the female of the larger *Z. cetoides*, but Cope (Amer. Nat. 1890, p. 602), who alludes to it as *Z. brachyspondylus*, considers that it may belong to a distinct genus—*Doryodon*. That genus is typically represented by the small *Doryodon pygmæus*, Leidy.

[2] There is a cast of this bone in the British Museum.

shaft, and the circumstance that the radius and ulna articulated to the distal end by means of two slightly convex facets set obliquely to each other, the one being anterior and the other posterior. It is quite evident that there was but little, if any, movement between the humerus and the radius and ulna, and that the whole limb formed a paddle strictly comparable to that of modern Cetaceans, although probably somewhat less specialized.

The peculiar structure of the humerus induces me to take this opportunity of making a few observations as to the systematic position of *Zeuglodon*. It will be remembered that in a recent memoir Prof. D'Arcy Thompson [1] has endeavoured to show that these animals, in place of being Cetaceans, have "the closest possible relation with the Pinnipedes." In that memoir the author has shown a wise discretion, from his point of view, in making no reference to the humerus. If that bone be compared with the humerus of a Seal it will be found that, beyond the fact that both have a strongly-developed deltoid crest, there is not the most remote resemblance between the two; the humerus of a Seal having condyles like those of any ordinary mammal. On the other hand, I submit, that between the Zeuglodont and Cetacean humerus there is a very pronounced general resemblance; both having a very large head, directed outwardly in the natural position, a more or less flattened shaft, and the distal end terminating in fore-and-aft facets for the radius and ulna. It is true that in the Zeuglodonts the head is relatively smaller, the shaft longer and more flattened, and the distal facets more rounded than in modern Cetaceans; while the latter have lost the distinct deltoid crest of the Zeuglodonts, and the two tuberosities have become confluent. These differences appear, however, to me to be precisely those which we should expect to meet with in a generalized form; and how it is possible to imagine that an animal with a humerus of this type, and a true paddle, in place of an ordinary fore limb, can have "the closest possible relation" with the Seals, passes my comprehension.

I do not propose to discuss all the points raised in Prof. Thompson's memoir, but it appears to me that several of the characters he refers to as distinguishing the Zeuglodonts from typical Cetaceans and allying them to the Seals are likewise merely generalized features. For instance, the presence of a large spine and a small coracoid process in the Zeuglodont scapula appear clearly to come under this category, for I think few will deny that the enormous coracoid of the ordinary Cetacean is an acquired and not an inherited character, and the loss of the spine is assuredly so. Then, again, the cervical vertebræ, with their elongated centra, small lateral canals, and approximated upper and lower transverse processes, although undoubtedly very like those of a Seal, appear to me to be merely another instance of the generalized characters of the Zeuglodonts. In confirmation of this I may mention that Prof. Cope [2] has recently figured the cervical vertebræ of an undoubted

[1] Stud. Mus. Dundee, vol. i. art. 9 (1890).
[2] Amer. Nat. 1890, p. 605, fig. 2.

Cetacean (*Priscodelphinus*) from the American Miocene, in which the vertebræ have much longer centra than ordinary, with the lateral canal small and nearly circular, and the roots of the transverse processes approximated. Indeed, Prof. Cope speaks of the Cetacean in question as having "a neck like that of a Seal in proportions."

I am therefore of opinion that, instead of being nearly allied to the Seals, *Zeuglodon* has much more the characters of a very generalized Cetacean; and that, if it should be found impossible to include it in the Cetacean order, it will have to form an order by itself.

Reverting to the consideration of the specimens from the Caucasus, I have to mention that I have merely figured the imperfect caudal vertebra represented in Pl. XXXVI. fig. 3, which I believe to be referable to *Zeuglodon*, in order to show its marked difference from the caudal vertebra represented in Pl. XXXVII. fig. 2.

With regard to the question of species, I have first of all to mention that the Caucasian Zeuglodont is certainly distinct from the larger American forms, and likewise from the Egyptian ones described by Prof. Dames [1], which may be specifically identical with the former. The Malta *Zeuglodon* has received no distinct name. Of other named forms, *Z. wanklyni*, Seeley [2], from the Barton beds, which is founded on an unfigured skull now not forthcoming, is sufficiently distinguished by its superior size—one of the teeth measuring $1\frac{3}{4}$ inch in length. *Z. vasconum*, Delfortrie [3], from the Eocene of France, is also a large species, founded upon the evidence of a tooth. There are also *Z. paulsoni*, Brandt [4], from the Eocene of Russia, and *Z. puschii*, Brandt [4], from that of Poland; both these were founded upon vertebræ, and appear to have been large-sized species. The other European form is *Z. vredense*, Landois [5], from the Eocene of Westphalia, but this is not sufficiently characterized to admit of its being at present regarded as a distinct species. *Kekenodon onomata*, Hector [6], from the Eocene of New Zealand, and *Zeuglodon harwoodi*, Sawyer [7], from the Eocene of South Australia, are both large species of *Zeuglodon*. The reference to *Doryodon pygmæus*, Leidy, from the Eocene of South Carolina, which would appear from its name to be a very small Zeuglodont, I have not been able to find.

Although I cannot be assured of the specific distinctness of the present form from the last-named species, yet, as it is inconvenient to allude to it without a separate name, I propose to call it provisionally *Z. caucasicus*, its distinctive character being its small size.

[1] Sitzber. Ak. Wiss. vol. vi. p. 130 (1883).
[2] Quart. Journ. Geol. Soc. vol. xxxii. p. 428 (1876).
[3] Act. Soc. Linn. Bordeaux, vol. ix. p. 115 (1873).
[4] Bull. Acad. St. Pétersbourg, vol. xix. column 246 (1874).
[5] Corresp. Nat. Hist. Ver. preuss. Rheinl. 1884, p. 49.
[6] Trans. N. Zeal. Inst. vol. xiii. p. 435 (1881).
[7] Proc. Linn. Soc. N. S. W. vol. v. p. 298 (1881).

II. Undetermined Cetacean.

(*? Platanistidæ.*)

The second species in the collection is represented by an associated series of four cervical, and the first dorsal, a lumbar, and a caudal vertebra; one of the cervicals being represented in Pl. XXXVII. figs. 1, 1 *a*, and a caudal in figs. 2, 2 *a* of the same. The vertebræ indicate a Whale of the approximate size of the existing Beluga, with the last four cervical vertebræ free and of moderate length, and the lumbars and caudals likewise of medium elongation. The form of both the cervical and caudal vertebræ shows that these specimens are not referable to *Zeuglodon caucasicus*. The cervical vertebræ are represented by their centra, with the roots of the transverse processes attached; the figured example having a width of 3·1 inches, a height of 2·2 inches, and an inferior length of 1 inch. The lumbar has a length of 2·3 inches, and a width of 2·6 inches across the anterior face of the centrum.

With regard to their affinity, it is clear, in the first place, that, as they belong neither to *Monodon* or *Delphinapterus*, they cannot be referred to any other existing genera of *Delphinidæ*, in all of which the first two cervicals are united, and the remainder extremely short, and generally more or fewer of them anchylosed. Free cervicals occur in the existing *Balænoptera*, *Megaptera*, and *Rhachianectes*, and the extinct *Cetotherium*. The small size of the specimens renders it, however, somewhat improbable that they belong to the *Balænidæ*; and to this it may be added that they differ in certain respects from those of *Balænoptera*. Moreover, we have no definite evidence of the occurrence of Baleen Whales in the Lower Miocene, to which it is quite probable that the Caucasian strata may belong.

The existing *Platanistidæ* and the numerous fossil forms referred by Prof. Cope to that family all have free cervicals, and, from the resemblance of the present specimens to some of the Miocene American representatives of that group described by that writer, I am inclined to think that they should be referred to the same family. The resemblance appears to be closest with the series of vertebræ figured [1] as *Ixacanthus*, and I am by no means certain that the Caucasian specimens do not indicate a member of the same genus, of rather larger size than its typical representative. Still, however, I do not propose to make any definite determination, leaving the matter with the expression of my opinion that the specimens probably belong to the *Platanistidæ*.

III. Iniopsis caucasica (*n. g. et sp.*).

The third Caucasian Cetacean is indicated typically by the hinder portion of a cranium, and also by some fragments of jaws and several vertebræ probably referable to the same form. It is much inferior in size to the preceding, and was of rather smaller dimensions than the existing *Inia*: that is to say, its total length was some six feet.

[1] Cope, Amer. Nat. 1890, p. 603, fig. 1.

The portion of the cranium is represented from the upper surface in Pl. XXXVIII. fig. 2, and, although somewhat crushed, is in a fair state of preservation. Alongside the Caucasian specimen there is represented (fig. 1) the corresponding portion of the cranium of an extinct Cetacean from the Tertiary of Argentina, described by Burmeister[1] under the name of *Pontistes rectifrons* (Bravard), which belongs to the *Platanistidæ*. A comparison of the figures will show the close relationship of the two forms at a glance. This is especially manifested by the form of the maxillary fossæ lying on the two sides of the narial aperture. In both the fossils, as well as in the existing *Stenodelphis*[2] and *Inia*, these fossæ are characterized by their depth and their squared posterior borders, which run close up to the parieto-occipital surface. On the other hand, in the *Delphinidæ* these fossæ are shallower, and shelve upwards towards the occiput, where they terminate gradually in a curved border.

The fragment of jaw represented in Pl. XXXVII. figs. 3, 3 *a* is one of a pair, and is, I think, a portion of the rostral region of the left maxilla. It contains 13 dental alveoli in the space of 5 inches, and is of a long and slender form. The alveoli are laterally compressed. These jaws have a great resemblance to those of the European Miocene *Schizodelphis sulcatus*[3], in which the dental alveoli have the same compressed form. If, however, as I think probable, they belong to the form under consideration, it is quite evident that they cannot be referred to *Schizodelphis*, that genus (although placed among the *Platanistidæ*) having the maxillary fossæ of the ordinary Dolphin-like form.

The vertebræ do not call for any notice beyond the bare mention that the centrum of a lumbar measures 1·3 inch in length and 1 inch in width.

Compared with *Inia*, the Caucasian cranium differs in the absence of the high prominence behind the nares, in the smaller development of the ridges bounding the maxillary fossæ, and in the less-inclined occiput. Assuming that the lower jaw belongs to the same form, the teeth will also differ in their relatively smaller size and lateral compression.

In many respects the fossil skull is more like *Stenodelphis*, but the maxillary fossæ are deeper, with more prominent borders; while the recent form has not the large and well-defined square surface behind the nares between these fossæ. The teeth of *Stenodelphis* are, moreover, cylindrical.

In *Pontistes* the occipital surface is more inclined forwards than in the Caucasian fossil, and the space between the fossæ behind the nares is also narrower. The dental alveoli are, however, elliptical in both. A much larger form has been described by Burmeister[4] from the Argentine Tertiary under the name of *Saurodelphis argen-*

[1] Ann. Mus. Buenos Ayres, vol. iii. p. 138, pl. ii. (1885).

[2] The name *Pontoporia* being preoccupied, it is necessary to adopt the later *Stenodelphis*.

[3] Gervais, Zool. et Pal. Françaises, 2nd ed. pl. lxxiii.

[4] Sci. An. Mur. Buenos Ayres, vol. iii. p. 451 (1891).

tinus, characterized by the great length of the rostrum and the extreme compression of the dental alveoli. The occipital region is more like that of the Caucasian fossil than is *Pontistes*, but there is not the square flat surface behind the nostrils; while the dental alveoli are quite different from those referred to the Caucasian form.

None of the other fossil forms referred to the *Platanistidæ*, of which the skulls are known, have the maxillary fossæ of the *Inia* type; and I accordingly regard the Caucasian skull as indicating a new genus and species, for which I suggest the name *Iniopsis caucasica*.

The evidence that the *Platanistidæ* are a very ancient type has been gradually accumulating; but the European Tertiary forms hitherto referred to that group have more Dolphin-like skulls. The occurrence of a form so closely allied to the South-American types in Russia is therefore a matter of considerable interest. Its association with the North-American Tertiary genus *Zeuglodon* is also significant, and suggests that both these groups of Cetaceans had originally a wide distribution.

P.S.—Since this paper was in type I have received from Dr. Sjögren a copy of an article[1] in which the Cetacean-yielding strata of the Caucasus are assigned to the Eocene.

EXPLANATION OF THE PLATES.

Plate XXXVI.

Fig. 1. Inner side of hinder part of the left ramus of the mandible of *Zeuglodon caucasicus*. ½.

Fig. 2. Dorsal aspect of left humerus of the same. *h*, head; *t*, greater tuberosity; *d*, deltoid ridge; *r*, radial facet; *u*, ulnar facet. ½.

Fig. 3. Inferior aspect of imperfect caudal vertebra. ½.

Plate XXXVII.

Figs. 1, 1 *a*. Anterior and right lateral aspect of centrum of posterior cervical vertebra of an undetermined Cetacean (? *Platanistidæ*). *a*, upper, *b*, lower transverse process. ½.

Figs. 2, 2 *a*. Anterior and inferior aspects of anterior caudal vertebra of the same. ½.

Figs. 3, 3 *a*. Fragment of jaw of (?) *Iniopsis caucasica*. ½.

Plate XXXVIII.

Fig. 1. Frontal aspect of imperfect cranium of *Pontistes rectifrons*. ⅛. (After Burmeister.)

Fig. 2. Corresponding view of imperfect cranium of *Iniopsis caucasica*. ⅛.

5. Descriptions of some new Genera and new Species of Phytophagous Coleoptera from Madagascar. By Martin Jacoby, F.E.S.

[Received September 1, 1892.]

(Plate XXXIX.)

But little is known at present of the Phytophagous Coleoptera of Madagascar, especially so far as the smaller species are concerned, and it is probable that many interesting forms will be found by a

[1] Meddel. Upsala Univ. Min.-Geol. Inst. vol. xiii. arts. 2, 3 (1891).


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W. Purkiss lith. Hanhart imp.

NEW PHYTOPHAGOUS COLEOPTERA FROM MADAGASCAR.

careful explorer who does not devote his attention only to the larger and more showy species. The present descriptions are drawn from a small collection which I have lately received from Mr. Sikora, who makes the study of this large island his aim. All the types are contained in my collection.

LEMA RUGICOLLIS, n. sp.

Subcylindrical, entirely dark piceous; antennæ short and robust; thorax subcylindrical, coarsely punctured anteriorly; elytra very closely and strongly punctate-striate, the interstices costate at the apex, the ninth row of punctures entire.

Length 2 lines.

Of parallel, subcylindrical shape; nearly black, the head not constricted behind, the vertex very finely punctured; eyes moderately deeply notched, subocular grooves not very deeply marked; clypeus and labrum obscure fulvous; antennæ scarcely extending beyond the base of the thorax, black, the terminal joints gradually and strongly widened and thickened; thorax longer than broad, subcylindrical, widened at the middle, without a basal sulcation, the surface coarsely punctured anteriorly, finely and closely towards the base, the middle of the disc with a longitudinal depression extending to the base, where it ends in a fovea; elytra with closely-approached rows of deep punctures, the latter also closely placed, the interstices at the sides and apex longitudinally costate; underside very sparingly clothed with greyish pubescence; posterior femora not extending to the end of the abdomen.

The shape and structure of the thorax, the sculpturing, and the uniform dark colour of this species will distinguish it from any of its allies from the same locality.

LEMA MADAGASCARIENSIS, n. sp.

Obscure piceous, the base of the head obscure fulvous; antennæ very short; thorax nearly impunctate, trifoveolate; elytra with basal depression, strongly and rather distantly punctate-striate, the interstices smooth, costate at the apex.

Length 2 lines.

Head elongate, finely rugose and pubescent, the vertex fulvous with a central longitudinal groove, the supraorbital grooves rather indistinct; clypeus with a transverse row of punctures; palpi fulvous; antennæ very short, extending only to the base of the thorax; thorax subquadrate, rather broader than long, the anterior angles distinctly tuberculate, the disc extremely closely and finely punctured, the basal sulcus deep, the space behind it with a transverse ridge, the anterior portion with a very short transverse groove at the sides, the middle of the disc with two short elongate foveæ, and another at the centre of the sulcus; scutellum truncate at the apex; elytra with a short depression below the base near the suture, brownish æneous, deeply and strongly punctate-striate, the punctures rather distantly placed, the 9th row entire; the interstices smooth, costate at the apex; underside very dark fulvo-piceous, thinly pubescent, legs more distinctly dark fulvous.

Allied to *L. ænea*, Lac., but of different coloration, and distinguished by the very short antennæ and the sculpture of the elytra.

CRYPTOCEPHALUS SCUTELLATUS, n. sp.

Robust, broad, black, above fulvous, head finely strigose, thorax impunctate, scutellum black; elytra strongly and regularly punctate-striate, a spot on the shoulder and the extreme basal and sutural margins black.

Length 2½–3¼ lines.

Head finely strigose-punctate, fulvous; the eyes large, but slightly indented; the antennæ two-thirds the length of the body, black, the lower four joints fulvous, the third and fourth joints equal; thorax proportionately long, strongly narrowed anteriorly, the sides nearly straight, strongly deflexed, the surface entirely impunctate, the posterior margin finely dentate, narrowly black, the median lobe toothed, bisinuate; scutellum one half longer than broad, black, shining, its apex broadly rounded; elytra not wider at the base than the thorax, fulvous, with deep and regular rows of punctures, of which the five inner ones do not extend to the base, the first and second rows are very short and joined at the apex, the sixth and seventh rows are also abbreviated at some distance before the apex; a small black spot is placed on the shoulders, the extreme basal and sutural margins are likewise of that colour; underside and pygidium black, clothed with long yellowish pubescence; the prosternum ends in a blunt projection in the male, but is broadly truncate in the female.

Three specimens are contained in my collection.

CRYPTOCEPHALUS DOHRNI, n. sp. (Plate XXXIX. fig. k.)

Black, thickly pubescent below, the thorax and legs fulvous, the former finely punctate; elytra metallic green, strongly punctate-striate, the interstices finely transversely rugose; tarsi black.

Length 2¼ lines.

Rather broad and robust, the head closely punctured, greenish black, the space between the eyes clothed with greyish pubescence; the antennæ extending scarcely to half the length of the elytra, black, the basal joint fulvous, the sixth and following joints slightly widened; thorax twice and a half broader than long, the sides rather strongly deflexed, the lateral margin slightly rounded, the surface opaque, fulvous, very minutely and closely punctured; scutellum black, not longer than broad, its apex truncate, the base with a fovea; elytra parallel, pale green, distinctly punctate-striate, the interstices very finely transversely rugose and sparingly clothed with short silvery pubescence; underside densely pubescent, black, as also the tarsi, the legs fulvous, the last abdominal segment with a deep round fovea; prosternum broad, flat, densely clothed with greyish pubescence.

The elytra in this species, of which I received a single specimen, are but slightly metallic and have a silky appearance on account of the fine pubescence and rugose or finely wrinkled interstices.

EULYCHIUS NIGRITARSIS, n. sp.

Fulvous, the terminal joints of the antennæ and the tarsi black; thorax rather sparingly punctured; elytra strongly punctate-striate; femora dentate.

Length 2 lines.

Head finely and sparingly punctured, the vertex convex; clypeus finely rugosely punctate, separated from the face by a transverse groove, eyes surrounded by a very narrow sulcus; antennæ extending a little beyond the base of the elytra, fulvous, the apical five joints black, strongly dilated and transverse, the third, fourth, and fifth joints equal, the sixth shorter; thorax transverse, the sides rounded, the anterior angles rather acutely produced, the surface finely and not very closely punctured on the disc; elytra not depressed below the base, distinctly punctate-striate, the punctures much finer towards the apex; femora with a small tooth; the extreme apex of the tibiæ and the tarsi black.

This species, like *E. dorsalis*, Duv., differs from the type in having armed femora; the transverse apical joints of the antennæ are, however, typical. The black tarsi and general system of coloration separate the present insect from the other two known species.

PHELOTICUS BRUNNEUS, n. sp. (Plate XXXIX. fig. 2.)

Broadly ovate, robust, dark fulvous; the antennæ (basal joints excepted), the knees, and the apex of the tibiæ black; thorax subconical, very sparingly and finely punctured; elytra finely punctate-striate anteriorly only; femora minutely toothed.

Length 3½ lines.

Head impunctate, the eyes with a very narrow sulcus at their inner margin, rather deeply notched, the epistome not separated from the face; jaws black; antennæ slender, filiform, extending to nearly two-thirds the length of the elytra, black, the lower four joints fulvous, the third and fourth joints equal; thorax subconical, narrowed in front, the sides nearly straight; the disc about one half broader than long, with a few fine punctures at the sides; scutellum smooth, subpentagonal; elytra much broader at the base than the thorax, convex, with a very shallow basal depression; the shoulders prominent, bounded within by a longitudinal depression; the disc with a few rows of fine punctures distinct only anteriorly, nearly obliterated below the middle; underside and legs fulvous, the apex of the femora and of the tibiæ as well as the claw-joint black; femora with a small tooth; tibiæ not channelled, the four posterior ones deeply emarginate before the apex; claws appendiculate, the inner division very short and pointed; prosternum slightly longer than broad, concave, deeply punctured, the thoracic episternum strongly convex.

A rather aberrant species and not typical of *Phelotieus* or allied genera, apparently allied to *P. scripunctatus*, Fairm., but differing in the colour of the antennæ and legs.

PHELOTICUS (?) ÆNEICOLLIS, n. sp. (Plate XXXIX. fig. 4.)

Below obscure æneous, the abdomen fulvous, the head and thorax greenish æneous, nearly impunctate, antennæ fulvous; elytra flavous, strongly punctate-striate, the sutural and lateral margin and a discoidal longitudinal stripe, not extending to the apex, greenish æneous.

Length 1½ line.

Head finely and distantly punctured, metallic æneous; eyes rather broadly emarginate, surrounded by a very narrow sulcus which extends downwards to the epistome, which is separated from the face by another transverse groove; clypeus broadly subquadrate, impunctate, labrum fulvous; antennæ filiform, extending to about half the length of the elytra, pale fulvous, the apex of the terminal joint black, the third joint distinctly shorter than the fourth, the terminal joints slightly thicker; thorax twice as broad as long, the sides rounded, narrowed towards the apex, narrowly margined, the anterior portion rather strongly deflexed, the surface very sparingly punctured, metallic greenish æneous; scutellum triangular, fulvous, its apex æneous; elytra subcylindrical, slightly broader at the base than the thorax, with a shallow depression below the base, fulvous, strongly punctate-striate, the punctures nearly disappearing at the apex, the sutural margin narrowly, the lateral one more broadly greenish æneous; a longitudinal stripe, angulate at its middle, extends from the middle of the base to some distance before the apex, the inner margin of this stripe is deeply concave at the angulate portion; breast æneous; abdomen more or less fulvous; legs flavous, the femora with a very minute tooth, the claws appendiculate, the inner division rather long and acute, the prosternum broadly subquadrate, the anterior thoracic episternum convex.

This species, which I have only provisionally placed in *Pheloticus*, has the general appearance and shape of a species of *Rhyparida* and does not quite agree with any genus described under the group of *Typophorinæ*, to which it undoubtedly belongs; the supra-ocular sulcus is very narrow and placed close to the inner margin of the eyes, while the claws may almost be called bifid; in one specimen, probably the female, the thorax is still broader and subangulate at the sides, and the femora and knees are stained with piceous.

PHELOTICUS (?) BIFASCIATUS, n. sp. (Plate XXXIX. fig. 3.)

Fulvous or obscure piceous, the head and thorax greenish, the latter remotely but strongly punctured; elytra strongly punctate-striate, fulvous; the suture narrowly, the lateral margin broadly, and a straight discoidal stripe abbreviated before the apex, metallic green.

Length 1¼ line.

Of the same shape as the preceding species and of similar structure; the antennæ entirely pale fulvous, the thorax distinctly but not closely punctured on the disc; the elytra without a basal depression, and with a broad and regular-shaped discoidal stripe, pointed at its

lower end and not extending to the apex, the lateral margins broadly metallic green as far as the middle of the elytra, the femora with a very minute tooth, slightly stained with piceous; everything else as in *P. æneicollis*.

IVONGIUS NIGROMACULATUS, n. sp. (Plate XXXIX. fig. 5.)

Testaceous, the head and thorax impunctate; elytra finely punctate-striate, nearly impunctate near the apex, the extreme lateral margin and a small spot below the middle black; femora unarmed.

Length 1 line.

Of convex and subcylindrical shape, the head impunctate, without any grooves or depressions, the clypeus not separated from the face, its anterior edge concave, the eyes surrounded by a narrow sulcus; the antennæ quite extending to half the length of the elytra, flavous, the basal two joints thick and short, of equal length, the third and following joints more slender, the terminal ones distinctly incrassate; thorax nearly twice as broad as long, subcylindrical, the sides very strongly deflexed, straight; the anterior margin straight, the posterior one rounded and widened at the middle, the surface impunctate; elytra slightly widened posteriorly, strongly convex, with a very slight depression below the base, the shoulders prominent, the surface finely punctate-striate, the punctures nearly obsolete near the apex, the extreme lateral margin and a small spot placed near the latter below the middle black; underside and legs flavous, the last tarsal joint and the claws stained with black; femora unarmed, claws bifid; prosternum widened posteriorly.

This species resembles much in shape those of the genus *Paria* and also of *Syagrus*; on account of the unarmed femora and bifid claws, however, I have placed it in *Ivongius*; in some specimens the lateral elytral margin is of the flavous or testaceous ground-colour.

RHEMBASTUS DIMIDIATICORNIS, n. sp.

Fulvous, the sixth and seventh joints of the antennæ black, thorax distinctly punctured on the disc; elytra violaceous blue, distinctly punctate-striate, the apex fulvous.

Var. *a*. Elytra flavous, the base, suture, and an oblique band at the middle obscure fuscous.

Var. *b*. Elytra entirely fulvous.

Length 1¼ line.

Of convex, subcylindrical shape; the head nearly impunctate, fulvous; the clypeus not separated from the face; eyes emarginate, widely separated, sulcate above their inner margin; antennæ scarcely extending to half the length of the elytra, fulvous, the sixth and seventh joints black, the terminal ones distinctly thickened, the first and second joints short, almost equal, the second and third joints thinner, equal; thorax about one half broader than long, narrowed in front, the sides nearly straight, the surface finely and sparingly punctured on the disc only, fulvous; scutellum fulvous; elytra broader at the base than the thorax,

obsoletely depressed transversely below the base, rather strongly punctate-striate, the punctures much finer posteriorly, the disc violaceous, the extreme apex fulvous; underside and legs fulvous; femora unarmed; claws bifid; prosternum dilated posteriorly.

This small species is principally distinguished by the colour of the antennæ and that of the elytra; the varieties do not show any differences except in the colour of the upper surface; the unarmed femora do not agree with the definition of *Rhembastus*, but neither this genus nor *Ivongius* are well defined by the author, who has said nothing about the sulcus at the sides above the eyes, nor does M. Lefèvre mention this character in his diagnosis of the genus. On the other hand, *Ivongius*, which agrees in the unarmed femora with the present species, is described by von Harold as having the clypeus separated from the face, which is not the case in the insect described here. *Ivongius antennarius*, Har., agrees very nearly with it (to judge from a three-line description), but is described with a smooth thorax. *R. pusillus*, Har., seems to be another closely allied species, but differs in the colour of the antennæ and of the head and thorax.

RHEMBASTUS ANTENNATUS, n. sp.

Reddish fulvous; antennæ flavous, the sixth, seventh, and apical two joints as well as the tarsi black; thorax sparingly punctured; elytra finely and distantly punctate-striate.

Length 1½ line.

Head impunctate, the eyes surrounded with a distinct sulcus, the vertex with a longitudinal groove, clypeus not separated from the face; jaws black; antennæ extending to half the length of the elytra, flavous, the third and fourth joints equal, the sixth and seventh and apical two joints black, the latter distinctly thickened; thorax one half broader than long, the sides straight, the surface sparingly and finely punctured at the disc, the sides impunctate; elytra convex, without basal depression, finely punctate-striate, more distinctly anteriorly than posteriorly, the shoulders with a deep depression within; femora dentate, tarsi black, claws bifid.

Principally distinguished from other nearly similarly coloured species by the colour of the antennæ.

EURYDEMUS METALLICUS, n. sp.

Obscure piceous, the antennæ and legs fulvous; above metallic greenish or cupreous; the head and thorax nearly impunctate, the elytra deeply punctate-striate, the interstices more or less longitudinally convex, femora dentate.

Length 1⅞–2 lines.

Of rather elongate and parallel shape; the head metallic greenish, with a few punctures at the vertex; the eyes large, rather closely approached, their inner margin sinuate; clypeus transverse, fulvous, its surface rather depressed, its upper margin separated from the face by a narrow transverse groove; antennæ long and slender, fulvous, the basal joint stained with piceous, the second joint half

the length of the third, the fourth slightly longer than the preceding joint; thorax about one half broader than long, the sides nearly straight, the surface very little convex, impressed with a few very minute punctures, visible only under a strong lens; elytra much broader at the base than the thorax, metallic green or cupreous, the sutural and lateral margins sometimes fulvous, the punctures very deep and regular, the interstices rather convex, the apex much more finely and distantly punctured; underside piceous, the breast with a metallic greenish hue, the legs fulvous; the femora with a distinct tooth; claws bifid; prosternum broadly transverse.

RHYPARIDA STRIATICOLLIS, n. sp. (Plate XXXIX. fig. 7.)

Fulvous, the head and thorax piceous, the antennæ flavous; the seventh joint black; thorax transverse, longitudinally strigose on the disc; elytra fulvous, with basal depression, strongly punctured anteriorly, nearly impunctate below the middle.

Length 1¼ line.

Vertex of the head convex with a few fine punctures, dark fulvous; eyes with a very narrow sulcus round their inner margin; clypeus separated from the face by a deep transverse groove, rugosely punctured; antennæ rather long, flavous, the seventh joint black, the third joint much shorter than the fourth, the terminal joints slightly thickened; thorax twice as broad as long, but slightly narrowed in front, the sides strongly rounded, the anterior angles rather prominent, the disc strongly and closely longitudinally strigose from the middle to the base, the anterior portion sparingly punctured, fulvo-piceous; elytra with a deep depression below the base, strongly punctate-striate, the punctures nearly obsolete below the middle; underside fulvous; legs flavous; the femora with a very minute tooth, claws bifid; the anterior thoracic episternum slightly concave; prosternum broadly subquadrate, strongly punctured.

I cannot find any differences whatever in regard to structural characters to justify a separation of this species from *Rhyparida*, of which, until now, no true species have been known from Africa. The general shape and that of the thorax is the same, the thoracic episternum is not in the least convex, the four posterior tibiæ are emarginate at the apex and the claws are bifid; the peculiar striation of the thorax will distinguish this species at first sight.

HEMYLOTICUS, n. gen.

Body elongate; antennæ filiform; eyes deeply notched; thorax broader than long; elytra punctate-striate, the four posterior femora toothed, their tibiæ emarginate at the apex; claws bifid, the inner division very short; prosternum bilobed; mesosternum quadrate, its base raised, truncate; the anterior margin of the thoracic episternum convex.

This genus will enter the section *Typophorinæ*, Chap., from all genera of which it differs in the bilobed posterior margin of the prosternum and in the structure of the mesosternum.

HEMYLOTICUS GENICULATUS, n. sp. (Plate XXXIX. fig. 6.)

Reddish fulvous; the antennæ (the basal joints excepted), the knees, apex of the tibiæ, and the tarsi black; thorax very sparingly punctured; elytra finely punctate-striate.

Length 3 lines.

Head with a few fine punctures; the epistome broad, subquadrate, scarcely separated from the front; mandibles black; antennæ slender, filiform, the lower three joints fulvous, the rest black, the fourth joint slightly longer than the third; thorax about one half broader than long, the sides rounded, the anterior margin straight, the surface rather convex, with a few fine punctures; elytra much broader at the base than the thorax, without basal depression, very finely punctate-striate, fulvous and shining like the rest of the upper surface; underside coloured as above; the knees, the apex of the tibiæ, and the tarsi black.

A single specimen is contained in my collection.

NISOTRA NIGRITARSIS, n. sp.

Oblong-ovate, dark fulvous, the antennæ (the basal three joints excepted) and the tarsi black; head and thorax nearly impunctate, the latter with four longitudinal grooves; elytra extremely finely and closely punctured.

Length 2½ lines.

Head impunctate, transversely grooved between the eyes, the frontal elevations but slightly raised; palpi slender; antennæ extending a little beyond the base of the elytra, black, the basal three joints fulvous, the second and third joints of equal length; thorax twice as broad as long, the sides rounded, the angles acute, the disc with a few scarcely perceptible punctures, the anterior and posterior margins with a short perpendicular groove at each side; elytra widened towards the middle, the shoulders slightly prominent, the surface extremely finely and closely punctured; underside and legs fulvous, the tarsi black.

This species seems allied to *N. spadicea*, Dalm., but differs in the extremely fine and not geminately-arranged punctation of the elytra and in the black tarsi and larger general size.

NISOTRA KLUGII, n. sp.

Black; the head, thorax, the anterior legs, and the posterior tibiæ fulvous; elytra metallic green or purplish, very closely and finely punctured; antennæ fulvous or with the last three joints black.

Length 2½ lines.

Head impunctate, the frontal tubercles small, clypeus thickened; the antennæ extending a little beyond the base of the elytra, fulvous, the last three joints black, the third and fourth joints equal, the terminal ones thickened; thorax twice as broad as long, fulvous, the sides slightly rounded, the surface extremely finely and closely punctured, the anterior and posterior margins with a very short and indistinct longitudinal depression near the sides; scu-

tellum fulvous; elytra slightly widened at the middle, very closely and more strongly punctured than the thorax, the interstices obsoletely longitudinally costate at the sides, the shoulders prominent; the breast and abdomen as well as the posterior femora black; legs fulvous.

This species varies in having metallic green or purplish elytra; in two specimens the antennæ have the last three joints black, in one they are entirely fulvous.

ASPHÆRA MADAGASCARIENSIS, n. sp.

Fulvous, shining; the antennæ (the basal two joints excepted), the apex of the femora, and the tibiæ and tarsi black; thorax impunctate; elytra closely punctured and finely rugose.

Length 4 lines.

Head impunctate, deeply transversely grooved between the eyes; frontal tubercles transverse, distinct; clypeus swollen; palpi black; antennæ robust, black, the basal two joints fulvous, the terminal joints rather flattened; thorax nearly three times as broad as long, the sides with a broad and reflexed margin, strongly rounded; the disc uneven, depressed at the sides and at the middle, impunctate, shining; elytra closely punctured, the interstices everywhere finely wrinkled and rugose; the apex of the femora and the tibiæ and tarsi black, tibiæ deeply channelled; the first joint of the posterior tarsi as long as the following joints together, claws moderately swollen.

Apparently allied to *A. melanarthra*, Fairm., but differing in the colour of the legs and the wrinkled elytra, also in having but two joints of the antennæ fulvous; M. Fairmaire describes his species as having fuscous legs (femora 3–4 excepted) (?), which is (probably through a misprint) unintelligible.

ASPHÆRA BREVICORNIS, n. sp.

Flavous; the head, thorax, and legs pale fulvous; antennæ (the basal four joints excepted) black, short; thorax impunctate; elytra very minutely and closely punctured.

Length 3 lines.

Head impunctate, the frontal tubercles transverse, nearly contiguous; clypeus raised, short and truncate at the raised portion; labrum, jaws, and palpi fulvous; antennæ only extending to the base of the elytra, black, the basal four joints fulvous, the third joint slightly shorter than the fourth, terminal joints thickened; thorax more than twice as broad as long, rather strongly narrowed in front, the sides slightly rounded, narrowly marginate, the anterior angles rather strongly produced and thickened, the surface impunctate, shining, fulvous, rather deeply longitudinally sulcate near the lateral margins; elytra pale flavous, very finely and closely punctured; legs fulvous; the first joint of the posterior tarsi as long as the following joints together; claws very slightly incrassate.

This species has nearly simple, that is scarcely swollen, posterior claws, but agrees in all other respects with *Asphæra*.

ŒDIONYCHIS CLYPEATA, n. sp.

Flavous; the antennæ (the lower four joints excepted) and the tarsi black; clypeus strongly produced; thorax impunctate; elytra scarcely perceptibly punctured, obscure fulvous.

Length 2½ lines.

Head impunctate, the frontal tubercles entirely absent, the space between the eyes deeply excavated; the clypeus produced, flattened and truncate at the apex; the antennæ extending to about half the length of the elytra, black, the lower four joints fulvous, the basal joint widened, nearly subquadrate and short, the second one half the size, the third and fourth equal, the terminal joints slightly thickened; thorax strongly transverse, not narrowed in front, the sides rounded, with a distinct flattened margin, the anterior angles pointed, the disc unevenly raised at the sides, with several depressions, entirely impunctate; elytra minutely punctured, darker than the thorax; legs flavous; the knees and the tarsi black; posterior claw-joint strongly swollen, black.

This differs from all the Madagascar species of *Œdionychis* described in the structure of the clypeus and head, &c.

DIPHAULACOSOMA, n. gen. (*Halticinæ*).

Body ovate; palpi thickened; antennæ robust and short, the terminal four joints dilated and compressed; thorax transverse, without depressions, the sides strongly dilated and widened at the middle, constricted at the base; scutellum subquadrate, its apex truncate; elytra narrowed and subacute at the apex, obsoletely punctured, their epipleuræ extending below the middle; femora robust, the posterior ones thickened; the tibiæ not channelled, the posterior ones with a spine; the first joint of the posterior tarsi as long as the following two joints together; claws appendiculate; prosternum narrow, convex; the anterior coxal cavities open.

The genus here proposed is principally distinguished by the dilated terminal joints of the antennæ and by the peculiar shape of the thorax, which is strongly widened and rounded at the middle, in connection with the open cavities. *Sphærophysa*, Baly, also inhabiting Madagascar, has the antennæ likewise dilated; but this dilatation is not confined to the terminal joints; the body in *Sphærophysa* is also strongly rounded, not ovate, and the coxal cavities are closed.

DIPHAULACOSOMA LÆVIPENNE, n. sp. (Plate XXXIX. fig. 8.)

Entirely fulvous, shining; terminal four joints of the antennæ black; thorax impunctate; elytra wider than the thorax, entirely impunctate; tarsi fuscous.

Length 2½ lines.

Head impunctate; the frontal tubercles oblique, distinct, bounded behind by a transverse groove; the clypeus with a short central ridge; penultimate joint of the palpi thickened; antennæ only extending a little beyond the base of the elytra, fulvous, the terminal four joints black; thorax twice as broad as long, dilated at the sides,

the latter strongly rounded at the middle, the posterior angles produced into an acute tooth, the surface rather convex, transversely depressed at the base, entirely impunctate; elytra strongly narrowed posteriorly, fulvous, shining, impunctate, or exceedingly finely and sparingly punctured, the interstices very finely wrinkled here and there.

The shape of the thorax is peculiar in this species, and the posterior angles are distinctly dentate, the tooth being placed above the middle line of the posterior margin, the angles themselves being obliquely shaped.

MALACOSOMA SIKORÆ, n. sp.

Piceous; the antennæ and the labrum fulvous; thorax finely punctured; elytra more closely punctate, the punctures arranged in closely approached rows.

Length 2–2½ lines.

Head impunctate, the frontal tubercles transversely oblique, the clypeus strongly triangularly raised; labrum pale fulvous; palpi slender, piceous; antennæ extending to half the length of the elytra, pale fulvous, the joints very slender, the third and fourth equal; thorax subquadrate, about one half broader than long, the sides nearly straight or slightly angulate before the middle (♀ ?), the anterior angles distinct, furnished with a single hair, the surface distinctly but not very closely punctured, piceous; elytra with a very slight depression below the base, closely and scarcely more strongly punctured than the thorax, the punctures arranged in closely approached semi-regular rows; legs more or less fulvous; tibiæ mucronate, the first joint of the posterior tarsi as long as the three following joints together; prosternum narrowly raised.

The two specimens before me show some differences which are probably sexual: in one the thorax is less transverse, with nearly straight lateral margins, and the elytra have a slight purplish gloss and are more irregularly punctured; in the other specimen the thorax is broader and the sides are distinctly subangulate before the middle, the elytra have no metallic gloss and are more regularly and less closely punctured in rows; both specimens, however, apparently represent the same species; the last abdominal segment in both is simple.

MALACOSOMA ATERRIMUM, n. sp.

Entirely black; the thorax but slightly broader than long, impunctate; elytra entirely impunctate.

Length 2 lines.

Head impunctate, black, the frontal tubercles distinct, transverse; palpi slender, the terminal joint acutely pointed; the antennæ extending to half the length of the elytra, black, the third joint slightly longer than the second; thorax subquadrate, about one half broader than long, the sides very slightly rounded, the anterior angles rather prominent, the surface entirely impunctate; elytra without basal depression, rather opaque, impunctate; tibiæ armed with a small spine, the first joint of the posterior tarsi as long as the three

following joints together; claws appendiculate; the prosternum very narrow, convex between the coxæ; the anterior coxal cavities open.

MALACOSOMA FLAVICORNE, n. sp. (Plate XXXIX. fig. 12.)

Flavous; the clypeus, thorax, the apex of the femora, and the abdomen black; thorax closely punctured; elytra flavous, punctured like the thorax.

Length 2¼ lines.

Head impunctate, pale fulvous, the frontal elevations narrowly transverse; the clypeus black; antennæ fulvous, rather robust, the third joint one half longer than the second, the fourth as long as the preceding two joints together; thorax about twice as broad as long, the sides rounded, the anterior angles slightly produced, the posterior ones rather obsolete, the surface rather strongly and closely punctured, black; elytra flavous, very closely punctured; the apex of all the femora black; tibiæ mucronate, the first joint of the posterior tarsi as long as the following two joints together; claws appendiculate; abdomen black, pubescent; prosternum very narrow but distinct, convex.

A single specimen.

ANTSIANAKA VIRIDIS, n. sp.

Testaceous; the antennæ, the abdomen, and the tibiæ and tarsi black; the head and thorax impunctate; elytra metallic green, finely punctured and transversely rugose.

Length 2 lines.

Head with a more or less distinct depression at the vertex, the latter with a faint metallic line, impunctate; labrum black; antennæ as long as the body, very slender, black, all the joints with the exception of the second very elongate; thorax short, without a distinct lateral margin, the surface impunctate, with some shallow transverse depressions, testaceous; scutellum black; elytra bright metallic green, finely transversely rugose, and closely punctured.

Closely allied to *A. pulchella*, Duviv., but differing in the pale head, the absence of the green thoracic margin, the entirely green elytra, and the black abdomen.

ANTSIANAKA LONGICORNIS, Duviv.

I refer a single specimen to this species; my specimen differs, however, from the description in having an entirely testaceous head. M. Duvivier does not mention the colour of the antennæ, which are fuscous in my specimen with the basal two joints black.

ANTSIANAKA ELEGANTULA, n. sp. (Plate XXXIX. fig. 10.)

Pale flavous; antennæ (the basal two joints excepted) black; elytra metallic blue, narrowly margined with flavous, rather strongly punctured; the interstices finely transversely rugose.

Length 1½ line.

Smaller than any of its allies, the antennæ extending beyond the elytra, entirely black, with the exception of the first two joints, which are flavous; the head swollen, impunctate; the thorax very

short, transversely depressed above and impunctate. Elytra narrowly margined with flavous, much more distantly punctured than *A. pulchella*, Duv., and the interstices much less strongly rugose, finely wrinkled transversely, and without traces of longitudinal costæ. The thorax also is entirely flavous like the head.

ÆLIANUS, n. gen. (*Galerucinæ.*)

Body elongate; antennæ rather robust, the second and third joints short, the following gradually elongate; thorax transverse, the anterior angles more or less produced; elytra irregularly punctured, their epipleuræ narrow but continued below the middle; tibiæ muconate, the first joint of the posterior tarsi nearly as long as the following joints together; claws appendiculate; the anterior coxal cavities open; prosternum not distinct.

This genus approaches closely *Malacosoma* in general shape and structural characters, but differs in the longer first joint of the posterior tarsi and in the scarcely visible and not convex prosternum. The female insect differs rather considerably from the male, the antennæ are shorter, the apical joints being much less elongate, and the anterior angles of the thorax are thickened and produced.

ÆLIANUS SCUTELLATUS, n. sp. (Plate XXXIX. fig. 9.)

Obscure piceous; the head, antennæ, the scutellum, and the tarsi black; above testaceous, thorax impunctate, spotted with black or without spots; elytra very minutely punctured; legs obscure fulvous, stained with piceous.

Length 2½ lines.

♂. Head shining, impunctate, black, the frontal elevations strongly raised, the clypeus with a distinct central ridge, obscure fulvous; palpi slender, piceous; antennæ extending to half the length of the elytra, black, the third joint slightly longer than the second, the following five joints equal, the others more elongate, the terminal joint half the length of the preceding one; thorax twice as broad as long, the sides nearly straight as well as the anterior margin, the posterior margin obliquely rounded at the sides; the anterior angles slightly thickened, the extreme lateral margin black; the disc flavous or testaceous, impunctate, with four piceous spots placed transversely, the outer ones being the largest; scutellum large, black, shining; elytra testaceous, the extreme sutural margin narrowly piceous, the disc finely and closely punctured, rather opaque; underside and legs obscure fulvous or piceous, finely pubescent, the tarsi black; the last abdominal segment deeply excavate, incised at the sides.

♀. The antennæ shorter, all the joints (the second one excepted) of nearly equal length, rather thickened; thorax with the anterior angles strongly thickened and produced outwards, the last abdominal segment simple.

MIMASTROIDES, n. gen. (*Galerucinæ.*)

Body elongate; antennæ filiform, the second joint short, the

following elongate, gradually diminishing in length; thorax transverse, short, the sides nearly straight; elytra irregularly punctured, their epipleuræ very narrow, entirely disappearing below the middle; legs slender; all the tibiæ with a spine, the first joint of the posterior tarsi as long as the following three joints together; claws appendiculate; prosternum invisible between the coxæ, the anterior coxal cavities open.

The insect for which this genus is proposed has the general appearance of the species forming the genus *Mimastra*, from which it is distinguished by the mucronate tibiæ; the narrow epipleuræ, invisible below the middle, and the spines on all the tibiæ separate the genus from *Luperus*.

MIMASTROIDES MADAGASCARIENSIS, n. sp. (Plate XXXIX. fig. 11.)

Obscure testaceous, the base of the head, the labrum, antennæ, the upperside of the femora, and the tibiæ and tarsi black; thorax and elytra testaceous, closely semi-rugosely punctured.

Length 3 lines.

Head finely and sparingly punctured on the vertex, the basal portion blackish, the frontal elevations small but distinct, the clypeus triangular, raised, yellowish; labrum and palpi black; eyes very large; antennæ about half the length of the body, black, the first joint elongate, thickened at the apex, the second one short, the third and fourth slender, equal, the apical joints shorter; thorax twice as broad as long, the sides straight, the anterior angles thickened and slightly oblique, the posterior angles in shape of a small tubercle, the surface flat, closely punctured, the interstices slightly rugose; scutellum obscure piceous, broad; elytra without basal depression, punctured like the thorax, obscure testaceous; breast slightly darker, the upper portion of the femora, the tibiæ, and tarsi black; the apex of the last abdominal segment triangularly emarginate.

GALERUSOMA, n. gen.

Elongate, impubescent. Head produced, eyes entire; palpi slender; antennæ filiform, the first joint very long and the longest; thorax subquadrate, scarcely broader than long, the surface flat without depression; scutellum rather broad; elytra wider at the base than the thorax, elongate, irregularly punctured, their epipleuræ narrow, disappearing below the middle; legs slender; tibiæ unarmed, the first joint of the posterior tarsi as long as the following three joints together; claws bifid; the anterior coxal cavities closed.

This genus, in its elongate and slender shape, resembles somewhat the genus *Mimastra*; its principal distinguishing characters are the very long and slender first joint of the antennæ and the bifid claws, which separate the genus also from *Mimastroides*.

GALERUSOMA APICICORNE, n. sp.

Fulvous, the lower and the apical three joints of the antennæ, the tibiæ, and tarsi black; thorax very minutely, elytra more strongly and very closely and irregularly punctured.

Length 2¾–3 lines.

Head very elongate, the vertex impunctate, the frontal elevations moderately raised, broadly trigonate, bounded by a transverse groove behind; the eyes large; clypeus broadly flattened; labrum large; antennæ extending below the middle of the elytra, fulvous, the lower three joints as well as the terminal three black, the first joint very long but slightly curved, the second less than half the length of the third, the following joints nearly equal, the apical two joints shorter; thorax but slightly broader than long, the sides nearly straight and slightly rounded before the middle, the angles in shape of a small tubercle, the surface flattened, scarcely perceptibly punctured and minutely granulate, the middle of the disc with a very indistinct longitudinal depression near the base; elytra narrowly elongate, fulvous, very closely and more distinctly punctured than the thorax, the interstices slightly wrinkled; underside and the femora pale fulvous, tibiæ and tarsi black, clothed with yellowish pubescence; prosternum invisible between the coxæ.

Three specimens are contained in my collection.

EXPLANATION OF PLATE XXXIX.

Fig. 1. *Cryptocephalus dohrni*, p. 566.
2. *Pheloticus brunneus*, p. 567.
3. —— *bifasciatus*, p. 568.
4. —— *æneicollis*, p. 568.
5. *Ivongius nigromaculatus*, p. 569.
6. *Hemyloticus geniculatus*, p. 572.
7. *Rhyparida striaticollis*, p. 571.
8. *Diphaulacosoma lævipenne*, p. 574.
9. *Ælianus scutellatus*, p. 577.
10. *Antsianaka elegantula*, p. 576.
11. *Mimastroides madagascariensis*, p. 578.
12. *Malacosoma flavicorne*, p. 576.

November 15, 1892.

Dr. A. Günther, F.R.S., Vice-President, in the Chair.

The following report from the Secretary on the additions to the Menagerie during the month of October was read:—

The registered additions to the Society's Menagerie during the month of October were 135 in number. Of these 104 were acquired by presentation, 14 by purchase, 1 by birth, 1 by exchange, and 15 were received on deposit. The total number of departures during the same period by death and removals was 121.

The most noticeable additions during the month were:—

1. A very fine male Ostrich (*Struthio camelus*), presented by Her Majesty The Queen, and received October 7th.

This is one of the largest Ostriches we have ever had. It measures 4 ft. 10 in. in height at the back, and about 4 ft. 3 in. in total length, whereas the male now next to it in the Gardens, which we obtained from the Zoological Society of Antwerp in May last, measures only 3 ft. 8 in. in height and about 2 ft. 2 in. in length.

The latter (originally received from Oran, Algeria) is no doubt of unusually small dimensions.

The "Queen's Ostrich" was procured by Mr. Williams, of Sierra Leone, during a recent expedition to the dominions of King Samory (or Samadou), about 700 miles in the interior from Freetown[1], in the basin of the Upper Niger, for Mr. Alfred L. Jones of Oaklands, Aigburth (at whose expense the expedition was organized), and offered by Mr. Jones as a present to Her Majesty The Queen, who was graciously pleased to deposit it in the Society's Gardens.

The colour of the naked skin on the neck and legs of this bird is reddish. In the Somali bird (*Struthio molybdophanes*, Reichen.[2]) it will be recollected that these parts are bluish. But the various geographical subspecies of the Ostrich have not yet been properly discriminated.

2. A specimen of what appears to be a new and undescribed Monkey of the genus *Cercopithecus*, obtained by Dr. Joseph A. Moloney at Chindi, on the Lower Zambesi, when returning to this country in company with Stairs's expedition. It is at once recognizable, as will be seen from the coloured figure by Mr. P. Smit, which I exhibit, by the strongly marked chestnut-red patches above the ears.

I propose to call it

CERCOPITHECUS STAIRSI, sp. nov. (Plate XL.)

Supra ochraceus, artubus extus cinereis; dorso summo et pileo cinereis, hoc lineis nigris variegato et flavicante lavato; macula magna supra-auriculari utrinque castanea; frontis pilis extantibus; auribus nudis; facie nigricante; subtus lactescenti-albus, cauda cinereo-nigricante, ad basin pallidiore, ad apicem obscuriore; crassitie C. petauristæ.

Hab. ad ripas fl. Zambezi inf.

Obs. Species *C. albigulari* frontis pilis erectis forsan affinis, sed macula auriculari castanea primo visu distinguenda.

I propose to dedicate this distinct species to the memory of Lieut. W. Grant Stairs, of the Royal Engineers, who died at Chindi, at the mouth of the Zambesi, on June 9th, 1892, on his return from his expedition to Katanga. The typical specimen was obtained from the delta of the Zambesi by Mr. Hellier, the British Central-African Company's Agent at Chindi, and given to Dr. J. A. Moloney, one of the surviving members of Stairs's expedition, who brought it home and presented it to this Society.

3. A large series of specimens of Mammals, Birds, and Reptiles, brought back by Mr. Frank Finn, F.Z.S., on his recent return from a zoological excursion to Zanzibar. These animals were given into Mr. Finn's charge by General Mathews, C.M.G., Dr. W. H. B. MacDonald, Mr. R. MacAllister, Mr. F. Pordage, and other Correspondents of the Society at Zanzibar and Mombasa. Amongst

[1] For an account of Mr. Williams's expedition see Rev. Franç. et Expl. xvi. p. 395.

[2] J. f. O. 1883, p. 399.



J. Smit del. et lith.

Mintern Bros. imp.

CERCOPITHECUS STAIRSI.

them are examples of the Puisa Ichneumon (*Bdeogale puisa*), the Black Gallinule (*Limnocorax niger*), the Madagascar Pratincole (*Glareola ocularis*), Grant's Francolin (*Francolinus granti*), and of other species new to the Society's collection.

