ZS 1A

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON

FOR THE YEAR

1887.

PRINTED FOR THE SOCIETY,
AND SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER ROW.

LIST

OF THE

COUNCIL AND OFFICERS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1887.

COUNCIL.

(*Elected April* 29, 1887.)

Professor W. H. Flower, C.B., LL.D., F.R.S., *President*.

Lieut.-Gen. The Lord Abinger, C.B.
William T. Blanford, Esq., F.R.S.
Major-Gen. Henry Clerk, R.A., F.R.S.
Henry E. Dresser, Esq.
Charles Drummond, Esq., *Treasurer*.
Sir Joseph Fayrer, K.C.S.I., F.R.S., *Vice-President*.
John P. Gassiot, Esq.
Col. James A. Grant, C.B., C.S.I., F.R.S.
Dr. A. C. L. G. Günther, F.R.S., *Vice-President*.
Dr. Edward Hamilton, *Vice-President*.
E. W. H. Holdsworth, Esq.
Professor Mivart, F.R.S., *Vice-President*.
Professor Alfred Newton, M.A., F.R.S., *Vice-President*.
Henry Pollock, Esq.
The Lord Arthur Russell, *Vice-President*.
Howard Saunders, Esq., F.L.S.
Philip Lutley Sclater, Esq., M.A., Ph.D., F.R.S., *Secretary*.
Henry Seebohm, Esq.
Joseph Travers Smith, Esq.
Surgeon-Gen. L. C. Stewart.

PRINCIPAL OFFICERS.

P. L. Sclater, Esq., M.A., Ph.D., F.R.S., *Secretary*.
Frank E. Beddard, Esq., M.A., *Prosector*.
Mr. A. D. Bartlett, *Superintendent of the Gardens*.
Mr. F. H. Waterhouse, *Librarian*.
Mr. John Barrow, *Accountant*.
Mr. W. J. Williams, *Chief Clerk*.

LIST

OF THE

CONTRIBUTORS,

With References to the several Articles contributed by each.

LIST OF PLATES.

1887.

LIST OF WOODCUTS.

1887.

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON

FOR THE YEAR

1887.

(PLATES.)

PRINTED FOR THE SOCIETY,
AND SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER ROW.

LIST OF PLATES.

1887.

LIST OF THE PUBLICATIONS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

THE scientific publications of the Zoological Society are of two kinds—"Proceedings," published in an octavo form, and "Transactions," in quarto.

According to the present arrangements, the "Proceedings" contain not only notices of all business transacted at the scientific meetings, but also all the papers read at such meetings and recommended to be published in the "Proceedings" by the Committee of Publication. From fifty to seventy coloured plates and engravings are attached to each annual volume of the "Proceedings," to illustrate the new or otherwise remarkable species of animals described in them. Amongst such illustrations, figures of the new or rare species acquired in a living state for the Society's Gardens are often given.

The "Proceedings" for each year are issued in four parts, on the first of the months of June, August, October, and April, the part published in April completing the volume for the preceding year. The price is 12*s.* per part for the edition with coloured, and 3*s.* per part for that with uncoloured Plates.

The "Transactions" contain such of the more important communications made to the scientific meetings of the Society as, on account of the nature of the plates required to illustrate them, are better adapted for publication in the quarto form. They are issued at irregular intervals.

Fellows and Corresponding Members, upon payment of a Subscription of One Guinea before the day of the Anniversary Meeting in each year, are entitled to receive all the Society's Publications for the year. They are likewise entitled to purchase the Publications of the Society at 25 per cent. less than the price charged for them to the Public. A further reduction of 25 per cent. is made upon purchases of Publications issued prior to 1861, if they exceed the value of five pounds.

The following is a complete list of the publications of the Society already issued. They may be obtained at the Society's Office (3 Hanover Square, W.), at Messrs. Longmans', the Society's publishers (Paternoster Row, E.C.), or through any bookseller.

[June 1, 1887.]

TRANSACTIONS OF THE ZOOLOGICAL SOCIETY OF LONDON.

4to. 11 vols. and Six Parts.

				To Fellows. £	s.	d.		To the Public. £	s.	d.
Vol. I., containing	59 Plates	(1833–35)	Price	3	13	6	....	4	18	0*
Vol. II., „	71 „	(1835–41)	„	4	0	0	....	5	6	6*
Vol. III., „	63 „	(1842–49)	„	3	8	3	....	4	11	0*
Vol. IV., „	78 „	(1851–62)	„	6	2	0	....	8	2	6*
Vol. V., „	67 „	(1862–66)	„	5	4	3	....	6	19	0
Vol. VI., „	91 „	(1866–69)	„	11	5	0	....	15	0	0
Vol. VII., „	73 „	(1869–72)	„	8	17	0	....	11	16	0
Vol. VIII., „	82 „	(1872–74)	„	9	8	3	....	12	11	0
Vol. IX., „	99 „	(1875–77)	„	12	0	0	....	16	0	0
Vol. X., „	94 „	(1877–79)	„	10	0	3	....	13	7	0
Index, Vols. I.–X.			„	0	7	6	....	0	10	0
Vol. XI., part 1, containing	4 Plates	(Jan. 1880)	„	0	12	0	....	0	16	0
Vol. XI., „ 2, „	7 „	(Aug. 1880)	„	0	18	0	....	1	4	0
Vol. XI., „ 3, „	8 „	(Mar. 1881)	„	1	2	6	....	1	10	0
Vol. XI., „ 4, „	3 „	(Apr. 1881)	„	0	7	6	....	0	10	0
Vol. XI., „ 5, „	13 „	(June 1881)	„	0	18	6	....	1	4	0
Vol. XI., „ 6, „	6 „	(Jan. 1882)	„	0	12	0	....	0	16	0
Vol. XI., „ 7, „	9 „	(Oct. 1882)	„	0	15	0	....	1	0	0
Vol. XI., „ 8, „	11 „	(Jan. 1883)	„	0	12	0	....	0	16	0
Vol. XI., „ 9, „	10 „	(Oct. 1883)	„	0	12	0	....	0	16	0
Vol. XI., „ 10, „	12 „	(May 1885)	„	1	11	6	....	2	2	0
Vol. XI., „ 11, „	14 „	(Nov. 1885)	„	1	11	6	....	2	2	0
Vol. XII., „ 1, „	6 „	(Feb. 1886)	„	0	9	0	....	0	12	0
Vol. XII., „ 2, „	7 „	(Apr. 1886)	„	0	12	0	....	0	16	0
Vol. XII., „ 3, „	2 „	(Aug. 1886)	„	0	4	6	....	0	6	0
Vol. XII., „ 4, „	12 „	(Oct. 1886)	„	0	15	0	....	1	0	0
Vol. XII., „ 5, „	5 „	(Dec. 1886)	„	0	9	0	....	0	12	0
Vol. XII., „ 6, „	7 „	(Apr. 1887)	„	0	12	0	....	0	16	0

PROCEEDINGS OF THE COMMITTEE OF SCIENCE AND CORRESPONDENCE OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 2 vols.

			To Fellows.		To the Public.
Part I.	1830–31.	1 vol. 8vo.	Price 4*s.* 6*d.*	..	6*s.*†
„ II.	1832.	„	„ 4*s.* 6*d.*	..	6*s.*

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 15 vols. and Index. (First Series.)

			Price to Fellows.	Price to the Public.				Price to Fellows.	Price to the Public.
Part I.	1833.	1 vol. 8vo.	4*s.* 6*d.* ..	6*s.*	Part IX.	1841.	1 vol. 8vo.	4*s.* 6*d.* ..	6*s.*
„ II.	1834.	„	4*s.* 6*d.* ..	6*s.*	„ X.	1842.	„	4*s.* 6*d.* ..	6*s.*
„ III.	1835.	„	4*s.* 6*d.* ..	6*s.*	„ XI.	1843.	„	4*s.* 6*d.* ..	6*s.*
„ IV.	1836	„	4*s.* 6*d.* ..	6*s.*	„ XII.	1844.	„	4*s.* 6*d.* ..	6*s.*
„ V.	1837.	„	4*s.* 6*d.* ..	6*s.*	„ XIII.	1845.	„	4*s.* 6*d.* ..	6*s.*
„ VI.	1838.	„	4*s.* 6*d.* ..	6*s.*	„ XIV.	1846.	„	4*s.* 6*d.* ..	6*s.*
„ VII.	1839.	„	4*s.* 6*d.* ..	6*s.*	„ XV.	1847.	„	4*s.* 6*d.* ..	6*s.*
„ VIII.	1840.	„	4*s.* 6*d.* ..	6*s.*†	Index	1830–1847.	„	4*s.* 6*d.* ..	6*s.*

* No perfect copies of these volumes remain in stock. Out of print.

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 13 vols. and Index. (Second Series.)

		Letterpress only. To Fellows.	To the Public.		With Plates Coloured. To Fellows. £ s. d.	To the Public. £ s. d.
Part XVI. 1848.	1 vol. 8vo.	4*s.* 6*d.* ..	6*s.* ..	Price	1 0 9 ..	1 7 6†
„ XVII. 1849.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 0 9 ..	1 7 6†
„ XVIII. 1850.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 8 6 ..	1 18 0†
„ XIX. 1851.	„	4*s.* 6*d.* ..	6*s.* ..	„	0 15 9 ..	1 1 0†
„ XX. 1852.	„	4*s.* 6*d.* ..	6*s.* ..	„	0 15 9 ..	1 1 0†
„ XXI. 1853.	„	4*s.* 6*d.* ..	6*s.* ..	„	0 18 0 ..	1 4 0†
„ XXII. 1854.	„	4*s.* 6*d.* ..	6*s.* ..	„	0 19 6 ..	1 6 0
„ XXIII. 1855.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 8 6 ..	1 18 0†
„ XXIV. 1856.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 0 9 ..	1 7 6†
„ XXV. 1857.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 0 9 ..	1 7 6
„ XXVI. 1858.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 11 6 ..	2 2 0
„ XXVII. 1859.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 11 6 ..	2 2 0†
„ XXVIII. 1860.	„	4*s.* 6*d.* ..	6*s.* ..	„	1 11 6 ..	2 2 0
Index 1848–1860.	„	4*s.* 6*d.* ..	6*s.*			

ILLUSTRATIONS TO THE PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON, 1848–60. 8vo. 6 vols.