4. Two Ypecaha Rails (*Aramides ypecaha*) from Brazil, purchased Oct. 24, new to the Society's collection.

The Secretary exhibited, on behalf of Mr. Thomas Ground, a specimen of the Siberian Pectoral Sandpiper (*Tringa acuminata*), shot by that gentleman on Breydon mudflats, in Norfolk, in August last[1], and read the following letter addressed to him on this subject:—

"School Lane, Moseley,
Birmingham,
Nov. 14th, 1892.

"DEAR SIR,

"I have sent you to-day by L. & N. W. passenger train the specimen of *Tringa acuminata* for exhibition at the meeting of your Society tomorrow evening.

"I shot the bird on the 29th August last on Breydon mudflats; it was in company with a Ringed Plover and three or four Dunlins. The boatman picked it up and threw it into the punt, saying it was a Dunlin. On reaching home I examined the bird, and having never seen a Dunlin with so fine and short a bill, I took it to the stuffers and was agreeably surprised to find a few days afterwards that it had been pronounced to be an example of *T. acuminata*.

"Yours faithfully,
"THOS. GROUND."

For the purpose of comparison with this specimen Mr. Thomas Southwell had, with the permission of the Trustees of the Norfolk and Norwich Museum, kindly sent up the specimen of *Tringa acuminata* purchased by the late J. H. Gurney in 1848, and at first referred to *Tringa pectoralis*[2].

Mr. Southwell wrote that since the specimen was recognized as *Tringa acuminata* it had been restuffed for the Museum by Mr. Roberts, who was decidedly of opinion that the specimen had been originally (that is when stuffed by Knights) set up from the flesh. It had been badly shot in the neck and legs.

Mr. G. A. Boulenger, F.Z.S., read a paper describing the remains of an extinct gigantic Tortoise from Madagascar (*Testudo grandidieri*, Vaill.), based on specimens obtained in caves in South-west Madagascar by Mr. Last, and transmitted to the British Museum. The species was stated to be most nearly allied to *Testudo gigantea* of the Aldabra Islands.

This memoir will be published entire in the Society's 'Transactions.'

The following papers were read:—

[1] See 'Zoologist,' 1892, p. 356 et p. 405.
[2] *Cf.* 'Zoologist,' 1892, p. 405.

1. Description of a new Monkey of the Genus *Semnopithecus* from Northern Borneo. By Oldfield Thomas.

[Received October 25, 1892.]

(Plate XLI.)

In 1889 I had the pleasure of describing before this Society[1] a very beautiful species of *Semnopithecus* from the Baram district, North-eastern Sarawak, which was discovered by Mr. Charles Hose, and was named in his honour *Semnopithecus hosei*. Of this Monkey many specimens, all from much the same district, have come to Europe, and I have reason to believe that most of the European Museums are now supplied with examples of it, all obtained by the same energetic and successful collector. In our own Museum we have, besides the type, another adult male, two young specimens, and an adult skeleton. All these specimens, including young ones barely a foot in length, have shown the most striking uniformity in their coloration, there being in none of them the smallest deviation from the colour depicted in my illustration of the type (*t. c.* plate xvi.).

Now, however, the Museum has received, first from Mr. A. Everett, who noticed the differences himself, one specimen, and then from Mr. Hose two more, of a Monkey undoubtedly closely allied to *S. hosei*, but yet all three so like each other and so different in markings from any specimen of that species which I have seen, that I feel unable to consider it to be *S. hosei*, and therefore must describe it as new.

Mr. Everett's specimen having been the first obtained, I propose to make it the type, and to name the species in honour of its discoverer, who, as already mentioned, had himself noticed its distinguishing characters.

Semnopithecus everetti, sp. n. (Plate XLI.)

Size and proportions as in *S. hosei*. Colour of body, limbs, and tail as in that species except that the white is everywhere replaced by dull cream-colour, and this change produces a marked yellowish suffusion in the mixed grey of the back and tail; the shoulders and the centre of the back are also darker, a character still more marked in the two Dulit specimens than in the type. Belly and the light parts of the head pale yellowish or cream-colour, quite different from the snowy white of *S. hosei*. The chief difference, however, lies in the distribution of the colours of the head, for while in *S. hosei* only the centre of the crown and a narrow line down the nape are black, the rest, including the whole of the region round and above the ear, being pure white, in *S. everetti* the whole of the forehead and top of head are black, the lower limit of the black passing across the middle of the ear, and the whole breadth of the

[1] P. Z. S. 1889, p. 159.



J. Smit del. et lith. Mintern Bros. imp.

SEMNOPITHECUS EVERETTI.

back of the neck is also black. A spot in the exact centre of the forehead just above the meeting of the eyebrows is, however, pale yellowish white. The pale cheeks and the pale sides of the neck are in this species in just as striking contrast to the dark crown as in *S. hosei*, and distinguish it equally from its near ally *S. chrysomelas*.

In the skull the differences are of course but slight, and many specimens of each would be needed before any of them could be claimed as genuinely differential characters. Comparing the type skull of *S. everetti* with that of *S. hosei*, the brain-case is longer and more flattened, the orbits are more circular in outline, and the length of the zygomata is decidedly greater. The development of the fifth cusp to the last lower molar is very much the same in both, *i. e.* much less than in *S. cristatus* and the majority of the species, but much greater than in *S. chrysomelas*, a species remarkable for the almost entire suppression of the cusp.

Dimensions of the type, an adult female in skin :—Head and body (c.) 550 millim., tail 650.

Skull—basal length 63·7, greatest length (gnathion to occiput) 94, greatest breadth 70, combined length of upper premolars and molars 24, of molars only 16·2.

The type specimen was obtained by Mr. Everett's hunters at an altitude of about 3500 feet on Mount Kina-balu, in March 1892. Mr. Hose's two specimens were killed at 3000 feet on Mount Dulit in June. The species is therefore no doubt a purely mountain one, and does not, like *S. hosei*, descend to the plains. This latter species, however, also occurs at considerable altitudes on Mount Dulit, but has not as yet been certainly found on Mount Kina-balu, the skull from that mountain doubtfully referred by me to it in 1889 [1] belonging very probably to *S. everetti*.

Finally, I must of course admit the possibility of intermediate specimens between *S. hosei* and *S. everetti* occurring, and the consequent necessity for the reduction of the latter form to the rank of a subspecies; but in the absence of such intermediate forms and in view of the great constancy in the coloration of *S. hosei* already noted, it seems best to give a name to the striking variation from it now described.

2. Description of a new Blennioid Fish from Kamtschatka. By G. A. Boulenger.

[Received October 25, 1892.]

Blenniophidium, g. n.

Body elongate, compressed, covered with very small cycloid scales. Mouth small, horizontal, protractile, with fleshy lips; small conical teeth in jaws and on palate. No opercular spine.

[1] *T. c.* p. 160.

Gill-membranes broadly connected, but free from isthmus; branchiostegals four. Dorsal fin very long, extending from the nape to the caudal, with which it is subcontinuous; a few of the posterior rays are stiff spines, the rest being soft, though not articulate; anal fin extending from the anus, which is a little nearer the anterior than the posterior extremity, to the caudal, formed exclusively of soft rays; caudal distinct, rounded. Pectorals well developed, with 21 rays. No ventrals. No lateral line. No prominent anal papillæ. Pyloric appendages present.

As the name I have chosen for this genus indicates, this is one of those numerous forms which might almost equally well be referred to the *Blenniidæ* or to the *Ophidiidæ*. The presence of pyloric appendages and the absence of prominent anal papillæ might induce us to include it among the Gadoids, as defined by Günther, whilst



Blenniophidium petropauli. ½.

the presence of spines in the dorsal fin, together with the unmistakable affinity it bears to *Cebedichthys*, indicate its correct place to be among the *Blenniidæ*.

BLENNIOPHIDIUM PETROPAULI, sp. n.

Depth of body 6¼ times in total length (without caudal); length of head same as depth of body. Diameter of eye equal to length of snout, ⅓ length of head, and a little more than interorbital width; maxillary extending to below anterior fourth of eye; some wide pores on the head; cheeks, opercles, and occiput closely scaled; strips of small scales on the branchiostegal membrane, between the rays. Dorsal 41 XI, continuous and subequal in depth, about ⅓ as deep as the body. Anal 37. Pectoral ⅔ length of head, about as long as caudal. Anus twice as far from caudal as from base of pectoral. Yellowish brown, with ill-defined darker marblings; a crescentic black line on the top of the head, from eye to eye; a black line, obliquely directed forwards, below the eye, and another, in opposite direction, from the eye to the opercle; two dark brown streaks across the nape, the second crossing the origin of the dorsal fin and extending to the base of the pectoral; dorsal and caudal fins greyish olive, lighter at the base, the dorsal with five large black spots at regular intervals; pectorals and anal colourless.

Total length 140 millim.

The single specimen, which is represented above, two thirds

natural size, was obtained by Sir George Baden Powell in Petropaulovski harbour, Kamtschatka, on Sept. 8, 1891. Before describing this fish as new I have satisfied myself, by a careful comparison with the original description, that it cannot by any means be referred to *Ophidium ocellatum*, Tilesius, which it strongly resembles in general appearance. Notwithstanding the several different names which have been bestowed upon it, this *Ophidium ocellatum*, obtained at Petropaulovski, has not been rediscovered since its description in 1811, and its affinities are altogether uncertain.

3. On some cases of Variation in Secondary Sexual Characters, statistically examined. By W. Bateson, M.A., Fellow of St. John's College, Cambridge, and H. H. Brindley, M.A., St. John's College, Cambridge.

[Received November 15, 1892.]

It is a familiar fact that many insects are provided with long, chitinous horn-like processes of various shapes and forms. Such horns are sometimes present in both sexes, but more commonly they attain their chief development in the male only. Among beetles the most striking examples are found in the Lamellicorns, many of which have horns of great size on the head, or on the thorax, or on both. Analogous developments are seen in the great mandibles of the males in some Lucanidæ, of which the Stag-beetle (*Lucanus cervus*) is a common representative. In the majority of these forms the similar parts of the females are either not produced at all or are much smaller. Now in many species having these curious horns in the male sex, it has long been observed that the males are not all alike in the degree to which the horns are developed; but that, on the contrary, some of the males may bear massive horns of prodigious size, while other males of the same species have hardly any horns at all, being in fact very like females. The males with the great horns are in common parlance known as "high" males, those with the rudimentary horns being "low" males. A good series of figures illustrating the phenomenon is given by Darwin [1], and examples of such Variation in *Odontolabis* &c. are exhibited in a show-case in the Natural History Museum at South Kensington.

The phenomenon of great Variation in the development of horns present in the males as a secondary sexual character is not peculiar to beetles, though in them it perhaps reaches a climax. A similar case is presented for instance by the Common Earwig (*Forficula auricularia*), in which the terminal forceps are in some males no larger than those of the female, while in others they are three times the size.

[1] 'Descent of Man,' 1871, vol. i. pp. 368–375.

The investigation we proposed to ourselves was as follows. Taking a species in which the horns of the male are sometimes small and sometimes of great size, we wished to see if individuals having any one degree of development of horns are more frequent than those having other degrees of development. The high males are an extreme form, and the low males are again an extreme form: would it then be found, on inquiry, that the mean form between these two is the commonest?

To those who are acquainted with the statistics set forth by Galton in 'Natural Inheritance' and elsewhere, it will be well known that measurements of certain quantities, as, for example, those of the stature of Englishmen, group themselves around a mean form in such a way that the curve representing the frequency of occurrence of the several measurements has the form known as a curve of Frequency of Error. In other words, there is a mean stature for that group of persons, and variations from this mean are rarer in proportion as they depart from it. Persons of mean stature are common, while the tall and the short are rarer. This group of individuals may then be described as *monomorphic* in respect of stature. If, on the other hand, it were found that tall persons were common and short persons were common, but persons of middle height were rare, such a group might be called *dimorphic* in respect of stature, and the curve representing the frequency of their various statures would not form one Curve of Error with one peak, but would have *two* peaks. In two of the three examples about to be described, the statistics showed that such dimorphism does actually exist, and that it is not the mean form which is the commonest, but rather the moderately high and the moderately low. After these remarks we may now describe our observations.

I. Forficula auricularia. (*The Common Earwig.*)

In a visit to the Farne Islands off the coast of Northumberland it was noticed by one of us that these small rocks were inhabited by vast quantities of Earwigs. The Farnes are a group of basaltic islands about 3–5 miles out to sea, few of them having human habitations. They are a well known breeding-place for sea-birds of many kinds. Above high-water mark most of the rocks are covered with a deep, black vegetable mould in which *Silene maritima* grows luxuriantly, constituting the chief vegetation, and it is in this that the burrows of the Puffins are for the most part made.

The abundance of Earwigs was most extraordinary. Under every stone or tussock there was an almost continuous sheet of Earwigs. This was the case not only among the sea-birds' nests, but also round the light-keepers' houses where no birds build. It did not seem, therefore, that the excessive quantity of Earwigs was necessarily connected with the presence of the nests.

It was at once seen that amongst these Earwigs were many males with extremely long forceps, like that shown in fig. 1, II. The usual form is seen in fig. 1, I, both figures being natural size. We

shall refer to these two forms as "high" and "low" males respectively.

It appears that the high male is known from many places in

Fig. 1.



I. II.

Forficula auricularia, the Common Earwig.
I. Low male. II. High male.

England and elsewhere, and that it was made into a distinct species by Stephens[1] under the name *F. forcipata*. This species has not been retained by later authorities (see Fischer[2] and Brunner von Wattenwyl[3]). After the visit to the Farnes, the high males were found on the mainland near Bamborough in fair quantity, though not so abundant as on the Farnes. We have received also a large sample of Earwigs collected in a Cambridge garden, containing 163 males, of which 5 would come into the "high" class. A sample kindly collected for us by Dr. Norman, F.R.S., in his garden at Burnmoor, near Durham, contains no high male. The great abundance of high males at the Farnes seems to be quite exceptional.

With a view to determining the frequency of the high and low forms, 1000 of these Earwigs were collected for us by Miss A. Bateson on Sept. 12, 1892. The whole were taken in one day from three very small islands known as the Knocksies and Widerpern, which are joined to each other at low tide.

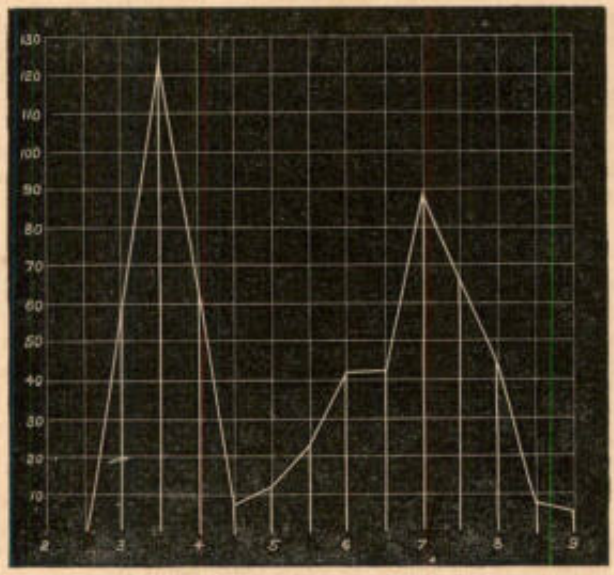
Of the 1000 specimens 583 proved to be mature males. Before giving the results of the measurements, it is perhaps necessary to give the reasons upon which we believe these specimens to have been all adult. In this matter we rely partly on the judgment of Dr. Sharp, F.R.S., who has most kindly assisted us in many ways throughout this investigation, and was so good as to take part in the work of measurement. We are informed by Dr. Sharp that the full development of the elytra is only reached in the adult state in *F. auricularia*, and we have been careful to include no specimen having imperfect elytra. As may be seen in the figures, the development of the elytra in the high and low males is the same. Besides

[1] 'British Entomology,' 1835, vi. p. 6, pl. xxviii. fig. 4.
[2] 'Orthoptera Europæa,' 1853, p. 74.
[3] 'Prodr. d. europ. Orthop.,' 1882, p. 12.

this, it is to be remembered that in most localities the high male is either unknown or very scarce, and it cannot be doubted that in these places the low males are really mature. Lastly, we know by the analogous case of horned beetles that high males coexist with low males, both being in this case of course mature. We think, therefore, that we are justified in considering that the 583 males available for measurement were all adult.

These specimens were laid out on squared millimetre paper covered with gum, and while the gum was still wet the posterior end of the forceps was brought up to one of the lines, and the length of the forceps was read to the nearest half millimetre, which is well within the limit of error. The results are set out in the accompanying curve (fig. 2), in which the figures on the ordinates denote

Fig. 2.



Curve showing frequency of occurrence of forceps of various lengths in male Earwigs (*F. auricularia*).

Ordinates give numbers of individuals; abscissæ give length of forceps in mm.

numbers of individuals, those on the abscissæ denoting millimetres. The smallest length of forceps was 2·5 mm., and the greatest 9 mm. As the curve shows, the greatest frequency is grouped about 3·5 mm. and 7 mm. respectively. The mean form, having forceps of moderate length, 4–6 mm., is comparatively rare. We consider that the number of cases is enough to justify the acceptance of these statistics, and it is unlikely that a greater number of cases would

much alter the shape of the curve[1]. The size of the forceps in the females scarcely varies at all, probably less than 1 mm. in the whole sample.

It is perhaps unnecessary to say that this result is of considerable importance to an appreciation of the way in which Variation may occur. There is here a group of individuals living in close communion with each other, high and low, under the same stones. No external circumstance can be seen to divide them, and yet they are found to consist of two well marked groups, containing about equal numbers. To those who are acquainted with the chapter on Organic Stability in Galton's 'Natural Inheritance,' this will be recognized as an instance of Variation about two positions of stability, the intermediate position being one of less stability. In the common language of naturalists, the facts of this case suggest that there is, for some wholly unknown reason, a dimorphism among the males of these Earwigs, maintained though all live together. In cases of dimorphism some have thought fit to speculate on the possible utility of the phenomenon. We know no basis of fact from which these discussions may be properly attempted, and we leave these matters to those who are satisfied with such methods of biological inquiry and have leisure and ingenuity to pursue them.

For the present we are content to recognize that in this case of the Earwig there is evidence of a definite and partially discontinuous Variation, in respect of a secondary sexual character.

II. Xylotrupes gideon.

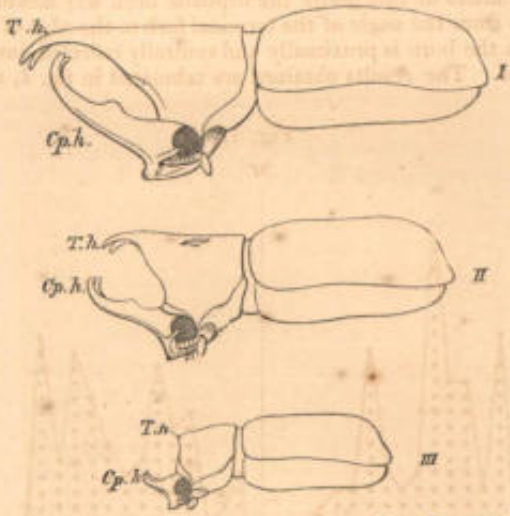
We are indebted to Baron A. von Hügel for a large supply of this species. They were collected by him at a height of 4000–5000 feet in the Willis Mountains, Kediri, Java, in February to April, 1878. In fig. 3 (p. 590) the males of this species are represented. As there seen, in this sex two horns are present, the one produced from the head, the other from the thorax. The two horns lie in the same vertical plane, and each ends in a small fork. Taken together, these two horns thus constitute a pair of forceps, which can be opened by depressing the head. The points of the forceps do not exactly meet, but the point of the cephalic horn in high males is overlapped by that of the thoracic horn. As the figures show, there is very great variation in the degree to which these horns are developed in the male, the three drawings representing "high," "medium," and "low" males respectively. In the female neither horn is developed, but there is considerable variation in total length. As may also be seen in the figures, those males which have very large horns are

[1] In most insects having high and low males, the high males are large in every way, while the low males are small. That this is so, generally speaking, in these Earwigs was clear, but it is not possible to get reliable measurements of total length, owing to the fact that the abdominal segments "telescope" into each other. Hence no examination of the correlation between total length and the length of the forceps could be attempted. There is nevertheless no doubt that the ratio of the length of the forceps to the total length is higher in high males than in the low.

also in other ways large individuals, while the males with small horns are small individuals. But though there is some correlation between absolute size and the degree to which the horns are developed, our measurements have shown that this correlation is not perfect. It is of course clear that the ratio of length of the horns to that of the body is greater in the high males than in the low.

Baron von Hügel gave us some interesting particulars as to the natural history of these beetles. They were collected in the height of the breeding-season, perhaps the greater number being found coupled. It was noticed that large males were often attached to

Fig. 3.



Diagrams of *Xylotrupes gideon*, ♂, seen from side. Legs not shown.
I. High male. II. Medium male. III. Low male.
T.h., thoracic horn; *Cp.h.*, cephalic horn.

small females and the reverse, but there appeared to be no regularity in this. In view of the circumstance that there are scarcely any observations as to the functions of the horns of beetles, the following statements of Baron von Hügel are especially noteworthy. He says that the animals were caught by himself and by natives, and were tied up with pieces of bast. When they were brought home and untied, the males immediately sought out the females, and seizing them transversely, carried them about, held between the two horns, with evident satisfaction. He tells us that this was observed again and again, and was clearly a definite habit. The males with small horns, though unable to lift the females, nevertheless made ludicrous efforts to do so. In answer to the question whether it was observed that these small males did not succeed in obtaining females

in the state of nature, Baron von Hügel tells us that he has no reliable recollection on this point.

The habit described above is not confined to *X. gideon*, for Baron von Hügel observed it also on one occasion in the case of *Chalcosoma atlas*, the well-known Atlas-beetle. A pair of this species from Java were presented by him to the Cambridge Museum, which were thus found, the female being carried between the horns of the male. In view, therefore, of the fact that the horns of many species are in various ways disposed as a pair of forceps, it is possible that this may be a habit widely spread; but that such a function cannot be attributed to all the cases of horns is shown by the fact that in many species the horns do not form a pair of forceps.

In 342 males of this beetle the cephalic horn was measured with compasses from the angle of the terminal fork to the edge of the ridge into which the horn is proximally and ventrally reflected, just in front of the eyes. The results obtained are tabulated in fig. 4, according

Fig. 4.

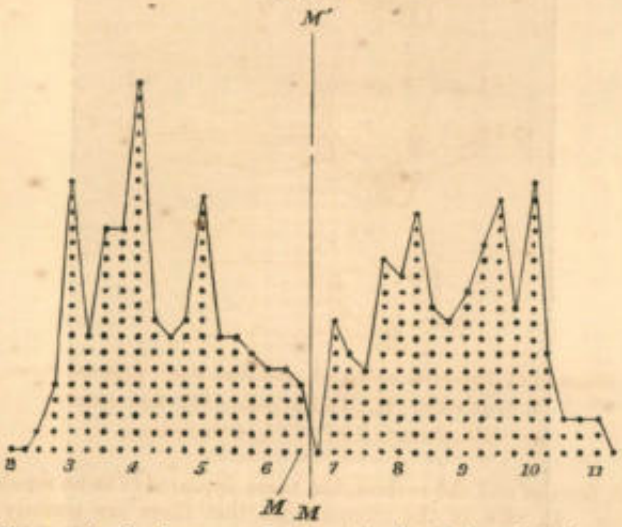


Diagram showing frequency of various lengths of the cephalic horns in *Xylotrupes gideon*, ♂.

M, mean case; M', mean value. Ordinates show number of cases; abscissæ show lengths four times nat. size. The numbers give the lengths in lines.

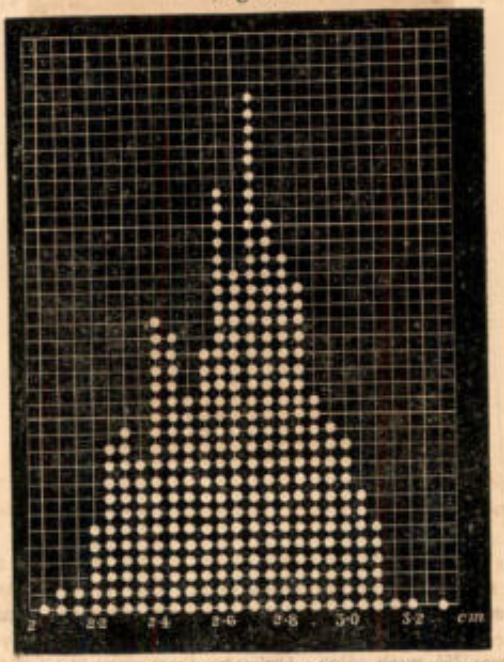
to the common system. Each dot represents a case, and the ordinates thus give the numbers of cases, while the abscissæ show the lengths of the horns; for clearness these measurements are shown four times the natural size. The shortest cephalic horn was 0·4 cm., while the longest was 2·4 cm. As the diagram shows, in the neighbourhood of the mean value (M') for the length of horn the

specimens were few, while the moderately high and moderately low males are common, the two groups being about equally numerous.

Measurements of the thoracic horn showed a similar dimorphism; but, for the reason that it is not possible to measure this horn apart from the thorax, these measurements are not so satisfactory.

The length of the elytra was also measured, and it may perhaps be taken as a measure of the body-length. For various reasons it is hard to obtain any more satisfactory measurement of the body-length. Such a measurement must either include the variable horns or else must depend on the degree of flexion of head or thorax. The result of the measurement of the elytra is perhaps unexpected in view of the knowledge that there is dimorphism in respect of the cephalic horn. Fig. 5 shows the result of grouping the statistics as to the

Fig. 5.



Xylotrupes gideon, ♂. Table of frequency of elytra of various lengths. Ordinates show number of cases; abscissæ show lengths of elytra in cm.

frequency of the various lengths of elytra, and it is hence clear that the mean form is the commonest, just as it is in the case of the stature of a given human community. Though dimorphic in respect of the length of the horns, these males are thus monomorphic as regards the elytra. There is of course nothing really contrary to

expectation in the fact that a race is dimorphic in respect of one character while in respect of another it is monomorphic.

III. Lucanus cervus. (*The Stag-beetle.*)

Of this insect we have no quantity of males sufficient to justify a statement that in respect of the development of the mandibles it is monomorphic or dimorphic. It is well known that very striking differences are found between high and low males in this species.

Males to the number of 115 obtained at Woking in 1891 and 1892 have been measured. The lengths of the mandibles from the apex to the internal angle between the base and the head were taken with compasses, and the result is exhibited in fig. 6. The fact that this

Fig. 6.

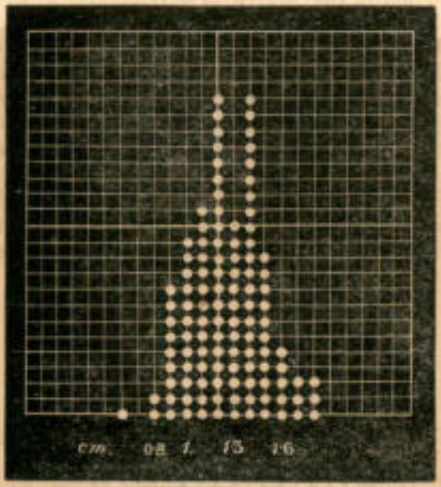


Table of frequency of various lengths of mandible in *Lucanus cervus*, ♂.
Ordinates show number of cases; abscissæ give lengths of mandibles in cm.

sample is monomorphic is quite clear, for the numbers are plainly grouped round the middlemost value. But in this case there is serious reason to doubt whether the sample examined contains really low males. In our experience of the Earwig's forceps and the *Xylotrupes* horns, the low males are almost like the females; but in the case of the Stag-beetle the mandible of the lowest male seen was much greater than that of the females. It seems possible that in the Stag-beetle the truly low male is either very rare or does not occur, and that the existing individuals belong to a group answering to those which were found in *Xylotrupes* above the middlemost value. There is in fact a possibility that we have in the Stag-beetle a case which is the converse of that of the Earwig. In most places the low male Earwig is to be found, the high male being absent or

very scarce, but in the Stag-beetle it is the high male that is common while in most places the low male is absent or scarce.

In this case, and in that of *X. gideon* also, the ratio of the mandibles or horns to the total length is higher in the high males than in the low males; or, in other words, though the body of a high male is larger than that of a low male, the horns of the high male are still larger in proportion to the body than those of the low male.

In conclusion we would call attention to the fact that fantastic secondary sexual horns present one of the most difficult problems in Evolution, for as to their modes of origin even guesses can scarcely be made. To their production a considerable expenditure of energy is clearly needed, and yet in many cases they have no obvious function. They are, further, notoriously variable. Darwin on the whole was disposed to regard them as ornaments. The knowledge therefore that variation in the degree of development of these structures may be discontinuous is a material assistance to the formation of any conception as to the manner of their origin. The question may be asked, does the dimorphism of which cases have now been given represent the beginning of a division into two species, or rather a division which might be accentuated so as to lead to such division? To this question we have no answer to make, but such a possibility may well be remembered.

We must express our thanks to Messrs Macmillan for their kindness in allowing us to use the drawings of figs. 1–4, which have been prepared by them in illustration of a forthcoming book by one of us on the subject of Variation.

December 6, 1892.

Dr. St. George Mivart, 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 November 1892:—

The total number of registered additions to the Society's Menagerie during the month of November were 144, of which 94 were by presentation, 7 by birth, 39 by purchase, 2 by exchange, and 2 on deposit. The total number of departures during the same period, by death and removals, was 82.

Dr. S. J. Hickson, F.Z.S., read a paper entitled "A Revision of the Genera of the *Alcyonaria Stolonifera*, with a Description of one new Genus and several new Species," of which the following is an abstract:—

In a communication made to the Royal Society in 1883, the author proposed to separate those Alcyonarians in which the polyps spring independently from a creeping stolon into a suborder, the Stolonifera.

The author's views have not been accepted by von Koch, Viguie,

Perceval Wright, and Studer, but a renewed investigation of the genera belonging to the suborder has convinced him that the proposed classification is perfectly justified. The suborder Stolonifera may be defined as follows:—

Colonial Alcyonaria with a membranous or ribbon-like stolon. Mesogloea poorly developed. Polyps either entirely free from one another except at their bases, or connected by horizontal platforms (*Tubipora*) or connecting tubes (*Clavularia viridis* and the fossil *Syringopora*). Skeleton composed of calcareous spicules which may be joined together to form firm tubes, or free from one another, or absent. In some cases the body-walls supported by a horny secretion.

The suborder Stolonifera contains two families: Tubiporidæ and Clavulariidæ.

The family Tubiporidæ contains one genus: *Tubipora*.

The family Clavulariidæ contains four genera: *Clavularia*, *Cornularia*, *Stereosoma*, and *Sympodium*, and probably *Syringopora*.

The genus *Cornularia* may be defined as follows:—

Clavulariidæ without spicules. Stolons with a simple cavity. Polyps retractile. The basal parts of the polyps and stolon protected by a horny secretion.

The genus *Clavularia* may be defined as follows:—

Clavulariidæ with a membranous or retiform creeping stolon into which the polyps cannot be completely retracted. Spicules usually present. No horny secretion of the ectoderm formed.

The genus *Sympodium* may be defined as follows:—

Clavulariidæ with a thick plate-like stolon into which the polyps may be completely retracted.

The genus *Stereosoma* may be defined as follows:—

Clavulariidæ forming small colonies, consisting of stiff non-retractile polyps situated at considerable intervals from one another on a thick plate-like stolon. Tentacles non-retractile. Pinnæ few and widely separated from one another. Spicules absent.

Rhizoxenia, *Sarcodictyon*, *Anthelia*, *Gymnosarca*, *Cyathopodium*, and *Cornulariella* can no longer be retained as separate genera, as it is impossible to separate them from the genus *Clavularia*. The species of these genera therefore become species of *Clavularia*.

The following new species of Stolonifera are described:—

Stereosoma celebense, from the shore reefs of Talisse Island, North Celebes.
Clavularia garciæ, from Diego Garcia, shallow water.
Clavularia reptans, 5–20 fathoms off Talisse Island, N. Celebes.
Clavularia celebensis, shallow water, Talisse Island, N. Celebes.

The following species previously named by the author in the Proc. Royal Society of Victoria are described in detail for the first time:—

Clavularia australiensis, varieties A & B.
Clavularia ramosa.
Clavularia flava.

An account of the anatomy of *Clavularia viridis* of Quoy and Gaimard is also given.

This paper will be printed entire in the Society's 'Transactions.'

The following papers were read :—

1. On the Convolutions of the Cerebral Hemispheres in certain Rodents. By FRANK E. BEDDARD, M.A., F.R.S., Prosector to the Society.

[Received December 6, 1892.]

The Rodents are for the most part smooth-brained animals ; there are, however, several exceptions to the universal applicability of this statement, which have been to some extent dealt with by previous writers, including myself. The Rodent brain has not, however, been subjected to that careful study to which the Ungulate and Carnivorous brains have in the hands of Dr. Krueg and Prof. Mivart. The only paper dealing with the Rodent brain in general known to me is by Dareste (1) ; but this article does not include a full description of the convolutions in any type except in the Capybara, though incidental references are made to other types in the author's general survey of the characters of the cerebral hemispheres in the group. Having formed a collection of Rodents' brains during the last year or two from material that came to hand at the Society's Gardens, I think it will perhaps be worth while to again call the attention of anatomists and systematists to the structure of the cerebral convolutions in this group of Mammalia. I have examined specimens of the following species, the brains of which show, at any rate, traces of convolutions :—

Cœlogenys paca.
Dasyprocta azaræ.
Lagostomus trichodactylus.
Capromys pilorides.
Hydrochœrus capybara.
Hystrix cristata.
Sphingurus prehensilis.
—— *villosus.*
Castor canadensis.
Cavia porcellus.
Octodon cumingi.
Myopotamus coypu.
Lepus cuniculus.
Aulacodus swindernianus.
Dolichotis patachonica.

The last two I have lately described in papers dealing with the general anatomy of the Rodents in question (3, 4). Several of these animals have been studied by previous observers; I shall refer to them in the following descriptive part of the present paper.

§ 1. *Description of the Cerebral Hemispheres in certain Genera.*

Castor canadensis[1].—Total length 54 mm., breadth 41 mm., height 25 mm.

The cerebral hemispheres trend away from each other posteriorly, permitting the corpora quadrigemina to be seen; they are closely applied anteriorly. The length of each hemisphere is 38 mm.; the hemispheres are wider behind than in front; the width gradually increases up to a point a little in front of the middle of the hemisphere; thence the two margins are approximately parallel to each other.

The upper surface of the cerebral hemispheres is nearly completely smooth; at about the end of the first half of the hemisphere is a short fissure shaped like the Greek letter γ; behind this, separated from it by a considerable interval and further from the middle line, is a very short (3 mm. long) longitudinal fissure. These two fissures are indicated by Leuret and Gratiolet as forming one continuous fissure. On the under surface of the brain no trace was apparent of the Sylvian fissure. The rhinal fissure is by no means clearly marked; it is only obvious anteriorly and again just before the posterior margin of the hemispheres; it ends at a distance of 15 mm. from the upper surface of the hemispheres. The olfactory bulbs are large.

Capromys pilorides.—Length 38 mm., breadth 26 mm., height 16 mm.

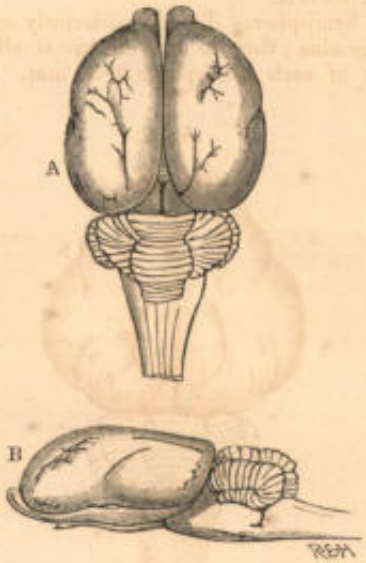
The cerebral hemispheres (fig. 1, p. 598) show the same rounded oval contour that distinguishes the brains of the Porcupines. The extreme diameter of the hemispheres is reached a very short distance behind the anterior end of the brain. The posterior divergence of the two hemispheres partly displays the corpora quadrigemina. Each hemisphere measures 25 mm. in length. The surface is faintly marked by a few furrows. A longitudinal furrow (see woodcut, fig. 1) on each side starts from the inner angle of the hemisphere; it is altogether 9 millimetres long; it passes at first forwards and outwards, and then at the middle of its length changes its direction and runs straight forwards parallel to the long axis of the brain; a very short branch is given off at this point which continues the straight line of the first part of the furrow; another short branch parallel to this is given off on the side just before the end of the furrow. These furrows are more strongly marked on the right half of the brain. In front of this posterior longitudinal furrow is a short C-shaped furrow not connected with it; the concavity of this furrow is directed inwards. There are indications of a very faint transverse furrow at a distance of 10 mm. from the intercerebral sulcus and about 4 mm. from the posterior margin of the brain. A diagonal furrow about 8 mm. in length is partly visible on the sides of the hemispheres when the brain is viewed from above; it

[1] Figured by Leuret and Gratiolet (8, plate i. fig. 1).

occupies the middle of the length of the hemisphere and runs from above downwards; on the left side of the brain this furrow gives off a faint branch which seems to be the Sylvian fissure—otherwise hardly marked.

On the inferior surface of the brain the rhinal fissure is seen to be

Fig. 1.



Brain of *Capromys pilorides*.

A, from above; B, from the side.

perfectly continuous and quite well marked from end to end. As already mentioned, I found the greatest difficulty in discovering any traces of the Sylvian fissure excepting in the lateral region of the hemispheres, where it is present.

Myopotamus coypu.—Total length 39 mm., breadth 28 mm., height 14 mm.

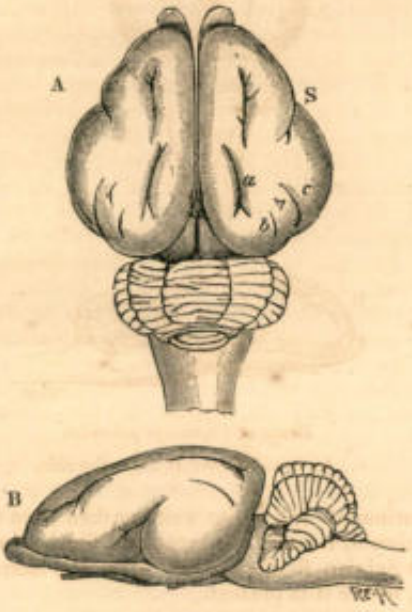
The cerebral hemispheres are nearly but not quite smooth; there being indications of furrows which are more strongly marked in other genera. The extreme length of each hemisphere is 28 mm. They diverge posteriorly so as to display a portion of the corpora quadrigemina—both nates and testes; the latter are, however, partly concealed by a projection of the cerebellum. Anteriorly the two hemispheres become very narrow and diverge in a marked way from each other; passing back, the hemispheres rapidly increase in

breadth until about the middle point, when the margins are nearly parallel, converging slightly posteriorly. The rhinal fissure is quite continuous; the Sylvian fissure is represented by the merest trace. On the upper surface of the brain there are two short furrows on each side, one in front of and to the outside of the other.

Lagostomus trichodactylus.—Total length 43 mm., breadth 35 mm., height 18 mm.

The cerebral hemispheres diverge posteriorly so as to display the corpora quadrigemina; they do not diverge at all anteriorly. The extreme length of each hemisphere is 31 mm. The hemispheres

Fig. 2.



Brain of *Lagostomus trichodactylus*.

A, from above; B, from the side: *a*, *b*, *c*, longitudinal fissures; S, Sylvian fissure. See p. 607.

are wider behind than in front; the breadth increases very gradually up to the Sylvian fissure; at this point the brain suddenly becomes wider.

The brain (fig. 2) is marked by several fairly deep furrows and by other slighter ones. These are perfectly symmetrical. On either side of the intercerebral fissure is a furrow 9 mm. long which

commences about 5 mm. from the posterior end of the brain and at about the same distance from the interhemispheral fissure; this furrow is slightly oblique in direction, the anterior end being nearer to the middle line than the posterior. In front of this is another furrow, rather deeper but about the same length; this furrow is twice the distance from the median furrow, that is the last described furrow, and shows a tendency (on one side) to bifurcate anteriorly. If the anterior end of the posterior furrow were bent away from the middle line of the brain, it would come to be continuous with the anterior longitudinal furrow; as it is a space of 3 mm. separates the two. Parallel with the posterior longitudinal furrow are two less conspicuous fissures; they run at about equal distances from each other and from the furrow first described: the inner of the two is only just visible; it is very short and very plainly marked: the outer is 10 mm. in length; it starts from the posterior border of the hemisphere; but the posterior part of this fissure is much shallower than the anterior half, and is indeed only plainly recognizable on the right hemisphere. The Sylvian fissure is very deep on the upper surface of the brain though shallow at its commencement; its direction is on the whole at right angles to the longitudinal axis of the brain; it is, however, curved, the convexity of the curve being forwards; at about the middle of its course it gives off a short forwardly running branch, the direction of which is also slightly downwards.

On the under surface of the brain the only distinct fissure (apart from the Sylvian) to be seen is the rhinal fissure. This is quite obvious from end to end. This fissure can be traced back on the posterior aspect of the hemispheres up to within 6 or 7 mm. of the upper surface of the brain.

Hystrix cristata[1].—Total length 45 mm., breadth 36 mm., height 20 mm.

The cerebral hemispheres are very broad and together have an almost circular contour. They diverge posteriorly so as to reveal the corpora quadrigemina. The upper surface is furrowed to some extent, though not to so marked a degree as in some other genera. The length of each hemisphere is 30 mm.

A longitudinal furrow about 10 mm. long runs on either side of the median furrow on the posterior half of the hemi-phere; rather in front of the middle of each hemisphere, this furrow is very nearly continuous with a much deeper furrow passing obliquely outwards at an angle of about 30° with the transverse axis; this furrow, which is about 13 mm. long, is restricted to the dorsal surface of the brain. The remaining furrows are decidedly asymmetrical in their arrangement.

On the left half of the brain there are two downwardly directed fissures running parallel with the Sylvian fissure. On the right

[1] Figured by Louret and Gratiolet (8, plate iii.).

hemisphere I could only recognize one of these. On the right half of the brain there is a marked indentation to the outside of the posterior extremity of the longitudinal furrow.

On the under surface of the brain the rhinal fissure is seen to be very distinct and complete. The Sylvian fissure is not so distinct where it joins the rhinal fissure as it is laterally; just in front of the Sylvian fissure is a small fissure arising from the rhinal fissure, which appears to be the termination of the anterior transverse fissure of the dorsal surface of the brain.

Sphingurus prehensilis.—Total length 36 mm., breadth 27 mm., height 19 mm.

The cerebral hemispheres show the same peculiar shape that is seen in *Hystrix*; their contour is almost circular; the posterior divergence of the two hemispheres is so nearly filled by the projecting cerebellum that the merest peep at the corpora quadrigemina is alone possible.

Each hemisphere measures 24 mm. in length; the upper surface is smooth, but not so smooth as in the Beaver; it is marked by a good many meandering lines which are for the most part directed downwards. I do not describe these particularly as they do not appear to me to be of any morphological importance. In addition to these there are two dents on the upper surface of the brain. The posterior of these is placed at a distance of about 6 mm. from the hinder margin of the brain; the anterior mark is about the same distance in front.

The rhinal fissure is not well marked, but it is complete. The Sylvian fissure was hardly apparent.

Sphingurus villosus.—Total length 36 mm., breadth 30 mm., height 20 mm.

This brain is almost exactly identical in size with that of the last species; nor is there any occasion to describe the general shape and the proportions of its various regions, for they are precisely as in *Sphingurus prehensilis*.

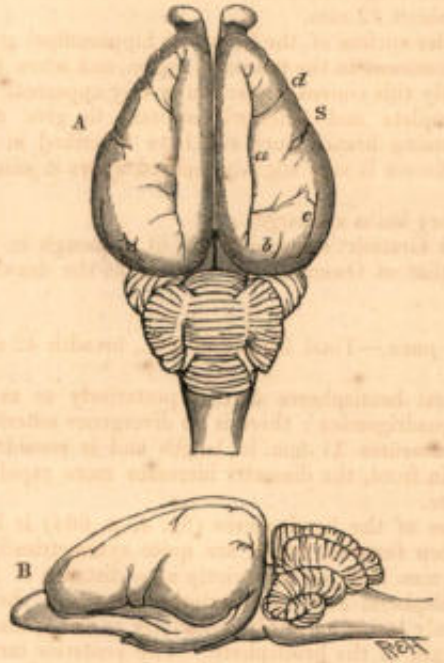
On the other hand, the brain is deeply furrowed in comparison with that of the other *Sphingurus*. It appears to me to be a very remarkable fact there should be this difference in the brain-surface of two animals of the same size and belonging to the same genus. The rhinal fissure is quite deep and perfectly complete. The Sylvian fossa is much deeper than in *Sphingurus prehensilis*. The Sylvian fissure is also quite conspicuous and passes on to the dorsal side of the brain, where it is deeper than at its origin; this region of the Sylvian fissure is represented by the posterior of the two dents upon the surface of the brain of *Sphingurus prehensilis*. In front of this fissure are two others equidistant from it and from each other, which run in a similar direction; besides these principal fissures are numerous smaller ones which are principally branches of them. There was no longitudinal fissure.

Dasyprocta azaræ.—Total length 46 mm., breadth 30 mm., height 20 mm.

The cerebral hemispheres are very closely applied along nearly their whole length; the divergence posteriorly only permits a portion of the anterior pair of corpora quadrigemina to be seen when the brain is viewed from above. Each hemisphere measures 30 mm. in length and is furrowed. The general contour of the hemispheres does not differ from that of the last animal.

The principal furrow (fig. 3) runs longitudinally at a distance

Fig. 3.



Brain of *Dasyprocta azaræ*.

A, from above; B, from the side: *d*, anterior transversely running furrow; S, Sylvian fissure; *a*, *b*, *c*, longitudinal fissures. See p. 607.

of about 5 mm. from the interhemispheral sulcus. It commences close to the posterior margin of the brain and passes nearly as far as the anterior end; at the end of the first third of the total length of the hemisphere this furrow gives off a branch which runs forwards and outwards, joining the rhinal furrow below; 8 mm. behind this point (on the left half of the brain), or 11 mm.

(on the right half), the Sylvian fissure also joins this longitudinally running furrow.

A second longitudinal furrow, at about the same distance from the first described longitudinal furrow as the latter is from the median interhemispheral furrow, and commencing about 5 mm. from the posterior margin of the brain, has a course of 4 or 5 mm.; this furrow is rather more strongly marked on the right half of the brain. Again, to the outside of this is a longer furrow but less strongly marked, which commences at the very margin of the brain just opposite to the point where the rhinal furrow is lost beneath the corpora quadrigemina; this furrow is situated about twice as far from the second longitudinal furrow as that furrow is from the first. Its length is about 12 mm.

On the under surface of the brain the hippocampal gyrus is seen to be very prominent in the temporal region, and when the brain is viewed laterally this convex projection is very apparent. The rhinal fissure is complete and anteriorly appears to give off a short forwardly running branch such as I have described in *Cœlogenys*. The Sylvian fissure is very slightly marked where it joins the rhinal fissure.

The olfactory bulbs are large.

Leuret and Gratiolet's figure (8, pl. iii.), though in my opinion better than that of Owen, is not so clear as the drawing which I exhibit.

Cœlogenys paca.—Total length 53 mm., breadth 42 mm., height 23 mm.

The cerebral hemispheres diverge posteriorly so as to display the corpora quadrigemina; there is no divergence anteriorly. Each hemisphere measures 34 mm. in length and is considerably wider behind than in front, the diameter increases more rapidly after the Sylvian fissure.

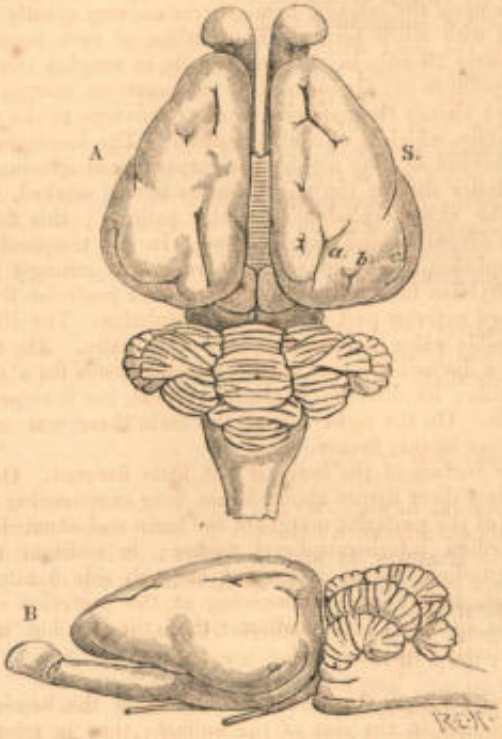
The surface of the hemispheres (fig. 4, p. 604) is indented by a few very deep furrows, which are quite symmetrically arranged. A furrow 10 mm. long lies posteriorly at a distance of 7 mm. from the interhemispheral sulcus; anteriorly there is a shorter furrow which suddenly bends outwards posteriorly and runs almost parallel with the margin of the hemisphere. The posterior furrow is continued forward by a very faintly marked furrow which approaches the middle line and then turns outwards, joining or running just behind the end of the anterior furrow. On the right side of the body there is a small but deep indentation on the inner side of the posterior furrow, between it and the interhemispheral furrow; there is also (on both sides of the brain) another dint—it is hardly long enough to be called a furrow—on a level with the hind extremity of the posterior furrow and about as far from it as that furrow is from the median interhemispheral sulcus.

Outside this again is a shallow furrow which begins at the posterior margin of the hemisphere, just on a level with the end of

the rhinal furrow (on the right side); its course is longitudinal, but at an angle of about 30° with the longitudinal axis.

On the under surface the rhinal fissure is complete and very deep and wide; on the hinder aspect of the brain it is seen to reach to within about 12 mm. of the inner corner of the hemisphere;

Fig. 4.



Brain of *Cælogenys paca*.

A, from above; B, from the side: S, Sylvian fissure; *a*, *b*, *c*, longitudinal fissures.

anteriorly the under surface of the pallium is marked by a short but deepish fissure which appears to become continuous with the rhinal fissure, but is really, in all probability, a distinct longitudinal groove upon the lower surface of the pallium. The hippocampal lobe is marked by an indentation just on a level with the Sylvian fissure; there are also faint transverse lines in front of this. The Sylvian fissure is represented by a mere notch, more emphasized on the right half of the brain than on the left.

The olfactory bulbs are large.

The brain of this animal is also figured by Leuret and Gratiolet (8, pl. iii.). The furrows are not, however, sufficiently marked in their drawing.

Cavia porcellus.—Length 28 mm., breadth 20 mm., height 12 mm.

The description of this brain need not occupy us long, since the convolutions upon the cerebral hemispheres are very greatly reduced as compared with allied forms. The outline of each hemisphere, which measures 20 mm. in extreme length, is roughly triangular; the widest point is not far in front of the posterior margin of the hemispheres; thence the opposite margins converge to the anterior end of the brain, which is of slight diameter. The hemispheres are divaricated behind so as to display the corpora quadrigemina.

On the under surface the rhinal fissure is well marked, entirely separating the rhinencephalon from the pallium; this fissure is considerably deeper behind than in front. In the temporal region the rhinencephalon is very convex, a more or less strongly marked fissure (the Sylvian fossa) separating the convex posterior from the more flattened anterior part of the rhinencephalon. The rhinencephalon is visible when the brain is viewed laterally. On the left side there is a distinct Sylvian fissure, which extends for a distance of about 6 mm.; its direction is almost vertical, but it slopes backwards a little. On the right side of the brain there was no trace that I could see of this fissure.

The upper surface of the brain is but little fissured. On each hemisphere is a short fissure about 5 mm. long commencing a little way in front of the posterior margin of the brain and situated 3 mm. from the median interhemispheral fissure; in addition to this another longitudinal fissure is present on each side 5 mm. away from the last, longer and commencing at the posterior margin. This fissure is, however, even shallower than the last, but in spite of this is perfectly evident.

It is generally stated that the convolutions of the hemispheres bear some relation to the size of the animal; thus in relation to the Cervidæ Sir W. H. Flower has pointed out[1] "how closely the amount of convolution bears relation to the bulk of the hemisphere, the primitive pattern being exactly the same in all." Again, among the Primates the Marmoset has the tiniest brain, and this brain is quite smooth. Broadly speaking the rodents form no exception to this generalization; its truth becomes more apparent when the comparisons of extent of complication of brain-surface are restricted to a family rather than when applied to the whole group.

Otherwise the brain of the Beaver forms a marked exception; it is as large as any rodent brain excepting *Hydrochœrus* and is nearly perfectly smooth, while considerably smaller brains, such as *Lagostomus*, are decidedly convoluted.

The above-given account of the various brains which I have been

[1] 7, p. 174.

able to examine leads me to disagree with some of the statements in Dareste's paper (1). After describing the convolutions of the Capybara he remarks :—"Il n'existe point dans les autres Rongeurs de véritables circonvolutions ; mais les anfractuosités et les depressions que l'on observe à la surface du cerveau de leurs grandes espèces sont manifestement, dans leur disposition, l'ébauche et comme l'indication des circonvolutions si développées et si nettement dessinées du Cabiai." Sir William Turner also, in his interesting survey of the Mammalian brain (2), says upon the same subject :—"The Rodentia are almost universally smooth-brained. But in some genera traces of shallow fissures may occasionally be seen on the surface which indicate an early stage in the formation of convolutions." It appears to me that both these statements underestimate the actual development of fissures and convolutions[1] upon the brain of the larger Rodents. I do not, I confess, see any reason for M. Dareste's distinction between the "circonvolutions" of the brain of *Hydrochœrus* and the "anfractuosités" of the brains of some other forms ; perhaps, however, Dareste had not in his hands such well-preserved brains as I have been able, thanks to the skill of my assistant Mr. Ockenden, to examine. Judging from a specimen of the brain of *Hydrochœrus* which I have seen by the kindness of Mr. Charles Stewart in the Museum of the Royal College of Surgeons, the fissures in this rodent are not more marked than they are in, for example, *Lagostomus* ; but the latter is one of the best developed brains in this respect, and it is one of the types which M. Dareste did not examine or refer to ; I should, however, dispute his statement even when applied to the Agouti ; I think that a comparison of my figure of the brain of this rodent with M. Dareste's figures of the brain of *Hydrochœrus* will bear out my remarks.

Another point in which I find myself in disagreement with M. Dareste concerns the Sylvian fissure. He remarks, and judging from his figure with perfect truth, that the Capybara has no fissure in its brain which can be compared to this universally present fissure ; it is, however, a little rash to found upon the examination of a single type (he says nothing in this matter of the other Rodents' brains) a generalization of so much importance as that which Dareste proceeds to formulate, viz. :—"Le cerveau des Rongeurs nous présente, selon toute apparence, un type distinct de celui des Primates, des Carnivores et des Ruminants ; type principalement caracterisée par l'absence de la scissure de Sylvius, et par suite par l'absence de la division du cerveau des deux lobes, l'un antérieur, l'autre postérieur à la scissure." Sir W. Turner also remarks that "The Sylvian fissure . . . is not seen . . . in the lissencephalous Rodents." The Sylvian fissure is undoubtedly feebly developed in the majority of those Rodents[2] the brains of which I have personally

[1] Leuret and Gratiolet head plate iii., on which Rodents' brains are figured, with the title "Encéphale des Mammifères dont les lobes cérébraux sont dépourvus de circonvolutions."

[2] The Sylvian fissure also exists in a few perfectly smooth-brained Rodents for instance in the following :—*Sciurus, Dipus, Gerbillus, Chinchilla.*

studied; but it is quite impossible to characterize the group by the absence of this fissure; for instance, there is a distinct trace of this fissure in *Cœlogenys* and in *Capromys*; *Dasyprocta* has quite a respectable Sylvian fissure, though, as I have already pointed out, it is not thoroughly certain which of the two fissures to be found in this neighbourhood is to be compared with the Sylvian fissure of other Mammals; but the best exception to M. Dareste's unfortunate generalization is shown by the genus *Lagostomus*, where the Sylvian fissure is so deep and extensive that it could not possibly be overlooked, and moreover appears on the dorsal aspect of the brain, as shown in the drawing which I have already exhibited (fig. 2, p. 599). I do not think it worth while to follow M. Dareste into his comparison of the Rodent brain with that of the Marsupials and more particularly of the Kangaroo; he chiefly bases this comparison upon the supposed absence of the Sylvian fissure in the latter animal, a supposition which is not true (see for example the woodcut (fig. ii.) illustrating Sir William Turner's paper upon the mammalian brain).

§ 2. *Comparison of the Brains of the Genera described* inter se.

The convolutions of the Rodent's brain can be satisfactorily compared; but unfortunately most genera have small brains which either show no traces of any furrows or only traces. The furrows are, however, well developed in *Cœlogenys*, *Dasyprocta*, *Dolichotis*, *Lagostomus*, and *Hystrix*; traces of the more important furrows can be recognized in *Castor*, *Aulacodus*, *Capromys*, *Sphingurus*, *Myopotamus*, *Lepus*, *Cavia*, and *Octodon*; the brains of *Sciurus*, *Dipus*, *Gerbillus*, and *Cricetus* are quite smooth.

The brain of *Dasyprocta* is a convenient starting-point; I shall therefore briefly recur to the furrows which mark the cerebral hemispheres of this Rodent. I do not propose to call these furrows by any names, for that would imply a direct comparison with the similarly named furrows in the brains of other Mammalia; I doubt very much how far such comparisons can be safely made. Each hemisphere has five furrows (apart from the "rhinal" furrow, which I leave aside for the present), three of which run parallel with the long axis of the brain and two somewhat transversely to that axis.

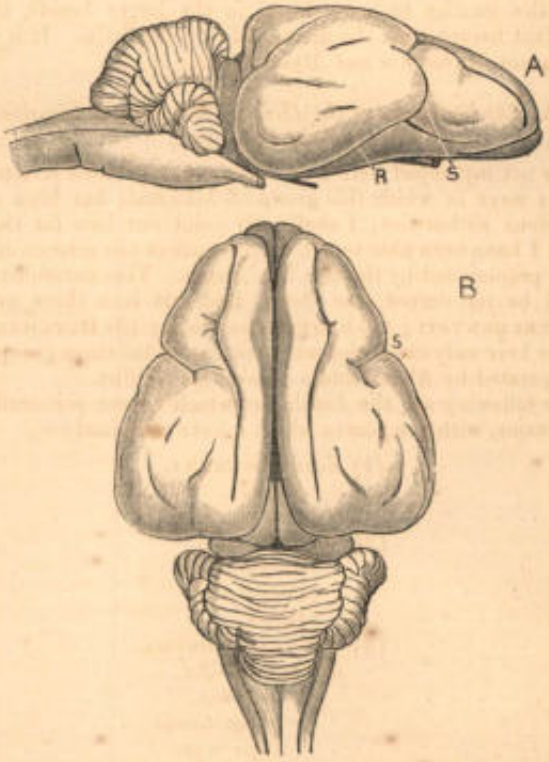
The most important of these furrows (*a*, see figs. 2, 3, & 4, pp. 599, 602, 604) runs at a distance of about 5 mm. from the interhemispheral sulcus nearly from end to end of the brain. The second longitudinal furrow (*b*) is very short, about 5 mm. long, and about 5 mm. distance from *a*. The third longitudinal furrow (*c*) is about twice the length of the last, and is situated about midway between the dorsal and ventral surfaces of the brain when the brain is seen in profile. At the end of the first third of the hemisphere the furrow *a* gives off a transverse furrow (*d*), which joins the rhinal fissure; behind this, at the end of the second third, is a second transverse fissure which joins *a* on one

side only, and separates the temporal from the frontal lobe; I have no hesitation in terming this the Sylvian fissure.

In the brain of *Lagostomus* (fig. 2, p. 599) the same fissures are present, but differently developed; *a* is broken into two separate fissures on each side, *b* has almost disappeared, *c* is also rudimentary; between *b* and *c* is a short fissure *b'* which seems to be unrepresented in *Dasyprocta*; of the transverse furrows *d* is only just indicated at its junction with *a*, while the Sylvian fissure is very deep and does not nearly reach *a*.

In *Dolichotis* (fig. 5) *a* is even longer and stronger than in

Fig. 5.



Brain of *Dolichotis patagonica*.

A, from the side; B, from above: S, Sylvian fissure; R, rhinal fissure.

Dasyprocta; *b* is not parallel to *a*, but converges towards it anteriorly; *b* is well developed and consists of two separated portions; *c* is fully developed; the only trace of *d* is a bend in the furrow *a* at the

point where *d* would join it were that furrow present; the Sylvian fissure is deep and bifurcate at the upper end, nearly joining *a*.

Cœlogenys (fig. 4, p. 604) has a less convoluted brain. The fissure *a* is divided into two quite separate portions, which occupy the first and last thirds of the hemisphere; *b* is merely a deep dent which is rather transverse in direction, running towards *c*: neither *d* nor the Sylvian fissure was well developed; on one side, however, the latter could be made out, and there were indications of *d* as a deepish depression connected by a shallow furrow with the end of the first part of *a*.

In *Hystrix* *a* is not extensive; fissures which possibly correspond to *b* and *c* are present but run obliquely outwards; *c* and *d* are well developed, so that altogether the furrows have a markedly oblique disposition.

In the smaller brains *a* is, as in the larger brains, the most important fissure upon the upper side of the brain. It is the only one present in *Octodon* and *Myopotamus*.

§ 3. *The Structure of the Hemispheres and the Classification of the Rodentia.*

It is not my object here to enter into any detailed account of the various ways in which this group of Mammals has been arranged by various authorities; I shall only point out how far the results which I have been able to get together affect the scheme of classification propounded by the late Mr. Alston. This naturalist divided, it will be recollected, the Order Rodentia into three groups:—(1) Hebedentati; (2) Simplicidentati; (3) Duplicidentati. We are here only concerned with the last of the three groups, which are separated by Alston into a number of families.

The following are the families of which I have personally examined brains, with the genera which I have examined:—

(1) Sciuromorpha.
- *Sciurus*.
- *Castor*.

(2) Myomorpha.
- *Gerbillus*.
- *Cricetus*.
- *Dipus*.

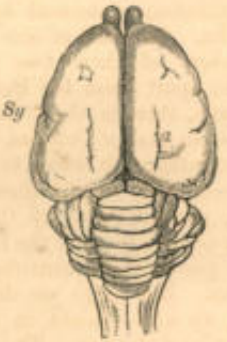
(3) Hystricomorpha.
- *a*. Octodontidæ.
  - *Octodon*.
  - *Myopotamus*.
  - *Capromys*.
  - *Aulacodus*.
- *b*. Hystricidæ.
  - *Hystrix*.
  - *Sphingurus*.
- *c*. Chinchillidæ.
  - *Lagostomus*.
  - *Chinchilla*.

d. Dasyproctidæ.
Dasyprocta.
Cœlogenys.
e. Caviidæ.
Cavia.
Dolichotis.
Hydrochœrus.

It will be noticed at once that the convoluted brains belong to the last of the three divisions of the Simplicidentati; the obscure dints upon the upper surface of the cerebrum of the Beaver are apparently the only apology for convolutions possessed by either the Sciuromorpha or the Myomorpha. In point of size there is every reason why some of the members of these two groups should have recognizable convolutions; apart from the Beaver, which is one of the largest of the Rodentia, there is the Common Squirrel, whose brain is distinctly bigger than that of *Octodon*, in which genus there are decided traces of convolutions; it seems to me therefore that—for the present at least—we may regard these two groups of the Simplicidentati as being characterized by the entire absence of convolutions. It is quite otherwise with the Hystricomorpha; the larger members of this group show convolutions which can be reduced to a common plan. But there are differences among the genera which permit of an arrangement in accordance with the varying condition of the convolutions. 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. Only in *Hystrix* itself is the principal longitudinal furrow *a*, which occurs in all other Rodents whose brains show any convolutions at all, represented to any extent. In relation to this fact it may be pointed out that we may fairly regard *Hystrix* as the least specialized of the Rodents whose brains are treated of here. The only animal whose brain approaches that of the Porcupines is, as I have already pointed out, *Capromys*; the brain of this Rodent is rounded off in the same way anteriorly. The convolutions are so feebly developed that the comparison can perhaps hardly be pushed any further. It may, however, be worth remarking that a lateral furrow, which I regard as being a part of the Sylvian fissure, is well marked both in *Capromys* and in the Porcupine. This latter furrow is also not inconspicuous in *Aulacodus* (fig. 6, p. 611), the relationships of which to *Capromys* are apparent from a comparison of their brains. Even in *Myopotamus*, where the shape of the brain is very different from that of other Octodontidæ, there is a distinct trace of the lateral oblique furrow which is so well marked in both *Aulacodus* and *Capromys*. In any case, therefore, the naturalism of the family Octodontidæ is shown by a comparison of their brains. We next come to the Dasyproctidæ, represented by the two genera *Dasyprocta* and *Cœlogenys*. Of these two brains *Cœlogenys* is the larger, and yet it has the fewest furrows;

these furrows are, however, deeper than in *Dasyprocta*. The chief point of agreement between them, and that which causes them to differ from the two remaining families, is the absence of the Sylvian fissure; this brings *Hydrochœrus* into relation rather with the Dasyproctidæ than the Caviidæ, where it is placed by Alston. Judging also from Dareste's figure, the general outline of the brain of *Hydrochœrus* is like that of *Cœlogenys*, but also of *Lagostomus*. In all these three genera the principal longitudinal fissure, which I have called "*a*," is divided into two portions, one anterior and one posterior. Apart

Fig. 6.



Brain of *Aulacodus*, viewed from above.
Sy, Sylvian fissure; *a*, longitudinal furrow.

from this the brain of *Lagostomus* appears to be nearer to that of *Dolichotis*. They have both of them a deep Sylvian fissure, and the furrows *b* and *c* tend to converge towards the middle line; finally, the rhinal fissure in both genera is deeper behind than in front. I have not ventured to treat at length of the evidences of affinity afforded by the convolutions, since the illustrations are before the reader, who can form his own opinions.

List of Papers and Books referred to.

(1) Dareste, C.—"Note sur le Cerveau des Rongeurs et particulièrement sur le Cerveau du Cabiai," Ann. Sci. Nat. sér. 4, vol. iii. (1855), p. 355, pl. xi.

(2) Turner, Sir W.—"The Convolutions of the Brain: A Study in Comparative Anatomy," J. Anat. Phys. vol. xxv. pp. 105–153 (1891).

(3) Beddard, F. E.—"Notes on the Anatomy of *Dolichotis patagonica*," P. Z. S. 1891, p. 236.

(4) Beddard, F. E.—"On the Brain and Muscular Anatomy of *Aulacodus*," P. Z. S. 1892, p. 520.

(5) Mivart, St. George.—"Notes on the Anatomy of *Erithizon dorsatus*," P. Z. S. 1882, p. 271.

(6) Owen, Sir R.—'Comparative Anatomy and Physiology of Vertebrates.'
(7) Flower, Sir W. H.—"On the Structure and Affinities of the Musk-Deer (*Moschus moschiferus*, Linn.)," P. Z. S. 1875, p. 159.
(8) Leuret, F., & Gratiolet, P.—'Anatomie comparée du Système nerveux.' Paris, 1839–1857.
(9) Alston, E. R.—"On the Classification of the Order Glires," P. Z. S. 1876, p. 61.

P.S. (December 29th, 1892).—I am indebted to the kindness of Prof. Howes for the opportunity of figuring (fig. 7) and describing a most remarkable Rabbit's brain. The animal was

Fig. 7.



Brain of Rabbit, showing abnormal development of convolutions.

a domesticated Rabbit, and was dissected in the laboratory of the Royal College of Science by one of Prof. Howes's students. Ordinarily the brain of this Rodent has but one slightly marked furrow upon the upper surface of each hemisphere, which corresponds to that lettered *a* in the series of woodcuts which illustrate this paper. In the brain before me this furrow is present, but it is continuous from one end of the brain to the other, having a somewhat zigzag course; at the angles formed by the zigzags of furrow *a* a number of transverse furrows are given off, which for the most part reach the under surface of the cerebrum joining the rhinal fissure. In addition to these (of which one seems to correspond to the Sylvian



J. Smit del. et lith. Mintern Bros. imp.

SEMNOPITHECUS THOMASI.

fissure) there are numerous connecting furrows; the whole surface of the brain is indeed divided up by a network of furrows with a development far in excess of anything met with in any other Rodent known to me. The very number and variety in direction and extent of these furrows make it quite easy to select some which can be identified with those upon the cerebral hemispheres of other Rodents. It is of course difficult, if not impossible, to come to any definite opinion as to the significance of the furrows upon this particular brain; if they are an accidental expression of the possibilities of modification in the brain-surface, it is noteworthy that the Rabbit departs very widely from the Simplicidentati. In the latter group the tendency upon the whole appears to be a stronger development of longitudinal furrows, thus resembling the Ungulata.

2. On a new Monkey from North-east Sumatra.

By R. Collett, C.M.Z.S.

[Received November 8, 1892.]

(Plate XLII.)

During the years 1888 and 1889, Herr Iversen, one of the preparators of the University Zoological Museum of Christiania, resided on the north-east side of Sumatra in order to collect specimens for the museum.

Through the kindness of two young Norwegians, the Messrs. Kamstrup, who are established there, one in the district of Langkat, the other in that of Deli, Herr Iversen, by living in turns on their estates, has been enabled to make a very important collection of the vertebrated animals of those districts. As the collection of Vertebrates is not yet completed, but is being steadily increased by Messrs. Kamstrup themselves, I intend, at a later opportunity, to give a general account of the whole of the materials furnished from these parts. On the present occasion, however, I wish to give a short diagnosis of a *Semnopithecus* which does not appear to have been previously described, and to which I have great pleasure in attaching my friend Mr. Oldfield Thomas's name.

Semnopithecus thomasi, sp. n. (Plate XLII.)

Diagnosis.—A central occipital crest sloping at first backwards, but reversed on the occiput; a lower (indistinct) crest on each side of the forehead. Colour above dark grey, white underneath; hands and feet black. The cheeks, front, and forehead are white; a black stripe from the upper jaw to the ear, and a black central stripe on the forehead; the very old male darker, with the upper part of the head brownish black, front whitish.

Locality.—Langkat, N.E. Sumatra (7 specimens procured; University Museum, Christiania).

In form and general appearance this Monkey resembles the group

to which *S. femoralis* and *S. obscurus* belong, and appears to be closely related to *S. hosei* from North-west Borneo [1], described in 1889 by Mr. Thomas. The distribution of the colouring is in several respects identical with that of the latter, but there is a characteristic difference in the colouring of the cheeks, which do not, as in *S. hosei*, form a connected white area with the white forehead, but the area is broken by a black band from the edge of the mouth to the ear (in the young male and the female); in the old male the upper parts of the cheeks are nearly entirely black. The crest likewise does not slope evenly backwards as in *S. hosei*, but is reversed on the back of the head and runs upwards towards the centre of the crown.

From *S. femoralis*, to which especially the old male seems to be nearly related, it is distinguished by the white forehead and the wholly white under surface, both of head, body, and tail.

Size.—The fully developed male is about 620 millim. in length (head and body); the length of the tail is about 810 millim.

The fully developed female is somewhat smaller. The length of the body (head included) is about 600 millim. The length of the tail varies, but is about 650 millim.; in one specimen it was only 590 millim., whilst in another specimen of equal size it was 710 millim.

The hair-covering of the head.—The greatest height of the longitudinal crest on the crown is about 75 millim. in the old male, while in the female it is shorter, or from 42 to 58 millim. It juts out from the centre of the forehead at a short distance from the eyebrows. On the front of the head the crest slopes backwards; but on the back of the head it is directed forwards, there being a hair spiral behind each ear. The hairs on the crown thus converge and form a high point on the occiput. On the neck the hairs of the crest again slope backwards. On the sides of the forehead the hairs have likewise (especially in the females) a disposition to form a low crest which runs parallel to the central crest; the hairs here run together to a projecting point, where they meet the spiral behind the ear. There is scarcely any trace of a chin-tuft, as seen in *S. hosei* and other species.

Colouring.—The upper part of the body is of exactly the same shade as in *S. hosei*, being a uniform grey colour owing to each hair being black and white in turn (without, however, having the rings sharply defined). On the sides of the body and the hinder parts of the thighs the grey colouring shows a tendency to form a darker line in the transition to the white, especially in the older specimens.

The crest on the crown is black; the occiput is partly whitish. The forehead is white, and divided in the middle by a black stripe, which joins the crest. The side crest, which extends from behind the side of the eye to the ear, is black and encloses in front (behind the eye) a whitish space. The lower part of the cheeks and the underside of the head are also white, but a black stripe which stretches backwards to a pointed whisker always runs from the upper jaw

[1] Proc. Zool. Soc. 1889, p. 159, pl. xvi.

down to the underside of the ear. The undersides of the head (lips included) and the whole of the underside of the body are white or whitish. The limbs are coloured on their outer sides as on the back; the hands and feet are black. The inner sides of the limbs are white like the belly. The upperside of the tail is grey, like the back, the underside white; only the extreme point is greyish brown both above and below.

The iris is brown.

The old male is slightly darker than the younger male and the females; the top of the head, and the sides from the eyebrows down to about the angle of the mouth, are black or blackish. The forehead is whitish. The limbs are also darker downwards; the lower part of the hind limb is mostly black.

The young one, in silky dress, is whitish. The head is almost entirely white, and likewise the hind limbs; the hands and feet are whitish; the back, shoulders, and uppersides of the fore limbs, as well as the upperside of the tail, are greyish (almost like the old ones); in the centre of the back there is a whitish patch.

The crest on the crown already forms a distinct point on the occiput, whilst the side crests and whiskers are barely discernible. Along the neck runs a black central stripe.

The distal portion of the tail is somewhat more hairy than the proximal.

The Skull.

	Old male. millim.	Old female. millim.
Greatest length	104	97 *
Zygomatic breadth	80	74
Distance from $i.^1$ to anterior margin of *foramen magnum*	73	63
Intertemporal constriction	46	46
Breadth across face	64·5	65
Breadth of brain-case	69	63
Interorbital breadth	8	8
Breadth of orbit	26	25
Height of orbit	23	21
Breadth of nasal opening	11	10
Height of nasal opening	18	17
Length of nasal bone	12	10·5
Length of palate	34	30
Breadth of palate inside $m.^1$	22	20
Combined length of upper pp. and mm.	27	27
Combined length of upper molars	18	18
Height of upper canine	20	9 †

The zygomatic arch is prominent and strong. The breadth across the zygomata is equal in the female to the distance from the posterior margin of *foramen magnum* to the base of $i.^1$; in the male

* Approximate length, the *os occipitale* being broken.
† Very much worn.

(in which the snout is proportionally longer) to the centre of the *foramen incisivum*.

Intertemporal constriction strong; it equals the distance from the *foramen magnum* to the centre or hinder edge of $m.^1$

The *nasals* are slender and straight, or even somewhat concave; above them the interorbital space is sunk inwards.

The *bullæ* are low, almost flattened in the female, but rather more elevated in the old male.

The canines in the male are particularly long.

The lower jaw is almost uniformly high throughout its length from $p.^1$ to $m.^3$.

The *occipital* is strongly rounded behind, and does not show a trace of any transverse crest.

The *orbits* are wide, with a distinct angle above on the outer side; their height is less than their breadth.

In the young one the peculiarities of the skull are still but little prominent. The *bullæ* are proportionally more swollen than in the old ones.

Habits.—These Monkeys were only met with by Herr Iversen in the Langkat district, and were not observed in Deli. They were fairly numerous on several of the estates, especially at Glen Bervie and Bekri. Their haunts were in the highest trees, and they never descended of their own accord to the ground or visited the rice-fields. Herr Iversen saw, however, one wounded individual take to flight on the ground. They always live in companies, and inhabit the dry spots in the thickest parts of the forests. They appear to be non-migratory, and may be met with at all times of the year in almost the same parts of the forest. They hardly ever visited the more open places, but kept to the highest tree-tops, where they moved about with the greatest ease, and made the most astonishing leaps through the branches. They were on the whole excessively shy; if they found themselves noticed, they endeavoured at once to hide themselves, and the mothers would leave their young sitting on the branches whilst they themselves sought shelter in the tree-tops. When hunted, they all took to flight in the same direction, so that the companies were not dispersed.

The companies appeared to consist chiefly of full-grown individuals, and young ones were but seldom seen. An occasional half-grown individual, however, might be noticed following the old ones; babies were not often seen, but these are, on the whole, more difficult to observe, as they are carried by the mother under her belly.

The young one brought home was noticed through the mother deserting it, after which it began to shriek. They have a very penetrating cry, which they generally utter in chorus after one has given the note. In the individuals which have been examined no fœtus has ever been found. Possibly the pregnant females and the younger ones hide themselves more closely.

They were seen in activity only in the daytime, and were not heard to cry at night. They lived, it appeared, only on fruits. In their stomachs was chiefly found the soft pulp of a fruit belonging



1.



2.



3.



6.



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9.

New Asiatic Butterflies.

H. Knight del. et lith.

West, Newman, chromo.


1.


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10.

New Asiatic Butterflies.

H. Knight del. et lith.

West, Newman chromo.

to a foliated tree, having a stony kernel. They were often observed foraging in company with *Hylobates syndactylus*, but with this exception they were never seen along with other Monkeys.

One individual, which was taken alive, proved to be wild and untamable.

3. On Butterflies collected by Mr. W. Doherty in the Naga and Karen Hills and in Perak.—Part II.[1] By Henry J. Elwes, F.Z.S.

[Received December 5, 1892.]

(Plates XLIII. & XLIV.)

Fam. Lycænidæ.

Gerydus symethus.

Pap. symethus, Cram. Pap. Ex. ii. t. exlix. B, C (1777).
Gerydus symethus, Butt. Ind. iii. p. 22.
Symetha pandu, Horsf. Cat. E. I. C. ii. 2 *a*, *b* (1828).
? *Miletus zinckeni*, Feld. Reise Nov. p. 284, t. 35. fig. 34.

Specimens from Perak, as well as others from Pulo Laut, Borneo, have a bluish tinge, which is not evident in Javan examples, and both sexes are much darker on the wings than specimens from Nias, which may be a local race, though they agree on the underside.

I cannot see how to distinguish *M. zinckeni*, Feld., from Java.

Gerydus biggsii.

? *Gerydus biggsii*, Dist. Rhop. Mal. p. 206, t. xxii. 12 ♀ (1884); Butt. Ind. iii. p. 24.

? *Gerydus gopara*, de Nicéville, Butt. Ind. iii. p. 25 ♂ (1890); id. Journ. Bomb. Nat. Hist. Soc. vol. v. p. 208. n. 8, pl. E. figs. 1 ♂, 2 ♀ (1890).

Several specimens from Perak agree with others from Sumatra, Nias, and Pulo Laut, one of which is marked *biggsii* ♀ by Doherty. I have little doubt that these are the same species as de Nicéville described from Perak, which he distinguishes from *biggsii* (of which he had not seen the type) by the distinctness of the markings below. Neither Distant's figure nor his description is clear enough to identify his species, which came from Malacca; and there is some variation in the markings of both the upper and underside among my specimens.

Gerydus heracleon.

Gerydus heracleon, Doh. J. A. S. B. lx. pt. ii. no. 1, p. 36 (1891).

The type of this species, from Perak, is like the last but larger, and with the markings below more like those of *G. symethus*.

[1] For Part I. see P. Z. S. 1891, p. 249.

It does not appear to me to be sufficiently distinct to be described from a single specimen, and the band is not appreciably broader than in *G. biggsii* (*gopara*), as Doherty says it is. Judging from the figure, it is also very close to *Miletus melanion*, Feld., from Luzon.

GERYDUS CROTON.

Gerydus croton, Doh. J. A. S. B. lviii. pt. ii. p. 439, t. xxiii. 9; Butt. Ind. iii. p. 25.

Four males and two females from Thandaung in East Pegu at 4000 feet elevation. The type was from the Tenasserim valley. The plate does not agree with the underside of my specimens (named by Doherty), which are of a more rusty colour and have broken markings on the hind wing. It seems, however, a very distinct species.

GERYDUS IRRORATUS, Druce, var. ASSAMENSIS.

Gerydus irroratus, var. *assamensis*, Doh. J. A. S. B. lx. pt. ii. no. 1, p. 37, t. 1. 7 ♂.

The type of this is from the Dhansiri valley in Assam, and a female from Perak is marked by Doherty with a ?.

This species seems identical with one of which I have several pairs from Pulo Laut, and differs from all the preceding in having a pale sexual patch in the cell of the fore wing of the male as in *Paragerydus horsfieldi*.

GERYDUS BOISDUVALI.

Miletus boisduvali, Moore, Cat. E. I. C. p. 19, t. 1 *a*. fig. 1 ♀ (1857).

Gerydus boisduvali, Butt. Ind. iii. p. 24.

Specimens from Margharita agree with those from Sikkim and from the Shan Hills.

I have one pair from Sikkim which differ considerably in the colour and pattern of the underside, having a dark transverse band on the hind wing below, and also in having the tuft of bristles at the base of the anal claspers in the male black instead of grey.

If these differences should prove to be constant, it seems to me that it could be separated specifically; but the group is a very difficult one and the anatomy requires more study than I am now able to give it.

PARAGERYDUS HORSFIELDI.

Miletus horsfieldi, Moore, Cat. E. I. C. p. 19, t. 1 *a*. fig. 2 ♂ (1857).

Paragerydus horsfieldi, Butt. Ind. iii. p. 26; Doh. J. A. S. B. 1889, pt. ii. p. 437.

Specimens from East Pegu, Momeit, and Perak agree with others from Sumatra and Pulo Laut. I have another form from Perak which is smaller and differs in the colour of the underside,

agreeing in this respect with three from Pulo Laut; but there are also three other forms from Pulo Laut, and one from Nias (*apocha*, Kheil), which differ again in their markings below, and make me think that the species is either a very variable one, or that there are several species not yet distinguished, and which can only be identified with certainty by a study of their anal organs.

PARAGERYDUS TARAS.

Paragerydus taras, Doh. J. A. S. B. lviii. pt. ii. p. 437, t. xxiii. 10; Butt. Ind. iii. p. 27.

Two specimens from the Karen Hills, so named by Doherty, are much damaged and have lost their abdomens, but agree on the underside with the figure. The species is well described and figured by Doherty, who says that its prehensores are obviously different from those of *P. horsfieldi*.

He also thinks that the genus *Paragerydus* of Distant is not distinct from *Allotinus*, Felder.

ALLOTINUS MULTISTRIGATUS.

Allotinus multistrigatus, de Nicév. J. A. S. B. lv. pt. ii. p. 253, t. xi. 11 ♂, 12 ♀; Butt. Ind. iii. p. 29.

A female from the Naga Hills agrees with specimens taken by myself at Cherrapunji in the Khasia Hills.

ALLOTINUS ALKAMAH.

? *Allotinus alkamah*, Dist. Rhop. Mal. p. 452, t. xliv. 3 ♂ (1886).
? *Allotinus subviolaceus*, Feld. Reise Nov. t. 35. figs. 27, 28 (1865).

I have no Burmese specimens of this, but two females from Pulo Laut, which agree with Felder's plate of *A. subviolaceus* from Java, also agree with Distant's figure, and make me think that the character mentioned by him, viz. the larger violaceous area of the fore wing, is inconstant.

ALLOTINUS PANORMIS, n. sp. (Plate XLIII. figs. 8 ♂, 9 ♀.)

Allotinus panormis, Doh. MSS.

A single female of this distinct species was so labelled, but I can find no description published by Doherty. It came from Petichaung at the foot of the Karen Hills. He also sent a female from Perak which appears to be the same species, though the markings of the underside are not quite identical.

♂ & ♀. Above dark brown, below milk-white, with numerous pale brown strigæ on both wings, which coalesce into an irregular bar beyond the middle of the wings and in the female form a line of lunules across hind wing; a row of white dots margined with black along the border, which with the apical area is darker brown; fringes paler.

Expanse, ♂ 30 mm., ♀ 38 mm.

ALLOTINUS NIVALIS.

Miletus nivalis, Druce, P. Z. S. 1873, p. 348.
Allotinus nivalis, Butt. Ind. iii. p. 30, t. xxvi. 159 ♀.
Logania substrigosa, Moore, J. A. S. B. liii. pt. ii. p. 22 (1884).

Specimens from East Pegu and Perak agree with others from Nias.

LOGANIA MARMORATA.

Logania marmorata, Moore, J. A. S. B. liii. pt. ii. p. 22 (1884); Journ. Linn. Soc., Zool. xxi. p. 39, t. 3. fig. 7; Butt. Ind. iii. 33, front. fig. 128.

Specimens from Perak of both sexes agree with the plate of the type from Mergui and with others from Pulo Laut.

LOGANIA MASALIA.

Logania masalia, Doh. J. A. S. B. lx. pt. ii. p. 37, t. 1. 8 ♀ (1891).

The type, from Margharita, is the only specimen of this species and is in my collection. As it is not in fresh condition I cannot see whether the non-undulated appearance of the margin by which Doherty separates it from *L. marmorata* is a good character, but the Perak specimens, which he speaks of as nearest to it, agree both with Moore's and de Nicéville's plates of *L. marmorata*; and I have a specimen from Moné in the Shan States, taken by Dr. Manders, which is also very near to if not identical with *L. marmorata* and shows that the species extends to the mainland north of Mergui. I have other specimens from Pulo Laut and Nias (*Miletus lahomius*, Kheil) which are closely allied, but a larger series is necessary to decide their specific distinctness.

Logania malayica, Dist., from the Malay Peninsula, of which I have several specimens from Pulo Laut, is easily distinguished by the shape of the wings, and is, moreover, much paler.

LOGANIA SRIWA.

Logania sriwa, Dist. Ann. Nat. Hist. 1886, xvii. p. 531; Rhop. Mal. p. 452, t. xliv. 16; Butt. Ind. iii. 33, note.

Two specimens from Perak and one from Pulo Laut, Borneo.

ZARONA JASODA.

Zarona jasoda, de Nicév. J. A. S. B. lvii. pt. ii. p. 280, t. xiv. 5 ♂; Butt. Ind. iii. p. 34, t. xxv. fig. 144 ♂.

Two specimens from the low country at the foot of the Karen Hills.

PORITIA PLEURATA.

Poritia pleurata, Hew. Trans. Ent. Soc. 1874, p. 346; Ill. Di. Lep. *Lyc.* p. 215, t. 88. 3, 4, ♂; Butt. Ind. iii. p. 40, t. xxvi. 160 ♀.

Four males and two females from the low country at foot of the

Karen Hills agree well with the figures referred to. Hewitson's plate of the female is, as de Nicéville remarks, quite different.

With the above came two other females which are quite different in colour above, having large orange patches, and agree nearly with Hewitson's plate of *P. phraatica*. They are, however, not the same as what I take to be the male of *P. phraatica* from Tavoy, as figured by Distant, and may be one of those cases of female dimorphism of which we have very similar instances among the Japanese Theclas, where orange and blue females occur at the same time and place.

It may be, however, that these belong to a different male which Doherty did not take.

PITHECOPS HYLAX.

Pap. hylax, Fabr. Syst. Ent. p. 526.
Pithecops hylax, Butt. Ind. iii. p. 49, t. xxvi. 161.

Occurs in the Naga Hills at 3000 ft., but not so commonly as *Neopithecops zalmora*, Butler.

PITHECOPS FULGENS.

Pithecops fulgens, Doh. J. A. S. B. vol. lviii. pt. ii. p. 127, t. x. 6 ♂; Butt. Ind. iii. p. 50.

Occurs commonly at Margharita, but taken nowhere else. A very distinct and pretty species. I have not recognized the female, which is described as wanting the blue of the male.

NEOPITHECOPS ZALMORA.

Pithecops zalmora, Butl. Cat. Fabr. Lep. B. M. p. 161 (1869).
Neopithecops zalmora, de Nicév. Butt. Ind. iii. p. 53, t. xxvi. 162 ♀.

Sent by Doherty only from the Naga Hills, where it seems common at about 2000 ft.

TARAKA HAMADA.

Miletus hamada, Druce, Cist. Ent. i. p. 361 (1875); Elwes, P. Z. S. 1881, p. 882.
Taraka hamada, de Nicév. Butt. Ind. iii. p. 5, t. xxvi. 164 ♀.

I am still unable to separate the Indian from the Japanese form, which occurs also in China, though I have seen none from the Indian region without some white on the fore wing, which in Japan is black. Doherty sent it from Margharita, Bernardmyo, and the Naga and Karen Hills, but it seems nowhere common. He describes in MSS. (copied by de Nicéville on p. 59 of Butt. Ind. vol. iii.) another species, *T. mahanetra*, from Perak, which by the description seems distinct, but the only specimens taken are said to be lost.

MEGISBA MALAYA.

Lycæna malaya, Horsf. Cat. E. I. C. p. 70 (1828).
Megisba malaya, Butt. Ind. iii. p. 61, t. xxvi. 165 ♂.

Sent from the Naga and Karen Hills.

CYANIRIS MARGINATA.

Cyaniris marginata, de Nicév. J. A. S. B. 1883, pt. ii. p. 70, t. 1. 9 ♂; Butt. Ind. iii. p. 96.

Sent from the Karen Hills and Bernardmyo. Agrees well with Sikkim specimens of the spring brood, whilst those taken in the Naga Hills in August and September have all the differences of the rainy season form described by de Nicéville, namely, a much broader black border above in both sexes, and larger and darker markings below.

CYANIRIS MELÆNA.

Cyaniris melæna, Doh. J. A. S. B. 1889, pt. ii. p. 434, t. xxiii. fig. 13 ♂; Butt. Ind. iii. p. 97.

Cyaniris jynteana, Dist. Rhop. Mal. p. 452, t. xliv. fig. 6, nec de Nicév.

Several males of this distinct species were sent from Perak, but the female is still undiscovered.

CYANIRIS ALBOCÆRULEUS.

Polyommatus albocæruleus, Moore, P. Z. S. 1879, p. 139.

Cyaniris albocæruleus, de Nicév. J. A. S. B. 1883, pt. ii. p. 71, t. i. figs. 4 ♂, 4 *a* ♀; Butt. Ind. iii. p. 98.

Sent from the Naga Hills and Bernardmyo.

CYANIRIS TRANSPECTUS.

Polyommatus transpectus, Moore, l. c.; de Nicév. J. A. S. B. vol. lii. pt. ii. p. 70, t. i. figs. 6 ♂, 6 *a* ♀ (1883); Butt. Ind. iii. p. 99, t. xxvi. figs. 170 ♂ wet-season form, 171 ♂ dry-season form.

A single male of the dry-season form from the Karen Hills.

CYANIRIS LAMBI.

Cyaniris lambi, Dist. Rhop. Mal. p. 211, t. xxi. fig. 22 ♂.

Three males from Perak, though nearly allied to *C. puspa*, seem to be distinguishable from it by the brighter blue of the wings, in which they resemble *C. puspinus*, Kheil, from Nias; they are quite distinct from *C. lavendularis*, Moore, from Ceylon, with which Distant compares them, and which I do not see how to distinguish from *C. puspa*.

CYANIRIS PUSPA.

Polyommatus puspa, Horsf. Cat. Lep. E. I. C. p. 67 (1828).

Cyaniris puspa, Butt. Ind. iii. p. 100.

Sent from the Naga Hills, Margharita, and Karen Hills.

CYANIRIS DILECTUS.

Polyommatus dilectus, Moore, P. Z. S. 1879, p. 136.

Cyaniris dilectus, de Nicév. J. A. S. B. lii. pt. ii. p. 68, t. i. fig. 5 ♂ (1883); Butt. Ind. iii. p. 107.

From the Naga Hills only.

CYANIRIS PLACIDA.

Cyaniris placida, de Nicév. l. c. t. i. fig. 8 ♂; Butt. Ind. iii. p. 103.

From the Naga Hills only.

CYANIRIS JYNTEANA.

Cyaniris jynteana, de Nicév. l. c. p. 69, t. i. figs. 7 ♂, 7 *a* ♀ (1883); Butt. Ind. iii. p. 104.

Seems as common in the Naga Hills as I found it in the Khasias.

CYANIRIS CHENELLI.

Cyaniris chennellii, de Nicév. l. c. p. 72, t. i. fig. 10 ♂ (1883); Butt. Ind. iii. p. 102.

Also common in the Naga Hills.

ZIZERA MAHA.

Lycæna maha, Kollar, Hügel's Kaschmir, vol. iv. pt. 2, p. 422 (1848).

Zizera maha, Butt. Ind. iii. p. 112, t. xxvi. fig. 172 ♂.

A few sent from Margharita, the Naga and Karen Hills, and Bernardmyo.

ZIZERA OTIS.

Papilio otis, Fabr. Mant. Ins. vol. ii. p. 73. n. 689 (1787).

? *Papilio lysimon*, Hübn. Eur. Schmett. vol. i. t. cv. figs. 534, 535 ♂ (1798–1803); Butt. Ind. iii. p. 116.

Zizera otis, Butt. Ind. iii. p. 119.

A specimen from Bernardmyo and one from Margharita which seem to belong to this species; but I do not at present see how to distinguish it from *P. lysimon*, whilst its identification with *P. otis*, Fabr., in which I follow de Nicéville, must be doubtful.

LYCÆNESTHES EMOLUS.

Polyommatus emolus, Godart, Enc. Méth. vol. ix. p. 656 (1823).

Lycænesthes emolus, Butt. Ind. iii. p. 128.

Included in all the collections sent me by Doherty.

LYCÆNESTHES LYCÆNINA.

Lycænesthes lycænina, Felder, Verh. zool.-bot. Ges. Wien, vol. xviii. p. 281 (1868); Butt. Ind. iii. p. 130.

A pair were sent from the Naga Hills.

NIPHANDA TESSELLATA.

Niphanda tessellata, Moore, P. Z. S. 1874, p. 572, t. lxvi. fig. 6 ♀; Butt. Ind. iii. p. 133 (note).

Four males from Bernardmyo and a single female from Perak. Both sexes are easily distinguished from *N. cymbia*, and the males have the cilia black and white.

TALICADA NYSEUS.

Polyommatus nyseus, Guérin, Delessert's Souv. d'un Voy. dans l'Inde, p. 78, t. xxii. figs. 1, 1 *a* (1843).

Talicada nyseus, Butt. Ind. iii. p. 135, t. xxvi. fig. 179 ♀.

Common at low elevations in the Naga Hills.

EVERES ARGIADES.

Papilio argiades, Pallas, Reise, vol. i. App. p. 472 (1771).

Everes argiades, Butt. Ind. iii. p. 137, t. xxvi. fig. 180 ♂.

Small dark specimens from the Naga Hills, where the tails usually found in this species seem to be wanting. A large and brilliantly coloured pair from Perak, which I should call *parrhasius* if I knew how to define that variety or species, which represents *E. argiades* in the tropical parts of India.

EVERES KALA.

Everes kala, de Nicév. Butt. Ind. iii. p. 139, t. xxvi. fig. 181.

Three males and a female of this from the Naga Hills at 5500 feet agree with de Nicéville's plate; the type came from the Khasia Hills. It is perfectly distinct from *Lycæna fischeri* by the much darker colour and more distinct spots of the underside, and even more so from the form or species which occurs in China, and which has been referred to *L. fischeri* by Leech, P. Z. S. 1887, p. 455.

Of this latter I have three males and two females from Ningpo, and one male from Kiukiang; one of the females bears a label in the late Mr. Pryer's writing, "*L. filicaudis*, Ningpo," but this name is, I think, a MS. one only. All of these agree in having two additional spots on the fore wing below near the base, which I do not find in any of my 13 specimens of *L. fischeri*, which come from Orenburg, Amurland, Askold, the Alatau mountains, Corea, and Shanghai; but I have one male from Staudinger, marked West Siberia, which has them; therefore I do not know at present whether to treat *L. filicaudis* as a local race of *L. fischeri* or not.

EVERES UMBRIEL.

Everes umbriel, Doh. J. A. S. B. 1889, pt. ii. p. 433, t. xxiii. 1 ♂ (issued Dec. 30, *fide* de Nicéville).

Six specimens of this interesting species from the Karen Hills at about 4500 feet elevation. I cannot be certain, but think that two of them are females, in which case there is no difference in colour or markings between the sexes. I cannot distinguish the species from *Lycæna potanini*, Alph. Mém. sur les Lép. v. p. 104, t. v. fig. 4, described from Mongolia, and of which I have four specimens taken in the province of Szechuen by Pratt. It is doubtful which name has priority, but I think that the fifth volume of the 'Mémoires' was not issued till 1890.

NACADUBA MACROPHTHALMA.

Lycæna macrophthalma, Felder, Verh. zool.-bot. Ges. Wien, vol. xii. p. 483 (1862).

Nacaduba macrophthalma, Butt. Ind. iii. p. 143.

Taken in the Naga and Karen Hills.

NACADUBA KERRIANA.

Nacaduba kerriana, Distant, Ann. N. H. (5) vol. xvii. p. 253 (1886); id. Rhop. Mal. p. 455, t. xlii. fig. 12 ♂; Butt. Ind. iii. p. 146.

A pair of this species from Perak: the female differs from the male exactly as do the females of *N. macrophthalma* and *N. atrata*, which last it closely resembles, from their respective males. I also have two specimens from the Karen Hills, which have the centre of both wings above pale bluish white, and the underside pale with the markings very indistinct, except the black marginal spots and anal ocellus; these agree exactly with *N. kerriana* and appear to me to be probably a dry-season form of it.

NACADUBA VIOLA[1].

Lampides viola, Moore, Ann. N. H. (4) vol. xx. p. 340 (1877).

Nacaduba viola, Butt. Ind. iii. p. 146.

Four males and two females from the Naga Hills.

NACADUBA ATRATA.

Lycæna atrata, Horsf. Cat. Lep. E. I. Co. p. 78 (1828).

Nacaduba atrata, Butt. Ind. iii. p. 148.

Sent from all the localities visited by Doherty except Bernardmyo.

NACADUBA CŒLESTIS.

Nacaduba cœlestis, de Nicév. J. A. S. B. vol. lv. pt. ii. p. 366, t. xvii. fig. 11 ♂ (1886); Butt. Ind. iii. p. 151, t. xxvii. fig. 184 ♂.

A few males from Margharita and the Naga Hills and one from Momeit; the female remains unknown to me.

NACADUBA ARDATES.

Lycæna ardates, Moore, P. Z. S. 1874, p. 574, t. lxvii. fig. 1.

Nacaduba ardates, Butt. Ind. iii. p. 153, t. xxvii. fig. 185 ♂ (tailless form).

Both forms were taken in the Karen Hills, but only the tailed form was sent from the Nagas.

NACADUBA BHUTEA.

Nacaduba bhutea, de Nicév. J. A. S. B. vol. lii. pt. ii. p. 72, t. l. fig. 13 ♂ (1883); Butt. Ind. iii. p. 152.

Males only from the Naga Hills, agreeing exactly with those from Sikkim. Although the female remains unknown to me, I have no doubt it is a perfectly distinct species.

[1] Mr. de Nicéville informs me that this is the same as *N. hermes*, Feld., of which he has seen the type.

NACADUBA ABERRANS, n. sp. (Plate XLIV. fig. 6, ♂.)

A single male specimen was sent from East Pegu, with the following note by Mr. Doherty: "*Nacaduba* sp., in appearance a *Catochrysops*. Petichaung low country."

It may be described as follows:—

Size, shape, and colour above of a small specimen of *N. atrata*, Horsf. Below paler, the two inner bands of the fore wing short, the outer bands more lunulate, the anal ocellus nearly as large as the one above it and showing plainly on the upper surface; tails as in *atrata*. It is unlike any other species known to me or mentioned in the 'Butterflies of India.' I have also four males, all taken by Doherty in Car-Nicobar Island some years ago, which agree with the type exactly, though the blue of the upperside is somewhat faded.

JAMIDES BOCHUS.

Papilio bochus, Cram. Pap. Ex. ix. p. 210, t. cccxci. figs. C, D ♂ (1782).

Jamides bochus, Butt. Ind. iii. p. 157.

Sent from the Naga and Karen Hills and Perak.

LAMPIDES ELPIS.

Polyommatus elpis, Godart, Enc. Méth. ix. p. 654 (1823).

Lampides elpis, Butt. Ind. iii. p. 161.

Naga Hills and Perak.

LAMPIDES KANKENA.

Lycæna kankena, Felder, Verh. zool.-bot. Ges. Wien, xii. p. 481 (1862).

Lampides kankena, Butt. Ind. iii. p. 174.

Specimens from Perak agree with those from the Andamans which pass under this name, and are hardly separable, as far as I can see, from *L. elpis*, though usually much smaller and having the black border of the fore wing in the male very narrow.

LAMPIDES CORUSCANS.

Lampides coruscans, Moore, Ann. N. H. (4) xx. p. 341 (1877); Butt. Ind. iii. p. 163.

Specimens from Perak, 7 males and 3 females, are constant in their deep blue colour, and seem to be quite easy to separate from all forms of *L. elpis*, though the markings of the underside agree.

LAMPIDES CELENO.

Papilio celeno, Cramer, Pap. Ex. vol. i. pl. xxxi. figs. C, D, ♂ (1775).

Papilio alexis, Stoll (*nec* Scopoli), Suppl. Cramer's Pap. Ex. vol. v. pl. xxxviii. figs. 3, 3 C, ♂ (1790).

Hesperia ælianus, Fabricius, Ent. Syst. vol. iii. pt. i. p. 280, n. 79 (1793).

Lampides zethus, Hübner, Verz. bek. Schmett. p. 70. n. 684 (1816).

Cupido agnata, Druce, Proc. Zool. Soc. Lond. 1874, p. 106. n. 4, pl. xvi. figs. 2, 4 ♂, 3 ♀.

Lampides conferenda, Butler, Ann. & Mag. Nat. Hist. 5th series, vol. xviii. p. 185. n. 25 (1886).

Plebeius malaccanus, Röber, Iris, vol. i. p. 57, pl. iv. fig. 3 ♂ (1886).

In adopting the name of *celeno* for this species I follow Mr. Salvin, who has pointed out to me that Cramer's plate exactly agrees with what is usually known as *P. alexis* and *H. ælianus*; for though Cramer says it comes from Surinam, his plate is unmistakable. For the synonymy I am indebted to Mr. de Nicéville.

It is the type of a group in which the 1st and 2nd bars of the fore wing below reach the costa though broken at the top, whilst the 3rd band extends to the hind margin and the 4th to the 2nd median nervule. A specimen of the wet-season form was sent from Perak, and some of the dry-season form from the Karen Hills.

LAMPIDES PURA.

Lampides pura, Moore, Journ. Linn. Soc. Lond., Zool. xxi. 41 (1886); Butt. Ind. iii. p. 170, front. fig. 132 ♀ dry-season form.

This species, which I distinguish from the last by the very narrow, usually obsolete black border of the fore wing in the male, occurs in Perak, and Doherty took both the wet- and dry-season forms in the Karen Hills.

LAMPIDES OSIAS.

Plebejus osias, Röber, Iris, i. (1886, March), p. 56, t. v. fig. 17.
Lycæna osias, Staudinger, Iris, ii. (1889), p. 164, t. i. fig. 4 ♀.
? *Lampides subdita*, Moore, l. c.; Butt. Ind. iii. p. 166.

This species I distinguish by the deep blue colour of the wings above, and dark grey ground of the underside, in which it agrees with *L. optimus*, Kheil, from Nias. The latter, however, is quite distinct by the pale colour of both sexes above, and double border of the fore wings in the female. Specimens from Perak agree with some from Sumatra which, I think, are *L. saturata* of Snellen.

CATOCHRYSOPS STRABO.

Hesperia strabo, Fabr. Ent. Syst. iii. pt. i. p. 287 (1793).
Catochrysops strabo, Butt. Ind. iii. p. 177.
Lampides lithargyria, Moore, Ann. N. H. (4) xx. p. 340; Butt. Ind. iii. p. 178.

Sent from Margharita and the Karen and Naga Hills.

I cannot see how to separate *C. lithargyria*, which seems to occur in the same places as *C. strabo*, though not so abundantly.

CATOCHRYSOPS PANDAVA.

Lycæna pandava, Horsf. Cat. Lep. E. I. Co. p. 84 (1828).
Catochrysops pandava, Butt. Ind. iii. p. 183.

Doherty sent this from Bernardmyo and Momeit only.

TARUCUS PLINIUS.

Hesperia plinius, Fabr. Ent. Syst. vol. iii. pt. i. p. 284 (1793).
Tarucus plinius, Butt. Ind. iii. p. 194.
Taken in the Karen Hills and at Bernardmyo.

CASTALIUS ROSIMON.

Papilio rosimon, Fabr. Syst. Ent. p. 523 (1775).
Castalius rosimon, Butt. Ind. iii. p. 197.
Occurs in all the collections sent by Doherty.

CASTALIUS ETHION.

Lycæna ethion, Doubl. & Hew. Gen. Di. Lep. vol. ii. 490, t. lxxvi. fig. 3 ♂.
Castalius ethion, Butt. Ind. iii. p. 198.
A single specimen from the Dhansiri valley, another from the Karen Hills.

CASTALIUS ROXUS.

Polyommatus roxus, Godart, Enc. Méth. vol. ix. p. 659 (1823).
Castalius roxus, Butt. Ind. iii. p. 199.
Sent from the Karen Hills and Perak.

CASTALIUS ELNA.

Lycæna elna, Hew. Ex. Butt. vol. v. *Lycæna*, t. i. fig. 8 ♀ (1876).
Castalius elna, Butt. Ind. iii. p. 201.
Sent from Margharita and the Naga Hills.

AMBLYPODIA ANITA.

Amblypodia anita, Hew. Cat. Lyc. B. M. p. 14, t. viii. 90, 91 ♂; Butt. Ind. iii. p. 191 ♀.
Males only of this species from Bernardmyo.

IRAOTA TIMOLEON.

Papilio timoleon, Stoll, Suppl. Cram. Pap. Ex. v. t. xxxii. 4, 4 D (1791).
Hesp. mæcenas, Fabr. Ent. Syst. iii. p. 271 (1793).
Iraota timoleon, Butt. Ind. iii. p. 215.
A single specimen from East Pegu.
I agree with de Nicéville that *P. timoleon* and *H. mæcenas* are the same species, as there are specimens intermediate between the two.

SURENDRA QUERCETORUM.

Amblypodia quercetorum, Moore, Cat. E. I. C. p. 42, t. i. *a*. 7 ♂.
Surendra quercetorum, Butt. Ind. iii. p. 220, t. xxvii. 194 ♂, 195 ♀.
Sent from Margharita and the Naga Hills.

ARHOPALA CAMDEO, var.?

Arhopala camdeo, Moore, Cat. E. I. C. i. p. 41, t. i. *a*. 6.
Among some specimens sent me by Doherty later than the rest were a few which he had kept to study with other new and rare

Lycænidæ. The localities of these do not seem in all cases to be quite certain, but I find two males and two females of a species which seems like a var. of *A. camdeo*, though the females are of a much darker blue than Khasia specimens, and both sexes have the spots below nearly of the grey ground-colour of the wing, and not black or almost black as in *A. camdeo*. One is marked "Tenasserim, Camdeo," by Doherty, and another "Thandaung."

ARHOPALA CENTAURUS.

Pap. centaurus, Fabr. Syst. Ent. p. 520 (1775).
Arhopala centaurus, Butt. Ind. iii. p. 234.
Naga Hills, Bernardmyo, and Perak.

ARHOPALA AGNIS.