		Plates Uncoloured. To Fellows. £ s. d.	To the Public. £ s. d.		Plates Coloured. To Fellows. £ s. d.	To the Public. £ s. d.
Mammalia	1 vol.,	1 2 6 ..	1 10 0 ..	Price	2 7 3 ..	3 3 0†
Aves	2 vols.,	2 7 3 ..	3 3 0 ..	„	4 14 6 ..	6 6 0†
Reptilia et Pisces ...	1 vol.,	0 15 9 ..	1 1 0* ..	„	1 2 6 ..	1 10 0†
Mollusca..............	1 vol.,	0 15 9 ..	1 1 0* ..	„	1 2 6 ..	1 10 0†
Annulosa et Radiata	1 vol.,	1 11 6 ..	2 2 0 ..	„	2 7 3 ..	3 3 0†

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

	Letterpress only. To Fellows.	To the Public.	Plates only. To Fellows.	To the Public.	Complete. To Fellows.	To the Public.
1861, cloth	4*s.* 6*d.*	6*s.*	30*s.* 9*d.*	41*s.*‡	33*s.* 9*d.*	45*s.*
1862, „	4*s.* 6*d.*	6*s.*	30*s.* 9*d.*	41*s.*‡	33*s.* 9*d.*	45*s.*
1863, „	4*s.* 6*d.*	6*s.*	30*s.* 9*d.*	41*s.*‡	33*s.* 9*d.*	45*s.*
1864, „	4*s.* 6*d.*	6*s.*	30*s.* 9*d.*	41*s.*‡	33*s.* 9*d.*	45*s.*
1865, „	4*s.* 6*d.*	6*s.*	30*s.* 9*d.*	41*s.*‡	33*s.* 9*d.*	45*s.*
1866, „	4*s.* 6*d.*	6*s.*	30*s.* 9*d.*	41*s.*	33*s.* 9*d.*	45*s.*

	With Plates, uncoloured. To Fellows.	To the Public.	With Plates, coloured. To Fellows.	To the Public.
1867	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*
1868	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*
1869	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*
1870	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*
Index, 1861–1870	4*s.* 6*d.*	6*s.*		
1871	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*
1872	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*§
1873	9*s.* 0*d.*	12*s.*	33*s.* 9*d.*	45*s.*§
1874	9*s.* 0*d.*	12*s.*§........	36*s.* 0*d.*	48*s.*§
1875	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*§
1876	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*§

* No perfect copies of these volumes remain in stock.
† Out of print.
‡ Only uncoloured copies of these plates can now be supplied, at 10*s.* 6*d.* each volume.
§ Out of print, but odd parts may be obtained.

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON (*continued*).

	With Plates, uncoloured.		With Plates, coloured.	
	To Fellows.	To the Public.	To Fellows.	To the Public.
1877	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1878	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1879	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1880	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*†
Index, 1871–1880	4*s.* 6*d.*	6*s.*		
1881	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1882	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1883	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1884	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1885	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1886	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1887, part 1 (Jan. & Feb.)	2*s.* 3*d.*	3*s.*	9*s.* 0*d.*	12*s.*

(Bound in Cloth 3*s.* extra.)

† Out of print, but odd parts may be obtained.

LISTS OF THE ANIMALS IN THE SOCIETY'S GARDENS.

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. 8vo. 1862. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Second Edition.) 8vo. 1863. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Third Edition.) 8vo. 1865. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Fourth Edition.) 8vo. 1866. Price 1*s.* 6*d.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. 8vo. 1872. Price 2*s.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—Supplement, containing Additions received in 1872, 1873, and 1874. 8vo. 1875. Price 1*s.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Sixth Edition.) 8vo. 1877. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Seventh Edition.) 8vo. 1879. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—First Supplement, containing Additions received in 1879. 8vo. 1880. Price 1*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Eighth Edition.) 8vo. 1883. Price 3*s.* 6*d.*

Catalogue of the Library of the Zoological Society of London. (Fourth Edition.) 1887. In cloth. Price 4*s.*

These publications may be obtained at the SOCIETY'S OFFICE (3 *Hanover Square, W.*), *at Messrs.* LONGMANS' (*Paternoster Row, E.C.*) *or, through any bookseller.*

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

January 18, 1887.

Prof. W. H. Flower, LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1886:—

The total number of registered additions to the Society's Menagerie during the month of December was 89. Of these 1 was by birth, 71 by presentation, 5 by purchase, 6 by exchange, and 6 on deposit. The total number of departures during the same period, by death and removals, was 125.

The most noticeable additions during the month were:—

1. A young male of the true Zebra, *Equus zebra*, purchased December 11th, which fills a serious void in our collection of Equidæ, no specimens of this now rare animal having been received by the Society since 1867. It would appear, however, from Mr. H. A. Brydon's recent letter in the Field [1], that this animal is not yet, as has been supposed, quite extinct in the Cape Colony.

2. A young male of the larger Indian One-horned Rhinoceros (*Rhinoceros unicornis*), presented by H.H. The Maharajah of Cooch Behar, F.Z.S., through the kind intervention of Dr. B.

[1] Mr. H. A. Brydon says:—"The true Zebra, the *Equus montanus*, the hippotigris of the ancients, the dhow of the Hottentots, and the wilde paard (wild horse) of the Cape Dutch, is purely and essentially a mountain-abiding animal. It inhabits the most remote and rugged ranges of the Cape Colony; and at the present time, though sadly reduced in numbers and in the limits of its occurrence, it may be found in the Sneewenburg, the Zwaart Ruggens, the Zwartberg, and Winterhoek mountains, and in one or two other localities, in the Eastern Province. Quite recently a troop was running on the slopes of the Cockscomb, the highest peak (6000 feet in height) of the Winterhoek."—*The Field*, vol. lxviii. p. 816, Dec. 4, 1886.

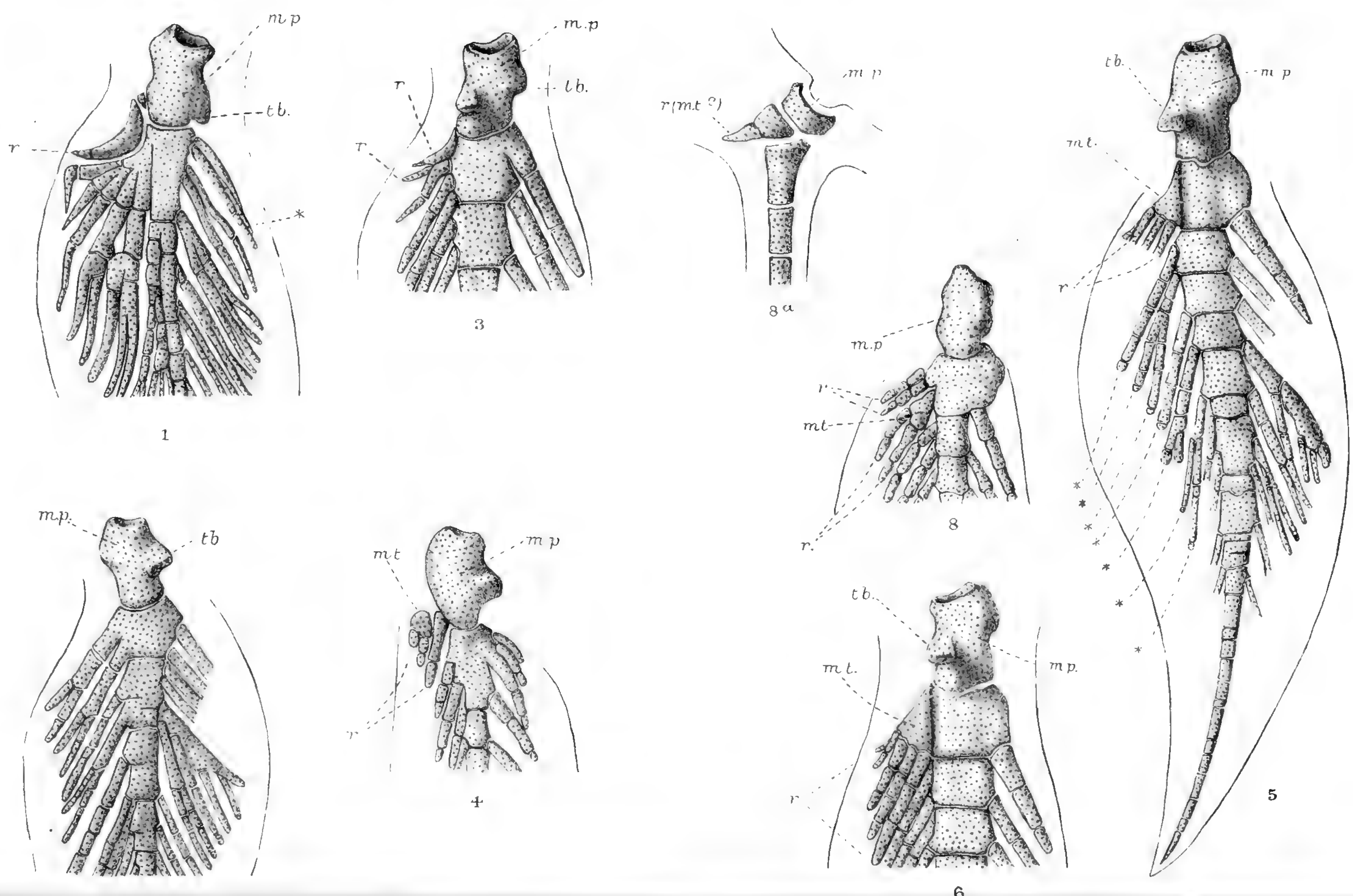
Simpson, and received December 25th. This is an important acquisition, as the only other specimen we possess of this huge animal is the male presented by the late Arthur Grote, Esq., F.Z.S., which has lately shown serious symptoms of old age.