Arhopala agnis, Feld. Reise Nov. ii. p. 228; Butt. Ind. iii. p. 236.
Two males from Perak, and a female, agreeing perfectly on the underside, from the Tenasserim valley. The latter is of a paler blue above than a female from Nias, which I take to be *A. agnis*.

? ARHOPALA AMANTES.

Amblypodia amantes, Hew. Cat. Lyc. B. M. p. 4, t. ii. figs. 2, 3 ♂, 1 ♀ (1862).
A male in bad condition from Margharita, marked by Doherty *Arhopala amantes*, var.

ARHOPALA ATOSIA.

Amblypodia atosia, Hew. Ill. Di. Lep. p. 9, t. ii. 8, 9 ♀.
Arhopala atosia, Butt. Ind. iii. p. 24, front. fig. 138 ♂.
A pair from Perak and three from East Pegu, which agree with the figures above referred to, and very nearly with the type from Sumatra in Hewitson's collection.

ARHOPALA AMATRIX.

Arhopala amatrix, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1891, p. 370, t. G. 23 ♂, 24 ♀.
Two males and a female from Bernardmyo, which I was about to describe as distinct from *Arhopala amantes* when Mr. de Nicéville's paper arrived.

ARHOPALA ABSEUS.

Amblypodia abseus, Hew. Cat. Lyc. B. M. p. 9, t. v. figs. 51, 52.
Arhopala abseus, Butt. Ind. iii. p. 242.
Several specimens from East Pegu and one from Perak. Both males and females are duller in colour than the Sikkim specimens I have, and there is more difference in the breadth of band in the sexes.

ARHOPALA AMMON.

Amblypodia ammon, Hew. Cat. Lyc. B. M. p. 9, t. v. figs. 49, 50 ♀ (1862).

Arhopala ammon, Butt. Ind. iii. p. 243.

A single specimen from Perak, which differs from the next species in the points mentioned by Doherty.

ARHOPALA AMMONIDES. (Plate XLIV. fig. 7, ♂.)

Acesina ammonides, Doh. J. A. S. B. lx. pt. ii. p. 34 (1891).

Two specimens from Tenasserim, which form the types of this species.

ARHOPALA AGABA.

Amblypodia agaba, Hew. l. c. p. 8, t. iv. figs. 39, 40 ♀.

Arhopala agaba, Butt. Ind. iii. p. 244.

Seems common in the Karen Hills.

ARHOPALA ATRAX.

Amblypodia atrax, Hew. l. c. p. 13, t. vii. figs. 80, 82 ♀.

Arhopala atrax, Butt. Ind. iii. p. 246.

Seems common at Bernardmyo, and agrees with Bengal and Sikkim examples.

ARHOPALA KHAMTI.

Arhopala khamti, Doh. J. A. S. B. lx. pt. ii. 1891, p. 32, t. i. fig. 5.

The type from Margharita was the only specimen sent of this new species.

ARHOPALA BAZALUS.

Amblypodia bazalus, Hew. l. c. p. 8, t. iv. figs. 37, 38 ♀.

Arhopala bazalus, Butt. Ind. iii. p. 249.

Common in the Naga Hills and a few sent from East Pegu.

ARHOPALA SINGLA.

Satadra singla, de Nicév. J. A. S. B. liv. pt. ii. p. 119, t. ii. figs. 8 ♂, 7 ♀ (1885).

Arhopala singla, Butt. Ind. iii. p. 250.

Two pairs from the Naga Hills, which are somewhat brighter and have more green above the tails than a Sikkim specimen.

ARHOPALA TEESTA.

Satadra teesta, de Nicév. J. A. S. B. lv. pt. ii. p. 253, t. xi. fig. 3 ♂ (1886).

Arhopala teesta, Butt. Ind. iii. p. 250, t. xxvii. fig. 197 ♂.

A few from the Naga Hills and Margharita, which agree with Sikkim specimens.

ARHOPALA APIDANUS.

Papilio apidanus, Cram. Pap. Ex. ii. t. cxxxvii. F, G.

Flos ahamus, Doh. J. A. S. B. lx. pt. ii. 1891, p. 33, t. i. 6 ♀.

I cannot separate the type of *Flos ahamus*, which Doherty sent me from Margharita, from Bornean specimens of what I believe to be the species figured by Cramer, which he says, by mistake, was from Surinam. Doherty sent two similar females from the Naga Hills marked in his own writing "near *apidanus*," but makes no allusion to this species in his description of *Flos ahamus*.

ARHOPALA ARTEGAL.

Flos artegal, Doh. J. A. S. B. lviii. pt. ii. p. 423, t. xxiii. fig. 5 (1889).

Arhopala artegal, Butt. Ind. iii. p. 255.

A good species, of which I have the type, which is marked "Myitta, Tenasserim," and another female from the Karen Hills.

ARHOPALA DIARDI.

Amblypodia diardi, Hew. l. c. p. 9, t. v. figs. 51, 52 ♂ (or 41, 42 MS.).

Arhopala diardi, Butt. Ind. iii. p. 256.

Several males from the Naga and Karen Hills, but only one female.

ARHOPALA ANTHELUS.

Amblypodia anthelus, Doubl. & Hew. Gen. Di. Lep. ii. p. 478, t. lxxiv. fig. 6 ♂ (1852).

Arhopala anthelus, Butt. Ind. iii. p. 259.

A male of this beautiful species from Perak agreeing with others from Tenasserim taken by Doherty.

ARHOPALA ANARTE.

Amblypodia anarte, Hew. l. c. p. 5, t. iii. figs. 16, 17 ♂.

Arhopala anarte, Butt. Ind. iii. p. 260.

A male of this distinct and handsome species from Perak, and a female in rather bad condition of which the locality is uncertain.

ARHOPALA ALBIPUNCTATA.

Amblypodia albipunctata, Hew. Ill. Diurn. Lep. p. 14 *e*, t. tii. b. figs. 43, 44 ♂ (1869).

Arhopala albipunctata, Butt. Ind. iii. p. 261.

This lovely and distinct species seems not uncommon in the Karen Hills.

ARHOPALA EUMOLPHUS.

Papilio eumolphus, Cram. Pap. Ex. iv. p. 19, t. cccxcix. G, H.

Arhopala eumolphus, Butt. Ind. iii. p. 263.

A. farquhari, Dist. Rhop. Mal. p. 264, t. xxiii. fig. 3; Butt. Ind. iii. p. 264.

A male and several females from East Pegu and Momeit, and two

males from Tenasserim, which are what Doherty calls *A. farquhari*, Dist., but which I cannot see my way to distinguish from *eumolphus* which I have from Java, Sikkim, and the Khasia Hills, though the underside is certainly darker.

ARHOPALA HELLENORE.

A. hellenore, Doh. J. A. S. B. lviii. pt. ii. p. 422, t. xxiii. fig. 7 ♂ (1889).

A. viridissima, Swinh. Ann. N. H. (6) vol. v. p. 449 (1889).

The type from Mergui agrees precisely with one given me by Col. Swinhoe as *A. viridissima* from Mandalay, except that there is rather more gold in the green of the centre of the fore wing.

They differ from *A. eumolphus* in having the black border of the costa very narrow, of the outer margin very narrow at the apex, so that the green almost reaches the apex in a point, and the border of the hind wings also narrower. Below it is paler than most specimens of *A. eumolphus*. I do not know whether the female of this species can be distinguished from *A. eumolphus*.

ARHOPALA MÖLLERI.

Nilasera ? moelleri, de Nicév. J. A. S. B. lii. pt. ii. p. 80, t. ix. figs. 4 ♂, 4 *a* ♀ (1883).

Arhopala moelleri, Butt. Ind. iii. p. 266.

A female from Margharita and another from Bernardmyo.

ARHOPALA PARAMUTA.

Panchala paramuta, de Nicév. l. c. p. 81, t. ix. figs. 7 ♂, 7 *a* ♀ (1883).

Arhopala paramuta, Butt. Ind. iii. p. 268.

One male from the Karen Hills, another from Margharita.

ARHOPALA PERIMUTA.

Amblypodia perimuta, Moore, Horsf. & Moore, Cat. Lep. Mus. E. I. C. i. p. 42 (1857).

Arhopala perimuta, Butt. Ind. iii. p. 270.

Sent from the Naga Hills and from Margharita.

ARHOPALA BELPHŒBE.

A. belphœbe, Doh. J. A. S. B. lviii. pt. ii. p. 421, t. xxiii. fig. 18 ♂ (1889); Butt. Ind. iii. p. 272.

A single male from Margharita agrees with the type from Tavoy, also sent me by Doherty.

ARHOPALA AGRATA.

Arhopala agrata, de Nicév. Butt. Ind. iii. p. 251 note, front. fig. 137 ♂ (1890).

Seems to be one of the commonest species in East Pegu and agrees perfectly with a pair from Singapore sent me by de Nicéville; other specimens from Perak are of a duller colour above.

ARHOPALA BUXTONI.

Amblypodia buxtoni, Hew. Ill. Di. Lep. Suppl. p. 22, t. viii. figs. 68, 69 ♀ (1878).

Arhopala buxtoni, Butt. Ind. iii. p. 262.

Specimens from Perak agree with the type from Sumatra in Hewitson's collection.

ARHOPALA PASTORELLA.

A. pastorella, Doh. J. A. S. B. lviii. pt. ii. p. 418, t. xxiii. fig. 12 ♂ (1889); Butt. Ind. iii. p. 274.

? *A. moolaiana*, Moore, P. Z. S. 1878, p. 835; Butt. Ind. iii. p. 274.

Also abundant in East Pegu, but rather smaller than the type from Tavoy and Tenasserim sent me by Doherty. I have a pair from Beeling, Tenasserim, taken by Lieut. Watson, which he calls *A. moolaiana*, Moore, and which are identical; if these are correctly named, the name of *moolaiana* has priority.

ARHOPALA AMPHIMUTA.

? *A. amphimuta*, Feld. Wien. ent. Mon. iv. p. 396 (1860); id. Reise Nov. p. 232, t. xxix. fig. 8 (1865); Butt. Ind. iii. p. 277, note.

? *A. hypomuta*, Hew. Cat. Lyc. B. M. p. 11, t. vi. 64 ♂ (1862); Butt. Ind. iii. p. 276.

An abundant species at Perak. I believe the above-given names both represent this species; but now that the Felderian types have been acquired by Mr. Rothschild, it may be possible to make sure of identifications which have hitherto been in such genera as this very doubtful.

ARHOPALA PERISSA.

A. perissa, Doh. l. c. p. 419, t. xxiii. fig. 11 ♂ (1889); Butt. Ind. iii. p. 278.

This pretty species seems very common in East Pegu, and agrees with the type sent by Mr. Doherty from Tavoy.

ARHOPALA DAVISONI.

Narathura metamuta (part.), Dist. Rhop. Mal. p. 267, t. xxiii. fig. 18 ♂ (1885), nec Hewitson.

Arhopala davisoni, Butt. Ind. iii. p. 280, front. fig. 135, ♂.

Common at Perak, and agrees with specimens sent me by de Nicéville from Singapore. I have others from Borneo which agree on the underside, but there seems to be considerable variation in the breadth of the border, and I expect to find that this species has an older name. In the Hewitson collection it stands as *A. inornata*, Feld., but the figure of that species is not good enough to make out what it is.

ACESINA ZEPHYRETTA. (Plate XLIV. fig. 8, ♂.)

A. zephyretta, Doh. J. A. S. B. lx. pt. ii. p. 33 (1891).

Four males, which are the types, of this species from Margharita. They closely resemble *A. paraganeesa*, but have no blue on the hind wing above and have darker ground-colour below.

ACESINA ARIEL. (Plate XLIV. fig. 9, ♂.)

A. ariel, Doh. l. c. p. 33.

The type of this species from Margharita is a male, and is quite distinct from any known to me.

ACESINA ABERRANS.

A. aberrans, de Nicév. Butt. Ind. iii. p. 281, t. xxv. 142 ♂, 143 ♀.

A single male from the Karen Hills.

I have also a female taken by Dr. Manders at Fort Stedman in the Shan States.

MAHATHALA AMERIA.

Amblypodia ameria, Hew. Cat. Lyc. B. M. p. 14, t. viii. figs. 85, 86, ♀ (1862).

Mahathala ameria, Butt. Ind. iii. p. 283, t. xxvii. fig. 200 ♀.

Common in East Pegu, and a single specimen from the Dhansiri valley, Assam.

CURETIS THETIS.

Papilio thetis, Drury, Ill. Ex. Ent. ii. p. 16, t. ix. fig. 3, 4, ♀ (1773).

C. thetis, Butt. Ind. iii. p. 287.

Only sent from Perak, but I have specimens from Akyab also.

CURETIS BULIS.

Anops bulis, Doubl. & Hew. Gen. Di. Lep. ii. p. 473, t. lxxv. fig. 5 ♂ (1852).

C. bulis, Butt. Ind. iii. p. 293.

I agree with de Nicéville in thinking that only two species of this genus can be defined in India.

The form of *C. bulis* sent from the Naga Hills has a white female and resembles the commonest Sikkim form in both sexes. In the Karen Hills the males usually have more black on the hind wing, and the females are like them in colour, but paler. From Perak I received a pair of smaller specimens of which the female is as deep-coloured as the male, but with more black on both wings.

ZEPHYRUS DUMA.

Dipsas duma, Hew. Ill. Di. Lep. Suppl. p. 15, t. vi. fig. 15 ♂ (1869).

Zephyrus duma, Butt. Ind. iii. p. 304.

A single much-worn male, which appears to belong to this

species, was taken on the summit of Mt. Japvo, 9890 feet, the highest point in the Naga Hills.

ZEPHYRUS PAVO.

Z. pavo, de Nicév. P. Z. S. 1887, p. 460, t. xl. fig. 11 ♀; Butt. Ind. iii. p. 309.

A single female from Margharita. I cannot be absolutely certain (as the abdomens of both this and of the type in Mr. Knyvett's collection now before me are somewhat damaged), but have little doubt, notwithstanding Doherty's remarks, *cf.* J. A. S. B. lviii. pt. ii. p. 130, that both specimens are females, and their coloration alone would make it almost certain.

It is curious that no species of this genus has yet been taken in the hills of Burmah, as its distribution would certainly lead one to expect it to occur there.

ILERDA EPICLES.

Polyommatus epicles, Godart, Enc. Méth. ix. p. 646 (1823).
I. epicles, Butt. Ind. iii. p. 325.

Occurs at Margharita, also in the Naga and Karen Hills, and at Momeit, extending in all cases to a lower level than the other species of *Ilerda*. In Chittagong, Doherty has taken it at sea-level.

ILERDA ANDROCLES.

Thecla androcles, Westw. Gen. Di. Lep. ii. p. 487.
I. androcles, Butt. Ind. iii. p. 328.

Very abundant in the Naga Hills, as it is in the Khasias, at 5000–6000 feet.

ILERDA VIRIDIPUNCTATA.

I. viridipunctata, de Nicév. Butt. Ind. iii. p. 329, t. xxviii. 207 ♂.
I. androcles, Elwes, Trans. Ent. Soc. 1888, p. 400.
I. hewitsoni, Moore, MSS.

This is the green species common in Sikkim from 5000 to 7000 feet which I supposed to be *I. androcles*. I have it from Kulu and Nepal; numerous specimens were taken in the Naga Hills not below 6000 feet. These differ from the Sikkim specimens in having the wings in some cases almost without the green shining scales which cover a large part of the wings in Sikkim, and these scales seem of a purer green without any blue tinge; but I cannot see my way to distinguish them, as the amount as well as the tinge of the green scales varies. I have two specimens from Western China, taken by Pratt at 5000–6000 feet, which agree with the Naga males. I cannot distinguish the females from those of *I. brahma*, with which this form may possibly interbreed, as the two species occur together in Sikkim, though both here and in the Nagas the range of *I. brahma* seems to be rather lower.

ILERDA BRAHMA.

I. brahma, Moore, Horsf. & Moore, Cat. Lep. Mus. E. I. C. i. p. 29, t. i. *a*. fig. 4 ♂ (1857); Butt. Ind. iii. p. 330.

Common in the Naga Hills and occurs at Bernardmyo and Momeit.

DACALANA VIDURA.

Dacalana vidura, Horsf. Cat. E. I. C. p. 113, t. i. figs. 6, 6 *a* (1829).

Dacalana burmana, Moore, J. A. S. B. liii. pt. ii. p. 36 (1884); Butt. Ind. iii. p. 335.

Two males and two females from the Karen Hills which agree with a female named "? *burmana*" by Moore from Akyab, and also with four males and a female from S.E. Borneo and Pulo Laut; there is no appreciable difference in the colour of the underside. All these three females have the same venation as the male of *Arrhenothrix*, of which the female remains unknown, and want the fourth branch of the subcostal.

ARRHENOTHRIX PENICILLIGERA.

A. penicilligera, de Nicév. Butt. Ind. iii. p. 337, t. xxviii. fig. 214 ♂ (1890).

A male from Margharita agrees with one from the Khasias. I am able to distinguish these specimens from *D. vidura* only by the difference in venation pointed out by de Nicéville.

CAMENA CIPPUS.

Hesperia cippus, Fabr. Ent. Syst. v. Suppl. p. 429 (1798).
Camena cippus, Butt. Ind. iii. p. 340.

Two males from East Pegu agree with one from the Shan States taken by Dr. Manders, and one from the Garo Hills obtained by Mr. Hamilton's native collectors.

CAMENA ICETAS.

Iolaus icetas, Hew. Ill. Diurn. Lep. p. 44, t. xviii. figs. 6, 7 ♂ (1865).

Camena icetas, Butt. Ind. iii. p. 342.

Four males and a female from East Pegu agree with specimens from the N.W. Himalayas, and I have one from Ichang in Central China which I believe to be the same.

CAMENA COTYS.

Iolaus cotys, Hewitson, l. c. p. 43, t. xix. figs. 19, 20 ♂.
Camena cotys, Butt. Ind. iii. p. 342.

A male from East Pegu agreeing with Sikkim specimens.

CAMENA ICETOIDES, n. sp. (Plate XLIV. fig. 3, ♂.)

♂. Like *C. icetas*, Hew., but wants the short transverse bars at end of cell in both wings below, and has the blue extending further

towards the apex of fore wing above. On the hind wing there is a well-defined dull patch at the base quite free from blue scales, and the tuft of hairs at the base of the hind margin below, which is present in all the other *Camenas* I know except *C. cotys*, is absent or very much reduced. The venation agrees with that of *C. icetas*.

Described from a single male taken on the Karen Hills at 4000–5000 feet.

CAMENA CLEOBOIDES, n. sp. (Plate XLIV. figs. 4 ♂, 5 ♀.)

Most like *C. cleobis*, Godt., but differs in having in the male a large round velvet patch free from blue scales in the cell of the fore wing and with raised androconia. It is smaller in size and has the transverse band on the underside nearer the base and directed more inwards from the hind margin. The band is pale yellow and there is more yellow at the anal angle than in *C. cleobis*. The shining patch at the base of hind margin of fore wing below, seen in *C. cleobis*, is wanting, and there is no trace of the tuft of black hairs in the same place.

♀. Similar, but of a duller paler blue as in *C. cleobis*, and without the velvety patch on fore wing.

Described from four males and two females taken in the Karen Hills. This species is allied to *Iolaus isæus*, Hew., from Sarawak, of which *Tajuria relata*, Dist., is the female. I have this latter from Nias Island in both sexes and a single worn male from Perak.

The venation of *C. cleoboides* differs from that of *C. cleobis* and *C. relata* in having only two branches to the subcostal, and it may perhaps on this account, and owing to the well-marked patch on the male, form a new subgenus.

MOTA MASSYLA.

Myrina massyla, Hew. Ill. Di. Lep. Supp. p. 7, t. iii. figs. 87, 88 ♂ (1869).

Mota massyla, Butt. Ind. iii. p. 345, t. xxviii. fig. 210 ♀.

A female from Margharita agreeing with Khasia specimens, but larger and with longer tails.

APHNEUS VULCANUS, var. MAXIMUS, n. var. (Plate XLIII. fig. 5, ♀.)

Papilio vulcanus, Fabr. Syst. Ent. p. 579.

A. vulcanus, Butt. Ind. iii. p. 349.

A male and two females from the Karen Hills are unlike any other form of this genus in my collection, and do not agree with any of those described in the 'Butterflies of India;' but I am unable to separate them specifically on account of the great amount of variation which prevails in this genus, in which I think too many species have already been made.

Above they resemble *A. vulcanus* in colour, having a slight tinge of blue at the base of the hind wing and a few blue scales at base of fore wing in both sexes. Below they resemble what de Nicéville calls *elima*, Hew., and *uniformis*, Moore, from Kashmir, in the dull

brown of their ground-colour and indistinctness of their markings. They are larger than any other *Aphneus* I have seen, the male measuring 27, the female 34 mm. in expanse.

APHNEUS SYAMA.

Amblypodia syama, Horsf. Cat. Lep. E. I. C. p. 107 (1829).
Aph. syama, Butt. Ind. iii. p. 355.
Aph. himalayanus, Moore, J. A. S. B. liii. pt. ii. p. 26; Butt. Ind. iii. p. 358 note.

I received from Margharita, the Naga and Karen Hills, Momeit, and Perak specimens which vary considerably, but are no doubt all forms of what de Nicéville calls *A. syama* and *A. lohita*. He separates these by the shape of the mark at base of fore wing below, which is entire and clavate in *A. syama*, and T-shaped, hook-shaped, or absent in *A. lohita*. I found, however, in a series of Sikkim specimens, this character too variable to be used as a distinguishing feature; and though the males are distinguished by the bright dark purple of their upperside, yet one from Momeit is entirely without a trace of this, as the females usually are, though agreeing below with the rest [1].

APHNEUS SANI, var.? (Plate XLIII. fig. 6, ♀.)

A. sani, de Nicév. J. A. S. B. lvii. pt. ii. p. 282, t. xiv. 7 ♀; Butt. Ind. iii. p. 307.

Three females from the Karen Hills most resemble the female of *A. sani* from Sikkim, having the same grey-blue on both wings, but the orange patch in the fore wing is entirely wanting. Below they also resemble *A. sani*, but are lighter in colour. It is impossible to separate them without a larger series and comparison of both sexes.

TAJURIA JANGALA.

Amblypodia jangala, Horsf. Cat. Lep. E. I. C. p. 113, ♀ (1829).
T. jangala, Butt. Ind. iii. p. 380.

A few from the Karen Hills.

SUASA LISIDES.

Myrina lisides, Hew. Ill. Di. Lep. p. 33, t. xiv. figs. 28, 29 ♂ (1863).
S. lisides, Butt. Ind. iii. p. 386, t. xxviii. fig. 220 ♂.

A single male from Perak.

THAMALA MINIATA.

T. miniata, Moore, P. Z. S. 1878, p. 834, t. lii. fig. 6 ♂; Butt. Ind. iii. p. 388, t. xxviii. figs. 212 ♂, 213 ♀.
? *T. marciana*, Hew. Ill. Di. Lep. p. 34, t. xvi. fig. 44 ♂, t. xii. figs. 12, 13 ♀ (1863).

Five males and two females from the Karen Hills.

I have no doubt that this species is, as de Nicéville says, very near

[1] Mr. de Nicéville, in a letter, maintains the distinctness of *A. syama* and *A. lohita*, which were defined by Horsfield; and as his material is far larger than my own in this genus, and has been most carefully studied by him, I am not disposed to dispute his opinions.

to, and perhaps identical with, *T. marciana* of Hew.; but, judging from the single specimen I have of the latter from Pulo Laut, it can be separated by the much greater amount of black at base of fore wings, on inner margin of hind wings, and on the central stripe of the fore wing, which in my males of ***T. miniata*** is a line on the vein only.

HYPOLYCÆNA ERYLUS.

Polyommatus erylus, Godart, Enc. Méth. ix. p. 633 (1823).
H. erylus, Butt. Ind. iii. p. 390.

A few from Margharita, Bernardmyo, the Karen Hills, and Perak.

CHLIARIA OTHONA.

Hypolycæna othona, Hew. Ill. Di. Lep. p. 50, t. xxii. figs. 17, 18 ♂ (1865).
C. othona, Butt. Ind. iii. p. 395.

One from Margharita and two from East Pegu.

CHLIARIA KINA.

Hypolycæna kina, Hew. Ill. Di. Lep. Suppl. p. 13, t. v. figs. 32 ♂, 33, 34 ♀ (1869).
C. kina, Butt. Ind. iii. p. 396, t. xxviii. fig. 211 ♂.

Very common in the Naga Hills and occurs at Bernardmyo, but only males were taken.

CHLIARIA TORA.

Hypolycæna tora, Kheil, Rhop. Nias, p. 31, t. v. fig. 40 (1884).

A single male from Perak agrees with one from the island of Nias so well that I cannot separate them, though the Perak specimen has rather more black on the fore wing.

CHLIARIA MERGUIA.

C. merguia, Doh. J. A. S. B. lviii. pt. ii. p. 427, t. xxiii. fig. 2 ♂ (1889); Butt. Ind. iii. p. 397.

A single male from Perak.

ZELTUS ETOLUS.

Papilio etolus, Fabr. Mant. Ins. ii. p. 66 (1787).
Z. etolus, Butt. Ind. iii. p. 400.

Sent from Margharita, the Naga and Karen Hills, and Perak.

CHERITRELLA TRUNCIPENNIS.

C. truncipennis, de Nicév. P. Z. S. 1887, p. 456, t. xxxix. figs. 4 ♂, 3 ♀; Butt. Ind. iii. p. 404.

Not uncommon in the Karen Hills at 4000–5000 feet, and agrees with a Sikkim specimen in Knyvett's collection.

NEOMYRINA HYEMALIS.

Myrina hiemalis, Godman & Salvin, P. Z. S. 1878, p. 640, t. xl. figs. 5, 6 ♂.

N. hiemalis, Butt. Ind. iii. p. 406.

Two males of this beautiful species from Perak.

TICHERRA ACTE.

Myrina acte, Moore, Horsf. & Moore, Cat. Lep. E. I. C. i. p. 47 ♀ (1857).

T. acte, Butt. Ind. iii. p. 407, t. xxviii. fig. 225 ♂, wet-season form.

Sent from Margharita, the Naga and Karen Hills.

CHERITRA FREJA.

Hesperia freja, Fabr. Ent. Syst. iii. pt. 1, p. 263 (1793).

C. freja, Butt. Ind. iii. p. 409.

Sent from the Karen Hills and Perak.

NEOCHERITRA AMRITA.

Myrina amrita, Felder, Wien. ent. Mon. iv. p. 395 (1860).

N. amrita, Butt. Ind. iii. p. 402 note.

A single female from Thandaung in the Karen Hills, taken at 4500 feet.

PURLISA GIGANTEA.

Iolaus (*Purlisa*) *giganteus*, Distant, Ent. Mo. Mag. xvii. p. 245 (1881).

P. gigantea, Butt. Ind. iii. p. 385.

A perfect male from Perak, taken at 1000 feet.

HORAGA ONYX.

Thecla onyx, Moore, Horsf. & Moore, Cat. Lep. E. I. C. i. p. 30 (1857).

H. onyx, Butt. Ind. iii. p. 416.

A single specimen from the Karen Hills which agrees with others from Sikkim, as does one from the Shan Hills taken by Dr. Manders.

CATAPŒCILMA SUBOCHREA, n. sp. (Plate XLIV. fig. 10, ♂.)

Two males of this lovely species were taken by Doherty at Thandaung in the Karen Hills at about 4500 feet elevation in April 1890. They appear to be quite distinct from *C. elegans*, which was found in the same locality, and may be distinguished best by the colour and arrangement of the beautiful markings of the underside, which are easier to figure than to describe. On the upperside the colour is a little brighter than in *C. elegans*, the black border of the fore wing not broader at the apex. From *C. bubases*, Hew., it is distinguished by the absence of a costal border on the fore wing, its smaller size, and the different markings below.

CATAPŒCILMA ELEGANS.

Hypochrysops elegans, Druce, P. Z. S. 1873, p. 350, t. xxxii. fig. 12 ♀.

C. elegans, Butt. Ind. iii. p. 421, t. xxix. fig. 228 ♀.

Taken by Doherty at same time and place as the last.

It is perhaps rather larger and paler on the underside than Sikkim specimens, and the female differs from the Sikkim female in having the hind wing without any dark border except a small patch at the outer angle. In this respect a female from the Nilgiri Hills is intermediate between the Burmese and Sikkim specimens.

BIDUANDA THESMIA.

Myrina thesmia, Hew. Ill. Di. Lep. p. 32, t. xiv. figs. 25, 27 ♂, 26 ♀ (1863).

B. thesmia, Butt. Ind. iii. p. 426, t. xxix. fig. 229 ♂.

Seems abundant at Perak.

BIDUANDA SCÆVA.

Myrina scæva, Hew. l. c. p. 30, t. xv. figs. 39, 40 ♂ (1863).

B. scæva, Butt. Ind. iii. p. 428 note.

Three males of this delicate insect from Perak.

DRUPADIA BOISDUVALII.

D. boisduvalii, Moore, Journ. A. S. B. liii. pt. ii. p. 31 (1884); Butt. Ind. iii. p. 430, t. xxix. fig. 230 ♂.

Two males from the Karen Hills.

DRUPADIA MOOREI.

Sithon moorei, Distant, Ann. N. H. (5) x. p. 246 (1882).

D. moorei, Butt. Ind. iii. p. 431 note.

Seems to be common at Perak.

EOOXYLIDES THARIS.

Oxylides tharis, Hübner, Zutr. ex. Schmett. figs. 883, 884 (1837).

E. tharis, Butt. Ind. iii. p. 433, t. xxix. fig. 231 ♂.

A few specimens from Perak.

LOXURA ATYMNUS.

Papilio atymnus, Cram. Pap. Ex. iv. p. 82, t. cccxxxi. figs. D, E (1780).

L. atymnus, Butt. Ind. iii. p. 436, t. xxix. fig. 232 ♂.

Naga and Karen Hills.

YASODA TRIPUNCTATA.

Loxura tripunctata, Hew. Ill. Di. Lep. p. 26 (1863).

Y. tripunctata, Butt. Ind. iii. p. 439, t. xxix. figs. 233, 234 ♀.

A single male from Momeit and a female from the Naga Hills.

DRINA DONINA.

Myrina donina, Hew. l. c. p. 39, t. xvii. figs. 61, 62 ♀ (1865).
D. donina, Butt. Ind. iii. p. 442, t. xxix. fig. 235 ♀.

Quite abundant in East Pegu, judging from the number taken by Doherty. I do not see the least variation or difference between the sexes.

ARAOTES LAPITHIS.

Myrina lapithis, Moore, Horsf. & Moore, Cat. Lep. Mus. E. I. C. i. p. 48 (1857).
A. lapithis, Butt. Ind. iii. p. 446, t. xxix. fig. 237 ♂.

A male from the Karen Hills and a female from Perak.

DEUDORIX EPIJARBAS.

Dipsas epijarbas, Moore, Horsf. & Moore, Cat. Lep. Mus. E. I. C. p. 32 (1857).
Deudorix epijarbas, Butt. Ind. iii. p. 449, t. xxix. fig. 238 ♂.

Naga Hills and Margharita.

ZINASPA DISTORTA.

Rapala distorta, de Nicév. P. Z. S. 1887, p. 461, t. xl. fig. 6 ♀.
Z. distorta, Butt. Ind. iii. p. 452, t. xxix. fig. 239 ♂.

A pair from Petichaung in East Pegu at about 500 feet elevation.

RAPALA ABNORMIS, n. sp. (Plate XLIV. fig. 2, ♂.)

Three males were sent from the Karen Hills, one of which was marked by Doherty "*Rapala* sp., possibly an abnormal *schistacea*." As, however, all three agree perfectly in the very peculiar markings of the underside, and there were no examples of *R. schistacea* in the collection, I think this must be a new species, of which I am, however, unfortunately only able to describe the male as follows:—

♂. Above same size and colour and blue gloss as *R. schistacea*, but darker. Below chalky white with yellow tinge, with a large lead-coloured patch in the centre of fore and hind wings; a broad transverse submarginal band of similar colour on both wings from costa to inner margin; a narrower and paler marginal band. A tinge of fulvous at anal angle; the lobe black, with indistinct pale fringe extending above the tail, which is black with white tip.

RAPALA ORSEIS.

Deudorix orseis, Hew. Ill. Di. Lep. p. 23 (1863).
R. orseis, Butt. Ind. iii. p. 461.

Sent from Margharita, the Karen Hills, and one male from Perak, which I think must be referred to *R. orseis*.

RAPALA NISSA.

Thecla nissa, Kollar, Hügel's Kaschmir, iv. pt. 2, p. 412, t. iv. figs. 3, 4 (1848).

R. nissa, Butt. Ind. iii. p. 463.

Only sent from the Naga Hills, where it does not seem to be so common as it is in the Khasias.

RAPALA PETOSIRIS.

Deudorix petosiris, Hew. Ill. Di. Lep. p. 22, t. ix. figs. 30, 31 ♂ (1863).

R. petosiris, Butt. Ind. iii. p. 465.

Margharita and the Karen Hills.

RAPALA SUFFUSA.

Deudorix suffusa, Moore, P. Z. S. 1878, p. 834, t. lii. fig. 8 ♂.

R. suffusa, Butt. Ind. iii. p. 466.

Deudorix barthema, Distant, Rhop. Mal. p. 280 (1885); Butt. Ind. iii. p. 450; Doh. J. A. S. B. lv. pt. ii. p. 260 (1886).

Mr. de Nicéville's supposition that these names would prove synonyms is correct, as I have a male from Perak named by himself, together with two females from East Pegu, which agree with it in the yellow colour of the underside, and with a female from Barakhal, Chittagong, taken by Doherty and alluded to by him in writing of *D. barthema*. *Rapala suffusa* is a perfectly good species, and the female may be known from the female of *R. xenophon* by the pale yellow of the underside.

I have another species with pale yellow underside in both sexes from the Khasia Hills which is a *Deudorix*, having no sexual mark in the male, and is larger than *R. suffusa*, but though I cannot discover a name for it the specimens are not good enough to describe.

RAPALA JARBAS.

Papilio iarbas, Fabr. Mant. Ins. ii. p. 68 (1787).

R. jarbas, Butt. Ind. iii. p. 468.

Sent from Bernardmyo and Perak.

RAPALA HYPARGYRIA, n. sp. (Plate XLIII. fig. 7, ♂.)

Doherty sends five specimens of this very distinct species from the Karen Hills, all of which appear to be males. Above they are most like *R. xenophon*, but of a more orange tint, with a broad black border on both fore and hind wings, the latter fringed towards the anal angle, and more conspicuously on the inner margin, with white; a dark streak runs from the base of the tail parallel to the inner margin. Beneath, the fore wing is dull silvery white, tinged with brown towards the costa and outer margin. Hind wing the same, with an obscure row of spots towards the anal angle. The anal lobe and a large round spot above the base of the tail black, a short broken line from near this towards the inner margin.

Frons, palpi, and breast white; abdomen fulvous. Head and thorax black.

Expanse 30–38 mm.

RAPALA SUBGUTTATA, n. sp. (Plate XLIV. fig. 1, ♂.)

Above, both wings dull purple, darkening towards apex and outer margin, which are nearly black.

Below dull vinous brown, with a short double bar at the end of cell in both wings; a single basal spot and cluster of three other spots beyond the bar on hind wing; a double streak from near these towards inner margin. On one side there is an additional spot beyond the bar on the fore wing, on the other a similar one near the costa of hind wing. Frons and underside of body and abdomen whitish; above black.

Expanse 33 mm.

Described from a single male taken in the Karen Hills at 4000–5000 feet.

The peculiar spotting of the underside makes this very distinct from any species in the genus known to me.

RAPALA SEQUEIRA.

? *Deudorix sequeira*, Dist. Rhop. Mal. p. 278, t. xxiii. 21 ♀.
R. sequeira, Butt. Ind. iii. p. 466 note.

A single specimen without head, body, or anal lobe from Perak agrees best with the figure above cited, but seems by the shape of the wings and absence of any sexual mark to be a female, whilst Distant's plate would give one the idea of a male.

RAPALA UTIMUTIS.

Deudorix utimutis, Dist. Rhop. Mal. p. 279, t. xxiii. 22 ♂.
R. utimutis, Butt. Ind. iii. p. 466 note.

A single male from Perak agrees with Distant's description and figure better than with Hewitson's description of *D. pheretima*. It has the antennæ black ringed with white, and a broad white band just below the rufous tip.

BINDAHARA PHOCIDES.

Hesperia phocides, Fabr. Ent. Syst. iii. pt. 1, p. 282 ♀ (1793).
B. phocides, Butt. Ind. iii. p. 473.

A single large male from the Naga Hills, another from the Dhansiri Valley, and two from East Pegu.

SINTHUSA NASAKA.

Thecla nasaka, Horsf. Cat. Lep. E. I. Co. p. 91 (1829).
S. nasaka, Butt. Ind. iii. p. 484.

Two males from Margharita and one from Momeit.

SINTHUSA AMBA.

? *Hypolycæna amba*, Kirby in Hew. Ill. Di. Lep. Suppl. p. 32, t. v. *b*. figs. 44, 46 ♂, 45 ♀ (1878).
S. amba, Butt. Ind. iii. p. 485; Dist. Rhop. Mal. p. 461, t. xliv. 12 ♂, 19 ♀.

A male from East Pegu and another from Perak agree perfectly

with Distant's good illustration and with a single pair from Pulo Laut, Borneo, which I think are the true *S. amba*. There is, however, a nearly allied but, as I think, distinct species, which also occurs in Pulo Laut, and may be *Hypolycæna amba*, Kirby, of which neither Hewitson's nor Distant's figures are clear in the distinctive points. In this the male has the costa of hind wing broadly black, the purple on fore wings more diffused, the markings of the underside more broken, and the colour of the base much paler; the tails and hind wings with broad white fringes. If this proves constant, as it is in four specimens I have, the Pegu and Perak forms may be called *S. amboides*.

SINTHUSA CHANDRANA.

Hypolycæna chandrana, Moore, P. Z. S. 1882, p. 249, t. xi. figs. 2, 2 *a* ♂.

S. chandrana, Butt. Ind. iii. p. 486.

Two pairs from the Karen Hills and Momeit.

SINTHUSA VIRGO.

Hypolycæna virgo, Elwes, P. Z. S. 1887, p. 446.

S. virgo, Butt. Ind. iii. p. 488, front. fig. 134 ♂.

One female from the Naga Hills and another from Bernardmyo agree perfectly with the type. It is very strange that in these places, as in Sikkim, the male of this species seems so difficult to procure, whilst in many of the allied species the females are taken very rarely.

Fam. HESPERIIDÆ.

UNKANA BATARA.

U. batara, Dist. Rhop. Mal. p. 370, t. xxxiv. 11.

Two males from Perak.

UNKANA ELIA.

Hesp. elia, Hew. Trans. Ent. Soc. 1866, p. 489.

Unkana elia, Dist. Rhop. Mal. p. 370, t. xxxiv. 25.

A single male from Perak agrees with the type in coll. Hewitson from Borneo and with Distant's plate.

UNKANA ATTINA.

Hesp. attina, Hew. Trans. Ent. Soc. 1866, p. 489.

Unkana attina, Dist. Rhop. Mal. p. 371, t. xxxiv.

I am indebted to Major Adamson for a female of this species from Moulmein, this being, I think, its first certainly recorded occurrence in British India.

BADAMIA EXCLAMATIONIS.

Pap. exclamationis, Fabr. Syst. Ent. p. 530.

Doherty took examples of this species at Margharita and in the Karen Hills.

CALLIANA PIERIDOIDES.

C. pieridoides, Moore, P. Z. S. 1878, p. 687, t. xlv. 2 ♂.
C. pieridoides, de Nicév. Journ. Bomb. N. H. Soc. vol. vi. no. 3 (1891), p. 377, t. G. fig. 25 ♀.

Two males of this remarkable insect from Margharita. The female, which has been described and figured by de Nicéville, is very unlike the male.

CHOASPES BENJAMINI, var.

Thymele benjamini, Guér. Del. Voy. Inde, ii. p. 79, t. 22. 2, 2*a* (1843).

There are two forms of this which may be distinct, but I have a series of them only from Sikkim. The one I take to be the typical form is of a greenish shade, but not constant, some specimens being lighter and some darker; and this I have from the N.W. Himalaya, Sikkim, the Khasias, Nilgiri Hills, and Japan, and Moupin in East Tibet. Another is metallic bluish on the thorax and base of both wings, sometimes with a tinge of green, and the rest of the wings, except anal area and fringe, black. This I have from Sikkim and the Naga Hills. These differences may be sexual; but it is very difficult to be sure of the sex in this genus.

CHOASPES HARISA.

Ismene harisa, Moore, P. Z. S. 1865, p. 783.
Choaspes harisa, Elwes, Trans. Ent. Soc. 1888, p. 439.

A single female from the Naga Hills agrees with the Sikkim females described by me.

CHOASPES AMARA.

Ismene amara, Moore, P. Z. S. 1865, p. 783.

Two from the Naga Hills, which have rather less yellow at base of costa than Sikkim specimens.

CHOASPES VASUTANA.

Ismene vasutana, Moore, P. Z. S. 1865, p. 782.

A single male from the Naga Hills.

CHOASPES CHUZA.

Ismene chuza, Hew. Ex. Butt. iv. *Ism.* t. 14.
Choaspes chuza, Dist. Rhop. Mal. p. 373, t. xxxiv. 27.

A single specimen from the Ruby-mine District at 2000 feet and another from the Naga Hills agree with Bornean examples.

CHOASPES CRAWFURDI.

Ismene crawfurdi, Dist. Ann. Nat. Hist. ser. 5, x. p. 247 (1882).
Choaspes crawfurdi, Dist. Rhop. Mal. p. 372, t. xxxiv. 26.

A specimen from Perak agrees with one from Province Wellesley in my collection, identified by Distant, and with two others from

Pulo Laut, Borneo. The Perak specimen is darker than the other three, showing the same tendency to vary as *C. benjamini*, to which it is closely allied. It may, however, be distinguished by the greater extent and paler colour of the yellow border and larger yellow lobe of the hind wing, and also by the difference in the black markings on the yellow beneath.

Ismene subcaudata, Feld. Reise Nov. t. lxxii. figs. 20, 21, from Java, which I only know from the figure, is evidently a near ally, but may be distinguished by the black spots showing on the yellow of the hind wing above.

PADUKA LEBADEA.

Hesperia lebadea, Hew. Ex. Butt. iv. t. iii. 22, 23 (1868).
Matapa subfasciata, Moore, Lep. Ceyl. vol. i. p. 164, t. lxiv. 3, 3*a* ♂ (1881).
Paduka glandulosa, Dist. Rhop. Mal. p. 376, t. xxxv. 5 ♂ (1886).
Ismene lebadea, var. *andamanica*, Wood-Mason & de Nicév. J. A. S. B. vol. l. pt. ii. p. 254 (1881).

A single male from Perak agrees with Distant's plate and with a male from Pulo Laut, Borneo, in my collection.

ISMENE MAHINTHA.

Ismene mahintha, Moore, P. Z. S. 1874, p. 575, t. lxvii. 4.

A single male from Bernardmyo, which differs from Moore's description in wanting the yellow discal spot above, though it shows below. The shape of the hind wing is different from his figure, being more lobed, but not so much so as in *Choaspes benjamini*.

ISMENE ŒDIPODEA.

I. œdipodea, Swains. Zool. Ill. i. t. 16 (1820).

A single male from the Karen Hills.

ISMENE JAINA.

I. jaina, Moore, P. Z. S. 1865, p. 782.

A pair from the foot of the Karen Hills. The absence of the red costal streak is not a mark of the female, as Moore says; both in the Karen Hills specimen and in *Ismene fergusonii*, de Nicév., from South India, this streak is quite conspicuous; but according to de Nicéville it is highly deciduous in all species of *Ismene*.

PIRDANA HYELA.

Hesp. hyela, Hew. Desc. Hesp. p. 23 (1867).
Pirdana hyela, Dist. Rhop. Mal. p. 376, t. xxxv. 6 ♀.

A male from Perak and another from Tenasserim agree with Distant's plate and with specimens from Pulo Laut, Borneo. The sexes differ as in the next species, the female being shot with blue on both wings.

? PIRDANA RUDOLPHEI.

? *P. rudolphei*, Elwes & de Nicév. J. A. S. B. 1886, pt. ii. p. 438, t. xx. 6 ♂.

A male from the Karen Hills and a much larger specimen, which I take to be the female, from Perak. The latter has the base of fore wing and great part of the hind wing shot with steely purple or green as in *P. hyela*; but the underside, which agrees precisely with that of the male, is free from the striation which is seen in *P. hyela* and to some extent in the type of *P. rudolphei*. I am not at all sure whether *P. rudolphei* is a good species, the extent of yellow in the fringes and hind wing being variable in *P. hyela*, with which it otherwise agrees. If the underside is constant, what I have here called *P. rudolphei* would be a new species, but the material existing is not sufficient to decide the point.

PISOLA ZENNARA.

P. zennara, Moore, P. Z. S. 1865, p. 786, t. xlii. 4.

Of this species, which I recently supposed to be confined to Sikkim, Doherty has sent two males from the Naga Hills, and two females from the Karen Hills; but the fore wing in these latter is much more rectangular than in the Sikkim female, and the vitreous band of a glassy white without yellow tinge as in that from Sikkim.

CAPILA JAYADEVA.

C. jayadeva, Moore, P. Z. S. 1865, p. 785, t. xlii. 3.

A single male from the Naga Hills and a female recorded from Margharita by Doherty.

ZEA MYTHECA.

Hesp. mytheca, Hew. Ann. Nat. Hist. ser. 4, xix. p. 81 (1877).
Yea (vel *Zea*) *mytheca*, Dist. Rhop. Mal. p. 377, t. xxxv. 7 ♀.

A single specimen (which looks like a male, though the abdomen is damaged) from Perak agrees with the figure cited.

PARATA ALEXIS.

? *Pap. alexis*, Fabr. Syst. Ent. p. 533.
Hasora alexis, Elwes, Trans. Ent. Soc. 1888, p. 441.
Parata chromus, Cram. Pap. Ex. iii. t. 284, E.

Sent from Bernardmyo and the Karen Hills. I still fail to see how to separate *P. alexis* and *P. chromus*.

BIBASIS SENA.

Goniloba sena, Moore, Cat. E. I. C. p. 245 (1857).

A single male from the Naga Hills.

MATAPA ARIA.

Ismene aria, Moore, P. Z. S. 1865, p. 784.
Matapa aria, Dist. Rhop. Mal. p. 378, t. xxxv. 8.

A pair from the foot of the Karen Hills.

MATAPA SHALGRAMA.

M. shalgrama, de Nicév. J. A. S. B. 1883, p. 85.

A male from the Karen Hills agreeing with Sikkim specimens.

MATAPA SASIVARNA.

Ismene? sasivarna, Moore, P. Z. S. 1865, p. 784.

Several males and a female from the Karen Hills.

MATAPA DRUNA.

Ismene druna, Moore, P. Z. S. 1865, p. 784.

A female from the Karen Hills.

PITHAURIA MURDAVA.

Ismene murdava, Moore, P. Z. S. 1865, p. 784.

P. murdava, Dist. Rhop. Mal. p. 378, t. xxxv. 9 ♂.

A male from the Naga Hills.

PITHAURIA STRAMINEIPENNIS.

P. stramineipennis, Wood-Mason & de Nicév. J. A. S. B. 1886, p. 388, t. xv. 5 ♂.

A male from Momeit.

CHAPRA PROMINENS.

Chapra prominens, Moore, P. Z. S. 1882, p. 261.

Sent from the Naga Hills.

CHAPRA MATHIAS.

Hesp. mathias, Fabr. Ent. Syst. Suppl. p. 433.

Karen Hills.

BAORIS OCEIA.

Hesperia oceia, Hew. Descr. Hesp. 1868, p. 31.

A female from the Naga Hills.

PARNARA TOONA.

Hesperia toona, Moore, P. Z. S. 1878, p. 689 ♂.

Parnara toona, Wood-Mason & de Nicév. J. A. S. B. 1886, p. 383 ♀.

Common in the Naga and Karen Hills, as it seems to be in most places.

PARNARA ELTOLA.

Pamphila eltola, Hew. Ex. Butt. iv. *Hesp.* t. iv. 40 (1869).

Parnara eltola, Wood-Mason & de Nicév. *l. c.* t. xviii. 6, 6 *a*.

Common in the Naga and Karen Hills.

PARNARA WATSONI.

P. watsoni, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1890, p. 222.

I have a pair of this from the Karen Hills, and one, taken by Dr. Manders, from Fort Stedman in the Shan States.

PARNARA SEMAMORA.

Hesperia semamora, Moore, P. Z. S. 1865, p. 791.

A pair from the Karen Hills agreeing with Sikkim specimens.

PARNARA MOOLATA.

? *Hesperia moolata*, Moore, P. Z. S. 1878, p. 843.

Baoris moolata, Dist. Rhop. Mal. p. 379, t. xxxiv. 10 ♂.

Two males from Perak, which agree with Distant's figure and with specimens from Pulo Laut, Borneo. I have not, however, been able to compare them with specimens from Tenasserim, whence the type came. The species seems nearest to *P. austeni*, but may be distinguished from that, and from all other species in my collection, by the dark chocolate colour of the underside.

PARNARA PAGANA.

P. pagana, de Nicév. P. Z. S. 1887, p. 465, t. xl. 7.

Doherty sent specimens from the Karen Hills which agree with Sikkim examples of *P. pagana*, except that there are only two instead of three apical spots. They also agree with some Andaman specimens which I have as *P. cahira*, Moore. I am not at all sure whether the two are distinct, as I have others from Perak, Calcutta, and Moulmein, which all seem to belong to the same species.

PARNARA MIOSTICTA.

P. miosticta, de Nicév. Journ. Bomb. N. H. Soc. vol. vi. no. 3 (1891), p. 385, t. G. fig. 31 ♂.

A single specimen from Perak, which has been described and figured by de Nicéville as above.

PARNARA GUTTATA.

Eudamus guttatus, Brem. & Grey, Schmett. Nördl. China's, p. 10 (1853).

Pamphila mangala, Moore, P. Z. S. 1865, p. 792.

Specimens from the Naga Hills agree with those from Sikkim.

PARNARA BEVANI.

Hesperia bevani, Moore, P. Z. S. 1878, p. 688.

Parnara bevani, Elwes, Trans. Ent. Soc. 1888, p. 447. 2.

Occurs in the Naga Hills.

PARNARA PUGNANS.

P. pugnans, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1891, p. 384, t. G. 30 ♀.

Taken at Perak, where it seems to be not uncommon.

PARNARA PLEBEIA.

P. plebeia, de Nicév. P. Z. S. 1887, p. 466, t. xl. 2 ♂.

A single male from Karen Hills, which agrees with Sikkim examples in my collection.

SUASTUS ADITUS.

S. aditus, Moore, J. A. S. B. 1884, p. 49.

A single specimen from the Karen Hills agrees with Sikkim examples.

TELICOTA AUGIAS.

? *Pap. augias*, Linn. Syst. Nat. i. 2, p. 794 (1767).

Telicota augias, Wood-Mason & de Nicéville, J. A. S. B. vol. lv. pt. ii. p. 384, no. 224, t. xvii. fig. 1 ♂ (1886).

? *T. bambusæ*, Moore, P. Z. S. 1878, p. 691, t. xlv. 11, 12.

Specimens from the Naga Hills and Perak, which I am still unable to compare with Javan specimens, from which Moore separated *T. bambusæ*. Whether the typical *T. augias* is distinct from what is so called in India I therefore cannot say; but I am unable to separate two species among my large series by the characters given by Moore or by Wood-Mason and de Nicéville [1].

TELICOTA SIVA.

Pamphila siva, Moore, P. Z. S. 1878, p. 692.

Common in the Karen Hills and also sent from Bernardmyo. The female differs from the male in being somewhat darker and has no sexual brand, which is conspicuous in the male, and by the form of which I distinguish this species from *T. brahma*, Moore, found in the N.W. Himalayas. In two of the males from Bernardmyo the spots on the hind wing are somewhat differently placed and the general colour darker. These may be of a distinct species, but the material is insufficient to enable me to describe it.

PADRAONA DARA.

Hesperia dara, Koll. Hügel's Kaschm. iv. p. 455 (1848).

Pamphila mæsa, Moore, P. Z. S. 1865, p. 509, t. xxv. 9.

Sent from the Naga and Karen Hills, but does not seem to be abundant.

PADRAONA MÆSOIDES.

Pamphila mæsoides, Butl. Trans. Linn. Soc., 2nd ser. Zool. i. 1879, p. 554.

Padraona mæsoides, Doh. J. A. S. B. 1886, p. 139.

? *P. sunias*, Feld. Sitz. Ak. Wiss. Wien, math.-nat. Cl. xl. p. 462 (1862).

Naga Hills, Burmah, and Perak.

I have a large series of specimens from different parts of India, as well as from the Andamans, Nias, Hongkong, Java, Borneo, and the Philippines, which seem to belong to one species, though there is considerable variation amongst them; and it is possible that there may be anatomical differences which I have not detected.

[1] Mr. de Nicéville, who has numerous examples from Java, since assures me that they are distinct and that he has specimens of both species from Central India.

PADRAONA GOLA.

Padraona gola, Moore, P. Z. S. 1877, t. lviii. 9 ♂.

A single specimen from Perak; I have it also from the Andamans, Nias, and Borneo.

PADRAONA PALMARUM.

Pamphila palmarum, Moore, P. Z. S 1878, p. 690, t. xlv. 6, 7.

Sent from Margharita, the Karen Hills, and Perak.

CUPITHA PURREA.

Pamphila purrea, Moore, P. Z. S. 1877, p. 594, t. lviii. 10.

Cupitha tympanifera, Moore, J. A. S. B. 1881, p. 261.

Two males and a female from the Karen Hills are somewhat smaller than Sikkim specimens, whilst the other differences by which Moore attempts to separate *C. tympanifera*, which was from Pegu, are not visible.