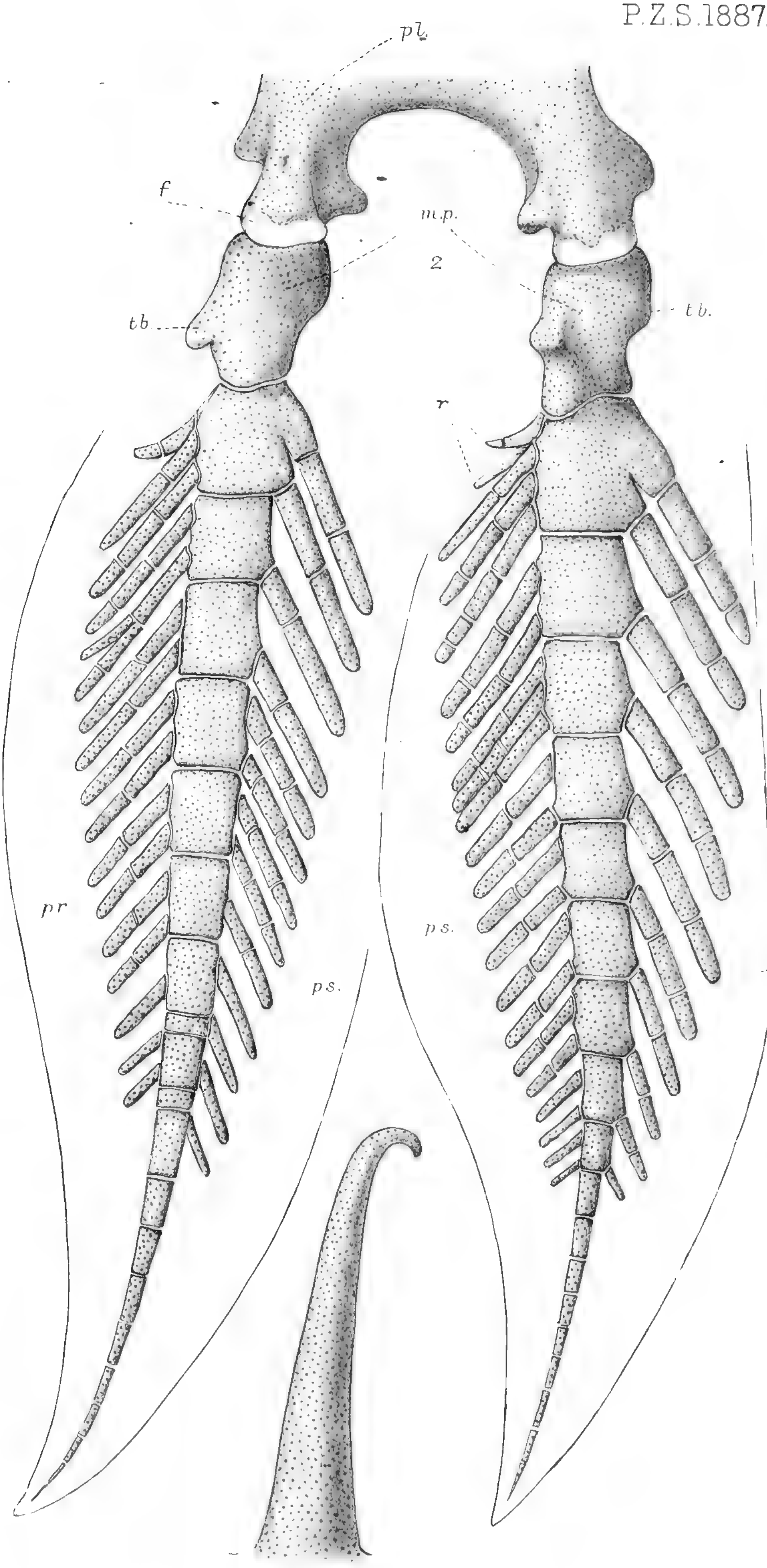
Mr. F. W. Styan, F.Z.S., placed on the table for exhibition a collection of eggs of Chinese birds, which he had made in the vicinity of Kinkiang and Shanghai. The collection contained clutches of the eggs of *Cyanopolius cyanus, Chibia hottentotta, Acridotheres cristatellus, Corvus torquatus, Munia acuticauda, Rhynchæa capensis, Hydrophasianus chirurgus, Gallicrex cristatus, Ardetta flavicollis, Anas zonorhyncha,* and *Podiceps minor.*

Mr. Howard Saunders, F.Z.S., called attention to a specimen of the Mediterranean Black-headed Gull (*Larus melanocephalus*), shot on Breydon Water, near Great Yarmouth, on the 26th December, 1886, and sent up for exhibition by Mr. G. Smith of that town. Mr. Saunders remarked that the bird was an adult in winter plumage (*i. e.* without the black nuptial hood), as indicated by the primaries being of a pure white, except a narrow black streak on the outer web of the first primary, a coloration which distinguishes the adult of this species from any other Gull of the Hooded group. An immature example of the same bird, said to have been shot near Barking Creek, on the lower Thames, in January 1866, was in the British Museum; and there could be little doubt of the correctness of its history, which Mr. Saunders had given in 'The Ibis,' 1872, p. 79, and in the fourth edition of 'Yarrell's British Birds,' vol. iii. p. 605. The somewhat restricted breeding-area of *L. melanocephalus* was known to extend from the Black Sea along the Mediterranean to the south-west coast of Spain outside the Straits of Gibraltar. Mr. Saunders had also reason for believing that this species breeds on the shores of France south of the Gironde; it undoubtedly frequented that coast up to Bordeaux in winter, and MM. Marmotton and Vian had stated that an example taken at Le Crotoy, in Normandy, on the 28th of November, 1878, was in the collection of the former. South-westerly gales, such as prevailed in December, would easily bring a straggler to our shores.

Mr. Sclater exhibited a skin of the rare Amazon Parrot, *Chrysotis bodini* of Finsch (P. Z. S. 1873, p. 569, pl. xlix.), brought by Mr. W. L. Sclater, F.Z.S., from British Guiana.

The specimen had been obtained alive from a settler on the Amacuru River, British Guiana, by Mr. E. F. im Thurn, in October last, and kept for some time living at Maccasseema, his residence on the Pomeroon. This Parrot was stated to be known to the Warrau Indians of the Amacuru district as the "Toua-toua," and to be found wild in the mountainous district of the Upper Amacuru. It was considered by the Indians to be rather a rare bird, and was much valued for its talking proclivities.

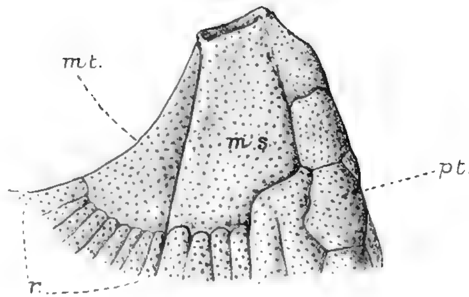

m.p
tb.
r
*
1
m.p
tb.
r
r
3
m.p
r(mt?)
8a
m.p
r
mt
r.
8
tb.
m.p
mt.
r
*
5
m.p.
tb
7
mt
m.p
r
4
tb.
mt.
m.p.
r
6



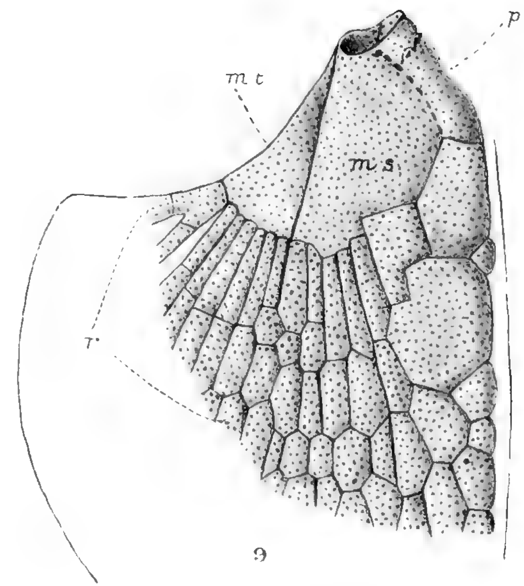
G. B. Howes del. ad nat.
C. M. Woodward lith.

Pelvic fins of Ceratodus.

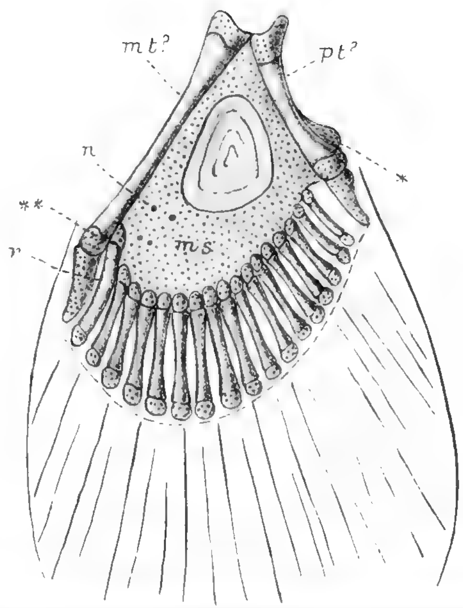
West, Newman & Co imp.