HYAROTIS ADRASTUS.

Hesp. adrastus, Cram. Pap. Ex. iv. t. 319, F, G.

A specimen from the Karen Hills.

SARANGESA DASAHARA.

Nisoniades dasahara, Moore, P. Z. S. 1865, p. 787.

Sent from the Naga and Karen Hills and Momeit.

ISMA INAREME.

I. inareme, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1891, p. 391, t. G. 38 ♂.

A single specimen, the type, from Perak.

AEROMACHUS KALI.

Thanaos kali, de Nicév. J. A. S. B. 1885, p. 123, t. 11. 3.

Aeromachus kali, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1890, p. 217.

Seems to be common in the Naga Hills, at about 3000–5000 feet. The female, which I have not seen before, differs from the male in the rounder shape of both wings.

AEROMACHUS JHORA.

Thanaos jhora, de Nicév. J. A. S. B. 1885, p. 122, t. 11, 12.

Aeromachus jhora, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1890, p. 216.

Two females from Bernardmyo.

AEROMACHUS STIGMATA.

Thanaos stigmata, Moore, P. Z. S. 1878, p. 694.

Aeromachus stigmata, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1890, p. 216.

Sent from the Naga Hills only.

CYCLOPIDES SUBVITTATUS.

C. subvittatus, Moore, P. Z. S. 1878, p. 692.

Common in the Naga Hills.

HALPE FUSCA, n. sp. (Plate XLIII. fig. 1, ♂.)

A single specimen was sent from Bernardmyo, which may be briefly described as like *Halpe gupta*, de Nicév. J. A. S. B. 1886, p. 255, t. xi. 1, but rather larger, with plain fringes of paler colour than the wings, and not spotted white as they are in *H. gupta*.

The double sexual brand is the same, but the spots above it are wanting, as is also sometimes the case in *H. gupta*, and the apical spot is double and not triple as in all my specimens of *H. gupta*. Below, the brown is paler than above, with the same spots on the fore wing, and the hind wing sprinkled with paler hairs.

HALPE SIKKIMA.

H. sikkima, Moore, P. Z. S. 1882, p. 407.

Naga and Karen Hills.

HALPE SEPARATA.

H. separata, Moore, P. Z. S. 1882, p. 407.

Sent from the Naga Hills only.

HALPE ZEMA.

Hesperia zema, Hew. Ann. Nat. Hist. 1877, vol. xix. p. 77.

A single specimen from the Naga Hills.

HALPE DOLOPIA.

Hesperia dolopia, Hew. Ex. Butt. v. t. lv. 60, 61 (1873).

Sent from the Naga and Karen Hills.

HALPE HYRIE.

H. hyrie, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1891, p. 388, t. G. 34 ♀.

Several males of this new species (from one of which it has been described by de Nicéville) were taken at 5000–6000 feet in the Naga Hills.

ISOTEINON ATKINSONI.

I. atkinsoni, Moore, P. Z. S. 1878, p. 693, t. xlv. 10.

I. subtestaceus, Moore, l. c. p. 844; Elwes, Trans. Ent. Soc. 1888, t. xi. 9.

I. atkinsoni was taken in the Naga Hills in July and August, whilst *I. subtestaceus* was obtained in the Karen Hills in March and April. This agrees with Watson's experience, and goes to strengthen Möller's opinion that the two are seasonal forms of one species.

ISOTEINON PANDITA.

I. pandita, de Nicév. J. A. S. B. 1885, p. 121, xi. 14 ♂.

Appears to be abundant in the Naga Hills at 5000–6000 feet in Aug.–Sept.

ISOTEINON SATWA.

I. satwa, de Nicév. J. A. S. B. 1883, p. 86, t. x. 15.

A pair from the Karen Hills.

ISOTEINON CEPHALA.

Hesperia cephala, Hew. Ent. Mo. Mag. 1876, p. 152.
Isoteinon cephala, Elwes, Trans. Ent. Soc. 1888, p. 456, t. xi. 10.

A single female from the Karen Hills.

ISOTEINON CEPHALOIDES.

I. cephaloides, de Nicév. J. A. S. B. 1888, p. 288, t. xiii. 4 ♂.

A male from the Naga Hills, and a female which agrees with it from Bernardmyo.

ISOTEINON IAPIS.

I. iapis, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1890, p. 313, t. E. 9 ♂.

A single specimen from Perak.

SATARUPA PHISARA, var.?

S. phisara, Moore, J. A. S. B. 1884, pt. ii. p. 35; Elwes, Trans. Ent. Soc. 1888, p. 457.

Four males from Bernardmyo differ from all my Sikkim specimens in having the band of the fore wing distinct on the hind margin, while in those from Sikkim it is faint or wanting; also in having two glassy spots above the large one in the middle of the fore wing, instead of one small one. The apical spots are also larger and better marked, agreeing in this respect with one female from Sikkim. As, however, there is some variation in all these points in Sikkim specimens, I do not think there is enough difference between the two forms to justify their separation.

SATARUPA BHAGAVA.

S. bhagava, Moore, P. Z. S. 1865, p. 781.
? *S. narada*, Moore, J. A. S. B. 1884, pt. ii. p. 35.

A single male from the Karen Hills which is intermediate between Sikkim specimens which I had referred to two supposed species. I am now, however, inclined to think that they are the same and that it is a variable one.

TAGIADES RAVI.

Goniloba ravi, Moore, Cat. E. I. C. i. p. 246.
T. khasiana, Moore, J. A. S. B. 1884, p. 51.

Naga and Karen Hills, where it seems common. I do not see how to distinguish *T. khasiana* from *T. ravi*.

TAGIADES OBSCURUS.

? *T. obscurus*, Mab. Ann. Soc. Ent. France, 1876, p. 274.

A pair from Perak which seem to come nearest to this species, and are identical with specimens from Pulo Laut.

TAGIADES DECORATUS.

Eudamus decoratus, Hew. Descr. Hesp. p. 17 (1867).
Pterygospidea decoratus, Hew. Ex. Butt. v. *Pterygospidea*, fig. 2 (1873).

Five males of this beautiful and distinct species were taken at the foot of the Karen Hills. I am not sure that it will come into this genus, though it seems best placed here at present.

TAGIADES TRICHONEURA.

Pterygospidea trichoneura, Feld. Reise Nov. t. 73. 14, 15.

Several specimens of this species from the Karen Hills and Perak. The white colour of the underside distinguishes it perfectly from *T. pralaya*, Moore.

TAGIADES ATTICUS.

? *Hesp. atticus*, Fabr. Ent. Syst. iii. 1, p. 339.
Pterygospidea menaka, Moore, P. Z. S. 1865, p. 778.

There seem to be three forms of this common butterfly, but I think they run into each other and are hardly separable. The first has two black spots within the white field of the hind wing and large marginal oblong dashes; I have it from the N.W. Himalaya, Nepal, and Sikkim, and one from the Naga Hills. The second has no spots within the field, and occurs in Sikkim, Bhutan, the Naga Hills, and Tenasserim. The third, of which I have a female marked *T. menaka* by Moore, I have only from the Karen Hills. It has the spot in the white field, but the marginal spots small, round, and separate, not united into a band as in the other two. From Malabar I have only one specimen, which combines the characters of the last two. From Pulo Laut I have two specimens, of which one is like *T. menaka*, and the other has the marginal spots of the hind wing almost absent.

UDASPES FOLUS.

Pap. folus, Cram. Pap. Ex. i. t. lxxiv. 7.

A single male from the Karen Hills has the white markings very large, especially in the hind wing.

TAGIADES DEALBATA.

T. dealbata, Dist. Rhop. Mal. p. 388, t. xxxv. 21 ♂.

Four specimens from Perak and one from Margharita have the white outer band of the fore wing spotless as figured by Distant, whilst two from Perak, one from the Karen Hills, and one from Burmah have two black spots on the white. There is also some

variation in the spots of the fore wing, in the marking of the underside, but all seem to me to belong to one species, as I have the two forms also from Pulo Laut.

TAGIADES TRIPURA.

T. tripura, de Nicév. Journ. Bomb. Nat. Hist. Soc. 1891, p. 392, t. G. 39 ♀.

A single specimen of this small species from Perak (the type specimen), which agrees with several from Pulo Laut, also sent by Doherty.

ABARATHA SYRICTHUS, var. (Plate XLIII. fig. 2, var., ♂.)

Pterygospidea syricthus, Feld. Reise Nov. iii. p. 530, t. lxxii. 22, 23.

Four specimens from Bernardmyo are so very small that they might be supposed to be another species, especially as the white marks at the base of the hind wing above are almost obsolete; but the identity of the position of all the spots and the peculiar shaped hind wing incline me to believe that they are only a form of *A. syricthus*, which I also have from Bhamo, the Shan Hills, and Java.

ABARATHA PYGELA.

Pterygospidea pygela, Hew. Descr. Hesp. p. 53 (1868); Ex. Butt. v. t. i. fig. 3 (1873).

A. pygela, Dist. Rhop. Mal. p. 390, t. xxxiv. fig. 18.

Of this remarkable species only two specimens were received, one from the Karen Hills and one from Perak.

CTENOPTILIUM MULTIGUTTATUM.

C. multiguttata, de Nicév. Journ. Bomb. Nat. Hist. Soc. v. p. 221, t. E. 10 ♂ (1890).

A specimen from Akyab, taken by Major Adamson in April, 1883.

CTENOPTILIUM VASAVA.

Achlyodes vasava, Moore, P. Z. S. 1845, p. 786.

Ctenoptilium vasava, de Nicév. Journ. Bomb. Nat. Hist. Soc. vol. v. (1890) p. 221.

Common in the Karen Hills.

ERIONOTA THRAX.

Pap. thrax, Linn. Syst. Nat. i. p. 794 (1767).

Erionota thrax, Dist. Rhop. Mal. p. 393, t. xxxiv. 17.

Sent from East Pegu by Doherty and taken at Akyab by Major Adamson. Specimens from Java, Borneo, and the Andamans agree.

CASYAPA PHANÆUS.

C. phanæus, Hew. Descr. Hesp. p. 14 (1867); Dist. Rhop. Mal. p. 386, t. xxxv. 18.

There are two forms of this species which seem very distinct, if their colour only is regarded; but I cannot see any difference in the markings by which to separate them. The one figured by Distant is bright orange-brown; of this form I have two pairs from East Pegu sent by Doherty, which agree with his type of *C. lalita* in my collection, taken in the Chittagong Hills.

Of the other form, which is of a much darker, more chocolate-brown, I have two females from Perak which agree with Hewitson's type from Borneo, and two males from Pulo Laut, Borneo. *Celænorrhinus omeia*, Leech, from West China, is nearly allied, but is olive-brown and shows no black spots on the hind wing.

HIDARI IRAVA.

Hesperia irava, Moore, Cat. Lep. E. I. C. vol. i. p. 254 (1857).
Hidari irava, Dist. Rhop. Mal. p. 395, t. xxxiv. 15 ♀.

Several specimens from Perak.

HIDARI STAUDINGERI.

H. staudingeri, Dist. Rhop. Mal. p. 395, t. xxxv. 25.

A single male from Perak which agrees with Distant's plate.

PLASTINGIA CALLINEURA.

Hesperia callineura, Feld. Reise Nov. iii. p. 513, t. 719. 10 (1866).
? *Hesperia latoia*, Hew. Ex. Butt. *Hesp.* t. 6. 62, 63 (1868).
? *Plastingia helena*, Butl. Trans. Ent. Soc. 1870, p. 511.

Doherty sent two large males from Perak which agree with Felder's plate. Also a smaller specimen which may belong to a distinct species, and if so will bear the name *H. latoia*, Hew., or *P. helena*, Butl., as it agrees with the type of that species from Sarawak and with others from Pulo Laut, Borneo.

There appears to be much variation in this genus, and I can see no characters which seem sufficiently constant to separate these forms.

Var. MARGHERITA.

Plastingia margherita, Doh. J. A. S. B. 1889, p. 131, t. x. 5.

I have the type of this species together with another from the Naga Hills and three from the Karen Hills. On the Naga specimen is a ticket in Doherty's handwriting, "probably not distinct from *H. latoia*, Hew." I may say, however, that though I cannot follow the characters given by Doherty in separating *P. margherita* from *P. callineura*, I can distinguish all these five specimens from any I have from Perak or Borneo by the colour and pattern of the underside, though none of them are quite fresh specimens, and I believe it will be found that this form is constant as a local race, if not as a species.

PLASTINGIA NOEMI.

P. noemi, de Nicév. J. A. S. B. 1885, pt. ii. p. 120, t. xi. 15 ♂.

A single male from the Karen Hills agrees with the plate, and seems quite distinct. I have a very closely allied if not identical species from Pulo Laut, Borneo.

PLASTINGIA NAGA.

Hesperia? naga, de Nicév. J. A. S. B. 1883, p. 89, t. x. 2 ♀.

A single specimen from the Karen Hills, which I believe to be a male, agrees with the plate except that the discal and apical spots of the fore wing are double. I have the same species from Pulo Laut. According to de Nicéville this species is the same as *P. tessellata*, Hew., which name has priority.

NOTOCRYPTA FICULNEA.

Hesperia ficulnea, Hew. Descr. Hesp. p. 37 (1868).
Plesioneura signata, Druce, P. Z. S. 1873, p. 360, t. xxxiii. 8.
Notocrypta signata, de Nicév. Journ. Bomb. Nat. Hist. Soc. vol. vi. p. 380. n. 26 (1891).

Four specimens from Perak which agree with Hewitson's type from Borneo and also with Druce's description; they are not unlike the spotless var. of *N. alysos*, but have no apical spot on fore wing, the transparent band shorter, and are of a deeper brown, almost pure black, with bluish instead of yellowish tinge in the band.

NOTOCRYPTA ALYSOS.

Plesioneura alysos, Moore, P. Z. S. 1865, p. 789.
Notocrypta alysos, de Nicév. Journ. Bomb. Nat. Hist. Soc. iv. p. 189 (1889).

Most of the specimens from Perak which I refer to this species have no spot beyond the band, and would by some be considered another species. I have, however, similar ones from Sikkim, and one Perak female has a single spot as usual in *N. alysos*, another having the additional spots which are found in *P. paralysos*, Moore. An allied species has been described as *P. monteithi* by Wood-Mason and de Nicéville in J. A. S. B. iv. p. 391, t. xviii. 3, 3 *a* ♀; another as *P. albifascia*, Moore, P. Z. S. 1878, p. 843, t. liii. 3; in neither of which can I discover any characters justifying their separation.

NOTOCRYPTA NEÆRA.

Notocrypta neæra, de Nicév. Journ. Bomb. Nat. Hist. Soc. vol. vi. 1891, p. 379, t. G. 27 ♀.

A single female from Perak was described by Mr. de Nicéville, who has others also from Perak in his collection. I have also a small worn male from the Karen Hills which agrees with a specimen from Singapore unnamed in the Hewitson collection.

COLADENIA INDRANI.

Plesioneura indrani, Moore, P. Z. S. 1865, p. 789.

Some specimens from Bernardmyo have the ground-colour brighter yellow than those from Sikkim and Tenasserim.

COLADENIA DAN.

Pap. dan, Fabr. Mant. Ins. ii. p. 88.

Hesperia fateh, Koll. Hügel's Kaschm. p. 454, t. xviii. 5, 6.

I am unable to define two forms of this insect, though there appear to be two races—one small and dark, which occurs in Perak, Burmah, and the Karen Hills; the other, from the North-west Himalayas and Sikkim, is larger and brighter. Intermediate forms, however, are common in Sikkim; and the Javan variety has the band of spots much more golden, and seems more distinct than either of the others.

TAPENA AGNI.

Plesioneura agni, de Nicév. J. A. S. B. 1883, pt. ii. p. 87, t. x. 4 ♀.

A specimen from the Naga Hills is darker than the type, as are others from the Karen Hills.

TAPENA THWAITESI.

Tapena thwaitesi, Moore, Lep. Ceyl. i. p. 181, t. 67. 2, 2 *a*.

Two males from Bernardmyo and one from Perak.

TAPENA LAXMI.

Plesioneura laxmi, de Nicév. J. A. S. B. 1888, p. 290, t. xiii. 5 ♀.

A single male of this species was sent from Perak and was described by de Nicéville as the type of this sex, his original specimen being a female and not, as described, a male.

CELÆNORRHINUS PULOMAYA.

Plesioneura pulomaya, Moore, P. Z. S. 1865, p. 787.

Celænorrhinus pulomaya, de Nicév. Journ. Bomb. Nat. Hist. Soc. iv. p. 180 (1889).

? *C. pyrrha*, de Nicév. l. c. p. 181, t. B. 11 ♀.

What I take to be a var. of this species was taken in the Naga Hills by Doherty at 6000–7000 feet. It has the two spots nearest the hind margin of the fore wing larger and paler in colour, the outer one being whitish as in *C. maculosa*, Feld. The markings of the underside are also clearer and paler than in *P. pulomaya*, but one specimen of the latter from the Naga Hills is like the Sikkim form. I remain in doubt as to whether this is only a variety of *P. pulomaya*, or whether it is *C. pyrrha*, of which de Nicéville figures only the female, and this is more like what I call *C. sumitra*.

CELÆNORRHINUS SUMITRA.

Plesioneura sumitra, Moore, P. Z. S. 1865, p. 787; Elwes, Trans. Ent. Soc. 1888, p. 463.

Celænorrhinus sumitra, de Nicév. Journ. Bomb. Nat. Hist. Soc. iv. p. 184 (1889).

? *C. plagifera*, de Nicév. l. c. p. 182, t. B. 13 ♀.

? *C. patula*, de Nicév. l. c. t. B. 4 ♀.

I cannot follow de Nicéville in his descriptions of these species. Perhaps what I call *C. sumitra* is one or other of them; but he says he knows *C. sumitra* from the description only. My *C. sumitra* occurs also in the Naga Hills, and is distinguished from the last by the partially white club and shafts of the antennæ, and by the absence of the yellow spot near the base of the fore wing. I have a female from Bernardmyo which nearly agrees with the figure of *C. patula*, but unless I am mistaken these species are more variable than de Nicéville supposes.

CELÆNORRHINUS PERO.

? *C. pero*, de Nicév. l. c. p. 183, t. B. 12 ♂.

This seems a good and distinct species, but I cannot be sure that it is *C. pero*. I have two fresh males from the Naga Hills and a female which may belong to *C. sumitra*; they agree fairly with the plate and better with the description of *C. pero*; but some of the points touched on by de Nicéville for distinguishing the species seem inconstant, and it is impossible to decide without a large number of specimens from different localities.

CELÆNORRHINUS CLITUS.

C. clitus, de Nicéville, Journ. Bomb. N. H. Soc. vol. vi. no. 3 (1891), p. 378, t. G. fig. 26 ♂.

♂. Above black, with olive hairs at base and on hind margin of fore wing, and longer olive hairs on inner half of hind wing. Spots glassy white on fore wing, bright yellow on hind wing, constant in colour and position as figured in three specimens. Cilia of fore wing and of hind wing as far as second median vein concolorous with the wings, on the rest of the hind wing they are yellow with a trace of brown at the end of the veins.

Below the same as above. Antennæ black, mixed with yellow above. Palpi and breast beneath pale yellow. Thorax clothed with olive hairs. Abdomen black, ringed yellow.

Expanse 52 mm.

Described from three specimens taken at Bernardmyo in May by Doherty.

After what I have just said of the variability of the species of this genus, it may be thought unwise to describe another, but this is so distinct from any in my collection that I have no doubt of its being a good one. The fringes of the hind wings, like those of *maculata*, from which it differs in its larger size and much longer, more pointed wings, will distinguish it from any Indian species [1].

[1] Since this was written I find that the species has been already described by de Nicéville, so I adopt his name.

CELÆNORRHINUS LEUCOCIRCA.

Hesperia leucocirca, Koll. in Hügel's Kaschm. p. 454, xviii. 3, 4.
Celænorrhinus leucocirca, de Nicév. l. c. p. 184.

Of this wide-ranging and variable species I have specimens from the Karen Hills and Momeit.

CELÆNORRHINUS PINWILLI.

Plesioneura pinwilli, Butl. Trans. Linn. Soc., 2nd ser. Zool. i. p. 556, t. lxviii. 4 ♂.
Celænorrhinus pinwilli, de Nicév. l. c. p. 187.

A single specimen of this beautiful species from Perak.

CELÆNORRHINUS NIGRICANS.

Plesioneura nigricans, de Nicév. J. A. S. B. liv. pt. ii. p. 123, t. 11. 6 ♀.
Celænorrhinus nigricans, de Nicév. l. c. p. 186.

Three specimens of this from the Karen Hills, though agreeing with one named *C. nigricans* by de Nicéville from Sikkim, are very near what I suppose to be *P. chamunda*, Moore, from the N.W. Himalayas and Sikkim.

CELÆNORRHINUS CHAMUNDA.

Plesioneura chamunda, Moore, P. Z. S. 1865, p. 788.
Celænorrhinus chamunda, de Nicév. l. c. p. 185.

A single specimen from the Naga Hills.

CELÆNORRHINUS CACUS.

C. cacus, de Nicév. Journ. Bomb. Nat. Hist. Soc. v. p. 223, t. E. 11 ♂ (1890).

A pair from the foot of the Karen Hills, which agree with the figure and description except in having three apical dots joined together on the fore wing, instead of two as in the type from Rangoon. The female does not differ from the male except in the slightly broader wings, and has the fringes concolorous with the wings, and the antennæ without white on shafts or club; the palpi are white below.

ASTICTOPTERUS SALSALA.

Nisoniades salsala, Moore, P. Z. S. 1865, p. 786.
A. salsala, Dist. Rhop. Mal. p. 401, t. xxxiv. 21.

ASTICTOPTERUS XANITES.

A. xanites, Butl. Trans. Ent. Soc. 1870, p. 510; Dist. Rhop. Mal. p. 402, t. xxxiv. 28.

Seems common at Perak; I have it also from East Pegu, Tenasserim, and Tavoy. It is variable in size and in the length and breadth of the yellow band of the fore wing, but seems to be distinguished from the next species by the deeper black of both wings, and the narrower band and the absence of the gem-like spots

on the underside of hind wings, which are visible when carefully examined.

ASTICTOPTERUS GEMMIFER.

A. gemmifer, Butl. Trans. Linn. Soc., 2nd ser. Zool. i. p. 555 (1877).
Kerana gemmifer, Dist. Rhop. Mal. i. p. 403, t. xxxiv. 29.

I have this also from Perak, where it seems not uncommon. It agrees with specimens from Pulo Laut, Borneo. I cannot follow Distant in his generic separation of this species from the last.

ASTICTOPTERUS LADANA. (Plate XLIII. fig. 4, ♂.)

Carystus ladana, Butl. Trans. Ent. Soc. 1870, p. 502.

Three specimens from Perak agree with the type from Borneo in the British Museum. Above they are very like *A. gemmifer*, but are easily distinguished by the yellow colour of the legs, palpi, and abdomen below, and by the orange tinge on the inner margin of the hind wings below. I do not know in what genus to put this species. *Carystus* is a name of Hübner's adopted by Butler, who puts in the genus four South-American species.

ASTICTOPTERUS SINDU. (Plate XLIII. fig. 3, ♂.)

A. sindu, Feld. Wien. ent. Mon. iv. p. 401 (1860).

A single specimen of this small species from Perak has the band of the fore wing less developed than in specimens from Borneo. It is distinguished by the colour of the hind wing below, which is sprinkled with yellow scales, from *A. xanites* or *A. gemmifer*.

ASTICTOPTERUS OLIVASCENS.

A. olivascens, Moore, P. Z. S. 1878, p. 692.
A. olivascens, Wood-Mason & de Nicév. J. A. S. B. 1886, pt. ii. p. 381, t. xviii. 2, 2 *a* ♀.

I believe there are two species confused under this name, of which one may be the *A. jama* of Felder; but what Distant calls *A. jama*, Rhop. Mal. p. 401, may be *A. subfasciatus*. The one is in the male sex plain unspotted black on both surfaces, with some green scales on the hind wing below; the female has two spots at the apex of the fore wing. I have it from Sikkim, Bhutan, the Khasia and Naga Hills, Margharita, the Shan Hills, Perak, and West Java.

The other has the underside dull brown with some darker markings on the hind wing below, two or three glossy spots in both sexes near the apex and another below it beyond the cell.

This I have from Burmah, the Karen and Shan Hills.

ASTICTOPTERUS BUTLERI.

A. butleri, Wood-Mason & de Nicév. J. A. S. B. 1883, pt. ii. p. 98, t. x. 3 ♂.

Two males from Margharita.

KERANA ARMATA.

Astictopterus armatus, Druce, P. Z. S. 1873, p. 359, t. xxxiii. 7.
Kerana armata, Dist. Rhop. Mal. p. 402, t. xxxv. 31.

This fine species seems not uncommon at Perak, and according to a note of Doherty's the male gives out a pleasant aromatic smell. The female differs in being of a paler brown colour.

KERANA DIOCLES.

Nisoniades diocles, Moore, P. Z. S. 1865, p. 787.
Kerana diocles, Dist. Rhop. Mal. p. 403, t. xxxiv. 8.

Common at Perak. The female here differs from the male in being of a paler brown, which does not seem to be the case in my Sikkim specimens.

KERANA AURIVITTATA.

Plesioneura aurivittata, Moore, P. Z. S. 1878, p. 483.

One specimen from the Karen Hills, one from the Naga Hills, and several from near Bernardmyo seem to belong to this species, which is distinguished from *P. cameroni*, not by the shape of the band, but by its colour, which is pale golden like that of *P. dhanada*, Moore, from which it is distinguished by the larger size and different shape.

? KERANA CAMERONI.

? *Plesioneura cameroni*, Dist. Ann. Nat. Hist. ser. 5, x. p. 248 (1882).
Kerana aurivittata, var. *cameroni*, Dist. Rhop. Mal. p. 403, t. xxxiv. 19.

Five specimens from Perak are easily distinguished from the last by the smaller size, different shape, and by the band being of a much deeper golden colour. The band is also wider, which makes the spots at the apex look nearer to it than in *K. aurivittata*. The fringe of both wings also is plain and unspotted, whilst in the latter a small part of the fringe of the fore wing opposite the end of the band is pale as in *K. dhanada*.

KERANA ? DHANADA.

Plesioneura dhanada, Moore, P. Z. S. 1865, p. 789.

Three specimens from the Karen Hills which agree with one from Tenasserim and one from Khasia, in my collection. This species was incorrectly identified in my list of the Sikkim butterflies; where I put it with a ? as a synonym of *C. dan*, but I have one specimen sent me by Möller from thence which differs in the band being much shorter outwardly and narrower on the costa. The underside, with the fringe of the hind wings, easily distinguishes this from either of the last two species.

SANCUS SUBFASCIATUS.

Astictopterus subfasciatus, Moore, P. Z. S. 1878, p. 842; Wood-Mason & de Nicév. J. A. S. B. 1886, pt. ii. p. 380, t. xviii. 1 ♂.
Sancus subfasciatus, de Nicév. Journ. Bomb. Nat. Hist. Soc. vol. vi. p. 396. n. 38 (1891).

Three males from Perak and one from the Karen Hills. What I have under this name is plain dull black above like *A. butleri*, which it resembles in shape, but differs in having no brush of hairs on the hind wing below, and in having pale obscure spots on the underside, of which six are near the apex of fore wing and five or six on the hind wing; there are also two purplish-grey bands, sometimes very faintly marked, across the hind wing below. I have the same species from Akyab, Moulmein, Borneo, and the Nilgiri Hills.

LOBOCLA LILIANA.

Plesioneura liliana, Atk. P. Z. S. 1871, p. 216, t. xii. 2.

Abundant in the Karen Hills at 4000 feet.

This is nearly allied to and perhaps only a local race of *L. bifasciatus*, Brem. & Grey, of Northern and Central China, with which I think *Lobocla casyapa*, Moore, is synonymous; but as all my specimens are separated by the larger size, blacker colour, broader white band, and more apical spots, I keep it as a distinct species. These two species, together with *Eudamus germanus* and *E. nepos*, Oberthür, and *E. simplex*, Leech, all from China, form a group which seems to have much affinity if not to be congeneric with the N. American *Eudamus*, which Moore in describing *Lobocla* does not mention. This genus and *Erynnis*, Schrank, are the only two that I know of in India which have the costa of the fore wing in the male folded over on to the upperside of the wing.

EXPLANATION OF THE PLATES.

PLATE XLIII.

Fig. 1. *Halpe fusca*, n. sp., ♂, p. 653.
2. *Abaratha syricthus*, var., ♂, p. 656.
3. *Astictopterus sindu*, Feld., ♂, p. 662.
4. —— *ladana*, Butl., ♂, p. 662.
5. *Aphneus vulcanus*, var. nov. *maximus*, ♀, p. 637.
6. —— *sani*, de Nicév., var.?, ♀, p. 638.
7. *Rapala hyparyyria*, n. sp., ♂, p. 643.
8. *Allotinus panormis*, Doh., ♂, p. 619.
9. —— ——, ♀.

PLATE XLIV.

Fig. 1. *Rapala subguttata*, n. sp., ♂, p. 644.
2. —— *abnormis*, n. sp., ♂, p. 642.
3. *Camena icetoides*, n. sp., ♂, p. 636.
4. —— *cleoboides*, n. sp., ♂, p. 637.
5. —— ——, ♀.
6. *Nacaduba aberrans*, n. sp., ♂, p. 626.
7. *Arhopala ammonides*, Doh., ♂, p. 630.
8. *Acesina zephyretta*, Doh., ♂, p. 634.
9. —— *ariel*, Doh., ♂, p. 634.
10. *Catapæcilma subochrea*, n. sp., ♂, p. 640.

December 20, 1892.

Osbert Salvin, Esq., F.R.S., Vice-President, in the Chair.

A letter addressed to the Secretary by Dr. A. B. Meyer, C.M.Z.S., dated "Royal Zoological, Anthropological, and Ethnographical Museum, Dresden, December 8th, 1892," was read.

Dr. Meyer said:—"Not being aware that *Semnopithecus nemæus* has been recorded from the island of Hainan, but only from Cochin China, I beg to state that the Dresden Museum has recently received a male specimen of this Monkey together with other objects from there. I cannot perceive any differences in this specimen from the descriptions and figures of the continental animal, but may remark that the specimen is in a bad state and that the hair of the head is partly torn out."

A communication was read from the Rev. T. R. R. Stebbing, entitled "Descriptions of nine new Species of Amphipodous Crustaceans from the tropical Atlantic." This communication contained descriptions and figures of some Hyperidean Amphipoda collected by Mr. John Rattray when on board the 'Buccaneer' at the beginning of 1886. The specimens had been taken in the tropical Atlantic off the west coast of Africa, by a series of "tow-nettings" carried out at the expense of Dr. John Murray and Mr. J. Y. Buchanan.

In the genus *Scina*, Prestandrea, seven new species were instituted, which were named respectively: *acanthodes*, *stenopus*, *œdicarpus*, *concors*, *rattrayi*, *similis*, and *uncipes*. Of these *S. acanthodes* was remarkable among the Hyperidea for the spine-like processes along the back, while *S. stenopus* was distinguished for a slenderness of the body and appendages unusual in the genus. The earliest example of *Scina* known to science had been obtained by Banks and Solander on Captain Cook's first voyage round the world and had been figured at the time by their ill-fated 'natural history painter' Sydney Parkinson. Since then the genus had yielded few specimens but many species, the distinctive characters depending chiefly on certain parts of the organization which appeared to be uncommonly variable.

In the genus *Rhabdosoma*, Adams and White, two new species were established, named respectively *pirata* and *brachyteles*. The generic name *Rhabdosoma* was upheld against *Xyphicéphale* and *Xiphocephalus*, and it was argued that the family name Xiphocephalidæ, referring to the sword-like head, should consequently give place to the equally appropriate name Rhabdosomidæ, referring to the rod-like body.

This paper will be published entire in the Society's 'Transactions.'

Dr. Hans Gadow, F.R.S., gave an account of the remains of some gigantic Land-Tortoises recently discovered in Mauritius, along with the bones of the Dodo described in a previous communication by Sir Edward Newton and himself. The remains

of the Tortoises were referred to *Testudo indica*, *T. triserrata*, *T. inepta*, and to two new forms proposed to be called *T. sauzieri* and *T. soumeirei*, the latter being possibly related to the gigantic Tortoises of Aldabra. Along with these Tortoises were found numerous bones of the extinct Lizard, *Didosaurus mauritianus*, of which an account was also given.

This paper will be published entire in the Society's 'Transactions.'

The following papers were read:—

1. On some new Species of Earthworms from various parts of the World. By Frank E. Beddard, M.A., F.R.S., F.Z.S., Prosector to the Society.

[Received December 2, 1892.]

(Plates XLV. & XLVI.)

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3. *Acanthodrilus smithi*, n. sp., p. 675.
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5. *Acanthodrilus falclandicus*, n. sp., p. 678.
6. *Acanthodrilus aquarum-dulcium*, n. sp., p. 680.
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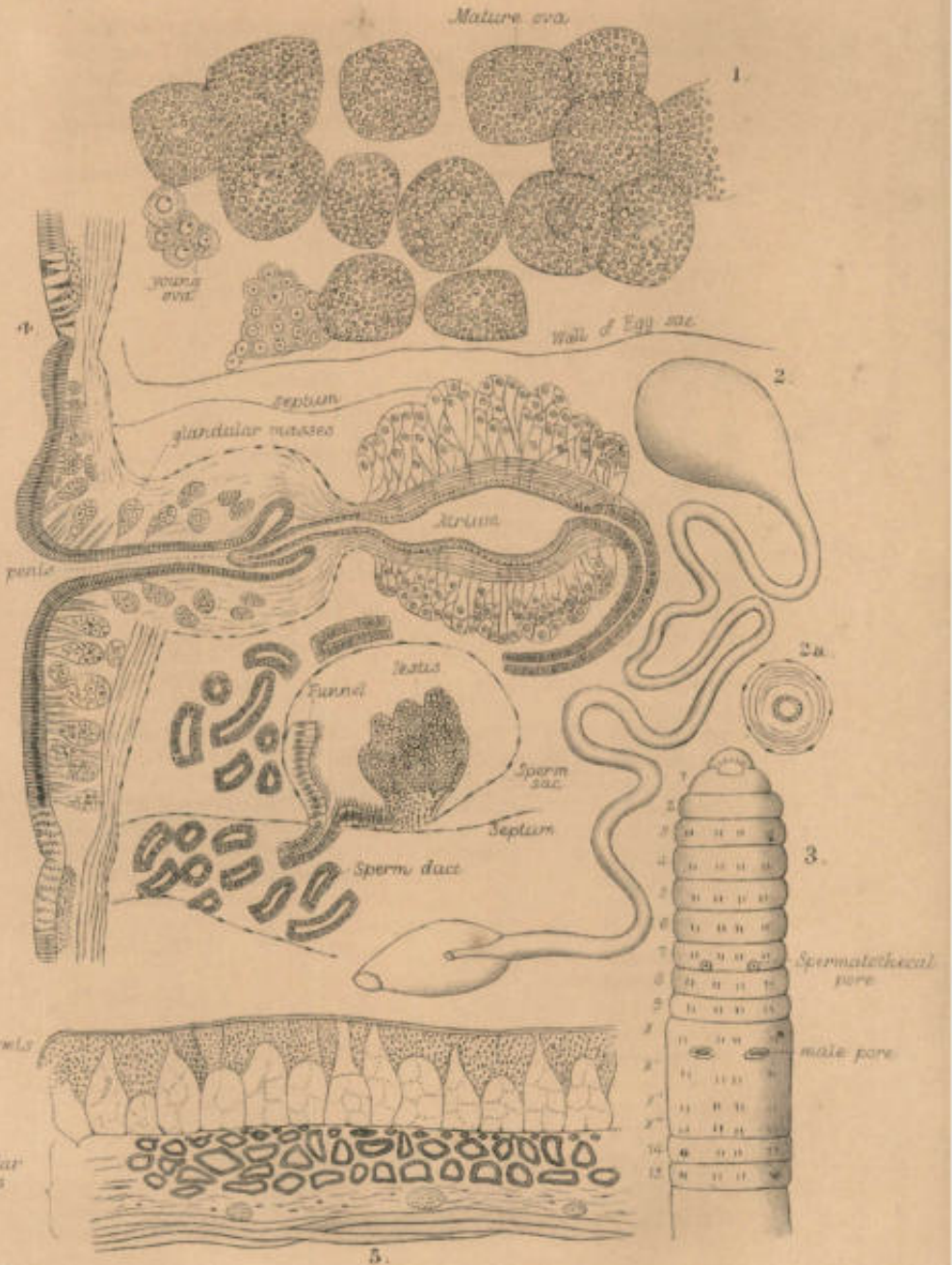
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VII. Explanation of the Plates, p. 705.

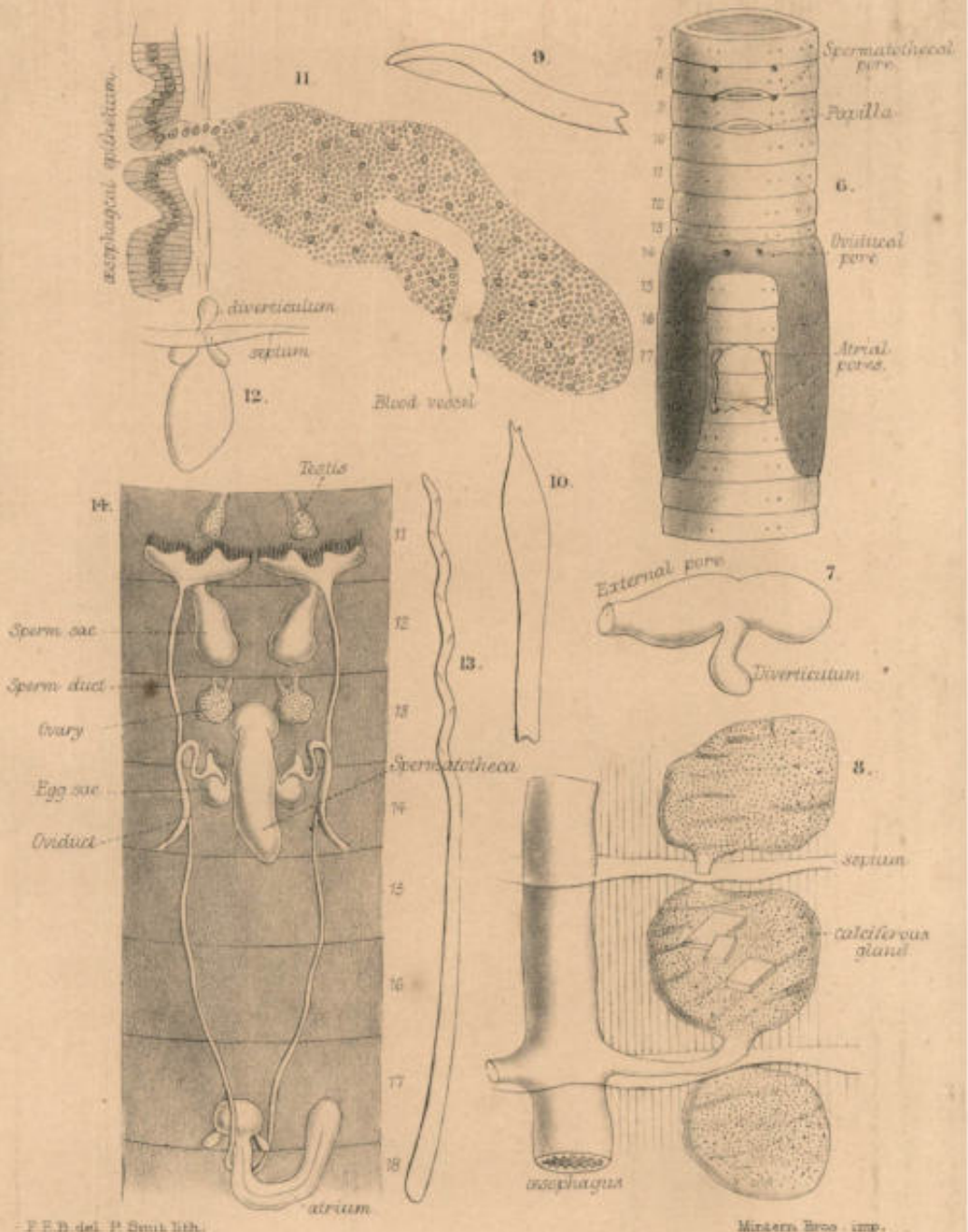
In the present paper I desire to offer to the Society some notes upon sixteen species of Earthworms, for the most part undescribed, which have come into my hands during the last year or two through the kindness of friends resident abroad, and from the Royal Gardens at Kew, through the kindness of Mr. Thiselton Dyer. The latter were received by me alive, and were carefully preserved for section-cutting; the specimens sent from abroad were, however, in most cases also well preserved.



F. F. B. del. P. Smit lith.

Mintern. Bros. Imp.

NEW SPECIES OF EARTH WORMS.
MONILIGASTER.



F.E.B. del. P. Smit lith.

Mintern Bros. imp.

NEW SPECIES OF EARTH WORMS.

BENHAMIA, ACANTHODRILUS, MICRODRILUS, EUDRILOIDES.

I. Family Acanthodrilidæ.

The majority of the new species of Acanthodrilidæ which I describe in the present paper are from New Zealand; I owe these specimens to the great kindness of Prof. T. J. Parker, F.R.S., and of Mr. W. W. Smith, of Ashburton.

The species of Acanthodrilidæ found in New Zealand have been hitherto referred to three genera; six years ago I described, under the name of *Neodrilus monocystis*[1], an Acanthodrilid differing from the typical forms (included within the genus *Acanthodrilus*) by the presence of but a single pair of atria and spermathecæ; this worm has been lately re-investigated by Dr. Benham[2], who has confirmed and extended my original account. I may add that I have within the last few months received some more examples of the same worm; there is accordingly no longer any doubt as to the characters of this species; it is not, as I at first thought it might be, a mere abnormality of such a species as *Acanthodrilus dissimilis*. Whether this Earthworm should be really referred to a distinct genus is another matter. I prefer, however, to leave the question alone for the present. In any case there can be no doubt whatever about the generic distinctness of *Deinodrilus* and the recently described *Plagiochæta*[3]. This latter may conceivably be identical with Hutton's *Megascolex sylvestris*[4]; at any rate that species is stated and figured by Hutton to possess numerous setæ arranged in couples, which is the principal external character of Benham's *Plagiochæta*.

The remaining Acanthodrilidæ have been all referred by me[5] to the genus *Acanthodrilus*. This genus comprises altogether some 40 species, of which 8 are inhabitants of New Zealand. Forty species are not, perhaps, an unwieldy number for a single genus: it has nevertheless been divided into two genera, *Acanthodrilus* and *Benhamia*, by Michaelsen; *Benhamia*, it should be remarked, includes Benham's *Trigaster*. In distinguishing the two genera Michaelsen has not considered the characters of the New Zealand Acanthodrilidæ. *Benhamia* is the name applied to those Acanthodrilidæ with a "diffuse" nephridial system—that is, in which the nephridia are not paired, but open on to the exterior by numerous pores; added to this character, Michaelsen originally called attention to the fact that the species with a diffuse nephridial system possess a pair of gizzards, or, as in *Trigaster*, three gizzards; later he was led, by a consideration of the species *Acanthodrilus schlegelii*, to reconsider the definition of the genus and to use, as part of the generic diagnosis,

[1] "Observations on the Structural Characters of certain new or little-known Earthworms," Proc. Roy. Soc. Edinb. 1887, p. 157.

[2] "Notes on two Acanthodrilid Earthworms from New Zealand," Q. J. M. S. vol. xxxiii. p. 289.

[3] Benham, *loc. cit.* p. 294.

[4] "On the New Zealand Earthworms in the Otago Museum," Tr. New Zeal. Inst. vol. ix. p. 352, pl. xv. fig. E.

[5] "On the Specific Characters &c. of New Zealand Earthworms," P. Z. S. 1885, p. 810. "On the Oligochætous Fauna of New Zealand," P. Z. S. 1889, p. 377. "On the Structure of three new Species of Earthworms &c.," Q. J. M. S. vol. xxix. p. 102.

the phrase "*as a rule* more than one gizzard." According to this definition my *Acanthodrilus multiporus* should be referred to the genus *Benhamia*; and yet it differs from the African species (Africa is at present the headquarters of the genus) in a number of characters: there are no penial setæ; the calciferous glands are limited to a single pair; the dorsal vessel is double; the setæ are not strictly paired, but separated by a little distance. There are two other species described in the present paper which agree with *A. multiporus* in these points; a fourth species, *Acanthodrilus antarcticus*, agrees with *A. multiporus* in most of these characters, but not in all.

It has penial setæ; the two pairs of calciferous glands are in segments xv., xvi., and there is a smaller gland in xiv.; only the single gizzard and the distant setæ distinguish this species from the majority of those assigned by Michaelsen and others to the genus *Benhamia*. In spite, however, of the near resemblance of this particular Acanthodrilid to *Benhamia*, I am not inclined to refer it to that genus. In the first place it is possible that *Benhamia schlegelii*, which is stated to have but one gizzard, has really two; the two gizzards in this genus are often so close together that it is not a little difficult to make out that they are really two; the interval of soft-walled œsophagus between them is reduced to the lowest terms in many cases. In the second place, *Acanthodrilus antarcticus* is so like *A. multiporus* in other particulars that it would be doing violence to their obvious relationship to separate them[1]. Taking into account also the distribution of these species it seems reasonable, now that the old genus *Acanthodrilus* is being broken up, to associate the New Zealand species here referred to into a genus distinct from *Benhamia*, which may be termed *Octochætus*. It will be thus defined:—

Octochætus, nov. gen.

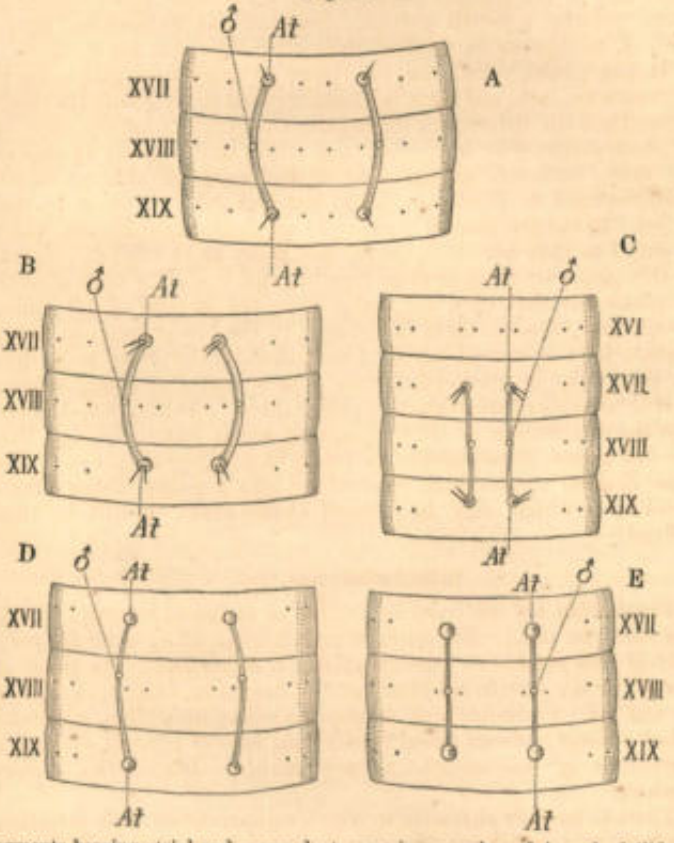
Prostomium not continued by grooves on to buccal segment; clitellum xiii.–xix. (xx.); male pores on prominent papillæ; setæ distant; ventral setæ present on segment xviii.; a single gizzard in vi., or v. and vi., or v.; calciferous glands one or two pairs, in xvii., xviii., or xv. and xvi.; typhlosole well developed; nephridia diffuse, a mucous gland present; dorsal vessel double from seventh segment onwards; diverticula of spermathecæ very minute.—Distribution: New Zealand.

There is another character to which comparatively little attention has been paid, which may prove to distinguish the genera *Benhamia* and *Acanthodrilus*. In the two species of *Benhamia* described in the present paper, as well as in *B. stuhlmanni* (for an opportunity of examining which I am indebted to Dr. Michaelsen), there are no setæ upon the xviiith segment where the ventral pair should

[1] It may turn out that the position of the gizzard distinguishes my genus *Octochætus* from *Benhamia*; I am aware that Rosa speaks of the gizzards of *B. sciogna* as occupying segments v. and vi.; this is at present the only exception to the rule that in *Benhamia* the gizzards are a segment or two further back.

be (woodcut, fig. 1); these setæ are also absent from the xviith and from the xixth segments, or rather they are there replaced by the penial setæ. In all the species of *Acanthodrilus*, on the other hand, which I have been able to examine, the ventral setæ are not missing from the xviiith segment, though they are not present on the xviith

Fig. 1.



Segments bearing atrial and sperm-duct pores in a number of Acanthodrilida.

A. *Octochætus antarcticus*; B. *Acanthodrilus capensis*; C. *Benhamia* (any species); D. *Acanthodrilus smithi*; E. *Acanthodrilus novæ-zelandiæ*.

At. atrial pores; ♂, sperm-duct pores; the groove connecting the atrial pores and the setæ is indicated; penial setæ are omitted in D and E. The segments are numbered.

and xixth segments, being there replaced by the penial setæ; this is also the case with the genus *Octochætus*; in two of the species of that genus at any rate, viz. *O. multiporus* and *O. antarcticus* (woodcut, fig. 1), the ventral pair of setæ of segment xviii. are

present and quite normal; on segments xvii. and xix. the ventralmost seta is present and unmodified. *Octochætus antarcticus* is furthermore remarkable for the fact that the setæ of the xviith and xixth segments appear at first sight to be present and normal; as a matter of fact, the outer seta of the ventral pair is replaced by the penial setæ, which occur exceptionally in this species: these setæ are very much smaller than in *Acanthodrilus dissimilis* for example, and can hardly be seen until they are examined microscopically, but they are undoubtedly there. The ventralmost seta of the ventral pair is not absent from these segments as it usually is, but is quite recognizable; this species is therefore in a less modified condition than is any other of the species of *Octochætus*, or *Acanthodrilus*, or *Benhamia*. In *A. annectens* and *A. paludosus*, described in the present paper, there is, as in *Octochætus*, a single seta ventrad of the atrial pores.

In all the species of *Benhamia* which I have dissected, the calciferous glands are different from those of *Acanthodrilus* or *Octochætus*. These glands are (in *Benhamia*) reniform pouches attached to the sides of the œsophagus; in *Acanthodrilus* and *Octochætus* these glands present the appearance of swellings upon the course of the œsophagus. Moreover, in *Benhamia* there appear to be always three pairs of calciferous glands which may, perhaps, prove to be always in segments xv., xvi., and xvii.; they have been for the most part described as in these segments, and it is possible that in those cases (e.g., *B. büttikoferi*, Horst) where they are stated to occupy the xivth, xvth, and xvith segments, a mistake of one segment may have been made; anyhow the three pairs seem to be characteristic, and nearly, if not quite, universal.

In the two species of *Benhamia* which I describe in the present communication, the spermatothecæ have a peculiar form, which is indicated in the accompanying drawing (Plate XLVI. fig. 7); the pouch is constricted in the middle, the constriction not coinciding with the attachment of the single diverticulum. Michaelsen has figured the spermatotheca of *Benhamia stuhlmanni*[1], which shows precisely the same structure, but does not remark upon it in the text of his paper. This peculiar form of spermatotheca is not, however, found in all the members of the genus *Benhamia*, for Horst figures the spermatothecæ of *Benhamia beddardi* as like those of the genus *Acanthodrilus*[2].

For the purpose of comparison I subjoin a definition of *Benhamia*:—

Benhamia, Michaelsen.

Prostomium sometimes continued by grooves on to buccal segment; clitellum xiii. (xiv.)–xix. (xxii.); setæ strictly paired; two gizzards in vi., vii., or vii., viii.; calciferous glands three pairs in xiv.–xvi. or xv.–xvii.; nephridia diffuse; dorsal vessel single; penial setæ nearly

[1] "Beschreibung der von Herrn Dr. Fr. Stuhlmann im Mündungsgebiet des Sambesi gesammelten Terricolen," JB. Hamb. wiss. Anst. vii. Taf. i. fig. 8.

[2] "Descriptions of Earthworms.—IV. *Acanthodrilus beddardi*, n. sp., a remarkable Earthworm from Liberia," Notes Leyd. Mus. vol. x. pl. vi. fig. 1.

always present; no ventral setæ upon xviii.—Distribution: Tropical Africa, Tropical America, and India.

The species *Acanthodrilus novæ-zelandiæ*, *A. dissimilis*, *A. rosæ*, and *A. smithi* (to be described in the present paper) I refer to the genus *Acanthodrilus sensu stricto*. I am doubtful about *Acanthodrilus annectens*, a species which I described some years since[1]. In possessing paired nephridia it agrees with *Acanthodrilus* (s. s.), but it has the "mucous gland" of *Octochætus*, and the gonads are placed in contact with the funnels of their ducts, as is the case with three of the species which I refer to this genus, *Octochætus*; it has the further peculiarity that the sperm-ducts run in the thickness of the body-wall, a peculiarity which it apparently shares with the genus *Octochætus*, but which, among other Oligochæta, is rare, and only found, so far as I am aware, in *Diplocardia communis* and in the not nearly allied form *Siphonogaster*. The absence of calciferous glands is occasionally met with in *Acanthodrilus*. The existence of this species serves to indicate how closely allied are the forms which do, and the forms which do not, possess a diffuse nephridial system. Another instance of the same approximation of species to each other which differ in their excretory system is afforded by *Benhamia beddardi* and *Acanthodrilus ungulatus*; in both of these there is an elaborate arrangement of modified setæ and glands appended in the neighbourhood of the spermathecæ. These facts possibly indicate that the passage from the diffuse to the paired nephridia may occur more than once in a genus, and of course discount the value of the modifications of the nephridial system in classification.

I shall now describe two apparently new species which I refer to my genus *Octochætus*:—

1. **Octochætus thomasi**, n. sp.[2]

I have received on various occasions during the last few years examples of a small-sized Acanthodrilid from New Zealand, which I have hitherto confounded with *O. multiporus*. I regarded these individuals merely as small specimens of that species. A full-sized specimen of *O. multiporus* is a very large worm, measuring, even in a contracted condition, some 14 inches in length by half an inch or so in breadth. On the other hand, the worms which I now consider to represent a new species of this genus are of a much more slender build. Unfortunately, I am not in a position to give any exact measurements; the specimens which I possess are none of them intact. An individual measuring 144 mm. is, I fancy, nearly complete; the diameter of this worm is not more than 5 mm., and the body consisted of 230 segments.

The external characters of the species recall *O. multiporus*; the *prostomium* is not continued by grooves on to the buccal segment. That segment and the two following are not annulate; segments

[1] "On the Structure of three new Species of Earthworms &c.," Q. J. M. S. vol. xxix. p. 102.

[2] Named after Prof. A. P. Thomas, of Auckland, New Zealand.

iv., v., vi. are triannulate, the middle annulus being much the narrowest; segments vii., viii., ix. are very much wider (antero-posteriorly), but still triannulate; so, too, are the segments which immediately follow, though much narrower. After the clitellum the segments continue to be triannulate.

The clitellum extends from segments xiii.–xix.; it is at first complete, extending right round the body; but on segments xvi.–xix. there is a ventral median area without any glandular modification.

The atrial pores are upon very conspicuous papillæ; the two of each side of the body are connected by a longitudinal groove, which is not straight but has a semicircular outline, the convexity being dorsal. The oviducal pores are just in front of the ventralmost seta. The setæ are rather distant from each other; a somewhat greater distance separates the two lateral setæ.

I have not seen any dorsal pores.

The pharynx occupies the first four segments of the body; the gizzard is very elongated, with parallel margins; it measures 6·5 mm. in length; the gizzard occupies two complete segments, the fifth and the sixth. The œsophagus bears in segment xvii. the single pair of calciferous glands, which present the appearance of an oval swelling of the œsophagus itself. The intestine commences in the xixth segment.

The septa of some of the anterior segments are, as is so constantly the case with Earthworms, strengthened and bound together with thin muscular strips which occasionally pass through one septum to reach another lying behind it; the number and appearance of these septa is illustrated in the accompanying drawing (woodcut, fig. 2, p. 673). The first septum, which is thin and transparent, divides segments iv./v.; it is traversed by a large number of muscular threads which bind the pharynx to the parietes: the next septum is also thin and delicate in texture; it is attached at the end of the first third of the gizzard; a good number of the threads which bind the pharynx to the parietes pass through it. The following seven septa are thickened; the last of them therefore bounds the thirteenth segment anteriorly.

The dorsal vessel is completely double; the two tubes of which it is composed retain their individuality where they pass through the intersegmental septa. The dorsal vessel is, however, at first a single tube; it is not until the seventh segment that it becomes double. In this segment commences the supra-intestinal vessel, which is large and very conspicuous. In segments x., xi., xii., xiii. are the four pairs of dilated hearts; in a few segments, anterior to the tenth, are more delicate peri-œsophageal vessels.

There are, as in *Octochætus multiporus*, a pair of large nephridia lying close against (in front of) the first septum; from each of these a slender duct was traced forwards which opens, it may be inferred, into the buccal cavity; I did not, however, succeed in seeing the actual orifice. In the rest of the body the nephridia are also constructed upon the plan which is characteristic of *Octochætus multiporus*; the tufts appear to be massed chiefly round the setæ.

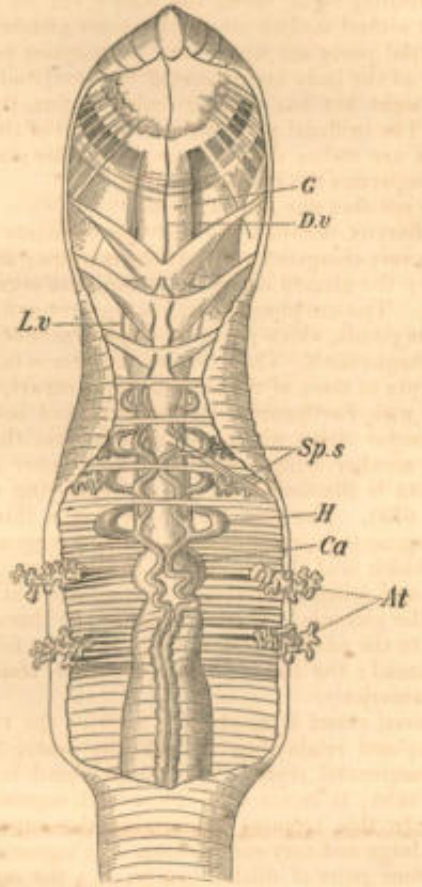
Both testes and ovaries occupy the usual segments, but the gonads

are attached to the posterior wall of their respective segments, as they are in *Acanthodrilus annectens* and in *Octochætus multiporus*.

The racemose sperm-sacs are in xi., xii.

The spermatothecæ are elongated pouches in viii. and ix.; they

Fig. 2.



Octochætus thomasi, dissected to show the principal organs.
G, gizzard; *D.v*, dorsal vessel; *L.v*, lateral vessel; *H*, hearts; *Sp.s*, sperm-sacs; *Ca*, calciferous gland; *At*, atria.

appear to have numerous minute diverticula crowded round the duct near to its external opening.

The atria do not extend beyond their proper segments. A number of strong muscular bands, such as occur in *Octochætus multiporus*, pass from the lateral to the ventral walls of segments, and serve, no

doubt, to extrude the papillæ already spoken of, on to which the atrial pores open. There are no penial setæ.

This species is clearly most intimately related to *Octochætus multiporus*; indeed it is not a little difficult to separate the two; the difficulty, too, is increased by the variability of the larger species. This difference of size is the most obvious difference; and it is, I think, a difference that must be allowed. The variability of *Octochætus multiporus* unfortunately concerns those very organs upon which I had at first attempted to lay stress as distinguishing the two. In some individuals of *Octochætus multiporus* the gizzard is limited to the sixth segment, the second septum lying just in front of it, attached therefore to the œsophagus; but in other specimens this septum is inserted on to the gizzard itself, which thus occupies two segments, as in *Octochætus thomasi*. In two individuals the single pair of calciferous glands are in segment xviii.; but in others, as is the case with *Octochætus thomasi*, in the xviith. Another possible distinction between the small and the large species concerns the dorsal vessel; in *O. thomasi*, as already mentioned, this vessel is single until the seventh segment. In a specimen of *Octochætus multiporus* the dorsal vessel was single until the commencement of the sixth segment only; in this segment it became double; in another the single dorsal vessel became double at the septum separating v./vi., but immediately after the two halves became fused, to again divide at about the middle of the segment. The shape of the gizzard and its relative length in the two species does appear to differ; in the smaller species it is proportionately longer and narrower than in the large species.

The next new species cannot by any possibility be confounded with the foregoing; I name it after Capt. Hutton, who has done so much in describing the fauna of New Zealand.

2. **Octochætus huttoni**, n. sp.

I had a number of examples of this species sent to me by Mr. W. W. Smith; they were all of approximately the same size; an individual selected for accurate measurement was 130 mm. in length by 7 mm. in breadth at the clitellum. It consisted of 233 segments.

The colour during life was pink, the clitellum being white; this colour is due to the fact that the species, like *O. multiporus*, had no pigment in the skin.

The anterior segments are much annulated. After the clitellum there is also, though to a less extent, an annulation of the segments.

The clitellum occupies segments xiii.–xix. (xx.).

The atrial pores are borne upon a very prominent fold overhanging on each side the ventral surface, which in this region appears in consequence as if hollowed out. The two pores of each side are connected by a longitudinal furrow.

The prostomium is short and wide, and is not continued by grooves on to the buccal segment, which is marked by numerous furrows.

The setæ are in pairs not closely approximated.

The dorsal pores commence between xi./xii.

The gizzard measures 8 mm. in length, and appears at first sight to occupy about four or five segments; it really corresponds to segment v., which is increased in size at the expense of neighbouring segments for its reception. The calciferous glands are in xv. and xvi.; they have the appearance of being merely dilatations upon the course of the œsophagus, which is the case with the other species of this genus.

The intestine begins in xviii., but the typhlosole (which is very prominent) does not begin before segment xx.; it ends at about 60 segments before the end of the body.

The first septum is in front of the gizzard. After the gizzard are six stout septa, and, following these, are two which are rather more developed than the rest, but not as strong as those which precede them. The nephridia are diffuse, and there is a particularly dense mass of tubes in the anterior segments, which seem to represent the mucous gland of *Octochætus multiporus*[1].

The dorsal vessel is double, and there are three pairs of hearts in x.–xii.

All the gonads are attached to the front wall of their segments.

The spermatothecæ (in viii., ix.) have a minute clump of diverticula, presenting the appearance of a solid body, about the size of a pin's head.

There are no penial setæ.

Hab. New Zealand.

This species is evidently perfectly distinct from the last; it is, however, clearly referable to the same genus, if this genus be admitted. The diffuse nephridia, double dorsal vessel, separate setæ, absence of penial setæ, and anterior position of gizzard cause it to resemble the three other species which I refer to the genus *Octochætus*. It differs from *O. multiporus* and from *O. thomasi* in the following points:—

(1) The prominence of the atrial pores as seen from the outside.

(2) The position of the gizzard in segment v., and its limitation to this segment.

(3) The presence of two pairs of calciferous glands in xv., xvi.; in this the present species resembles *O. antarcticus*.

(4) The existence of only three pairs of hearts instead of four.

(5) Six thickened septa instead of seven.

(6) The attachment of the gonads to the front wall of their segments; in this character *O. huttoni* resembles *O. antarcticus*.

The next species which I describe is referable to the genus *Acanthodrilus* (s. s.).

3. **Acanthodrilus smithi**, n. sp.

I have been able to examine, though the kindness of Mr. W. W. Smith, some seven examples of this new species of *Acanthodrilus*; the general appearance of the worm is very different from that of

[1] I did not ascertain whether these opened into the buccal cavity as in *O. multiporus*.

the other New Zealand Acanthodrilidæ which I have so far had the opportunity of studying—so different that it was unnecessary to dissect the species in order to ascertain its distinctness. All the New Zealand Acanthodrilidæ, with the exception of the present species, are either devoid of pigment in the skin, or, if pigment is present, the worms are of a brownish colour. *Acanthodrilus smithi* is (after preservation in alcohol) of a violet colour, the clitellum being whitish yellow; the ventral surface of the body is the same colour as the clitellum.

The worms are slender, measuring up to 75 mm. in length with a diameter of 3 mm. at the widest part of the body. An individual of this size consisted of 114 segments.

The prostomium completely divides the buccal segment, as it does in the New Zealand species *Acanthodrilus novæ-zelandiæ* &c.

The setæ are paired and the pairs are equidistant, the body being thus divided into four equal areas. There is no difference in size between the setæ of different segments.

The clitellum occupies segments xiii.–xix.; it is saddle-shaped, and is not developed ventrally beyond the outermost of the two ventral setæ.

I could find no dorsal pores.

The nephridiopores are very evident; they alternate in position from segment to segment, as is the case also with other species of *Acanthodrilus* from New Zealand. They sometimes lie in front of the dorsal, sometimes in front of the ventral setæ. When they open in front of the ventral setæ they appear to be particularly related to the outer of the two setæ; when, on the other hand, they open in front of the dorsal setæ, the orifice is in front of the innermost of the two setæ which constitute the pair.

The spermatothecal pores lie on the border-line between segments vii./viii. and viii./ix. They lie in front of and to the outside of the ventral pair of setæ.

The atrial pores (see fig. 1, p. 669) are upon segments xvii. and xix.; their position corresponds exactly with that of the ventral pair of setæ, which are absent from these segments. The ventral setæ are, on the other hand, present upon the xviith segment; and the sperm-duct pores lie a little to the outside of and in front of these setæ; their position therefore corresponds more accurately to that of the spermatothecal pores than do those of the atria.

The internal structure does not present any special points of interest, being on the whole very similar to that of the other New Zealand *Acanthodrili*.

The nephridia are alternate in position, as in *A. dissimilis*; this peculiarity is confined, as regards the genus *Acanthodrilus*, to the New Zealand species.

The dorsal blood-vessel is single; there are four pairs of dilated hearts, the last of which is in segment xiii.

The alimentary canal is furnished with a rudimentary gizzard, which needs a microscopical examination for its demonstration; such as it is, it lies in segment v. There are no conspicuous calciferous glands,

but in segments xiv. and xv. the œsophagus becomes wider, and its lining membrane much folded and very vascular. This region evidently corresponds to the calciferous glands of other Earthworms: all doubt upon the matter appears to be removed by the discovery of crystals exactly similar to those which occur in the calciferous glands of other Oligochæta. The vascularity of the œsophagus is not limited to these two segments; from the tenth segment onwards its walls are vascular, though not so folded as in the two segments xiv. and xv. The intestine commences in the xviiith segment.

The gonads occupy the usual position; the sperm-sacs are in segments ix., x., xi., xii. The atria are like those of other Acanthodrilidæ, and each is provided with a bundle of penial setæ. These setæ (Plate XLVI. figs. 9 and 10) are recurved at the extreme end; the extremity has two delicate wing-like processes which, when the seta is viewed from above, give to the end an oval contour; the tip of the seta in this aspect is seen to be bifid. The absence of any ornamentation upon the setæ appears to distinguish the New Zealand Acanthodrilidæ with the exception of *Octochætus antarcticus*, where it is only very slight.

The spermatothecæ are, as is nearly universally the case with the Acanthodrilidæ (*Acanthodrilus* [*Diplocardia*] *communis* is, so far as I am aware, the only exception), two pairs situated in segments viii. and ix. Each pouch has three small diverticula, one of which is constantly in front of the septum.

4. **Acanthodrilus paludosus**, n. sp.

This is a small and slender worm, but I have not preserved any accurate notes of its dimensions; it was about an inch in length and something like 1 mm. in diameter. It was found in a marsh in New Zealand by Mr. W. W. Smith, to whom I am indebted for the specimen.

This species is a near ally of *Acanthodrilus annectens*, which I have already referred to as possibly worthy of generic separation from the Acanthodrilidæ with paired nephridia.

The present species has the same arrangement of the setæ, which are not modified upon any of the segments of the body. I did not describe, in my account of *Acanthodrilus annectens*[1], the fact that only one of the two ventral setæ is missing on the segments which bear the atrial pores, *i. e.* xvii. and xix.; the apertures take the place of the missing outer seta of the ventral couple; on the xviiith segment both setæ of the ventral pair are present; the pore itself lies to the outside of the pair. *Acanthodrilus paludosus* shows exactly the same arrangement, and both species therefore differ from *Acanthodrilus smithi* and from the other New Zealand species of *Acanthodrilus* in this matter: in them the ventral setæ are entirely absent from the xviiith and xixth segments.

The clitellum was not developed, though in other respects the worm appeared to be fully mature.

[1] "On the Structure of three new Species of Earthworms &c.," Q. J. M. S. vol. xxix. p. 102.

The gizzard lies in segments v. and vi., but only one-fourth of the organ lies in the anterior segment. Calciferous glands are, as in *A. annectens*, totally absent; the intestine begins in the twentieth segment. Some of the septa are thickened.

There is a mucous gland, and the nephridia are paired.

The gonads are normal in position; they are not situated on the posterior face of their segments as is the case with *A. annectens*. Opposite to them are the funnels of the ducts, which are like those of other species and occupy the same segments. The sperm-ducts, however, agree with those of *A. annectens* to differ from those of most other Earthworms, in running within the thickness of the body-wall; they retain their individuality until just before the external aperture.

The atria have no peculiarities of structure; there are no penial setæ; strong muscular bands run from the lateral to the ventral parietes in the neighbourhood of the atria, a character which unites this species and *Acanthodrilus annectens* to the genus *Octochætus*: the presence of these muscular strands is perhaps to make up for the absence of penial setæ; the atrial papillæ can possibly be considerably protruded by their means, and as they (the extruded papillæ) are tapered at the extremity, they can, it is likely, be actually inserted in the spermatothecal orifice and convey the sperm direct.

The oviducal pores are placed just in front of the ventralmost setæ.

The oviducts have no egg-sacs attached to them.

The sperm-sacs are in segments ix., xi., xii.; I could not find any sac in the intervening segment.

The spermatothecæ are, as in all the Acanthodrilidæ (excepting only *A. communis*), two pairs and lie in the usual segments, *i. e.* viii., ix.; each pouch has, as in *Acanthodrilus annectens*, more than one diverticulum; in the present species there are two, one of which is rather the larger.

Closely allied to *Acanthodrilus annectens* as this species undoubtedly is, there will be no difficulty in distinguishing it. The chief points of difference are:—(1) position of gizzard; (2) normal position of gonads; (3) form of spermathecæ.

5. **Acanthodrilus falclandicus**, n. sp.

Some time since I added[1] some anatomical details to Michaelsen's account of *Acanthodrilus georgianus*[2], which had been derived from the study of what I believed to be an identical form. More recently Michaelsen[3] gave reasons for regarding the species described by myself as not identical with that named by him *Acanthodrilus georgianus*. Dr. Michaelsen has been so good as to send me two specimens of his *A. georgianus*, and I have therefore been able to follow the account which he has given regarding the species.

[1] "Contributions to the Anatomy of Earthworms, with descriptions of some new Species," Q. J. M. S. vol. xxx. p. 421.

[2] "Die Oligochaeten von Süd-Georgien &c.," JB. Hamb. wiss. Anst., Bd. v. p. 68.

[3] "Oligochaeten des Hamburger naturhistorischen Museums, iii.," JB. Hamb. wiss. Anst. vii. p. 7.

The differences between the two forms may be stated in a tabular form as follows:—

Setæ.—In *A. georgianus* the distance separating the two setæ of the lateral couple is hardly greater than that which separates the ventral couple.

In my species, which I propose to call *A. falclandicus*, the distance between the lateral setæ is markedly greater than that between the ventral setæ.

Nephridiopores.—In *A. georgianus* these are placed in front of and below the third seta.

In *A. falclandicus* these pores are directly in front of the third seta of each segment.

Gizzard.—Totally absent in *A. georgianus*.

Rudimentary in *A. falclandicus*.

Penial setæ.—In *A. georgianus* these have fewer tubercles upon the extremity and these tubercles have no serrations.

Michaelsen goes on to suggest that my species is possibly identical with Rosa's *Acanthodrilus bovei*. I am not able, however, to adopt this suggestion, and for the following reasons.

In the first place *Acanthodrilus bovei* is a much smaller species than the one named by myself *Acanthodrilus falclandicus*; the measurements of *A. bovei* are 35 mm. in length by 3 mm. in diameter; *A. falclandicus* measures 60 mm. in length and upwards.

Of *A. bovei* the prostomium is said by Rosa to extend on to the buccal segment for about two-thirds of the length of the latter; the prostomium is less extensive in *A. falclandicus*.

The clitellum in *A. falclandicus* is quite complete, extending right round the body; in the species with which it is sought to identify my *A. falclandicus* there is a non-glandular triangular area reaching as far forwards as the xvth segment.

Acanthodrilus falclandicus possesses a pair of papillæ upon the xth segment which lie behind the ventral setæ—exactly behind them. In *A. georgianus* Michaelsen has described a similar pair of papillæ upon the tenth segment, but not anything is stated with regard to their position upon the segment except that they lie upon the seta-line 2. In *A. bovei* there are such papillæ, but they lie between the ventral setæ on segments x. and xi.; Rosa also speaks of an oval area occupying a median position upon the ninth segment.

These differences are, I think, sufficient to distinguish my species from Rosa's *Acanthodrilus bovei*[1], though doubtless the two are very nearly related. In my paper upon the anatomy of this form I referred to its occurrence in fresh water as well as upon the land; I have since re-examined more carefully the specimens which occurred in water, and I find that they are really different from *A. falclandicus*, though very nearly related; indeed the differences between all of these Patagonian Acanthodrilidæ are not very large.

[1] "I Lombrichi della spedizione antarctica italiana del 1882," Ann. Mus. Civ. Genova, ser. 2 *a*, vol. vii. p. 143.

I name the species

6. **Acanthodrilus aquarum-dulcium**, n. sp.

I need not trouble to give a detailed description of this species, but will merely indicate the differences which it shows from *A. falclandicus*. It is in the first place a much smaller species; the measurements of a full-sized specimen are as follows:—Length 47 mm.; breadth 3 mm.; number of segments 90.

The species is altogether of a more slender build than *A. falclandicus* and has thinner body-wall. The two atrial pores of each side are connected by a groove in which lies the pore of the sperm-duct; this latter pore, as in *A. falclandicus*, is just outside the ventral setæ which are present upon the xviiith segment, though of course absent or perhaps rather replaced by the penial setæ on segments xvii. and xix. Between the ventral setæ on the xviiith and on the xxth segments are a pair of small papillæ. I did not find any papillæ in the neighbourhood of the spermatotheeal orifices.

The internal anatomy hardly differs from that of *A. falclandicus*; there are, however, no thickened septa; the sperm-sacs may be different, but I was not able to make out their arrangement accurately. I observed egg-sacs in segment xiv. The principal difference between this species and *A. falclandicus* concerns the penial setæ. In the present species they have only a very faint ornamentation at some little distance from the free extremity. The large tubercles characteristic of *A. falclandicus* are entirely absent; there are merely a series of minute spines with their apices directed downwards.

7. **Benhamia whytei**, n. sp.

Among a large quantity of insects and other invertebrates collected, for Mr. H. H. Johnston, C.B., by Mr. Alexander Whyte, F.Z.S., in Nyassaland was a single example of an Earthworm evidently belonging to the genus *Benhamia*, which I cannot identify with any of the African forms described by Michaelsen. The specimen was unfortunately not in a sufficiently good state of preservation to admit of an exhaustive account of its structure; but I have been able to ascertain some of the principal characters which serve to discriminate it from the other African species of the genus.

The specimen is 2½ inches long and is of a dark brown colour.

The prostomium is not prolonged over the buccal segment; the dorsal pores commence very early between segments iii./iv.

The clitellum occupies segments xiii.–xix.; on the ventral side the male pores are surrounded by a circumscribed area, as in other species of the genus; within this area there is no development of glandular tissue.

The apertures of the atria are as usual upon segments xvii., xix.; the orifices are circular and each is surrounded by a circular rim; the two apertures of each side are connected by a groove; the ventral setæ of the three segments xvii., xviii., xix. are absent. Their place is taken on the xviith and the xixth segments by the penial setæ.

The setæ are strictly paired and are on the ventral surface.

There are two gizzards, whose exact position I am not able to state.

The calciferous glands are kidney-shaped; there are three pairs of them, in segments xv., xvi., xvii. The intestine commences in the middle of segment xviii.

The dorsal blood-vessel is single; there are three pairs of hearts, in segments x., xi., xii.

Six septa following the gizzard are thickened, but their increase in thickness is not so well marked as it often is in Earthworms.

The internal anatomy of this species is precisely like that of *Benhamia crassa* above described; the form of the penial setæ, which are the only structures by which some of these *Benhamiæ* can be distinguished, were hardly different from those of *Benhamia crassa*; in the specimen from Dominica they were even twisted into a spiral at the extremity, there were possibly rather more denticulations on the end; in the same way the end of the two vasa deferentia of each side were enclosed in a common muscular sheath.

It may be that the glandular cæcum of the buccal cavity will prove to be a character of generic value. I followed out the ducts of the mucous gland, and find that each gland opens into the pharynx by a wide aperture, which has, however, a shorter duct than in *Octochætus multiporus*; the opening is also situated further back than in that genus; besides the opening into the buccal cavity, the mass of nephridial tubules, which I have called the mucous gland, also open on to the exterior by numerous openings.

I should mention that in this species, as in *B. crassa*, the last pair of hearts is in segment xii.

8. **Benhamia crassa**, n. sp.

Among a number of living Earthworms lately received from Kew, whither they had been accidentally transported from Lagos, West Africa, were two very small individuals, measuring about an inch in length after preservation, which apparently belong to two distinct species. Their appearance while alive was so very similar that I regarded them as of the same species, and proceeded therefore to examine one by means of a series of longitudinal sections, while the other was cut into two halves and the viscera teased out. I had hoped in this way to supplement by one method of study the results obtained by the other. The two individuals, however, turned out to differ in a slight degree, the difference being possibly of specific value; the difference mainly concerned the extent of the clitellum; in other points they appeared to agree.

The prostomium is imbedded in the buccal segment, but it is not continued by grooves over any part of this segment.

The dorsal pores begin between segments v./vi. if not earlier.

The clitellum commences in the hinder half of segment xiii., and extends until the xxist segment; only on the thirteenth segment is it developed over the ventral as well as the dorsal and lateral surfaces; in the remaining segments there is an area, occupying the whole of

the space between the ventral pairs of setæ, where there is no development of the clitellum at all.

The setæ are strictly paired and are all ventral in position; the distance between the two ventral pairs is about half again as great as that between a ventral and a lateral pair; there is no specialization of the setæ anywhere except upon the xviith, xviiith, and xixth segments; the ventral pairs of setæ are absent from all of these segments; on segments xvii. and xix. their place is taken by the penial setæ. I have already commented upon the apparently universal absence of the ventral setæ of segment xviii. in the genus *Benhamia*.

Between segments viii./ix. and ix./x. there is a single oval papilla lying in a position which corresponds to the interval between the two ventral pairs of setæ.

The oviducal pores lie in front of the outer of the two ventral setæ on each side.

The alimentary canal has two gizzards; there are the usual three pairs of calciferous glands in segments xv., xvi., xvii.; that section of the œsophagus from which they arise is of a very narrow calibre; but from the xviiith segment the alimentary canal widens out very greatly and forms a dilated and thin-walled region without any typhlosole, which should perhaps be reckoned as belonging to the œsophagus. The intestine proper begins in segment xxii.; the buccal cavity is remarkable for the fact that it has a short cæcum on the dorsal surface, which differs from the rest of the buccal cavity in the character of its lining epithelium; the cells which constitute the innermost layer of this cæcum are like those of the epidermic layer; the cells are of two kinds, there being among them cells with clear contents and not staining deeply with borax carmine, which are exceedingly like the gland-cells of the integument. I comment later upon the similarity which this worm shows in the said particular to a representative of a totally distinct genus (*Microdrilus* ex fam. Cryptodrilidæ).

The nephridia in the posterior part of the body, that is to say behind the clitellum, are enveloped in a thick mass of vesicular cells, a condition which is very common among tropical Earthworms; the nephridia are of course "diffuse," and there is a mucous gland.

The reproductive organs show one peculiarity not common among Earthworms—the terminal part of the vas deferens is ensheathed in a muscular coat of some thickness; it is only from the xvith segment to the opening of the tube that this muscular coat is to be seen; the penial setæ are wavy at the extremity, being bent into a spiral with not very close coils; on the last bit of the seta are a very few denticulations with their apices directed forwards.

From Lagos I have also received examples of what I believe to be Michaelsen's *Benhamia bolavi*; this same species has also turned up from Dominica, Trinidad, Jamaica, St. Vincent, and, more remarkably still, from Seebpore, near Calcutta. I cannot distinguish any of these individuals from *Benhamia bolavi* as described by

Michaelsen[1]. All of my specimens are excessively small, not measuring much more than an inch in length; this is about the size given by Michaelsen. They all have the single median oviducal pore, which not only distinguishes the species from the one just defined, but also from every other *Benhamia* except *B. gracilis*. This pore lies between the ventral setæ of segment xiv. I found the extent of the clitellum to vary somewhat; Michaelsen gives segments xiii.–xx. This was the case with the worms from Jamaica and with the single specimen from Seebpore; in the individual from Dominica the clitellum extended as far as the xxist segment, commencing with the xiiith; in the specimen from Lagos, on the other hand, the clitellum was less extensive, viz. xiv.–xviii.

II. Family Cryptodrilidæ.

9. **Microdrilus saliens** (sp. et gen. nov.).

I have had about a dozen specimens of this small Earthworm for examination; they were picked out from earth that arrived at Kew Gardens from Singapore; another individual turned up from Java and others from Penang. The small size of the species suggested the generic name; the largest individuals are in alcohol hardly more than an inch in length. During life the species is, like *Perichæta*, remarkable for its extreme agility; when touched they twist themselves violently from side to side and can often spring for a short distance above the table. The worms were preserved in corrosive sublimate and acetic acid, followed by increasing strengths of alcohol, and were investigated by transverse and longitudinal sections. The genus belongs to the family Cryptodrilidæ as defined by myself[2]. Though I have examined a considerable number of individuals, the presence of sand in the intestines spoilt a good many of the sections; hence my account of the anatomy of what is in all probability a new genus in less than it should be. As, however, the worm shows one feature of some little interest, I have thought it worth while to add to the present paper such notes as I am able to give.

There are two gizzards, which follow each other almost immediately and are only separated by the slightest constriction. In segments xv., xvi., and xvii. lie the calciferous glands; these have the usual structure and contain large rhomboidal crystals. Their connexion with the œsophagus is interesting; each pouch does not, as is generally the case, open into the gut; there is only one duct on each side communicating with the œsophagus. It lies just behind the septum separating segments xv./xvi.; the two remaining pouches of each side communicate with the middle pouch, which alone has

[1] "Oligochaeten des Hamburger naturhistorischen Museums, iv.," JB. Hamb. wiss. Anst., Bd. viii.
"Terricolen der Berliner zoologischen Sammlung," Arch. f. Nat., Bd. 1892.

[2] "The Classification and Distribution of Earthworms," Proc. Roy. Phys. Soc. Edinb. 1890, i. p. 236.

an opening into the gut. This arrangement, however, occurs in *Lumbricus*, where it was first, I believe, accurately described by Messrs. Marshall and Hurst in their 'Practical Zoology'; but it has not been described in any other genera, and most certainly does not exist in many Earthworms, *e.g. Pontoscolex* (=*Urochæta*), where each gland opens by its own duct into the œsophagus. The calciferous gland of the xvth segment has a rather smaller development of the internal folds; the duct leading to the œsophagus is ciliated. The intestine begins in the xviiith segment.

Another feature of interest in this genus concerns the male efferent apparatus, which differs in detail from that of many other Earthworms; the male pores are upon segment xvii. within the ventral pair of setæ; each aperture is really double, though this point is not recognizable without having recourse to section-cutting. The two apertures of each side are enclosed by the swollen epidermis, of which the cells are very elongated and at the same time narrow; one aperture lies in front of the other; the anterior of the two is connected with the atrium, and through it project a few penial setæ which are enclosed in a muscular sac; these penial setæ have the form illustrated in Plate XLVI. fig. 13. The atrium is not in any way remarkable; it belongs to the tubular type and is divided, as in *Acanthodrilus*, &c., into a granular and a muscular portion. The vas deferens near to its external opening, in fact from segment xv. onwards, is enveloped by a thick muscular coat which is fully as thick as is that of the atrium. I have already described in *Pygmæodrilus* a similar muscular investment of the terminal region of the sperm-duct; and I have met with the same thing in two species of *Benhamia* described above.

The nephridia of this worm are diffuse. The position of the male pores distinguishes the genus from *Digaster*, in which the male pores are upon segment xviii. On the other hand, it is quite possible that it is congeneric with *Dichogaster* as extended by Michaelsen to include his new species *D. minus* and *D. hupferi*. The particular points referred to in the above description are not mentioned by Michaelsen; accordingly it is uncertain how far I am justified in creating a new genus.

III. Genus Perionyx.

This genus was founded by Perrier[1] for a worm closely related to *Perichæta*, but differing from that genus by "the development of the clitellum, the arrangement of the male orifices, the position of the spermatothecæ, and finally the clearness of the segmental organs." Although the investigations of *Perichæta* which have been carried out since Perrier's paper was published have led to a necessary alteration of the wording of the above quoted phrase, there is every reason to agree with Perrier in holding the genus *Perionyx* as distinct from *Perichæta*. There is at present no reason for

[1] "Recherches pour servir à l'histoire des Lombriciens, &c.," Nouv. Arch. du Muséum, t. viii. p. 126.

uniting, as Perrier thought might be eventually necessary, the two genera *Perionyx* and *Perichæta*. Vaillant in thus uniting these genera errs, in my opinion, as much on the one side as does Benham [1] on the other, when he relegates the two to different families.

I have recently studied four species of *Perionyx*—one of which I referred to some years since in connexion with the remarkable variations in structure exhibited by individuals; the second species, of which I owe examples to the kindness of Dr. Michaelsen, has been lately described by that naturalist [2] as *Perionyx gruenewaldi*. The specimens of the two remaining species were sent to me some time since by the kindness of Dr. King; they are from Seebpore. Putting together what we know from Perrier's investigations, from my own [3 4], from those of Michaelsen [5], Rosa [6], and Bourne [7], and what I have to say here with regard to this genus, we may thus define it:—

Genus Perionyx, Perrier.

Perionyx, E. Perrier, Nouv. Arch. Mus. t. viii. p. 126.

Setæ forming complete circles, present as such upon all the segments of the clitellum; male pores close together upon a depressed area on segment xviii., with a group of modified setæ in some species near to each orifice; atria lobate; spermathecæ two (or three) pairs in (vii.) viii., ix., with or without diverticula; nephridia paired; no specially thickened septa; no cæca.

The above definition of the genus may now be supplemented by a few remarks. These remarks will chiefly concern the species of the genus; the type species, *P. excavatus*, has been described by Rosa as well as by Perrier, and to a more limited extent by myself. But I am not quite certain, after comparing two out of the three species described here in addition to Michaelsen's *P. gruenewaldi*, as to which of them is really Perrier's *P. excavatus*.

The worms from Manila agree very closely with Michaelsen's *P. gruenewaldi*. Michaelsen distinguishes his species from that of Perrier on the following grounds:—The pigmentation is so marked that, if *P. excavatus* were of the same dark violet colour above, Perrier would hardly have omitted to notice the fact: secondly, the penial setæ of *P. gruenewaldi* appear to distinguish it from *P. excavatus*: thirdly, the position of the gizzard; this organ is fixed by Perrier in the twelfth segment; Michaelsen, on the other hand,

[1] "An Attempt to Classify Earthworms," Q. J. M. S. vol. xxxi. p. 247.
[2] "Oligochaeten des Hamburger naturhist. Mus. iv.," JB. Hamb. wiss. Anst. viii. p. 33.
[3] "Descriptions of some new or little-known Earthworms, &c.," P. Z. S. 1886, p. 308.
[4] "Note on some Earthworms from India," Ann. & Mag. Nat. Hist. ser. 5, xii. p. 217 (1883).
[5] "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar, &c.," JB. Hamb. wiss. Anst. ix.
[6] "Perichetidi di Birmania," Ann. Mus. Civ. Genova, ser. 2 *a*, vol. vi. p. 157.
[7] "On Indian Earthworms," P. Z. S. 1886, p. 662.

finds that in his species the gizzard is a mere rudiment in the fourteenth segment, in front of which (in segment xiii.) are a pair of calciferous glands not refered to by Perrier.

In all these points, with one exception, my "*Perionyx excavatus*" agrees with Michaelsen's species; I can distinguish no marked difference of any kind between these worms, except in size, and the size is after all not so marked as to lead to the opinion that it is an index of specific distinction—110 mm. as compared to 85 mm. In the more detailed description which follows of the male pores there may indeed appear to be a little difference, but I am uncertain how far to refer this to defective preservation of the *P. gruenewaldi*. The exception to which I have referred concerns the gizzard; this organ in the worms examined by myself and referred to Perrier's *P. excavatus* is rudimentary indeed, but such as it is it appears to lie in the sixth segment, as it does in the two other species to be described presently.

Rosa gives some account of a worm from Burmah[1] which he identifies with *Perionyx excavatus* of Perrier; he points out that the gizzard is situated anteriorly, and not, as Perrier stated, in the xiith segment; Rosa, however, makes no mention of the calciferous glands, nor of the genital setæ. The description of the male pores agrees with Perrier's description and with the appearance of these pores in the worms which I am disposed to identify with Perrier's *Perionyx excavatus*. A very characteristic feature of the latter was the absence of any diverticulum of the spermatotheca; with regard to *Perionyx excavatus* Perrier remarks (*loc. cit.* p. 129), "les poches copulatrices sont situées dans les anneaux sept et huit; elles m'ont paru formées d'un simple sac piriforme." I take it that this sentence implies the absence of any diverticula. On the other hand, Michaelsen refers to diverticula in his *Perionyx gruenewaldi* and *P. sansibaricus*. This seems, at any rate, to be a good distinction between the two species.

I have received from Seebpore examples of a species of *Perionyx* which appears to be different from *Perionyx excavatus*; it is certainly different from the worms identified as such by myself; but as Perrier's account is incomplete in one or two points, it is a little difficult to be absolutely certain. These examples were rather stouter in build than the Manila worms, and the coloration was a little less marked; this, however, may be the effect of the corrosive sublimate used in the preparation of them. In the internal anatomy this species is to be distinguished by five differences from the Manila species; these are as follows:—

The gizzard is fairly well marked and lies in the vith segment; there are no calciferous glands at all, though the œsophagus is somewhat folded and vascular posteriorly. The last pair of hearts lie in the xiiith segment; in the form from Manila the twelfth segment is the last which contains a pair of hearts; nothing is said upon this point by either Perrier or Rosa. The spermatothecæ are, as in the other species (excepting *P. sansibaricus*), two pairs and they

[1] *Loc. cit.*

occupy the same segments, but each has a small irregularly shaped diverticulum sessile upon the duct of the spermatotheca. Finally, the atria are much larger than they are described in *Perionyx excavatus* or than they are in the species which I here identify with Perrier's *Perionyx excavatus*; they are much broken up into lobes and extend through three segments; the duct, too, is longer and is contorted; these glands in fact resemble very closely those of a typical *Perichæta*.

Some years ago I briefly described a species of *Perionyx* from Akyab [1] to which I gave the name of *Perionyx macintoshii*; this species is admitted by Vaillant [2], but not very heartily allowed by Rosa [3].

I have got two individuals of a large *Perionyx* which I believe are referable to the same species; if so it is certainly a "good species."

My observations upon *Perionyx macintoshii* were made upon a single, not sexually mature, example; they were therefore not quite conclusive as to the distinctness of the species, though the large size alone is, as it proves, a sufficient index of the species, when compared with the three others described here.

The internal anatomy is more like that of the first species from Seebpore, which I propose to term *Perionyx intermedius*; the last pair of commissural vessels are in the xiiith segment; the atria, however, are limited to a single segment, and the spermatothecæ have no appendix. The principal differences concern the external characters; this species has a more extensive clitellum, it reaches from the xiiith to the xixth segment, being thus longer by two segments than in the other species; the male pores have not, as I pointed out in my earlier description of the species, the characteristic appearance of those of *Perionyx excavatus*; they are placed in a ventral area, but the two pores are not upon separate papillæ. The four species of *Perionyx* referred to in this paper show certain very characteristic differences in the condition of the male pores and of the setæ in their immediate neighbourhood, of which the following is an account.

In *Perionyx gruenewaldi* the area upon which the atrial pores are borne is not, owing to the small size of the worm, very well marked when looked at through a lens. When this part of the body is submitted to a microscopic examination, the area is seen to be bounded by an obvious groove. The ordinary setæ of this segment (the xviiith) do not extend on to this area except on one side of the body, where a single seta is inserted on to the outer edge of the area; as, however, a groove cuts off the tract of integument which bears this seta from the genital area, it might be held that the line between the genital area and the surrounding integument was indicated by this groove. There are four genital setæ on each side which, although

[1] "Note on some Earthworms from India," Ann. & Mag. Nat. Hist. ser. 5. xii. p. 217 (1883).

[2] Annelés in 'Suites à Buffon,' p. 86.

[3] "Perichetidi di Birmania," Ann. Mus. Civ. Genova, ser. 2 *a*, vol. vi. p. 157.

close together, are really in a line which is in the same direction as the circle of setæ of the segment; there is, however, a gap between the last seta of the ring of unmodified setæ and the first of the genital setæ. The atrial pores are just in front and to the outside of the groups of the genital setæ. The setæ themselves have been figured by Michaelsen.

In *Perionyx excavatus* the male genital apertures are each placed upon a semicircular elevation, the two being in close contact. These flat papillæ are both depressed below the surface of the surrounding integument; this depressed area appears to be only sharply marked off anteriorly and posteriorly by grooves; laterally there is no sharp demarcation, the papillæ gradually rising until they attain the level of the surrounding integument. Each papilla has 5 or 6 genital setæ of a precisely similar appearance to those of *Perionyx gruenewaldi* just described; they are arranged in the same way, being continuous with the line of setæ of the segment and are separated from them by a space. These genital setæ are also longer than the ordinary setæ of the body, but the latter show a certain amount of ornamentation, which was specially marked in the case of the ventral setæ of segment xix.

In *Perionyx macintoshii* the ventral area which bears the atrial pores forms a sucker-like structure completely sunk below the level of the surrounding epidermis; it measured in one individual 3 mm. across. This difference from the other two species may possibly be correlated with the fact that in *Perionyx gigas* the clitellum extends beyond the male apertures.

In *Perionyx intermedius* the arrangement is rather different from that which obtains in the two species just described. The xviiith segment is widened in the middle ventral line; the integument has a tumid swollen appearance, and there is a transverse groove into which open the atrial pores. The row of setæ of this segment are not continued over the median area, but in one specimen I observed two setæ, one on each side at the bottom of the groove already referred to. As the extremities of these were unfortunately broken off I am not able to say whether they showed any more marked ornamentation than the other setæ of the body; in any case they were not different in form.

It will be seen from the above details that the genus, as we at present know it, falls into two subdivisions. In *Perionyx macintoshii* and *P. intermedius* there are no specially modified setæ in the neighbourhood of the male pores, and the latter are placed upon a median area which is not divided by a cross furrow into two areas, one for each pore.

In *Perionyx excavatus* and *P. gruenewaldi* there is a group of specially modified setæ near to each male pore, and these pores are placed each upon a separate papilla, both papillæ being enclosed within an area marked off from the surrounding integument.

It appears to me that in this genus we have an early stage in the evolution of the penial setæ of other types—*e.g.*, the genus *Megascolex*; if the modified setæ of *Perionyx excavatus* were withdrawn

from the exterior of the body and lodged in a sac formed by their withdrawal, we should have the sac of penial setæ such as occurs in so many Earthworms. *Perionyx macintoshii* is in an earlier stage still; the setæ in the neighbourhood of the male pores are not modified, but appear to resemble those of other segments. Finally the four species may be thus briefly defined. (I have not included Bourne's *Perionyx saltans* pending further details, or Michaelsen's *P. sansibaricus*, which seems to resemble it in the alternation of the nephridia and may be identical.)

10. **Perionyx excavatus**, E. P.

P. excavatus, E. Perrier, Nouv. Arch. Mus. t. viii.
P. excavatus, F. E. Beddard, P. Z. S. 1886, p. 308.
Megascolex excavatus, L. Vaillant, Annelés, t. iii. p. 69.

Length 110 mm.; breadth 4 mm.; number of segments 165.

Colour (in spirit) purplish on the dorsal surface, yellow beneath; clitellum yellowish brown.

Clitellum occupying segments xiii. (xiv.)–xvii.

Setæ: on either side of male pores about 5 longer setæ with strong ridges at free extremity; these lie within the area surrounding the male pores.

Dorsal pores commence v./vi.

Gizzard very slight in xii.; a single pair of calciferous glands in xiii.; intestine begins in xvii.; œsophagus widens out in xii., but becomes narrow again in xiv.

Last pair of hearts in xii.

Sperm-sacs very extensive, x.–xiii.

11. **Perionyx intermedius**, n. sp.

Length 105 mm.; breadth 5 mm.; number of segments 117.

Colour (in spirit) with a faint purple tinge dorsally, not nearly so marked as in preceding species.

Clitellum xiii.–xvii.

The pit on segment xviii. bearing the atrial pores is shallow and not very marked; the two pores lie in a transversely running groove and the integument is thrown into a series of folds on either side of the groove.

Gizzard in vi., not at all prominent. No calciferous glands. Intestine begins in xviii.

Last pair of hearts in xiii.

Spermatothecæ in viii., ix., each with a small globular diverticulum sessile upon the duct.

Atria very large and of a loose consistency, extending through three segments, xvii.–xix. Duct comparatively long and coiled.

12. **Perionyx macintoshii**, F. E. B.

? *P. macintoshii*, F. E. Beddard, Ann. & Mag. Nat. Hist. ser. 5, xii. p. 217.

Length 249 mm.; breadth 9 mm.; number of segments 261[1].

[1] 320 mm. in length; 244 segments in another specimen.

Colour (in spirit, and after corrosive sublimate) purplish on the dorsal surface and yellow beneath; clitellum yellow.

Clitellum xiii.–xix.

On segment xviii. an oval depression 3 mm. wide round the male pores which lie behind the setæ; the latter are less modified than in *P. excavatus*.

Oviducal pore single and median, in front of setæ of segment xiv.

Dorsal pores commence v./vi.

Gizzard in vi.; intestine commences in xix. No septa very much thickened.

The last pair of hearts is in segment xiii.; the first pair of commissural vessels in vi.

Sperm-sacs in x.–xii.

Nephridia commence in segment iii.

IV. Genus Moniligaster.

13. Moniligaster bahamensis.

This genus and the closely allied *Desmogaster* of Rosa have been hitherto only discovered in the tropics of the Old World; India, Burma, Japan, and the islands of Luzon, Ceylon, and Sumatra have yielded all the known species. In the present paper I describe a form which I received alive together with a number of other species from Kew, whither it had been imported accidentally with plants from the Bahamas.

The worm is small and slender, measuring about 25 mm. in length. Although this interesting genus has been now so frequently studied, there yet remain a few points upon which further information is desirable: some of the hitherto missing information I am able to supply in the present paper. The genus is chiefly interesting on account of the fact that it upsets in so many points the old distinction between "Terricolæ" and "Limicolæ." Though terrestrial in habit and in general appearance the anatomical structure is in many respects that of certain aquatic Oligochæta. Our present information upon the genus is derived from the following memoirs:—

(1) F. E. Beddard.—"Note on some Earthworms from Ceylon and the Philippine Islands." Ann. & Mag. Nat. Hist. ser. 5, xvii. p. 89 (1886).

(2) F. E. Beddard.—"Note on the Reproductive Organs of *Moniligaster*." Zool. Anz. Bd. x. p. 678.

(3) F. E. Beddard.—"On the Structure of three new Species of Earthworms, with Remarks on certain points in the Morphology of the Oligochæta." Q. J. M. S. vol. xxix. p. 119.

(4) F. E. Beddard.—"Preliminary Notes on Oligochæta. (3) Note on *Moniligaster*." Zool. Anz. Bd. xii. p. 533.

(5) F. E. Beddard.—"Observations upon the Structure of a Genus of Oligochæta belonging to the Limicoline Section." Tr. R. Soc. Ed. vol. xxxvi. pt. i. no. 1.

(6) A. G. Bourne.—"On Indian Earthworms: Pt. I., Prelim-

inary Notice of Earthworms from the Nilgiris and Shevaroys." P. Z. S. 1886, p. 670.

(7) R. Horst.—"Descriptions of Earthworms.—I. *Moniligaster houtenii*, n. sp., a gigantic Earthworm from Sumatra." Notes Leyd. Mus. vol. ix. p. 97.

(8) E. Perrier.—"Recherches pour servir à l'histoire des Lombriciens terrestres." Nouv. Arch. Mus. vol. viii. p. 130.

(9) D. Rosa.—"Viaggio di Leonardo Fea in Birmania e Regioni vicine: xxv. Moniligastridi, Geoscolecidi ed Eudrilidi." Ann. Mus. Civ. Genova, ser. 2 *a*, vol. ix. p. 368.

(10) W. Michaelsen.—"Terricolen der Berliner Zoologischen Sammlung." Arch. f. Nat. 1892, p. 209.

In this list, it should be mentioned, I have only included papers containing new facts with reference to the genus; other papers which refer to it will be quoted in their place in the course of the following pages.

External Characters.

In the present species, which I name *Moniligaster bahamensis*, the clitellum was fortunately developed; it was not, however, visible until the worm was examined by means of sections, and was then found to occupy four segments, viz. x.–xiii. It will be remembered that Perrier created a special group, the *Aclitelliens*, for *Moniligaster*, since it appeared to possess no clitellum; the anterior segments were, however, described as resembling in certain particulars the clitellum of other worms and as probably representing that organ; but it is not necessary to remark that frequently the anterior segments of Earthworms, especially of the smaller species, are considerably thicker, and also appear more opaque owing to the enclosed viscera. The first to describe the clitellum was Prof. Bourne; he wrote that it occupied segments x.–xiii.; but there are no details given as to whether the clitellum was visible without first having recourse to section-cutting; it certainly is not in the present species. The clitellum begins and ends sharp at the margins of the segments which it occupies. The resemblance which the forward position of the clitellum in *Moniligaster* gives this genus to the Lumbriculidæ need not be again emphasized; I have already sufficiently dwelt upon the matter.

I have, however, now to refer to an interesting point with regard to the clitellum which has not yet been described: the minute structure of the clitellum differs from that of all other Earthworms and agrees with that of all "Water-worms" in being composed of a single layer of cells only. This appears to me to be a point of great importance; coupled with the position of the clitellum it gets even greater importance than it would otherwise have. Rosa has sought to minimize the significance of the anterior position of the clitellum; but I do not think that anyone will deny that the resemblance in structure which it shows to the lower Oligochæta cannot be explained away; there is, moreover, no resemblance in

habit which might perhaps discount the value of the characters afforded by the clitellar epithelium. Although the clitellar epithelium is only one cell thick, it is made up of cells of two kinds: there are large non-staining cells, imbedded among smaller cells loaded with darkly staining granules. Plate XLV. fig. 5 illustrates the structure of the clitellum, which, as will be seen, is not very much thicker than the epidermic tissue of adjacent segments not modified.

The setæ, as in other species, are strictly paired; I could find no setæ upon the second segment of the body: I have already mentioned that in *M. barwelli* these setæ are very small and easy to be overlooked; I could not find the least trace of them in the present species.

The muscular layers of the body-wall are remarkable in certain points. The circular layer, as is shown in fig. 5, does not extend quite up to the longitudinal layer: between the two is a space occupied by a delicate connective tissue with interspersed nuclei; in this layer run the nerves, of which there are three main trunks in each segment. The muscle-fibres, when seen in transverse section, show the characteristic appearance of the muscular fibres of the Leech in a more distinct way than I have ever noticed in any Oligochætous worm: the layer of muscular substance in each fibre is very narrow as compared to the central cavity, which is filled by a faintly granular matter; this is not stained; the fibres differ greatly in diameter, the smaller ones being nearest to the epidermis. One might perhaps speak of the layer which lies between the circular and longitudinal muscles as a "nervous layer"; it contains many small nerve-twigs besides the main trunks already referred to. The longitudinal muscular layer is, comparatively speaking, narrow; its fibres tend to be arranged in the bipinnate fashion which is so common, though not universal, among the higher Oligochæta. Here also it was easy to see that each fibre has a central soft core. On the whole the structure of the body-wall of the Annelid, with the exception of course of the clitellum, is like that of Earthworms rather than the aquatic genera; but *Phreoryctes*, which Claparède ranged among his "Limicolæ," has a body-wall which is also like that of the higher Oligochæta; so that this point of resemblance is not conclusive as to the affinities of *Moniligaster*.

Internal Anatomy.

The internal structure of this new species of *Moniligaster* is not widely different from that of *Moniligaster barwelli*; there are four thickened septa which divide segments v./ix. Probably the existence of this number of septa is a character of generic importance, as they seem to occur in *M. beddardi* as well as in the two species referred to. The alimentary canal, again, presents no differences from that of other species; there are no calciferous glands, and there appears to be no vascular tract of the œsophagus which in so many Oligochæta replaces functionally these glands; the usual three gizzards are present, commencing in the xiiith segment. The nephridia have a large cæcum as in other species; I observed the

funnel of the nephridia, which lies in the segment in front of that which contains the rest of the nephridia. The structure of the nephridia is not that of the aquatic Oligochæta; they recall those of the Geoscolecidæ. It is of course the reproductive organs which are so different from those of the higher Oligochæta.

The testes, as in the other species of the genus, are placed within the sperm-sacs attached to the front wall of segment x.; they are also in contact with the ciliated rosettes, which open likewise into the interior of the sperm-sacs. In *Moniligaster barwelli* I figured and described the ciliated rosettes as lying in the same segment as that upon which the atria open on to the exterior; this is also the case with *M. beddardi* and with the species described in the present paper; in those two Moniligasters the sperm-duct is very short and lies entirely within the xth segment. In *M. bahamensis* the sperm-ducts are remarkably long and much convoluted, recalling the sperm-ducts of such genera as *Pachydrilus*; they do not lie entirely within the xth segment but extend forwards into the segment in front. It is quite possible that the difference is merely one of maturity in the various individuals. The arrangement of the sperm-ducts is, curiously, the reverse of the arrangement characteristic of the posterior sperm-duct of the Lumbriculidæ; in these worms the sperm-ducts in question traverse the septum lying behind the male pore, and then bend back to traverse the same septum again. This is exactly what occurs in *Moniligaster bahamensis*, only that it is the segment in front of that which bears the male pores which is twice perforated by the sperm-ducts. I do not, of course, intend a serious comparison between the two forms in this matter; but at any rate the disposition of the sperm-ducts in *Moniligaster* is exceedingly different from anything that occurs in the remaining genera of Earthworms.