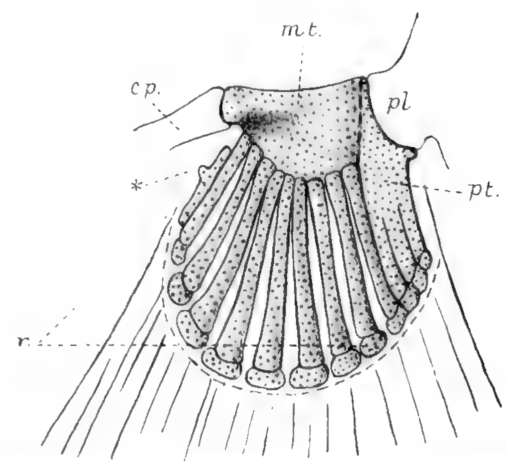
10



9



11



12

Fins of Elasmobranchs & Polypterus

West, Newman & Co imp.

Mr. Tegetemier exhibited and made remarks on some heads of the Sumatran Rhinoceros (*Rh. sumatrensis*), male, female, and young, forwarded from Sarawak, Borneo, by Mr. Brooke-Lowe.

Prof. Bell exhibited a specimen of *Nereis pelagica* which he had received from his excellent correspondent Mr. R. L. Spencer of Guernsey, and which was remarkable for the bifid arrangement of the posterior portion of the body. He remarked that although Mr. Robertson, of Oxford, Dr. Horst, and himself had put on record Lumbrici with trifid ends, which probably were not really uncommon, he had not been able to find any record of a similar condition in a Polychæte.

A communication was read from Messrs. H. B. Brady, F.R.S., W. K. Parker, F.R.S., and T. Rupert Jones, F.R.S., containing an account of the Foraminifera procured on the Abrohlos Bank during the cruise of H.M.S. 'Plumper' in 1857.

This memoir will be printed in the Society's 'Transactions.'

The following papers were read:—

1. On the Skeleton and Affinities of the Paired Fins of *Ceratodus*, with Observations upon those of the *Elasmobranchii*. By G. B. Howes, F.Z.S., F.L.S., Assist. Prof. of Zoology, Normal School of Science and Royal School of Mines, S. Kensington.

[Received December 14, 1886.]

(Plates I.–III.)

Contents.

I. *Introduction.*

I have lately described (17, p. 277) the vertebral column of a Frog in connexion with which there had taken place, under dislocation of the urostyle, a process tantamount to that of reproduction of a lost part. While searching for literature bearing upon this subject, there came under my notice a short paper by Traquair (26, p. 143), in which he describes the restoration of parts of the tail of *Protopterus*. Finding that he had discovered certain irregularities in the skeletal elements of the said restored tails, and knowing that Haswell had recorded (15) some irregularities of the *Ceratodus* paired fins, it occurred to me that the same determining cause might have been at work in the two cases—*i. e.*, that Haswell's "branching" fins might perchance be "restored" ones, like Traquair's. I was soon undeceived; for, apart from Haswell's paper, I have had the good fortune to examine one such fin, sent by him to Prof. Huxley. The deductions arrived at in the sequel have arisen out of a study of it and of the fins of five other individuals. Three of them were kindly lent me by my master, Prof. Huxley; of the two which remain, one forms part of our teaching-collection at South Kensington; for the loan of the other I am indebted to my Demonstrator, Mr. M. F. Woodward.

It is remarkable that Günther, in his Monograph on *Ceratodus* (14), does not mention Traquair's discovery already alluded to. It is clear that that author's paper must have escaped him, as I fail to find note of it under either "*Pisces*" or "*Ganoidei*," as reported by him for the 'Zoological Record' during both its year of publication and the succeeding one.

The structural plan of the fin of *Ceratodus* is too familiar to merit detailed description here. Huxley has described (19, p. 46 *et seq.*) its general features with exceeding care, and I shall, in accordance with his system, speak of the segments of the axis as "*mesomeres*."

The lateral rays will be described, under the same nomenclature, as *parameres*; those which look dorsally when the fin is placed against the side wall of the body (anteriorly when it is held out at right angles thereto) I shall speak of as *preaxial*; those which look ventrally under the first-named condition (posteriorly under the last-named) I shall describe as *postaxial*. Preaxial and postaxial correspond to the "dorsal" and "ventral" of the Germans. As the basal segment of the axis differs in its essential characters from those which follow upon it, I shall refer to it as the *proximal mesomere* (the "zwischen-Stuck" of Davidoff (7), the "erste Glied" of Schneider (23)).