The sperm-sacs in the present species are restricted to the xth segment; this was the case at any rate with one of the two species which I studied by means of longitudinal sections; the segment in which they lie is the xth; as in the other species of the genus, their cavity is undivided by trabeculæ, but filled with developing sperm.

The orifices between segments x./xi. lead into a pair of muscular sacs; each sac has a narrow lumen bordered by a single layer of low columnar cells covered with a moderately thick chitinous layer; outside the epithelium is a mass of muscles which are somewhat loosely arranged, and in the interstices of which lie groups of glandular cells. The sac is oval in form and at the distal end the lining epithelium is reflected back over a conical process which contains the duct of the atrium proper; *the terminal sac with this evidently protrusible structure has clearly the closest possible resemblance to the penis and penis-sheath of the Tubificidæ.* Vejdovsky has figured[1] a protrusible penis in the Lumbriculid *Stylodrilus*—a family which is in some respects nearer to *Moniligaster* than are the Tubificidæ. Among Earthworms the nearest approach to the penis

[1] System. u. Morph. Oligochaeten, pl. xi. figs. 11–16.

of the aquatic Oligochæta and of *Moniligaster* is to be seen in the genus *Eudrilus*. But *Moniligaster* obviously comes much closer to the aquatic Oligochæta than does *Eudrilus* in this particular.

Communicating with this muscular penis is the atrium. I have already described and figured the structure of the atrium in *Moniligaster barwelli*, and have pointed out its close similarity to the atrium of the Lumbriculidæ; the Tubificid *Branchiura* has an atrium which is also constructed upon the same plan. In *Moniligaster bahamensis* we have the same low and darkly staining columnar epithelium lining the lumen; this is surrounded also by the same comparatively thick circular muscular layer; in *M. bahamensis*, as in *M. barwelli*, the outermost covering of the atrium is formed by oval groups of pear-shaped cells. I find, however, that in the species of *Moniligaster* with which the present paper deals, the ducts of these cells, which are simply filiform prolongations of their substance, pierce the muscular layer in bundles and evidently pour their secretion into the lumen of the atrium. These ducts were exceedingly conspicuous owing to their dark staining, an effect possibly due to the presence of abundant secreted granules. They were probably overlooked in *Moniligaster barwelli*, owing to their not being stained. I could find no peritoneal layer even of the thinnest round the atrium.

Rosa has described a somewhat different structure for the "prostates" (atria) of *Desmogaster*. He has above all insisted upon the presence of a peritoneal layer investing the organ superficially. The minute structure is described in the following words:—"Il lume interno è piccolissimo, appena $\frac{1}{10}$ del diametro; esso è tappezzato da un epitelio cilindrico. Esternamente a questo la massa delle pareti è prevalentemente muscolare; nella parte più centrale le fibre sono annulari; in tutto il resto sono longitudinali, disposte in fasci raggianti. Nella regione più esterna questi fasci divergendo racchiudono fra di loro delle ghiandole pluricellulari piriformi che per lunghi condotti vanno a raggiungere il lume interno, ma queste ghiandole non arrivano alla parete esterna della prostata perche i fasci muscolari, benche ridotti a sottili strischie, passano fra una ghiandola e l'alta e si ricongiungono fra loro, formando spesso solo un sottile rivestimento attorno alla base di esse. E inoltre ben evidente un rivestimento esterno peritoneale che spesso nelle sezioni si vede staccato. La superficie delle prostate non e racemosa como nei *Moniligaster*, ma liscia o appena ondulata, ed ha lo stesso aspetto sericeo delle prostate degli *Eudrilus*." This description and the illustrative figure are suggestive rather of the penis than the atrium of *Moniligaster*, particularly with regard to the gland-cells imbedded among the muscles. It appears to me to be possible that *Desmogaster* differs from *Moniligaster* in that the atrium is not specialized into two regions.

The ovaries are in the xith segment, attached to the front wall of that segment, as is so usual; the oviducal funnels open opposite to them and appear to be particularly large; but the most remarkable feature of the female reproductive organs of this Annelid are

the large egg-sacs. Even Rosa, who is so anxious to minimize the affinities of the Moniligastridæ to the lower Oligochæta, admits that the size of the eggs-sacs is unknown in the Terricolæ, though it is, he remarked, going rather too far to exclude *Moniligaster* from the Terricolæ on these grounds. In *Moniligaster beddardi* no egg-sacs were found by Rosa; but I do not think that this failure to find the structure in question is tantamount to a proof that they are non-existent in that species, as Rosa seems to imply. Anyhow they are large in the present species, and occupy at least three segments. Bourne, the first to discover these bodies, stated that they occupy in *Moniligaster minutus* segments xii.–xv. As to the ova of *Moniligaster*, Bourne says nothing about them save that there *are* ova in these sacs; the eggs in *Moniligaster beddardi* are, according to Rosa, very minute. In the species here under consideration the ova present a very remarkable character, unique among Earthworms: they are not particularly large, though, perhaps, larger than in many Earthworms; the remarkable fact about them is that they are crowded with yolk-particles: to so great an extent is the yolk developed that the nucleus is by no means always apparent; the yolk-particles are moreover, as is shown in the accompanying figure (Plate XLV. fig. 1), of considerable size, quite as large as they are in eggs of a much greater size. This fact about the ova of *Moniligaster bahamensis* is of considerable interest. I pointed out some time since [1] that the only distinguishing characters between the Megadrili and the Microdrili of Benham [2], not alluded to by Benham himself, are the three following:—

(1) Large size of ova.
(2) Clitellum consisting of only a single layer of cells.
(3) Sexual maturity at a fixed period.

In the three points mentioned the Microdrili (= Limicolæ of Claparède *minus* Naids and *Æolosoma*) differ from all the Megadrili or Earthworms. Now I have just pointed out that the ova of *Moniligaster*, although not so large as they are in the Microdrili, agree with them in having a great quantity of yolk, a character not found in any other Earthworm; this is, at any rate, an indication of a step in the direction of the Microdrili, even if it be not held to be a point of close affinity with them. On a previous page I have pointed out that the structure of the clitellum is quite like that of the lower Oligochæta in being made up of a single layer of epithelium only; it may be added that in all possibility the sexual maturity is at a fixed period; this would account for the failure of so many investigators to find the clitellum; Prof. Bourne tells me that he expects that the clitellum will be found at the proper season in all Moniligasters.

It is difficult therefore to see on what grounds *Moniligaster* is to be referred to the Earthworms as opposed to various groups of the aquatic Oligochæta. Rosa justly points out that *Tetragonurus*

[1] "On the Anatomy of *Oenerodrilus* (Eisen)," Trans. Roy. Soc. Edinb. vol. xxxvi.
[2] "An Attempt to Classify Earthworms," Q. J. M. S. vol. xxxi.

probably, and *Allurus* certainly, have the male pores situated very far forwards, nearly as far forwards as in *Moniligaster*; this he holds renders it unnecessary to lay any particular stress upon the forward position of the pores in question, in *Moniligaster*, as an indication of affinity with the lower Oligochæta. Granting this for the moment, it seems a little unfair that Rosa should use precisely the same character as an indication of affinity with the Lumbricidæ, especially with the two genera just mentioned. On p. 386 of his memoir, however, he states, as a feature of resemblance between *Moniligaster* and these genera, the fact that in both the male pores are in front of the oviducal pores.

As to the forward position of the clitellum in *Moniligaster*, Rosa quotes the instance of *Buchholzia appendiculata*, where the organs of the body are two segments in front of the usual position which they occupy in allied species. I do not think from what we now know that it will prove to be the case that in any species of *Moniligaster* the clitellum is so far back as segments xii.–xv., a position which, as Rosa justly points out, is after all not so very different from what we find in other undoubted Earthworms. The new facts contained in the present paper do not furnish any material for a renewed discussion as to what group of Earthworms comes nearest to the Moniligastridæ: the only pronounced feature in which they resemble any Earthworms is the presence of several gizzards lying at the end of the œsophagus; but we now know that this character is found in several genera belonging to at any rate three families, viz., *Pleionogaster*, *Bilimba*, and the three Eudrilids *Hyperiodrilus*, *Heliodrilus*, and *Libyodrilus*. This character, therefore, must be neglected as a mark of affinity.

V. Family Eudrilidæ.

14. Eudriloides durbanensis.

The division of the Eudrilidæ into genera requires some further consideration; we are at present but imperfectly acquainted with a large proportion of the many forms recently described from tropical Africa by Dr. Michaelsen; and as there are doubtless a large number of forms awaiting discovery, it is also premature to attempt any systematic revision of the family. I therefore refer provisionally the species, which I describe in the present paper, to the genus *Eudriloides*, without pretending that it may not ultimately be transferred to some other genus; I give at the end of the description my reasons for this course.

The worms which I describe here were obtained from Kew Gardens; they had reached those gardens from Durban, Natal; I preserved them in alcohol after killing them in weak spirit. There were five specimens, of which two were studied by longitudinal sections, the others examined in glycerine. The species is a small one; the length is about two inches by a breadth of not more than two millimetres; the worms are therefore long and slender. During life the colour was red—a colour owing, of course, to the absence of

integumental pigment and to the consequent visibility of the blood-vessels through the skin.

The setæ are strictly paired. The clitellum is not developed ventrally, it extends dorsally over four segments, viz. xiv.–xvii; the male pore is single and median upon segment xvii. near to the posterior end of that segment; the spermatothecal orifice is also single and upon the xiiith segment.

There are a few papillæ present; on the eleventh segment are a pair on each side of the median ventral line; on the fifteenth segment are another pair occupying a corresponding position; finally there are two pairs on segment xiii., one pair in front of and one behind the spermatothecal orifice; in sections these papillæ are seen to be slight depressions of the integument, and the epithelium is deeper than that which covers the body generally; it is also composed of large clear cells which have a glandular appearance. It is possible that the papillæ are adhesive disks, and not, as they seem frequently to be in some other Oligochæta, sense-organs.

A very marked peculiarity of the family Eudrilidæ is the presence in the skin of those peculiar sense-bodies which were first described by myself in *Eudrilus*, and have since been found in a few other genera of the family; they are, however, by no means universal, but have never been met with in any worm not belonging to the family Eudrilidæ: they occur in the species under consideration. I only observed them in the clitellar region; this was perhaps due to the fact that elsewhere they were not so readily visible owing to the thinness of the epidermic layer; they lie in the clitellum beneath the epidermis, and are placed longitudinally with reference to the long axis of the body.

The muscular layers are not very thick; but there are no noteworthy points to comment upon.

With regard to the internal anatomy, the alimentary tract shows a peculiarity not hitherto described in any Eudrilid: in many genera of this family there are calciferous glands of two kinds—paired organs in segment xiii., and ventral unpaired pouches in segments ix., x., xi. The present species has neither of these two kinds of appendages; but it is not, as are many forms (e. g. *Libyodrilus*), entirely without glands appended to the œsophagus.

In segments vi.–x. there are pairs of whitish-coloured glands which have a remarkable structure, quite unusual and unparalleled in the group Oligochæta (see, however, the following description of *Trichochæta barbadensis*). One of these glands is illustrated in fig. 11 of Plate XLVI.; the gland is of an oval or sometimes a more irregular shape; it is bounded externally by a thin layer which stains darkly with borax carmine, and which is perhaps to be regarded as the peritoneal layer investing the gland externally; within this there is a mass of tissue consisting of innumerable spherules like the yolk-spherules of an ovum, and, like them, not stained by the reagent. Here and there among the mass of spherules are scattered nuclei, evident on account of their staining very deeply with the reagent that produces no effect upon the surrounding granules; there were

no cell-outlines visible, but nevertheless I cannot but regard the mass as being composed of cells with perhaps very thin boundary lines. In the centre of each of these glands was a darkly staining rod of tissue which appears to be a blood-vessel; at the apex these glands opened into the lumen of the œsophagus by an exceedingly narrow diverticulum of the œsophagus; this tube soon ends, leaving the greater bulk of the calciferous gland composed of the peculiar tissue that I have already described.

The only other Oligochæts in which calciferous glands at all comparable to these exist are the genera *Gordiodrilus* and *Trichochæta*. I have lately [1] described the principal anatomical characters of the former new genus, which is mainly found in tropical Africa, though also extending its range to the New World. In all the species of that genus there is a single unpaired median pouch in the ninth segment which in certain particulars resembles the calciferous glands of *Eudriloides durbanensis*; the resemblance consists in the tissue which builds up the greater part of the gland and which is apparently identical with that which builds up a greater proportion of the glands in *Eudriloides*. The peculiar kind of tissue which characterizes the calciferous glands of these two genera of Oligochæta is, however, not unknown in the group; in several aquatic Oligochæta, for example in some Naids and in many Lumbriculidæ such as *Sutroa* [2], the nephridium, just after traversing the septum, is swollen out into an oval tract which shows precisely the same structure as that of the glands already described. I have figured this tissue in the American Lumbriculid *Sutroa*, and suggested that it might possibly serve as a filtering tissue. The oval swelling is permeated by fine canaliculi which are not always apparent; in the same way the similar tissue in the calciferous glands of *Eudriloides* and of *Gordiodrilus* seems to be traversed by fine canaliculi (shown in the case of *Gordiodrilus* in fig. 8 of plate vii. of my memoir already quoted dealing with the anatomy of that worm). It is quite possible, therefore, that Michaelsen's notion that these glands serve as organs of assimilation, rather than as organs of secretion, may prove to be correct in the two Annelids which possess this peculiar form of calciferous gland; although, as I have pointed out, there can be no doubt that the ventral pouches of *Eudrilus* do not, at any rate, entirely serve such a purpose, for I found particles of calcareous secreted matter in the lumina of the said pouches; furthermore the resemblance of this tissue to that found in the nephridia is worthy of note in relation to the fact that in *Gordiodrilus* there appears to be a communication between the ventral pouches and the nephridia. I do not, however, wish to insist upon more than the actual structural likeness between the tissue in the two series of organs; this is indeed very striking. It may be that this resemblance between the calciferous pouches of *Eudriloides* and *Gordiodrilus* is some evidence

[1] "On a new Genus of Oligochæta &c.," Ann. & Mag. Nat. Hist. ser. 6, x. p. 74 (1892).

[2] "A Contribution to the Anatomy of *Sutroa*," Tr. Roy. Soc. Edinb. (to appear immediately).

of their affinity; *Gordiodrilus* is clearly a rather degenerate form, with no marked affinities to any other genera except to *Ocnerodrilus* and *Pygmæodrilus*—an affinity which may be merely due to the fact that they are all degenerate forms, and thus not a real affinity. In any case it is remarkable that this curious form of glandular tissue should be limited to the calciferous glands of the two genera *Eudriloides* and *Gordiodrilus*.

As regards the rest of the alimentary canal, there are not many points which require notice; there is a gizzard in the fifth segment, well developed and by no means rudimentary.

The first septum lies just in front of the gizzard and thus separates segments iv./v.; the four septa which follow the gizzard are thicker than the rest. The nephridia are of course paired, and the first pair appear to belong to the fourth segment.

There is only a single pair of testes, which lie in the xith segment, attached to the front wall of that segment; opposite to them are the funnels of the sperm-ducts, these are very large and much folded. The sperm-duct has no swelling at its origin from the funnel; it is a narrow tube, much narrower than the oviduct; it opens into the atrium a little way before the opening of the latter into the terminal copulatory apparatus. The atria are two closely applied tubes contained within one sheath, so that on a dissection the atrium would no doubt appear to be single. Whether the division of the atrium is an indication of its being the result of the fusion of two separate atria is not obvious; at first sight it does appear to be obvious, but it will be remembered that in *Eudrilus* each atrium is similarly divided into two completely separated tubes within a common sheath. This atrium consists entirely of a layer of glandular cells ensheathed in a very thin peritoneal layer; the terminal apparatus is a muscular diverticulum of the body-wall, with which are also connected a pair of sacs each containing a single penial seta, whose shape I am unable to describe.

The spermatotheca is unpaired, it opens on to the exterior in segment xiii.; the aperture leads into a thick-walled sac from which arises a thinner-walled sac extending backwards into the next segment; this latter is lined by cells which appear to be similar to those found in the corresponding organ of other Eudrilidæ, and suggest that in this species as in others the spermatothecæ are developed from the cœlom, and are therefore not homologous with the spermatothecæ of other Earthworms. The terminal sac of the spermatotheca is lined by an epithelium which has preserved the characters of the epidermis whence it is derived; the cells are of two kinds, the usual glandular and the interstitial cells.

To the spermatotheca on each side is attached a receptaculum ovorum; these sacs, although attached to the spermatotheca, are not really connected with it, that is to say they do not open on to the spermatotheca; the egg-sacs are not in any way unusual in their structure, their cavity is divided up into numerous compartments by trabeculæ. In the compartments are lodged the ova: the ova in the egg-sacs are not accompanied by masses of developing ova or by

cells serving as nutritive cells to the developing ova; *the oviducts are peculiar in that they perforate the septum dividing segments* xiii./xiv. *twice*. The funnel opens freely into the interior of segment xiii. right opposite the ovary and also into the interior of the egg-sac; it then passes into the cavity of the thirteenth segment and bending back runs straight along the body-wall up to its point of opening on to the exterior. The oviduct has thus an unusually long course, which is further increased by the fact that the pore is situated near to the hinder end of the fourteenth segment; the calibre of the oviduct is considerably greater than that of the sperm-duct; the two can be easily compared in this respect, as the sperm-duct passes close to the oviduct; the oviduct is not ensheathed in a muscular coat; the ciliated epithelium is only covered by a delicate peritoneal layer.

The ovaries lie in the thirteenth segment, attached, as is usual, to the front wall of that segment. The septum dividing segments xii./xiii. joins that which follows, and a sac is thus formed which encloses the ovaries and the terminal bulbus of the spermatotheca. Centrally this sac is almost filled by the bulbus, but laterally there is plenty of room, and the spacious cavity thus formed is occupied not only by the ovaries and detached ova, but also by an immense quantity of small nucleated, often fusiform corpuscles; similar corpuscles are also found in great abundance in the xiith segment. I am doubtful whether to regard these as slightly metamorphosed cells of the ovary and testis respectively or merely as perivisceral corpuscles, which happen to have been aggregated together in greater numbers in the two segments referred to than elsewhere.

The ripe ova (from the egg-sac) have no striated membrane such as is found in certain other Eudrilids.

This worm evidently belongs to one of the more simply organized of the Eudrilidæ; for the fusion of the female organs is incomplete. It must therefore be referred to one of the following genera, viz. *Eudriloides*, *Platydrilus*, *Megachæta*, *Reithrodrilus*, or *Notykus*.

As to external characters it agrees with *Platydrilus* in having a saddle-shaped clitellum, and also in the extent of the clitellum.

The internal anatomy is in some respects unlike any of these genera; for instance, the peculiar form of the calciferous glands marks out the present species from all Eudrilidæ including those mentioned, in none of which are there calciferous glands at all.

In possessing one pair of testes and in the corresponding single funnels &c. the worm resembles *Notykus*, *Eudriloides*, *Megachæta*?; but this is not of course an important difference from *Platydrilus* &c. The complete fusion of the two atria is peculiar to the worm, though a commencing fusion occurs in *Eudriloides*, from which, however, the species described here differs in the shortness of the atria and in the absence of a muscular tunic. The principal reason which leads me to refer the worm to the genus *Eudriloides* is the structure of the female organs. I have described the modification of the septum dividing segments xiii./xiv., which forms a sac enclosing the terminal part of the spermatothecal sac and the ovaries and oviducal funnels;

though this seems to be perfectly similar to the arrangement figured by Michaelsen [1] for *Notykus emini*, I am inclined to think that in the latter there is a distinct sac independent of the septa.

VI. Family Geoscolecidæ.

15. Trichochæta barbadensis, n. sp.

I have examined a single specimen of this species which I received alive from Kew; it is a native of Barbadoes.

The worm was 24 mm. long and consisted of 84 segments; the colour during life was red, the skin containing no pigment.

The setæ are paired, their shape is precisely that of *Trichochæta hesperidum*, a new genus and species of Earthworms which I have recently [2] described from the island of Jamaica. On the clitellum the setæ appeared to be rather larger than those upon the other segments of the body, and the ornamentation at the tip a little more pronounced. Although the setæ in the present species show no trace of the characteristic irregularity of *Trichochæta hesperidum*, I do not hesitate to place them in the same genus on account of the peculiar form of the setæ, which is unmatched in any other Oligochæt. At first one would be inclined to regard the irregularity of the setæ as a mark of generic distinction; but it must be borne in mind that in *Pontoscolex*, as was first pointed out by Fritz Müller [3], and I have been able to confirm his discovery, the setæ are occasionally regular and paired.

The clitellum, exceptionally for the family Geoscolecidæ, is complete; that is to say, there is no ventral tract free from glandular tissue. Rosa has used the saddle-shaped clitellum as one of the characters of the Geoscolecidæ; the present species shows that this character can be no longer used. The clitellum extends from the xiiith segment to the xxiind.

The prostomium appeared, before the worm was examined by means of sections, to resemble that of *Rhinodrilus* or *Trichochæta hesperidum*, that is to say it lay apparently in the mouth instead of projecting above it. In longitudinal section, however, this appearance is seen to be largely due to the retraction of the prostomium, which is perhaps facilitated by the division of the first segment into two annuli by a groove.

The nephridia are paired, the first pair being rather larger than those which follow: the large size of the first pair of nephridia is commonly found to be a character of the Geoscolecidæ; it is hardly so pronounced in the present species as in *Pontoscolex* for example. The duct of this nephridium is long and appears to open on to the exterior on the third segment.

As to the vascular system, the only point that I particularly note is the presence of a pair of large hearts in each of segments x., xi.

[1] "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar &c.," JB. Hamb. wiss. Anst. ix.

[2] Q. J. M. S. Jan. 1893, p. 252.

[3] "Description of a new Species of Earthworm," Ann. & Mag. Nat. Hist. ser. 2, vol. xx. p. 13 (translated from a paper in the Arch. f. Naturg.).

Separate calciferous glands like those of *Pontoscolex* do not exist in the present species, though it is very possible that three pairs of œsophageal cæca, the structure of which will be described presently, are the homologues of those glands. The calciferous glands are, however, functionally represented, as is so generally the case with Earthworms in which no separate cæca exist, by a tract of œsophagus with much folded walls; numerous crystals lying in the interstices of the folds appear to be the product of their epithelium, and are apparently similar to the crystals met with in true calciferous glands. This tract of œsophagus extends through about three segments, commencing with the tenth. It closely resembles the corresponding structure in the nearly allied form *Onychochæta*[1].

In segments vii., viii., ix. are three pairs of very small œsophageal cæca; their calibre in transverse section is about the same as that of the dorsal vessel, but as they are very short and narrower at both extremities, they only possess even this small diameter for a limited distance. Each cæcum is lined by a layer of low cubical epithelium which does not appear to be ciliated; between this epithelium and the peritoneum is a plexus of blood-vessels which are very large in proportion to the cæcum itself, and protrude into the lumen, reducing it very greatly and causing it to assume here and there a star-shaped contour. It will be noticed that these cæca occupy the same segments as do the calciferous glands of *Pontoscolex*, and they may probably be safely regarded as the degenerate representatives of the latter.

The gizzard is large and extends apparently through a considerable number of segments; defining its limits by the septum which bounds it posteriorly, it would seem to lie in the sixth segment, but the anterior septa are not sufficiently clear to permit of fixing its anterior limits.

There are, as in some other Geoscolecidæ, only a single pair of testes. These belong to the xith segment, and are attached to the front wall of that segment. They are, together with the funnel of the vas deferens, enclosed in a sac, which extends back for some segments (to about the xviith) and is the sperm-sac; the sperm-sacs, however, although the worm was fully mature, contained no sperm, and were of a very narrow calibre as in *Trichochæta hesperidum*.

The funnel of the sperm-duct is very large and folded; the funnel extends below the testes and nearly reaches the septum to which the testis is attached; the posterior limit of the funnel, still of course enclosed within the sperm-sacs, is in the septum bounding segments xiii./xiv.; but they lie close to the ovary. The sperm-duct itself opens on to the exterior on or beyond the xviith segment; I only traced it as far as the latter, but did not observe the actual opening. The ovaries are in xiii. and opposite to them are the funnels of the oviducts; the oviducal pores are just in the groove between the xivth and xvth segments. The spermatothecæ are three pairs of simple sacs like those of *Pontoscolex* in ix., x., xi.; the last pair open on to the boundary line of segments xi./xii.

[1] Q. J. M. S. vol. xxi. p. 159.

16. **Ilyogenia africana**, nov. gen., n. sp.

Among the specimens of *Eudriloides durbanensis* was an example of a totally different species—a fact which I only recognized after examining longitudinal sections of the head end of the worm; the smallness of size, absence of pigment, and similarity in the position of the clitellum prevented me from distinguishing them when alive. They belong, however, to totally different families; the species now to be described is a Geoscolecid.

It has paired setæ which show no recognizable ornamentation. I did not observe whether those upon the clitellum were in any way different from the rest.

The clitellum commences in the xiith segment and ends in the xixth; it is a little difficult to be precise about the actual beginning and ending. If we reckon as clitellum only that tract of epidermis where the "untere" and "obere Saülenregion" of Claparède can be recognized, then the clitellum begins at the commencement of segment xiii.; but the epidermis covering segment xii. dorsally differs from that lying in front by the fact that the glands are elongated and very darkly stained; they are indeed the exact counterpart of the clitellar gland-cells in many aquatic Oligochæta which I have examined when prepared in a similar fashion. These deeply staining cells contrast in that very particular with the clear and very faintly stained gland-cells of the segment in front. The clitellum is "saddle-shaped." The nephridia are paired structures; the first pair are situated in segment iii. The funnels have the usual position and are not large. The nephridia themselves are without the terminal muscular duct; I observed the plexus formed by the "fine tubes" of the nephridium to which Benham has called attention in *Microchæta*. The external orifice of the nephridium is in front of the ventral setæ; those belonging to segment ix. open just behind but quite independently of the spermatothecæ. From the eighth segment, but more distinctly from the ninth, the nephridia are invested by a thick sheath of clear pyriform cells with deeply staining nuclei; the cells themselves are not much stained. These cells, which cover the nephridia, are sometimes quite clear but more often have a vacuolate appearance.

The alimentary canal presents the usual divisions; there is, however, no trace at all of a gizzard—not even the slightly thickened tract of muscle which marks a portion of the œsophagus in *Pontodrilus*. The pharynx commences in the second segment, the brain lying rather behind the transverse furrow which separates it from the buccal cavity, and therefore near to the posterior boundary of segment ii. The pharynx appears to occupy the third segment and a part of the fourth; as usual, numerous retractor muscles are inserted into its dorsal wall. Masses of septal glands occupy the fourth to the seventh segment; those of the last segment are very much smaller; the masses of unicellular glands of successive segments are connected by fibrous strands which pass through the septa. The œsophagus passes straight back to the twelfth segment, where it opens into the intestine. It is nowhere ciliated, except just

where it passes into the intestine; the latter tube is ciliated throughout. In the ixth segment a pair of ventrally situated calciferous glands arise from the œsophagus. The lumen of these is much divided; they are very vascular.

The circulatory system consists only of two longitudinal trunks—the dorsal and ventral vessels; I could find neither supra-intestinal nor subneurian. Another pair of longitudinal vessels exist in the anterior region of the body; these arise one on each side from the free extremity of the calciferous glands, and pass forwards through the septal glands. The last pair of hearts are in segment xi.; in front of these are two pairs which are equally large.

The two pair of testes are in x. and xi.; corresponding to them are two pairs of ciliated rosettes; the single sperm-duct of each side opens on to the xviith segment, and there are no glands of any kind or penial setæ associated with these orifices. One pair of spermathecæ open on to the anterior boundary of segment ix.; they are simple oval pouches without diverticula and were full of sperm.

The sperm-sacs have an arrangement which is unusual among Earthworms in general and hitherto unknown in this particular family; they lie in segments ix. and xii., the intermediate segments being occupied by masses of developing sperm unenclosed by any membrane. The sperm-sacs of segments ix. and xii. are attached to the posterior and anterior septa respectively of their segments respectively and are racemose in form.

The ovaries lie in segment xiii. attached, as usual, to the front septum of the segment; they lie just above the nerve-cord, but below the ventral blood-vessel, and in the middle line are squeezed almost flat between the blood-vessel and the nerve-cord. In a continuous series of longitudinal sections the ovary of one side is seen to pass into that of the opposite side without any break, though the middle part is rather thinner. This is one of the very few Oligochæta with an unpaired ovary; *Æolosoma* is another instance, but in that Annelid the ovary is not plainly made up of two fused halves as it is in the species here described. Quite recently Schneider[1] has described a *Rhinodrilus* with a single ovary in segment xvii.: in view of the constancy in the position of the ovary, this statement in my opinion requires verification. The ripe ova are invariably surrounded by a follicle of relatively considerable thickness; this follicle has a fibrillated appearance, and there are numerous interspersed nuclei. There were ova, free from the follicle, within the mouth of the oviduct. The oviducts open on to the exterior part in front of the ventral setæ. There are no egg-sacs.

It is clear that this worm should be referred to the family Geoscolecidæ, but it is not clear as to which genus of that family it most nearly approaches: in the first place, it should be noted that *Ilyogenia* is in certain respects a somewhat degenerate form when compared with other Geoscolecidæ; this would in any case render the decision as to its affinities a matter of difficulty. The

[1] "Ueber eine neue Regenwurm Art auf Trinidad," Dorpat Naturf. Ges. Jhrg. 18, p. 42.

genus is so far degenerated that it possesses no gizzard, not even the faintest vestige of one; the nephridia, which in other Geoscolecidæ have a large terminal end sac, very often with a capacious cæcum attached, are totally without anything of the kind. Another indication of a low position among the terricolous Oligochæta is perhaps the opening of the sperm-ducts upon the xviith segment; we find that this segment is the one which bears the pores in question in the genus *Ocnerodrilus* and also in *Microdrilus* and *Microscolex*. It is a coincidence, though probably no more, that there is but one pair of calciferous glands and that these are in the ninth segment; in three low forms of terrestrial Oligochæta we meet with exactly the same condition of the calciferous glands, viz., in *Ocnerodrilus*[1], *Gordiodrilus*[2], and in the Acanthodrilid *Kerria*.[3] As, however, there are Geoscolecids (such as *Microchæta*) in which the calciferous glands are similarly reduced to one pair, but which are evidently not degenerate forms, too much stress cannot be prudently laid upon the point of similarity to the three genera aforementioned.

Rosa[4] and I[5] have independently pointed out that the family Geoscolecidæ can be most conveniently divided into two subfamilies, confined respectively (with the exception only of *Pontoscolex*, which is cosmopolitan) to the Old and to the New World; I need not again go into the matter here, as the reasons which led me to this conclusion have been fully given in the paper quoted below. The present genus interferes with the symmetry of this proposed arrangement; it evidently belongs in structure to the New World section of the family, but lives in the Old World. The spermathecæ lie in front of the testes and the other reproductive organs, and there are no copulatory papillæ.

The genus *Ilyogenia* agrees with no other genus in every point: the form and position of the sperm-sacs are unique in the family; the ventral position of the nephridiopores is characteristic of the genus *Geoscolex*, with which, however, *Ilyogenia* has no other marked points of resemblance. It comes nearest, perhaps, to *Anteus* and *Rhinodrilus*; but differs from both of these genera in a number of small differences, which are, in my opinion, collectively at least, of sufficient importance to justify its distinction by a separate generic name.

VII. EXPLANATION OF PLATES XLV. & XLVI.

Fig. 1. Part of an egg-sac of *Moniligaster bahamensis*, showing ripe ova.
2. Spermatotheca of *Moniligaster bahamensis*: *a*, transverse section.
3. Ventral view of anterior segments of same; the segments are numbered.
4. Male genital apparatus of the same worm; the figure is reconstructed from a series of sections.

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[1] "On the Anatomy of *Ocnerodrilus*," Tr. Roy. Soc. Edinb. vol. xxxvi. no. 21.
[2] "On a new Genus of Oligochæta, &c.," Ann. & Mag. Nat. Hist., July 1892.
[3] P. Z. S. 1892, p. 355.
[4] *Kynotus michaelsenii*, n. sp. "Contributo alla morfologia dei Geoscolecidi," Boll. Mus. Zool. vol. vii. no. 119.
[5] Q. J. M. S. vol. xxxiv. p. 258.

Fig. 5. Transverse section through the clitellum of the same, to show the unicellular layer of the epidermis and the hollow fibres of the transverse muscular coat.
6. Ventral view of the genital segments of *Benhamia crassa*; the clitellum is shaded and the groove connecting the atrial pores is shown.
7. Spermatotheca of the same.
8. Calciferous glands of *Microdrilus asiaticus*.
9, 10. Genital setæ of *Acanthodrilus smithi*, in lateral and ventral view.
11. A rudimentary calciferous gland of *Eudriloides durbanensis*.
12. A spermatotheca of *Acanthodrilus smithii*.
13. A penial seta of *Microdrilus asiaticus*.
14. Genital organs of *Eudriloides durbanensis*; the segments are numbered.

2. On the Presence of a Branchial Basket in *Myxine glutinosa*. By R. H. Burne, B.A., F.Z.S., Anatomical Assistant at the Royal College of Surgeons of England.

[Received December 6, 1892.]

(Plate XLVII.)

One would expect the branchial basket, which forms such a large and striking part of the skeleton of the Lampreys, to be present, at least to some extent, in their nearest allies, the Hags; and, in fact, such is the case, for in 1835 Johannes Müller, in his work upon the Myxinoids[1], described and figured a small triradiate piece of cartilage supporting the anterior and dorsal faces of the cutaneo-œsophageal duct of *Bdellostoma*, which cartilageno doubt is the homologue of a branchial basket. Again, in 1883 Parker[2] mentioned this cartilaginous support to the cutaneo-œsophageal duct of *Bdellostoma*, representing it as an irregular plate having the same position as Müller's triradiate cartilage.

Manifestly, as far as *Bdellostoma* is concerned, there is a branchial skeleton which, although present on one side only, cannot well be anything but a branchial basket in a very much reduced condition. This being the case, one would naturally expect to find some such supporting structure to the gill-tubes of *Myxine glutinosa*, but neither Müller, Parker, nor, as far as I can discover, any other observer has found anything answering to it; I fancy, however, that Müller implies in a passage which I quote below[3] that he believed that some such branchial skeleton was present, although he was unable to actually demonstrate it.

While lately preparing a series of Marsipobranch skeletons for the Museum of the Royal College of Surgeons, I naturally was on the look-out for this cartilage both in *Bdellostoma* and *Myxine*.

[1] J. Müller, 'Vergleichende Anatomie der Myxinoiden' (Berlin, 1835), p. 122.
[2] W. K. Parker, "On the Skeleton of the Marsipobranch Fishes.—Pt. I. Myxinoids," Phil. Trans. 1883.
[3] *L. c.* p. 122. "Dieser Knorpel (in *Bdellostoma*) ist sehr zart und dünn, und kann bei *Myxine*, wegen der Feinheit der Theile, nicht mehr nachgewiesen werden."

Fig. 1.

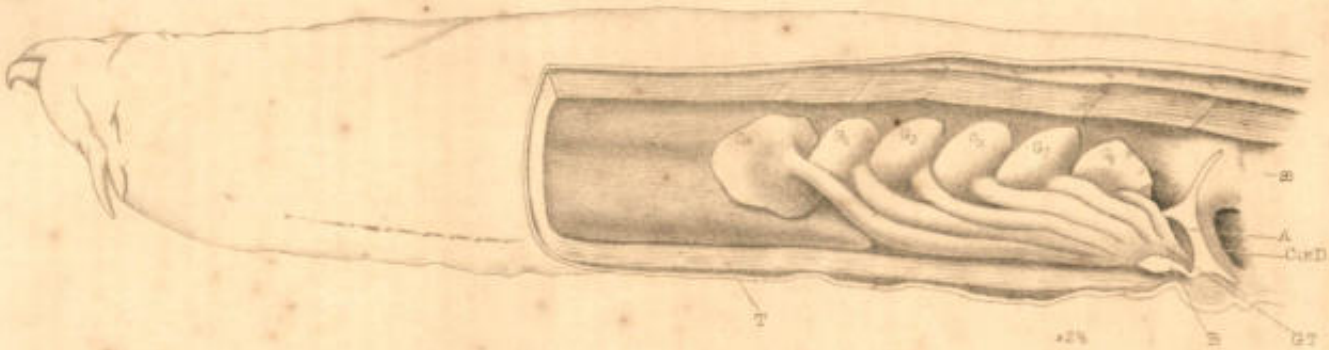


Fig. 2.

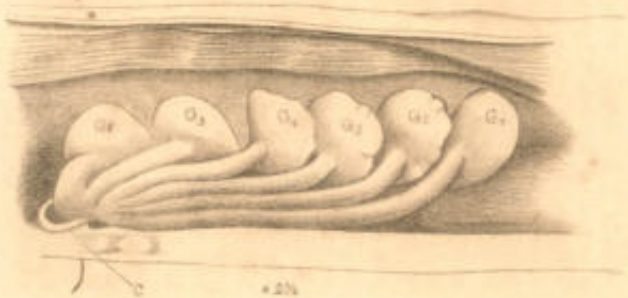


Fig. 3.



Fig. 4.



Fig. 5.

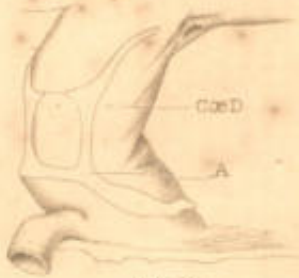


Fig. 6.



H.N.B. del.
M.P. Parker lith.

Structure of Myxine glutinosa.

West, Newman imp.

In *Bdellostoma* I found that in the main it answered very well to Müller's figure and description, although it is apparently liable to vary in shape, as will be seen by referring to my drawings (see Plate XLVII. figs. 5 and 6, which represent the cartilage as present in the two specimens I dissected). Fig. 6 corresponds very much to Müller's drawing; fig. 5, however, although constructed on the same triradiate plan, is a good deal more complicated by means of angles and processes; this variation in shape is still more marked in Parker's figure [1]. None of the true gill-tubes on either side had any supporting skeleton. We may say, then, with regard to *Bdellostoma*, that the branchial basket is represented upon the left side only by a small plate of cartilage, usually more or less triradiate, supporting the anterior dorsal wall of the cutaneo-œsophageal duct.

Let us now consider the branchial basket in *Myxine glutinosa*. Upon removing the body-wall on the left side and clearing the gill-tubes of fat, a small piece of cartilage (fig. 1, A, Plate XLVII.) can be seen lying on the lateral wall of the cutaneo-œsophageal duct; it may be said to consist of a rectangular rod-like body produced at each corner into a ray; of these the two dorsal and the posterior ventral seem to answer to the three rays of the branchial basket of *Bdellostoma*; the relations of the fourth ray (figs. 1 & 3, B), however, point it out as being something different, for, leaving the cutaneo-œsophageal duct, it runs forward as a fine bar of cartilage, which bends beneath the confluent gill-tubes, spreading out as it does so into a thin sheet, to form, as it were, a sling for the support of the gill-tubes.

On the right side of the animal the structural conditions are considerably simpler, owing chiefly to the absence of a cutaneo-œsophageal duct: the branchial basket here is represented merely by a cartilaginous ring (figs. 2 & 4, C) which surrounds the fused gill-tubes and supports them much in the same way as on the opposite side, the anterior part of the ring being broadened out into a sling-like plate, the posterior being thin and rod-like.

The branchial basket of *Myxine* can be conveniently divided up into two parts: the one, unpaired, related to the cutaneo-œsophageal duct and comparable to the triradiate cartilage of *Bdellostoma*; the other paired, and acting as a support to the true gill-tubes.

Owing to the small size of this branchial skeleton in *Myxine*, it is impossible without the microscope to determine whether it is composed of cartilage or no. To be certain upon this point I had some sections of it cut, which upon examination showed precisely the same structure as the cartilage of the branchial basket of *Petromyzon fluviatilis*; that is to say, a feeble soft form of cartilage, the cells large and varying greatly in size and shape, the cement-substance between them thin—in fact, much the same as the cartilage at the sides of the notochord of the Lamprey described by Gegenbaur [2].

Although some sort of branchial basket was to be expected in *Myxine*, yet this, I think, is specially interesting in that, besides

[1] *L. c.* pl. 16. fig. 7.
[2] Gegenbaur, Jenaische Zeitschrift, v. 1870, p. 49.

APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1892.

Jan. 1. 1 Diana Monkey (*Cercopithecus diana*), ♀. Presented by Mrs. Robert Godfrey.
4 Gouldian Grass-Finches (*Poëphila gouldiæ*). Received in Exchange.
2 Crimson Finches (*Estrelda phaëton*), ♂ ♀. Received in Exchange.
2 White-breasted Finches (*Donacola pectoralis*). Received in Exchange.
4 Mississippi Alligators (*Alligator mississipiensis*). Presented by Mr. W. S. Copleston.
4. 1 Toque Monkey (*Macacus pileatus*), ♀. Presented by John Bell, Esq.
1 White-tailed Sea-Eagle (*Haliaëtus albicilla*). From Asia Minor. Presented by Sir H. F. de Trafford, Bart., F.Z.S.
8. 1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Presented by R. J. White, Esq.
9. 1 Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*). Presented by J. Buckingham, Esq.
12. 2 Virginian Opossums (*Didelphys virginiana*), 2♂. Presented by John Brinsmead, Esq., F.Z.S.
13. 1 Common Jay (*Garrulus glandarius*). Presented by Charles Faulkner, Esq.
14. 1 Bonham's Partridge (*Ammoperdix bonhami*). From Aden. Presented by Lieut. H. E. Barnes, Aden.
15. 1 Moustache Monkey (*Cercopithecus cephus*), ♂. Presented by Alfred Lloyd, Esq.
1 Great Titmouse (*Parus major*). Presented by Capt. Salvin.
1 Coal Titmouse (*Parus ater*). Presented by Capt. Salvin.
1 Blue Titmouse (*Parus cæruleus*). Presented by Capt. Salvin.
16. 1 Bronze-winged Pigeon (*Phaps chalcoptera*), ♀. Purchased.
1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Presented by Canon Taylor Smith.
1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by Canon Taylor Smith.

Jan. 16. 1 Long-eared Fox (*Otocyon megalotis*). From Damaraland, S. Africa. Presented by E. Aubrey Hart, Esq.
19. 2 Ring-necked Parrakeets (*Palæornis torquatus*). Presented by the Misses Heinekey.
22. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Alfred J. Hayward, Esq.
23. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. E. Day.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by B. H. Heald, Esq.
24 2 Common Squirrels (*Sciurus vulgaris*). Presented by Master Fred. Corfield.
25. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*), ♀. Deposited.
26. 1 Grey Ichneumon (*Herpestes griseus*), ♂. Presented by R. Meinertzhagen, Esq.
27. 2 Snow-Buntings (*Plectrophanes nivalis*), ♂ ♀. Purchased.
1 Yellow Bunting (*Emberiza citrinella*). Purchased.
2 Reed-Buntings (*Emberiza schæniclus*), ♂ ♀. Purchased.
30. 7 Coypus (*Myopotamus coypus*). Born in the Menagerie.

Feb. 1. 1 Black-eared Marmoset (*Hapale penicillata*). Presented by Harley M. Usill, Esq.
6 Dingos (*Canis dingo*). Born in the Menagerie.
3. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by M. E. Tandy, Esq.
1 Tabuan Parrakeet (*Pyrrhulopsis tabuensis*). Purchased.
1 Dwarf Chameleon (*Chamæleon pumilus*). Presented by Capt. J. C. Robinson.
5. 2 Herring-Gulls (*Larus argentatus*). Presented by T. A. Cotton, Esq., F.Z.S.
9. 1 Roseate Cockatoo (*Cacatua roseicapilla*). Presented by Mrs. Hennah.
1 Grey Parrot (*Psittacus erithacus*). Presented by Mrs. Hennah.
1 Cape Dove (*Ena capensis*), ♂. Presented by the Rev. Geo. Smith.
11. 1 Red-winged Parrakeet (*Aprosmictus erythropterus*), ♂. Presented by Lieut.-Col. R. J. H. Parker, R.E.
12. 1 Herring-Gull (*Larus argentatus*). Presented by T. A. Cotton, Esq., F.Z.S.
6 Common Gulls (*Larus canus*). Presented by T. A. Cotton, Esq., F.Z.S.
5 Black-headed Gulls (*Larus ridibundus*). Presented by T. A. Cotton, Esq., F.Z.S.
15. 1 Sociable Marsh-Hawk (*Rostrhamus sociabilis*). Purchased.
1 Azara's Agouti (*Dasyprocta azaræ*). Purchased.
1 Sulphury Tyrant (*Pitangus sulphuratus*). Purchased.
2 Short-winged Tyrants (*Machetornis rixosa*). Purchased. See P.Z.S. 1892, p. 174.
6 Rosy-billed Ducks (*Metopiana peposaca*), 3♂, 3♀. Purchased.
1 Brown Milvago (*Milvago chimango*). Purchased.
1 Strickland's Coot (*Fulica leucoptera*). Purchased.
1 Cayenne Lapwing (*Vanellus cayennensis*). Purchased.
2 Yaks (*Poëphagus grunniens*), ♂ ♀. Deposited.
1 Sykes' Monkey (*Cercopithecus albigularis*), ♀. Presented by Mr. G. N. Wylie.

Feb. 16. 1 Hybrid Goose (between *Anser cinereus* and *A. brachyrhynchus*). Captured in Holland. Presented by F. E. Blaauw, Esq., C.M.Z.S.
1 Gould's Monitor (*Varanus gouldi*). Presented by T. Hellberg, Esq.
1 Stump-tailed Lizard (*Trachydosaurus rugosus*). Presented by T. Hellberg, Esq.
1 Chub (*Leuciscus cephalus*). Presented by H. E. Young, Esq.
17. 1 Goshawk (*Astur palumbarius*). Presented by Capt. Noble.
3 Gigantic Salamanders (*Megalobatrachus maximus*). Deposited.
18. 1 American Bison (*Bison americanus*), ♂. Received in Exchange.
19. 1 Gayal (*Bibos frontalis*), ♀. Born in the Menagerie.
1 Beatrix Antelope (*Oryx beatrix*), ♀. From Arabia. Presented by Lieut.-Col. Talbot. See P. Z. S. 1892, p. 174.
1 Indian Gazelle (*Gazella bennetti?*), ♀. From the Island of Bahrein, Persian Gulf. Presented by Lieut.-Col. Talbot.
1 Common Quail (*Coturnix communis*), ♂. Presented by W. K. Purnell, Esq.
1 Spotted Owl (*Athene brama*). Purchased.
1 Horsfield's Scops-Owl (*Scops horsfieldi*). Purchased.
22. 1 Green Toad (*Bufo viridis*). Purchased.
3 Moorish Toads (*Bufo mauritanica*). Purchased.
1 Hybrid Fire-bellied Toad (*Bombinator igneus* × *B. pachypus*). Purchased.
6 Painted Frogs (*Discoglossus pictus*). Purchased.
23. 4 Coqui Francolins (*Francolinus coqui*), 2♂, 2♀. Presented by the Hon. F. Erskine.
1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by G. W. Bowles, Esq.
25. 2 Alpine Accentors (*Accentor collaris*). Presented by Lord Lilford, F.Z.S.
27. 1 Bauer's Parrakeet (*Platycercus zonarius*). Presented by Edward F. Baillon, Esq.
1 Toque Monkey (*Macacus pileatus*). Presented by Arthur Wallis, Esq.
29. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♂. Deposited.
1 Brazilian Tapir (*Tapirus americanus*), ♀. Purchased.
1 Blue-and-Black Tanager (*Tanagrella cyanomelæna*). Purchased.
1 Prince Albert's Curassow (*Crax alberti*), ♀. Purchased.

Mar. 1. 4 Scarlet Ibises (*Eudocimus ruber*). Purchased.
4 Hairy-rumped Agoutis (*Dasyprocta prymnolopha*). Purchased.
1 Mexican Agouti (*Dasyprocta mexicana*). Purchased.
2. 2 Silver-backed Foxes (*Canis chama*). Presented by C. Holmes, Esq.
2 Leopard Tortoises (*Testudo pardalis*). Presented by C. Holmes, Esq.
1 Vulpine Phalanger (*Phalangista vulpina*), ♂. Presented by W. J. C. P. Macey, Esq.
1 Milky Eagle-Owl (*Bubo lacteus*). From Mashonaland, S. Africa. Presented by E. A. Maund, Esq.
3. 1 Ring-tailed Coati (*Nasua rufa*). Presented by Miss M. Tew.
1 Fallow Deer (*Dama vulgaris*), ♀. Presented by Mrs. Edith Hilder.

Mar. 3. 1 Sharp-nosed Crocodile (*Crocodilus acutus*). From Havana. Presented by Arthur Morris, Esq.
4. 4 Herring-Gulls (*Larus argentatus*). Presented by Mrs. Kate Taylor.
1 Lesser Black-backed Gull (*Larus fuscus*). Presented by Mrs. Kate Taylor.
2 Black-headed Gulls (*Larus ridibundus*). Presented by Mrs. Kate Taylor.
1 Jackdaw (*Corvus monedula*). Presented by Mrs. Kate Taylor.
1 Tawny Owl (*Syrnium aluco*). Presented by Mrs. Kate Taylor.
1 Orange-cheeked Waxbill (*Estrelda melpoda*). Presented by Mrs. Kate Taylor.
1 Indian Silver-bill (*Munia malabarica*). Presented by Mrs. Kate Taylor.
12 Barbary Turtle-Doves (*Turtur risorius*). Presented by Mrs. Kate Taylor.
2 Hooded Finches (*Spermestes cucullata*). Presented by Mrs. Kate Taylor.
7 Common Squirrel (*Sciurus vulgaris*). Presented by Mrs. Crick.
1 Green Monkey (*Cercopithecus callitrichus*), ♂. Deposited.
1 Merlin (*Falco æsalon*). Presented by T. A. Cotton, Esq., F.Z.S.
8. 1 Rook (*Corvus frugilegus*). Purchased.
10. 16 Puff-Adders (*Vipera arietans*). Born in the Menagerie.
1 Blue Titmouse (*Parus cæruleus*). Presented by Capt. Salvin.
1 Red-bellied Sparrow-Hawk (*Accipiter rufiventris*). Purchased.
12. 4 Yellow-bellied Liothrix (*Liothrix luteus*). Received in Exchange.
2 Blossom-headed Parrakeets (*Palæornis cyanocephalus*), ♂ ♀. Presented by La Comtesse Cottrell.
14. 1 Ring-necked Parrakeet (*Palæornis torquatus*), ♂. Presented by George H. Whitaker, Esq.
1 Grey-breasted Parrakeet (*Bolborhynchus monachus*). Presented by Miss Mildred S. Whitaker.
15. 1 Roseate Cockatoo (*Cacatua roseicapilla*). Presented by J. S. Gibbons, Esq.
16. 1 Nutmeg Fruit-Pigeon (*Carpophaga bicolor*). Presented by Mrs. Fitzgerald.
17. 1 Mantchurian Crane (*Grus viridirostris*). Purchased.
19. 1 Mantchurian Crossoptilon (*Crossoptilon mantchuricum*), ♀. Deposited.
2 Pike (*Esox lucius*). Presented by P. F. Coggin, Esq.
23. 1 Brush Bronze-wing Pigeon (*Phaps elegans*), ♀. Presented by H. H. Sharland, Esq., F.Z.S.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. F. D. Lyon.
25. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by J. G. Wythe, Esq.
2 Red Kangaroos (*Macropus rufus*), 2 ♀. Presented by the Hon. Walter Rothschild, F.Z.S.
26. 2 Great American Egrets (*Ardea egretta*). Purchased.
2 Snowy Egrets (*Ardea candidissima*). Purchased.
2 Buff-backed Egrets (*Ardea russata*). Purchased.
1 Eland (*Oreas cana*), ♂. Born in the Menagerie.

Mar. 28. 1 Guinea Baboon (*Cynocephalus sphinx*), ♀. From British East Africa. Presented by Keith Anstruther, Esq.
1 Bateleur Eagle (*Helotarsus ecaudatus*). From British East Africa. Presented by Keith Anstruther, Esq.
1 Puff-Adder, jr. (*Vipera arietans*). From British East Africa. Presented by Keith Anstruther, Esq.
1 Puff-Adder (*Vipera arietans*). Presented by D. Wilson, Esq.
29. 1 Wedge-tailed Eagle (*Aquila audax*). Presented by Miss Carr.
2 Common Vipers (*Vipera berus*). Presented by W. H. B. Pain, Esq.
30. 1 Black-necked Swan (*Cygnus nigricollis*), ♂. Purchased.
1 Japanese Deer (*Cervus sika*), ♀. Presented by Sir Douglas Brooke, Bart.
1 Tawny Owl (*Syrnium aluco*). Presented by E. A. Rocheda, Esq.
31. 4 Topela Finches (*Munia topela*). Purchased.

April 1. 1 Shielded Eryx (*Eryx thebaicus*). From Egypt. Deposited.
4. 2 Mute Swans (*Cygnus olor*). Purchased.
2 Common Vipers (*Vipera berus*). Presented by T. A. Cotton, Esq., F.Z.S.
5. 1 Orange-winged Amazon (*Chrysotis amazonica*). Deposited.
1 Green Conure (*Conurus pavua*). Presented by Mrs. Hill.
6. 1 Entellus Monkey (*Semnopithecus entellus*), ♂. Presented by Dr. William Eames, R.N., and Dr. Earle, R.N.
8. 1 Mantchurian Crossoptilon (*Crossoptilon mantchuricum*), ♀ Deposited.
1 Finely-marked Owl (*Pseudoscops grammicus*). From Jamaica. Presented by the Jamaica Institute. See P. Z. S. 1892, p. 299
2 Sharp-nosed Crocodiles (*Crocodilus acutus*). From Jamaica. Presented by Sir Henry Arthur Blake, K.C.M.G.
9. 2 Bar-breasted Finches (*Munia nisoria*). Purchased.
1 Angora Goat (*Capra hircus*, var.), ♀. Born in the Menagerie.
2 Mississippi Alligators (*Alligator mississippiensis*). Deposited.
10. 1 Slow Loris (*Nycticebus tardigradus*). Purchased.
4 Spiny-tailed Mastigures (*Uromastix acanthinurus*). Deposited.
11. 1 Grivet Monkey (*Cercopithecus griseo-viridis*), ♂. Presented by Miss G. A. Vicars.
1 Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*). Presented by Mrs. Kate Taylor.
12. 1 Wonga-Wonga Pigeon (*Leucosarcia picata*), ♀. Deposited.
14. 1 Leopard (*Felis pardus*), ♂. Presented by Marcus W. Millet, Esq.
1 Cereopsis Goose (*Cereopsis novæ-hollandiæ*). Deposited.
15. 1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Presented by Earle Whitcombe, Esq.
16. 1 Yak (*Poëphagus grunniens*), ♂. Born in the Menagerie.
18. 1 Crested Porcupine (*Hystrix cristata*). Born in the Menagerie.
19. 1 Cheer Pheasant (*Phasianus wallichii*), ♂. Purchased.
1 Swinhoe's Pheasant (*Euplocamus swinhoii*), ♀. Purchased.
20. 1 Pheasant (*Phasianus colchicus*), ♀. Purchased.
2 Chinese White-eyes (*Zosterops simplex*). Deposited.
2 Orinoco Geese (*Chenalopex jubata*). From British Guiana. Presented by Everard F. Im Thurn, Esq., C.M.Z.S.
2 Mute Swans (*Cygnus olor*). Presented by Mrs. Melville.

April 21. 1 Patas Monkey (*Cercopithecus patas*), ♀. Presented by W. P. Hewby, Esq.
1 Egyptian Goose (*Chenalopex ægyptiaca*), ♂. Received in Exchange.
22. 1 Herring-Gull (*Larus argentatus*). Presented by Miss Lota Bowen.
6 Wigeons (*Mareca penelope*), 6 ♀. Purchased.
12 Common Teal (*Querquedula crecca*), 6 ♂, 6 ♀. Purchased.
23. 1 Black Wallaby (*Halmaturus ualabatus*), ♂. Received in Exchange.
25. 1 Rufous-necked Weaver-bird (*Hyphantornis textor*), ♂. Purchased.
1 Great Kangaroo (*Macropus giganteus*). Presented by Mrs. Frazer.
1 Purple Heron (*Ardea purpurea*). Presented by Capt. Woodward.
26. 1 Rhesus Monkey (*Macacus rhesus*). Presented by Miss B. Raymond.
1 Bateleur Eagle (*Helotarsus ecaudatus*). From South Africa. Presented by Capt. Webster.
1 Tawny Eagle (*Aquila nævioides*). From South Africa. Presented by Capt. Webster.
27. 7 Striped Snakes (*Tropidonotus sirtalis*). Born in the Menagerie.
1 Raven (*Corvus corax*). Presented by F. J. Stokes, Esq.
1 Wild Swine (*Sus scrofa*). Presented by E. H. Banfather, Esq.
30. 7 Common Vipers (*Vipera berus*). Presented by T. A. Cotton, Esq., F.Z.S.

May 1. 1 English Wild Bull (*Bos taurus*, var.). Born in the Menagerie.
2. 1 Reindeer (*Rangifer tarandus*), ♀. Born in the Menagerie.
1 Bearded Lizard (*Amphibolurus barbatus*). Presented by Herbert E. Swayne, Esq.
3. 1 White-faced Heron (*Ardea novæ-hollandiæ*). Purchased.
4. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by C. C. Drew, Esq.
1 Song-Thrush (*Turdus musicus*). Presented by Baldwin M. Smith, Esq., F.Z.S.
1 Alexandrine Parrakeet (*Palæornis alexandri*), ♂. Presented by E. Bond, Esq.
8 Ruffs (*Machetes pugnax*), 4 ♂, 4 ♀. Purchased.
5. 1 Guinea Baboon (*Cynocephalus sphinx*), ♀. Deposited.
1 Rhesus Monkey (*Macacus rhesus*), ♂. Deposited.
1 Grey Ichneumon (*Herpestes griseus*). Deposited.
6. 1 Grivet Monkey (*Cercopithecus griseo-viridis*), ♀. Presented by Geo. Conquest, Esq.
1 Common Fox (*Canis vulpes*), ♀. Presented by Miss Norah Dunn.
2 Punctated Agoutis (*Dasyprocta punctata*). Purchased.
1 King Vulture (*Gypagus papa*). Purchased.
1 White-eyebrowed Guan (*Penelope superciliaris*). Purchased.
6. 2 Cerastes Vipers (*Vipera cerastes*). Presented by Col. Holled Smith, C.B.
7. 1 Grey Ichneumon (*Herpestes griseus*). Presented by J. E. Barber, Esq.
9. 2 Laughing Kingfishers (*Dacelo gigantea*). Presented by Mrs. H. M. Stanley.

May 9. 2 Grey Coly-Shrikes (*Hypocolius ampelinus*), ♂ ♀. From Fao, Persian Gulf. Presented by W. D. Cumming, Esq. See P. Z. S. 1892, p. 470.

10. 1 Brown-throated Conure (*Conurus æruginosus*). Deposited.

11. 2 Palm-Squirrels (*Sciurus palmarum*). Presented by Lord Dormer, F.Z.S.

1 Palm-Squirrel (*Sciurus palmarum*). Deposited.

1 Egyptian Jerboa (*Dipus ægyptius*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.

1 Hairy-footed Jerboa (*Dipus hirtipes*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.

6 Smaller Egyptian Gerbilles (*Gerbillus ægyptius*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.

2 Larger Egyptian Gerbilles (*Gerbillus pyramidum*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.

2 Fat Sand-Rats (*Psammomys obesus*). From Egypt. Presented by Dr. John Anderson, F.R.S., F.Z.S.

1 Egyptian Ichneumon (*Herpestes ichneumon*). Presented by Mons. de Rodakowski.

13. 1 Ring-tailed Coati (*Nasua rufa*), ♂. From Maceio, Brazil. Presented by J. E. Wolfe, Esq., C.M.Z.S.

1 Kinkajou (*Cercoleptes caudivolvulus*). From Maceio, Brazil. Presented by J. E. Wolfe, Esq., C.M.Z.S.

1 Blue-bearded Jay (*Cyanocorax cyanopogon*). From Maceio, Brazil. Presented by J. E. Wolfe, Esq., C.M.Z.S.

2 Ravens (*Corvus corax*). Presented by Gregory Haines, Esq.

1 Common Fox (*Canis vulpes*). Deposited.

14. 1 Grey-headed Porphyrio (*Porphyrio poliocephalus*). Purchased.

1 Crowned Horned Lizard (*Phrynosoma coronatum*). Presented by R. Thorn Annan, Esq.

15. 1 Vulpine Phalanger (*Phalangista vulpina*). Born in the Menagerie.

1 Persian Gazelle (*Gazella subgutturosa*), ♂. Born in the Menagerie.

16. 2 Greater Black-backed Gulls (*Larus marinus*). Bred in the Menagerie.

17. 4 Hybrid Greenfinches (between *Ligurinus chloris* ♂ and *L. kawarahibi* ♀). Bred in the Menagerie.

1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by M. McPherson, Esq.

18. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♀. Bred in the Menagerie.

2 Black Bears (*Ursus americanus*). Deposited.

19. 4 Himalayan Monauls (*Lophophorus impeyanus*). Bred in the Menagerie.

20. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.

1 Crested Porcupine (*Hystrix cristata*). Presented by J. Bellock, Esq.

21. 1 Common Peafowl (*Pavo cristata*), ♀. Presented by Col. Bagot-Chester.

22. 2 Yellow-bellied Toads (*Bombinator bombinus*). Presented by A. M. Amsler, Esq.

23. 1 Chinese Goose (*Anser cygnoides*), ♂. Presented by Miss Hill.

2 Common Vipers (*Vipera berus*). Presented by C. Browne, Esq.

May 23. 4 Common Snakes (*Tropidonotus natrix*). Presen ed by C. Browne, Esq.
1 Slowworm (*Anguis fragilis*). Presented by C. Browne, Esq.
24. 1 Common Peafowl (*Pavo cristata*), ♂. Presented by Col. Bagot-Chester.
1 Cinereous Vulture (*Vultur monachus*). Presented by W. H. Still, Esq.
2 Purple-capped Lories (*Lorius domicella*). Deposited.
2 Scaly-breasted Parrakeets (*Trichoglossus chlorolepidotus*). Deposited.
1 Angora Goat (*Capra hircus*, var.), ♂. Born in the Menagerie.
26. 2 North-African Jackals (*Canis anthus*). From Egypt. Presented by James Kerr, Esq.
4 Shaw's Gerbilles (*Gerbillus shawi*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
1 Egyptian Jerboa (*Dipus aegyptius*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
6 Leith's Tortoises (*Testudo leithii*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
5 Common Skinks (*Scincus officinalis*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
1 Egyptian Eryx (*Eryx jaculus*). From Egypt Presented by Dr. J. Anderson, F.R.S., F.Z.S.
1 Schneider's Skink (*Eumeces schneideri*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
2 Clifford's Snakes (*Zamenis cliffordi*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
1 Hissing Sand-Snake (*Psammophis sibilans*). From Egypt. Presented by Dr. J. Anderson, F.R.S., F.Z.S.
1 Mocassin Snake (*Tropidonotus fasciatus*). Presented by Master Denny Stradling.
27. 2 Black-backed Jackals (*Canis mesomelas*). Presented by Master Logan.
2 West-African Love-birds (*Agapornis pullaria*). Presented by Lady McKenna.
28. 4 Common Sheldrakes (*Tadorna vulpanser*), 2 ♂, 2 ♀. Purchased.
4 Ring-Doves (*Columba palumbus*), 2 ♂, 2 ♀. Purchased.
29. 2 Black-eared Marmosets (*Hapale penicillata*). Born in the Menagerie.
1 Yellow-legged Herring-Gull (*Larus cachinnans*). Bred in the Menagerie.
30. 1 European Pond-Tortoise (*Emys europea*). Presented by Miss Lilian Powell.
1 Moloch Lizard (*Moloch horridus*). Presented by John McLey, Esq.
1 Four-horned Antelope (*Tetraceros quadricornis*), ♂. Presented by W. J. Sinclair, Esq., C.S.
1 Four-horned Antelope (*Tetraceros quadricornis*), ♀. Presented by W. Wells Willis, Esq.
31. 1 Black-necked Hare (*Lepus nigricollis*). Presented by J. C. Kellock, Esq.

June 1. 1 Common Squirrel (*Sciurus vulgaris*). Presented by Miss Ruxton.
2. 1 Common Crowned Pigeon (*Goura coronata*), ♂. Purchased.

June 2. 2 Victoria Crowned Pigeons (*Goura victoriæ*), ♂ ♀. Purchased.
2 Narrow-barred Pigeons (*Macropygia leptogrammica*). Purchased.
2 Pale-headed Parrakeets (*Platycercus pallidiceps*). Purchased.
2 Vociferous Sea-Eagles (*Haliaëtus vocifer*, jr.). Purchased.
2 Roseate Spoonbills (*Platalea ajaja*). Purchased.
1 Ostrich (*Struthio camelus*), ♂. Purchased.
1 One-wattled Cassowary (*Casuarius uniappendiculatus*). Purchased.
2 Alligators (*Alligator mississippiensis*, jr.). Presented by R. White, Esq.
1 Masked Parrakeet (*Pyrrhulopsis personata*). Presented by A. B. Holdsworth, Esq.
3. 1 Booted Eagle (*Nisaëtus pennatus*). Presented by Lieut. J. E. Rhodes.
1 Kestrel (*Tinnunculus alaudarius*). Presented by Frank Allen, Esq.
1 Llama (*Lama peruana*), ♂. Purchased.
4. 1 Huanaco (*Lama huanacos*), ♂. Presented by Frank Parish, Esq., F.Z.S.
5. 1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.
7. 3 Little Green-winged Doves (*Chalcophaps chrysochlora*), 2 ♂, 1 ♀. Deposited.
1 Magellanic Goose (*Bernicla magellanica*), ♀. Presented by the Rev. J. Chaloner.
8. 6 Common Lizards (*Lacerta vivipara*). Presented by Mr. Percy W. Farnborough, F.Z.S.
1 Slowworm (*Anguis fragilis*). Presented by Mr. Percy W. Farnborough, F.Z.S.
1 Four-horned Antelope (*Tetraceros quadricornis*), ♀. Presented by Haji Bakir Faki.
1 Four-horned Antelope (*Tetraceros quadricornis*), ♀. Presented by Shekh Burhán úd din Khot.
9. 1 Macaque Monkey (*Macacus cynomolgus*). Presented by Oswald Norman, Esq.
1 Common Fox (*Canis vulpes*). Presented by Mr. Onslow Wakeford.
1 Great Kangaroo (*Macropus giganteus*), ♂. Born in the Menagerie.
10. 2 Diamond Snakes (*Morelia spilotes*). Received in Exchange.
1 Punctulated Tree-Snake (*Dendrophis punctulata*). Received in Exchange.
1 Bearded Lizard (*Amphibolurus barbatus*). Deposited.
1 Burton's Lizard (*Lialis burtoni*). Deposited.
1 N. Australian Banded Snake (*Pseudonaia nuchalis*). Purchased.
3 Maugé's Dasyures (*Dasyurus maugæi*). Received in Exchange.
14. 2 Black Swans (*Cygnus atratus*). Presented by Lady Wm. Osborne Elphinstone, F.Z.S.
1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Presented by F. E. Brown, Esq.
2 Burrhel Wild Sheep (*Ovis burrhel*), ♂ ♀. Born in the Menagerie.
4 Temminck's Tragopans (*Ceriornis temminckii*). Bred in the Menagerie.

June 14. 1 Himalayan Monaul (*Lophophorus impeyanus*). Bred in the Menagerie.

15. 2 Wonga-Wonga Pigeons (*Leucosarcia picata*), ♂ ♀. Purchased.
1 Rosy-billed Duck (*Metopiana peposaca*). Purchased.
20 Common Teal (*Querquedula crecca*), 10 ♂, 10 ♀. Purchased.

16. 1 Greater Spotted Woodpecker (*Dendrocopus major*). Presented by Lieut.-Gen. Sir H. B. Lumsden, K.C.S.I., F.Z.S.
2 Common Cormorants (*Phalacrocorax carbo*). Presented by Lieut.-Gen. Sir H. B. Lumsden, K.C.S.I., F.Z.S.
1 Brown Capuchin (*Cebus fatuellus*), ♂. Presented by Edward Solomon, Esq.
1 Axis Deer (*Cervus axis*), ♂. Born in the Menagerie.

17. 1 Erxleben's Monkey (*Cercopithecus erxlebeni*), ♂. Purchased.

18. 1 Victoria Crowned Pigeon (*Goura victoriæ*), ♀. Purchased.

19. 1 Thar (*Capra jemlaica*). Born in the Menagerie.

20. 2 Small Hill Mynahs (*Gracula religiosa*). Presented by Lieut.-Col. W. S. Hore.

21. 1 Chough (*Pyrrochorax graculus*). Presented by Miss Balfour.

22. 2 Axolotls (*Siredon mexicanus*). Purchased.
1 Cayenne Lapwing (*Vanellus cayennensis*). Purchased.

23. 2 Macaque Monkeys (*Macacus cynomolgus*), ♂ ♀. From North Borneo. Presented by the Rev. Augustus D. Beaufort.
1 Thar (*Capra jemlaica*). Born in the Menagerie.
4 Hybrid Greenfinches (between *Ligurinus chloris* and *L. kawarahibi*). Bred in the Menagerie.

24. 4 Soemmerring's Pheasants (*Phasianus soemmerringi*), 2 ♂, 2 ♀. From Japan. Presented by Frank Walkinshaw, Esq., F.Z.S.

25. 1 Ruddy-headed Goose (*Bernicla rubidiceps*), ♀. Received in Exchange.

26. 1 Burchell's Zebra (*Equus burchelli*), ♂. Born in the Menagerie.
1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
1 Æsculapian Snake (*Coluber æsculapii*). Presented by Alfred Scrivener, Esq.
1 Vivacious Snake (*Tachymenis vivax*). Presented by Alfred Scrivener, Esq.

27. 1 Tuberculated Tortoise (*Homopus femoralis*). From Craddock, Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Tent Tortoise (*Testudo tentoria*). From Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
2 Fisk's Tortoises (*Testudo fiski*). From Cape Colony. Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Robben-Island Snake (*Coronella phocarum*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
2 Green Lizards (*Lacerta viridis*). Presented by the Rev. F. W. Haines.
3 Viperine Snakes (*Tropidonotus viperinus*). Presented by the Rev. F. W. Haines.

28. 2 Wapiti Deer (*Cervus canadensis*), 2 ♀. Born in the Menagerie.

30. 2 Asiatic Wild Asses (*Equus onager*), ♂ ♀. Received in Exchange.
1 Libyan Zorilla (*Ictonyx lybica*). From Egypt. Presented by Dr. J. Anderson, F.Z.S.

June 30. 1 Grey Monitor (*Varanus griseus*). From Egypt. Presented by Dr. J. Anderson, F.Z.S.
1 Wapiti Deer (*Cervus canadensis*), ♀. Born in the Menagerie.
1 Stanley Parrakeet (*Platycercus icterotis*). Deposited.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Samuel L. Bensusan, Esq.
1 Water-Viper (*Cenchris piscivora*). Presented by Ernest Brewerton, Esq.

July 1. 1 Palm-Squirrel (*Sciurus palmarum*). Presented by Miss Daisy Fox.
1 Wapiti Deer (*Cervus canadensis*), ♂. Born in the Menagerie.
1 Common Roe (*Capreolus capræa*), ♂. Presented by C. J. H. Tower, Esq., F.Z.S.
2. 1 Barbary Wild Sheep (*Ovis tragelaphus*), ♂. Born in the Menagerie.
3. 1 Tawny Owl (*Syrnium aluco*). Presented by Leigh Robinson Esq.
1 Bronze Fruit-Pigeon (*Carpophaga ænea*). Presented by J. L Shand, Esq.
2 European Pond-Tortoises (*Emys europæa*). Presented by Miss Chidley.
4. 1 Common Boa (*Boa constrictor*). Presented by A. E. Oakes, Esq.
5. 1 Hippopotamus (*Hippopotamus amphibius*), ♂. Born in the Zoological Gardens, Antwerp, September 6, 1891. Purchased.
6. 2 Mountain Ka-Kas, or Keas (*Nestor notabilis*). From New Zealand. Presented by the Earl of Onslow, K.C.M.G.
1 Chilian Sea-Eagle (*Geranoaëtus melanoleucus*). Presented by Edward Jewell, Esq.
1 Broad-fronted Crocodile (*Crocodilus frontatus*). From Lagos, W. Africa. Presented by G. T. Carter, Esq., C.M.G., C.M.Z.S.
7. 16 Common Boas (*Boa constrictor*). Purchased.
8. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Deposited.
1 Tiger (*Felis tigris*, jr.), ♂. From Amoy, China. Presented by Robert Bruce, Esq.
9. 1 Kinkajou (*Cercoleptes caudivolvulus*). Deposited.
10. 1 Indian Muntjac (*Cervulus muntjac*), ♂. Born in the Menagerie.
11. 2 Red-handed Tamarins (*Midas rufimanus*). Presented by J. J. Quelch, Esq., C.M.Z.S.
6 Mandarin Ducks (*Æx galericulata*). Bred in the Menagerie.
5 Summer Ducks (*Æx sponsa*). Bred in the Menagerie.
7 Chilian Pintails (*Dafila spinicauda*). Bred in the Menagerie.
6 Australian Wild Ducks (*Anas superciliosa*). Bred in the Menagerie.
4 Upland Geese (*Berniela magellanica*). Bred in the Menagerie.
1 Variegated Sheldrake (*Tadorna variegata*). Bred in the Menagerie.
1 Impeyan Pheasant (*Lophophorus impeyanus*). Bred in the Menagerie.
1 Cheer Pheasant (*Phasianus wallichii*). Bred in the Menagerie.
2 Dwarf Chameleons (*Chamæleon pumilus*). Presented by Mr. E. Wingate.

July 12. 2 Green Tree-Frogs (*Hyla arborea*). Presented by Count Povoleri, F.Z.S.
2 Green Lizards (*Lacerta viridis*). Presented by Count Povoleri, F.Z.S.
1 Rough-eyed Cayman (*Alligator sclerops*). Presented by Dr. Rudyard.
13. 1 Pig-tailed Monkey (*Macacus nemestrinus*), ♀. From Baram River, Sarawak, Borneo. Pale variety. Deposited.
14. 2 Soemmerring's Gazelles (*Gazella sæmmerringi*), ♂ ♀. From Suakim. Presented by Col. Holled Smith, C.B.
2 Speke's Gazelles (*Gazella spekii*), ♂ ♀. From Suakin. Presented by Col. Holled Smith, C.B.
1 Dorcas Gazelle (*Gazella dorcas*), ♀. From Suakin. Presented by Col. Holled Smith, C.B.
3 White-shafted Francolins (*Francolinus leucoscepus*). From Suakin. Presented by Col. Holled Smith, C.B.
1 Slender-billed Cockatoo (*Licmetis tenuirostris*). Presented by Miss Duppa.
1 Horned Lizard (*Phrynosoma cornutum*). Presented by Conrad Kelsall, Esq.
1 West-African Python (*Python sebæ*). Received in Exchange.
15. 1 Red Deer (*Cervus elaphus*), ♀. Presented by J. Newton Hayley, Esq.
16. 1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. J. Cornwall.
17. 6 Undulated Grass-Parrakeets (*Melopsittacus undulatus*), 6 ♀. Purchased.
18. 1 Large Brown Flying-Squirrel (*Pteromys oral*). Shevaroy Hills, South India. Presented by W. L. Sclater, Esq., F.Z.S. Deposited.
2 Rufous-necked Wood-Doves (*Haplopelia larvata*). Presented by W. H. Wormald, Esq., C.M.Z.S.
1 Grand Eclectus (*Eclectus roratus*). Presented by Messrs. Chas. and Walter Seton.
1 Common Gull (*Larus canus*). Purchased.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Master S. E. Thorns.
19. 1 Mongoose Lemur (*Lemur mongoz*). Purchased.
1 Pine-Marten (*Mustela martes*). Presented by Harold Hanauer, Esq., F.Z.S.
1 Barraband's Parrakeet (*Polytelis barrabandi*). Deposited.
2 Red-crested Cardinals (*Paroaria cucullata*). Presented by Miss Edith M. Fox.
20. 1 American Bison (*Bison americanus*), ♀. Received in Exchange.
21. 1 Common Marmoset (*Hapale jacchus*). Presented by Gerald F. Youll, Esq., R.N.
22. 1 African Civet Cat (*Viverra civetta*). From Ibea or British East Africa. Presented by F. Pordage, Esq.
1 White-tailed Ichneumon (*Herpestes albicauda*). From Ibea. Presented by F. Pordage, Esq.
2 Ostriches (*Struthio camelus*), 2 ♀. From Ibea. Presented by F. Pordage, Esq.
3 North-American Turkeys (*Meleagris gallopavo*). Presented by Col. H. W. Feilden, C.M.Z.S.
26. 1 Malbrouck Monkey (*Cercopithecus cynosurus*). Presented by Count Povoleri, F.Z.S.
1 Hainan Gibbon (*Hylobates hainanus*). From Hainan. Presented by Julius Neumann, Esq. See P. Z. S. 1892, p. 541.

July 26. 1 Bennett's Wallaby (*Halmaturus bennettii*), ♂. Presented by Capt. E. A. Findlay, Lieut. R.N.R.
1 Short-toed Eagle (*Circaëtus gallicus*). Presented by B. Vincent, Esq.
4 Common Snakes (*Tropidonotus natrix*). Presented by Count Povoleri, F.Z.S.
27. 1 Red Lory (*Eos rubra*). Deposited.
1 Leadbeater's Cockatoo (*Cacatua leadbeateri*). Presented by Mrs. E. Phillips.
1 Slender-billed Cockatoo (*Licmetis tenuirostris*). Presented by Mrs. E. Phillips.
28. 1 Blackbird (*Turdus merula*). Presented by Mr. L. Cossavella.
1 Rock-Thrush (*Monticola saxatilis*). Presented by Mr. L. Cossavella.
2 Solitary Thrushes (*Monticola cyanus*). Presented by Mr. L. Cossavella.
1 Nightingale (*Daulias luscinia*). Presented by Mr. L. Cossavella.
1 Common Jay (*Garrulus glandarius*). Presented by Mr. L. Cossavella.
1 Ortolan Bunting (*Emberiza hortulana*). Presented by Mr. L. Cossavella.
1 Common Jay (*Garrulus glandarius*). Presented by G. B. Coleman, Esq.
3 Sand-Lizards (*Lacerta agilis*). Presented by G. Coleman, Esq.
1 Natterjack Toad (*Bufo calamita*). Presented by G. B. Coleman, Esq.
2 Common Toads (*Bufo vulgaris*). Presented by G. B. Coleman, Esq.
5 Yellow-bellied Toads (*Bombinator bombinus*). Presented by G. B. Coleman, Esq.
1 Edible Frog (*Rana esculenta*). Presented by G. B. Coleman, Esq.
6 Crested Newts (*Molge cristata*). Presented by G. B. Coleman, Esq.
3 Palmated Newts (*Molge palmata*). Presented by G. B. Coleman, Esq.
1 Humboldt's Lagothrix (*Lagothrix humboldti*). Presented by Charles Clifton Dicconson, Esq., F.Z.S.
1 Garnett's Galago (*Galago garnetti*). From Nyassaland. Presented by Commander H. J. Keene, R.N.
2 Common Squirrels (*Sciurus vulgaris*). Deposited.
29. 1 Red Howler (*Mycetes seniculus*). From Trinidad. Presented by John F. Chittenden, Esq., C.M.Z.S.
1 Barbary Wild Sheep (*Ovis tragelaphus*), ♂. Deposited.
2 Black Apes (*Cynopithecus niger*). Purchased.
2 Tarantula Spiders (*Mygale*, sp. inc.). From Trinidad. Presented by J. Terry, Esq., C.C., F.R.G.S.
30. 1 Common Raccoon (*Procyon lotor*). Presented by A. C. Cooke, Esq.

Aug. 1. 1 Black-headed Caique (*Caica melanocephala*). Deposited.
2. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by H. S. Wilson, Esq., Lieut. R.N.R.
1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Dunnington Jefferson.

Aug. 3. 4 Scarlet Ibises (*Eudocimus ruber*). Purchased.
1 Testaceous Snake (*Ptyas testacea*). Received in Exchange.
3 Spiny-tailed Mastigures (*Uromastix acanthinurus*). Presented by Lady Sebright.
4. 3 Short-headed Phalangers (*Belideus breviceps*), 1 ♂, 2 ♀. Purchased.
1 Black Kite (*Milvus migrans*). Presented by Dr. Ferrier.
1 Egyptian Vulture (*Neophron percnopterus*). Presented by Dr. Ferrier.
1 South-American Rat-Snake (*Spilotes variabilis*). From Trinidad. Presented by Messrs. W. F. Urich and R. R. Mole.
1 Yellow-tailed Rat-Snake (*Spilotes corias*). From Trinidad. Presented by Messrs. W. F. Urich and R. R. Mole.
1 Boddaert's Snake (*Coluber boddaerti*). From Trinidad. Presented by Messrs. W. F. Urich and R. R. Mole.
1 Royal Snake (*Liophis reginæ*). From Trinidad. Presented by Messrs. W. F. Urich and R. R. Mole.
2 Black-backed Snakes (*Liophis melanotus*). From Trinidad. Presented by Messrs. W. F. Urich and R. R. Mole.
1 Crowned Snake (*Scytale coronatum*). From Trinidad. Presented by Messrs. W. F. Urich and R. R. Mole.
5. 1 Hairy Armadillo (*Dasypus villosus*), ♂. Purchased.
1 Ring-tailed Coati (*Nasua rufa*). Presented by C. Carrington, Esq.
6. 1 White-throated Capuchin (*Cebus hypoleucus*), ♀. Purchased.
8. 1 Indian Chevrotain (*Tragulus meminna*), ♀. Deposited.
3 Martineta Tinamous (*Calodromas elegans*). From Bahia Blanca, Argentina. Presented by T. W. Horn, Esq.
9. 1 Indian Oriole (*Oriolus kundoo*). Purchased.
10. 1 Puma (*Felis concolor*). From Maceio, Brazil. Presented by J. E. Wolfe, Esq.
1 Tayra (*Galictis barbara*). From Maceio, Brazil. Presented by J. E. Wolfe, Esq.
11. 5 Black-necked Tanagers (*Euphonia nigricollis*), 5 ♂. Purchased.
1 Violet Tanager (*Euphonia violacea*), ♂. Purchased.
6 Thick-billed Tanagers (*Euphonia laniirostris*), 6 ♀. Purchased.
1 Greenish Tanager (*Euphonia chlorotica*), ♂. Purchased.
1 Lead-coloured Tanager (*Hypophœa chalybea*), ♂. Purchased.
12. 1 Magellanic Goose (*Bernicla magellanica*). Received in Exchange.
6 Garganeys (*Querquedula circia*). Received in Exchange.
1 Macaque Monkey (*Macacus cynomolgus*). Presented by Mr. H. D. Bowditch.
13. 1 Slender-billed Cockatoo (*Licmetis tenuirostris*). Presented by Dr. J. G. Victor Sapp.
2 Himalayan Tree-Pies (*Dendrocitta himalayensis*). Purchased.
16. 1 Japanese Ape (*Macacus speciosus*), ♂. Presented by H. H. Jacobs, Esq.
1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by R. Dodman, Esq.
1 Common Cormorant (*Phalacrocorax carbo*). Presented by Capt. Salvin.

Aug. 16. 2 Spotted-sided Finches (*Amadina lathami*). Purchased.
17. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by C. W. Emlyn, Esq.
2 Crowned Lemurs (*Lemur coronatus*). Purchased.
3 Hardwicke's Mastigures (*Uromastix hardwickii*). Purchased.
2 Common Chameleons (*Chamæleon vulgaris*). Deposited.
18. 1 Robben-Island Snake (*Coronella phocarum*). Presented by Miss M. Rutherford.
19. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. R. Rocca.
20. 25 Cambayan Turtle-Doves (*Turtur senegalensis*). Deposited.
2 Tambourine Pigeons (*Tympanistria bicolor*). From British East Africa. Presented by General Mathews.
1 Emerald Dove (*Chalcopelia afra*). From British East Africa. Presented by General Mathews, C.M.G.
1 Nilotic Monitor (*Varanus niloticus*). From British East Africa. Presented by General Mathews, C.M.G.
1 Nilotic Monitor (*Varanus niloticus*). From British East Africa. Presented by Frank Finn, Esq., F.Z.S.
2 Smooth Clawed Frogs (*Xenopus lævis*). From British East Africa. Presented by Frank Finn, Esq., F.Z.S.
1 Common Boa (*Boa constrictor*). Presented by Messrs. F. Sander & Co.
21. 4 Indian Wild Swine (*Sus cristatus*). Born in the Menagerie.
22. 2 Fringed Chameleons (*Chamæleon tæniobronchus*). Presented by Charles W. Heaton, Esq.
1 Lobed Chameleon (*Chamæleon parvilobus*). Presented by Charles W. Heaton, Esq.
23. 4 Virginian Foxes (*Canis virginianus*). From Mount Hamilton, California. Presented by Edward Chauvenet Holden, Esq.
1 Ruffed Lemur (*Lemur varius*). Deposited.
1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by J. Hall Brown, Esq.
24. 1 Blue-and-Yellow Macaw (*Ara ararauna*). Presented by R. Larchin, Esq.
6 African Scorpions (*Scorpio*, sp. inc.). Presented by J. F. Hawtayne, Esq.
25. 2 Ogilby's Rat-Kangaroos (*Hypsiprymnus ogilbyi*). Presented by John D. Roche, Esq.
1 Black Iguana (*Metopoceras cornutus*). Purchased.
26. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mr. Rivers.
2 Ravens (*Corvus corax*). Deposited.
29. 1 Black-shouldered Kite (*Elanus cæruleus*). Presented by J. Watson, Esq.
1 Falcated Teal (*Querquedula falcata*), ♂. Presented by A. C. Moule, Esq.
30. 1 Bronze-winged Pigeon (*Phaps chalcoptera*). Bred in the Menagerie.
1 American Black Snake (*Coluber guttatus*). Deposited.
31. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Gerald E. Bridge, Esq.

Sept. 1. 1 Black-handed Spider-Monkey (*Ateles geoffroyi*). Presented by F. Vyner, Esq.
1 Cambayan Turtle-Dove (*Turtur senegalensis*). Bred in the Menagerie.

Sept. 1. 1 Turtle-Dove (*Turtur communis*). Bred in the Menagerie.
3. 2 Mule Deer (*Cariacus macrotis*), 2 ♀. Born in the Menagerie.
7. 2 Yellow-bellied Liothrix (*Liothrix luteus*). Presented by J. Holmes, Esq.
4 Poë Honey-eaters (*Prosthemadera novæ-zealandiæ*). Presented by Capt. Edgar J. Evans, R.M.S. 'Tainui.'
1 Little Grebe (*Tachybaptes fluviatilis*). Presented by Mr. Thomas Riley.
8. 1 Hoopoe (*Upupa epops*). Purchased.
1 Greater-spotted Woodpecker (*Dendrocopus major*). Purchased.
9. 12 Fire-bellied Toads (*Bombinator igneus*). Purchased.
10. 2 Philantomba Antelopes (*Cephalophus maxwelli*). Presented by P. Lemberg, Esq.
12. 1 Mona Monkey (*Cercopithecus mona*) ♀. Presented by Col. Makins.
1 Vulpine Squirrel (*Sciurus vulpinus*), ♂. Presented by the Hon. G. Carew.
1 Great Eagle-Owl (*Bubo maximus*). Presented by Mr. Stuart, of Braila.
1 White-backed Piping-Crow (*Gymnorhina leuconota*). Deposited.
13. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Palmer.
1 Black-crested Cardinal (*Gubernatrix cristatella*). Presented by the Rev. W. B. K. Frances.
1 Adorned Terrapin (*Clemmys ornata*). Deposited.
1 Robben-Island Snake (*Coronella phocarum*). Purchased.
14. 1 Malayan Tapir (*Tapirus indicus*), ♀. From Tavoy, Burmah. Presented by Col. F. M. Jenkins. See P. Z. S. 1892, p. 541.
1 Pig-tailed Monkey (*Macacus nemestrinus*), ♂. Deposited.
1 Black-fronted Weaver-bird (*Hypotriorchis velatus*). Bred in the Menagerie.
16. 1 Red Kangaroo (*Macropus rufus*), ♀. Born in the Menagerie.
17. 2 Leopard Tortoises (*Testudo pardalis*). From British East Africa. Presented by D. Wilson, Esq.
5 Bell's Cinixys (*Cinixys belliana*). From British East Africa. Presented by D. Wilson, Esq.
1 Puff-Adder (*Vipera arietans*). From British East Africa. Presented by D. Wilson, Esq.
1 Sharp-snouted Snake (*Ramphiophis oxyrhynchus*). From British East Africa. Presented by D. Wilson, Esq.
1 Long-nosed Crocodile (*Crocodilus cataphractus*). Presented by Capt. F. G. Dunbar, R.N.
1 Small Hill-Mynah (*Gracula religiosa*). Presented by George Grigs, Esq.
19. 1 Three-striped Paradoxure (*Paradoxurus trivirgatus*). Presented by Mr. Douce.
1 Jackdaw (*Corvus monedula*). Presented by Lieut.-Col. R. F. Darvall, F.Z.S.
1 Shag (*Phalacrocorax graculus*). Purchased.
1 Indian Cobra (*Naia tripudians*). Presented by Arthur H. Cullingford, Esq., F.Z.S.
1 Indian Rat-Snake (*Ptyas mucosa*). Presented by Arthur H. Cullingford, Esq., F.Z.S.
20. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Mrs. Trafford Rawson.

Sept. 20. 1 Common Fox (*Canis vulpes*). Presented by Lucius Fitz-Gerald, Esq.
1 Common Boa (*Boa constrictor*). From St. Lucia, W. I. Presented by H.E. Sir Walter F. Hely-Hutchinson, K.C.M.G.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Miss Withers.
21. 1 Duyker Bok (*Cephalophus mergens*), ♂. Deposited.
4 Emus (*Dromæus novæ-hollandiæ*). Deposited.
1 Indian Chevrotain (*Tragulus meminna*), ♀. Purchased.
2 Violet Tanagers (*Euphonia violacea*). Presented by Alfred Petre, Esq.
22. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by A. de Turckheim, Esq.
1 Black-headed Lemur (*Lemur brunneus*), ♀. Deposited.
2 Tarantula Spiders (*Mygale*, sp. inc.). Presented by H. Strong, Esq.
23. 1 Grey Ichneumon (*Herpestes griseus*). Presented by Hugo Marshall, Esq.
24. 2 Tigers (*Felis tigris*), ♂ ♀. Presented by the Maharana of Oode-ypore.
3 Wild Swine (*Sus scrofa*). Born in the Menagerie.
26. 1 Herring-Gull (*Larus argentatus*). Presented by H. H. Johnson, Esq.
27. 1 Tuatera Lizard (*Sphenodon punctatus*). Presented by Capt. G. Eriksen.
28. 3 Wild Swine (*Sus scrofa*). Born in the Menagerie.
2 Common Kestrels (*Tinnunculus alaudarius*). Presented by Mr. L. Bergasse.
1 Sweet-voiced Lark (*Alauda cælivox*), ♀. Presented by Gervase F. Mathew, Esq., R.N., F.Z.S.
29. 6 American Green Frogs (*Rana halecina*). Purchased.
4 Noisy Frogs (*Rana clamata*). Purchased.
30. 1 Grivet Monkey (*Cercopithecus griseo-viridis*), ♀. Presented by W. Howard, Esq.

Oct. 1. 4 Smooth Snakes (*Coronella lævis*). Presented by Mr. Penton.
1 Concave-casqued Hornbill (*Dichoceros bicornis*). Received in Exchange.
3. 1 Vulpine Phalanger (*Phalangista vulpina*), ♂. Presented by Master H. H. Barrett.
1 Canarian Laurel Pigeon (*Columba laurivora*), ♂. Deposited. From the Island of Gomera, Canary Islands.
2 Nicobar Pigeons (*Calænas nicobarica*). Deposited.
3 Ringed Plovers (*Ægialitis hiaticula*). Purchased.
2 Dunlins (*Tringa alpina*). Purchased.
4. 1 Macaque Monkey (*Macacus cynomolgus*). Presented by Miss E. A. Hill.
5. 1 Grey Ichneumon (*Herpestes griseus*). Presented by Mrs. Wyndham Bewes.
6. 1 Indian Muntjac (*Cervulus muntjac*), ♀. Purchased.
7. 2 Raccoons (*Procyon lotor*). Presented by Capt. Sharp.
1 White Stork (*Ciconia alba*). Presented by Sir H. Rae-Reid, Bart., F.Z.S.
3 Negro Tamarins (*Midas ursulus*). Deposited.
1 Stanleyan Chevrotain (*Tragulus stanleyanus*). Presented by Charles J. Noble, Esq.

Oct. 7. 1 Ostrich (*Struthio camelus*), ♂. From West Africa. Presented by H.M. The Queen. See P. Z. S. 1892, p. 579.
1 Ringed Plover (*Ægialitis hiaticula*). Purchased.
1 Chameleon (*Chamæleon vulgaris*). Presented by Mrs. Davidson.
10. 1 Grivet Monkey (*Cercopithecus griseo-viridis*), ♀. Presented by the Rev. J. W. Scarlett.
1 Bengal Fox (*Canis bengalensis*). Presented by the Rev. J. W. Scarlett.
1 Hairy Armadillo (*Dasypus villosus*). Presented by I. Hamilton Benn, Esq.
11. 1 Stairs's Monkey (*Cercopithecus stairsi*). From the Lower Zambesi. Presented by Dr. Joseph A. Moloney. See P. Z. S. 1892, p. 580, pl. xl.
1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by the Rev. Sidney Vatcher.
1 White Stork (*Ciconia alba*). Presented by the Rev. Sidney Vatcher.
1 Naked-footed Owlet (*Athene noctua*). Presented by R. B. Shipway, Esq.
12. 1 Puisa Ichneumon (*Bdeogale puisa*). From British East Africa. Presented by General Mathews, C.M.G.
1 Green-necked Touracou (*Corythaix chlorochlamys*). From British East Africa. Presented by General Mathews, C.M.G.
2 Black Gallinules (*Limnocorax niger*). From British East Africa. Presented by General Mathews, C.M.G.
1 Tambourine Pigeon (*Tympanistria bicolor*). From British East Africa. Presented by General Mathews, C.M.G.
1 Bronze-spotted Dove (*Chalcopelia chalcospilos*). From British East Africa. Presented by General Mathews, C.M.G.
4 Half-collared Doves (*Turtur semitorquatus*). From British East Africa. Presented by General Mathews, C.M.G.
1 Delalande's Fruit-Pigeon (*Vinago delalandii*). From British East Africa. Presented by General Mathews, C.M.G.
4 Spotted Tree-Frogs (*Hylambates maculatus*). From British East Africa. Presented by General Mathews, C.M.G.
7 Smooth Clawed-Frogs (*Xenopus lævis*). From British East Africa. Presented by General Mathews, C.M.G.
1 Garnett's Galago (*Galago garnetti*). From British East Africa. Presented by Thos. E. C. Remington, Esq.
3 Mitred Guinea-fowls (*Numida mitrata*). From British East Africa. Presented by W. Hall Buxton MacDonald, Esq., M.D.
1 Varied Bush-Snake (*Philothamnus semivariegatus*). From British East Africa. Presented by W. Hall Buxton MacDonald, Esq., M.D.
1 Madagascar Pratincole (*Glareola ocularis*). From British East Africa. Presented by R. MacAllister, Esq.
1 Half-collared Dove (*Turtur semitorquatus*). From British East Africa. Presented by R. MacAllister, Esq.
1 Nilotic Monitor (*Varanus niloticus*). From British East Africa. Presented by R. MacAllister, Esq.
2 Grant's Francolins (*Francolinus granti*), ♂ ♀. From British East Africa. Presented by F. Pordage, Esq.
1 Senegal Coucal (*Centropus senegalensis*). From British East Africa. Presented by F. Pordage, Esq.
5 Half-collared Doves (*Turtur semitorquatus*). From British East Africa. Presented by F. Pordage, Esq.

Oct. 12. 1 Black-tailed Hawfinch (*Coccothraustes melanurus*), ♀. Presented by F. Pordage, Esq.
1 Flap-necked Chameleon (*Chamæleon dilepis*). From British East Africa. Presented by E. Millar, Esq.
2 Square-marked Toads (*Bufo regularis*). From British East Africa. Presented by E. Millar, Esq.
1 Half-collared Dove (*Turtur semitorquatus*). From British East Africa. Presented by Mr. Galbraith.
1 Galeated Pentonyx (*Pelomedusa galeata*). From British East Africa. Presented by Frank Finn, Esq., F.Z.S.
2 Greater Skinks (*Gerrhosaurus major*). From British East Africa. Presented by Frank Finn, Esq., F.Z.S.
5 East-African Geckos (*Hemidactylus mabouia*). From British East Africa. Presented by Frank Finn, Esq., F.Z.S.
3 Striated Lizards (*Mabuia striata*). From British East Africa. Presented by Frank Finn, Esq., F.Z.S.
2 Common Boas (*Boa constrictor*). From Trinidad. Presented by Messrs. Mole and Urich.
1 Yellow-tailed Rat-Snake (*Spilotes corais*). Deposited.
1 Common Quail (*Coturnix communis*). Presented by Mr. A. Torrie.

13. 1 African Wild Ass (*Equus tæniopus*), ♀. Born in the Menagerie.

14. 1 Mona Monkey (*Cercopithecus mona*), ♀. Presented by Miss Synge.
1 Common Badger (*Meles taxus*). Presented by Mr. W. Butler.

15. 1 Black-headed Lemur (*Lemur brunneus*), ♀. Deposited.
1 Honey-Buzzard (*Pernis apivorus*). Presented by Mons. P. A. Pichot, C.M.Z.S.

17. 1 Roseate Cockatoo (*Cacatua roseicapilla*). Presented by Mrs. Addiscott.
1 King Parrakeet (*Aprosmictus scapulatus*), ♀. Presented by Mrs. Addiscott.
1 Buffon's Touracou (*Corythaix buffoni*). Presented by A. L. Jones, Esq.

18. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by W. F. Faulding, Esq.

19. 2 Double-banded Sand-Grouse (*Pterocles bicinctus*), ♂ ♀. Presented by H. H. Sharland, Esq., F.Z.S.

21. 2 Thick-billed Seed-Finches (*Oryzoborus crassirostris*). Deposited.
1 Tropical Seed-Finch (*Oryzoborus torridus*). Deposited.
1 Bluish Finch (*Spermophila cærulescens*). Deposited.
1 Saffron Finch (*Sycalis flaveola*). Deposited.
4 Alligators (*Alligator mississippiensis*). Presented by John Terry, Esq.

22. 1 Gannet (*Sula bassana*). Presented by Dr. Davis.

24. 1 Thick-tailed Opossum (*Didelphys crassicaudata*). Purchased.
1 Garden's Night-Heron (*Nycticorax gardeni*). Purchased.
2 Ypecaha Rails (*Aramides ypecaha*). Purchased.
1 Martial Hawk-Eagle (*Spizaetus bellicosus*). Presented by T. White, Esq.

26. 1 Philantomba Antelope (*Cephalophus maxwelli*). From Sierra Leone. Presented by C. B. Mitford, Esq.
3 Gambian Pouched Rats (*Cricetomys gambianus*). From Sierra Leone. Presented by C. B. Mitford, Esq.

Oct. 26. 1 Ground-Rat (*Aulacodus swindernianus*). From Sierra Leone. Presented by C. B. Mitford, Esq.
1 White-faced Tree-Duck (*Dendrocygna viduata*). From Sierra Leone. Presented by C. B. Mitford, Esq.
1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Pascoe Grenfell, Esq., F.Z.S.
1 Squirrel Monkey (*Chrysothrix sciurea*). Deposited.
27. 2 Weaver-birds (*Hyphantornis*, sp. inc.). Presented by Mr. A. W. Arrowsmith.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Miss Kate Higgins.
2 Silver Pheasants (*Euplocamus nycthemerus*), 2 ♂. Presented by E. Mitchener, Esq.
2 American Darters (*Plotus anhinga*). Purchased.
1 Common Boa (*Boa constrictor*). Purchased.

Nov. 1. 3 Verticillated Geckos (*Gecco verticillatus*). From Burmah. Presented by W. G. Bligh, Esq.
2. 1 Laughing Kingfisher (*Dacelo gigantea*). Presented by J. W. Hornsby, Esq.
3. 1 Golden Eagle (*Aquila chrysaëtos*). From Labrador. Presented by J. C. Baxter, Esq.
1 Jackdaw (*Corvus monedula*). Presented by the Rev. H. W. Reynolds.
4. 6 Short-tailed Voles (*Arvicola agrestis*). Presented by J. E. Harting, Esq., F.Z.S.
4 Bar-tailed Pheasants (*Phasianus reevesi*), 2 ♂, 2 ♀. Purchased.
5. 1 Purple-faced Monkey (*Semnopithecus leucoprymnus*), ♀. Presented by Mrs. Elgee.
7. 1 Himalayan Bear (*Ursus tibetanus*), ♀. Presented by Major W. H. Cunliffe.
1 Herring-Gull (*Larus argentatus*). Presented by the Rev. Sidney Vatcher.
18 Filfola Lizards (*Lacerta muralis filfolensis*). From the Island of Filfola, Mediterranean. Presented by Capt. Robt. A. Threshie.
18 Wall-Lizards (*Lacerta muralis tiliguerta*). From Malta. Presented by Capt. Robt. A. Threshie.
1 Ocellated Sand-Skink (*Seps ocellatus*). From Malta. Presented by Capt. Robt. A. Threshie.
1 Moorish Gecko (*Tarentola mauritanica*). From Malta. Presented by Capt. Robt. A. Threshie.
1 Turkish Gecko (*Hemidactylus turcicus*). From Malta. Presented by Capt. Robt. A. Threshie.
8. 1 Squirrel Monkey (*Chrysothrix sciurea*). Presented by Mrs. K. Betts.
9. 1 Common Kite (*Milvus ictinus*). Received in Exchange.
10. 5 Dingos (*Canis dingo*). Born in the Menagerie.
11. 1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by Miss L. Blackburn.
1 Goshawk (*Astur palumbarius*). Presented by Capt. F. Manley.
12. 1 Egyptian Vulture (*Neophron percnopterus*). From Portugal. Presented by J. L. Teage, Esq.
2 Sahara Buntings (*Fringillaria saharæ*). Presented by Lord Lilford, F.Z.S.
14. 1 Blue-and-Yellow Macaw (*Ara ararauna*). Deposited.

Nov. 15. 12 Snow-Buntings (*Plectrophanes nivalis*). Purchased.
4 Lapland Buntings (*Calcarius lapponicus*). Purchased.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. J. Pettitt.
16. 18 Deadly Snakes (*Trigonocephalus atrox*, jr.). From British Guiana. Presented by J. J. Quelch, Esq., C.M.Z.S.
17. 6 Cirl Buntings (*Emberiza cirlus*), 3 ♂, 3 ♀. Purchased.
19. 2 Maholi Galagos (*Galago maholi*). Presented by Luscombe Searelle, Esq.
1 Tigrine Genet (*Genetta tigrina*). From Matabeleland, S. Africa. Presented by B. B. Weil, Esq.
1 White-eared Scops Owl (*Scops leucotis*). From Matabeleland, S. Africa. Presented by B. B. Weil, Esq.
1 Tawny Eagle (*Aquila nævioides*). From Matabeleland, S. Africa. Presented by B. B. Weil, Esq.
2 Jackdaws (*Corvus monedula*, albino). Presented by Harding Cox, Esq., F.Z.S.
21. 1 Black-backed Jackal (*Canis mesomelas*, jr.). Presented by Miss Thornton.
2 Shaw's Gerbilles (*Gerbillus shawi*). Born in the Menagerie.
22. 1 Common Jackal (*Canis aureus*), ♀. From Fao, Persian Gulf. Presented by D. W. Cumming, Esq., C.M.Z.S.
2 Short-headed Phalangers (*Belideus breviceps*), ♂ ♀. Presented by Capt. S. M. Orr.
24. 1 Nilotic Monitor (*Varanus niloticus*). Received in Exchange.
25. 2 Common Marmosets (*Hapale jacchus*). Presented by Mrs. Comolli.
1 Otter (*Lutra vulgaris*). Presented by Fred. Collier, Esq.
6 Crab-eating Opossums (*Didelphys cancrivorus*), ♀ et 5 jr. Purchased.
4 Ypecaha Rails (*Aramides ypecaha*). Purchased.
26. 1 Lemur (*Lemur*, sp. inc.). Purchased.
1 Green-cheeked Amazon (*Chrysotis viridigenalis*). Purchased.
1 Yellow-cheeked Amazon (*Chrysotis autumnalis*). Purchased.
28. 1 Common Chameleon (*Chamæleon vulgaris*). Presented by Miss Truefitt.
29. 1 Sykes's Monkey (*Cercopithecus albigularis*), ♀. Deposited.

Dec. 2. 2 Great Kangaroos (*Macropus giganteus*), 2 ♀. Presented by Sir Francis Wyatt Truscott, J.P., F.Z.S.
1 Lesser White-nosed Monkey (*Cercopithecus petaurista*), ♂. Presented by W. H. Henniker, Esq.
5. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Deposited.
1 White-fronted Lemur (*Lemur albifrons*), ♀. Presented by M. C. Parker, Esq.
1 Large-eared Fox (*Otocyon megalotis*). From Mashonaland, S. Africa. Presented by B. B. Weil, Esq.
1 Leadbeater's Cockatoo (*Cacatua leadbeateri*). Presented by Lieut.-Col. Wharton.
4 Pileated Song-Sparrows (*Zonotrichia pileata*). Received in Exchange.
7. 2 Black-backed Jackals (*Canis mesomelas*). Presented by Capt. Ralph H. Carr-Ellison.
9. 1 Common Fox (*Canis vulpes*), ♀. Presented by Miss Morgan
1 Brown Capuchin (*Cebus fatuellus*), ♀. Presented by Earle Tudor Johnson, Esq.
12. 1 Alpine Chough (*Pyrrhocorax alpinus*). Purchased.

Dec. 13. 1 Red-and-Blue Macaw (*Ara macao*). Presented by the Rev. T. N. Talfourd Major.
16. 2 Gold Pheasants (*Thaumalia picta*), 2 ♀. Purchased.
19. 3 Sulphury Tyrants (*Pitangus sulphuratus*). Purchased.
2 Pintailed Sand-Grouse (*Pterocles alchata*), ♂ ♀. Purchased.
20. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Deposited.
1 Chestnut-bellied Squirrel (*Sciurus castaneiventris*). From Hainan. Presented by Julius Neumann, Esq.
1 Crowned Hawk-Eagle (*Spizaëtus coronatus*). Presented by T. H. Mills, Esq.
23. 6 Common Wigeon (*Mareca penelope*), 3 ♂, 3 ♀. Purchased.
4 Common Pintail (*Dafila acuta*), 2 ♂, 2 ♀. Purchased.
28. 1 Common Snipe (*Gallinago cælestis*). Purchased.
29. 1 Bittern (*Botaurus stellaris*). Presented by Lord Ilchester F.Z.S.
30. 2 Hamsters (*Cricetus frumentarius*). Presented by Miss Pugh.
2 Alligators (*Alligator mississippiensis*). Presented by Master Williams.

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