II. *On the Structure of the* Ceratodus *Paired Fins in general and of the Pelvic Fins in particular.*

The majority of observations made thus far upon the fins of *Ceratodus* bear especially upon the pectoral member; its pelvic representative has received less attention. Davidoff (7) and Haswell (15) have dealt most fully with it, the last-named author especially as to certain "irregularities" mentioned in the Introduction. Fig. 1 is a faithful representation of the pelvic fin presented by him to Prof. Huxley; and as it does not appear to correspond with any one figured in his own paper, I proceed to describe it in detail.

The fin reached me cleaned and prepared, as represented in the figure, and it had first to be ascertained from which side of the body it was derived. Its proximal mesomere (*m.p.*, fig. 1) carries a large tubercle (*tb.*), which, as Schneider has lately pointed out, "bei der Brustflosse ventral, bei der Bauchflosse dorsal steht"—when the limb is in apposition with the body-wall. This process is, in all pelvic fins examined by me, somewhat crescent-shaped and outwardly directed, its inner face being excavated. In the fin under discussion its outer surface was flattened; but as its inner one sloped obliquely outwards, I conclude that that fin was a right-sided one. It is represented in the figure as seen from the dorsal aspect. Its axis is for the most part unequally segmented and irregular, the proximal mesomere being the least modified portion thereof, as compared with the more normal fin. The second mesomere is greatly elongated, and it bears upon its postaxial border (left hand of the figure) a notched lobe, with which are connected five parameres. The two distal of these break up peripherally, and, on examining the individual specimen, it is hard to conjecture how far the lines of demarcation between the parameres and the lobe, and between it and the main piece of the axis, may represent the last traces of original lines of separation, or the lines of cleavage of a primarily continuous sheet. Preaxially, the second mesomere carries five parameres; these are fairly uniformly set upon it, and the distal one of the series branches in a true dichotomy. Interposed between the free ends of the two proximal of these rays there is a smaller one (marked * in the figure), which I take to resemble those found by Davidoff (7, p. 127), occasionally lying free at the distal end of the fin. The rest of the skeleton is chiefly remarkable as concerns the axis; this appears to be longitudinally cleft, and made up of a longer preaxial and a shorter postaxial piece, both of which are very irregularly segmented. All the parameres borne upon it, however, are simple unbranched rods, which differ from those more generally present only as regards their feeble segmentation.

On examining the above-named fin with care, my attention became arrested by the cartilage marked *r* in the figure, the characters and relations of which are altogether exceptional. Wiedersheim has called attention (30) to the fact that in *Protopterus* the basal segment of the axis may bear a lateral piece. To the consideration of this I shall return. In no regular *Ceratodus* fin (*i. e.* that bearing an equally segmented axis) yet described has there been found, postaxially, a cartilage like the above named, attached directly to the basal mesomere. That element is generally held to be destitute of rays. Günther has figured (14, pl. 36. fig. 4) a pelvic fin of the right side, which bears lateral cartilages in the above-named region; but I find no mention of the fact in his text. It is to me inexplicable for what reason he should have failed to describe so remarkable a feature. I shall return, in the sequel, to the discussion of this fin. Haswell has figured and described (15, figs. 5, 6, 7 [1])

[1] His fig. 2 is said to be a representation in outline of the pectoral fin, after Huxley. It is unfortunate that the boundary-line between the two basal mesomeres, indicated in the original, should have been omitted.

what I imagine may represent the cartilage in question, and that, as is here the case, in irregular fins. Be it, as it there exists, what it may, its characters in the fin figured by me are still further noteworthy. The entire fin-skeleton (fig. 1), with the exception of this bar and the proximal mesomere, is very slender and leaf-like; the two elements just named (which, be it remembered, are in direct connexion) are relatively massive and much thicker and more powerful than the rest. The bar *r*, instead of being ellipsoidal in transverse section, as is invariably the case with even the most powerful parameres, is expanded along its free border in a manner strikingly suggestive of the metapterygium as it exists in many Elasmobranchs. It is segmented into a main piece and two small terminal ones, and appears, at first sight, to represent an element of greater importance than an ordinary ray.

The fact that this new element appears in "irregular" fins, taken in conjunction with the fact that no such structure has hitherto been recorded for a "regular" fin, appears at first sight to detract from its novelty. Before proceeding further, therefore, three questions must be met:—1. How far is the fin under discussion abnormal? 2. Can the existence of the new element be demonstrated for a more normal fin?, and 3. If so, under what structural conditions does it exist? Günther, in his original description of the *Ceratodus* fin, described (14, p. 532) certain "slight irregularities" in the distribution of the rays. Huxley (19, p. 47), commenting upon these, remarks that they are "in respect of the median pieces . . . . constant peculiarities of no small importance." Davidoff (7, p. 126) describes the stem of the pelvic fin as consisting of a row of pieces "deren Zahl bei den verschiedenen Individuen beträchtlich variirt;" he adds—"nirgends fand ich ein so unregelmässiges Verhältniss derselben zu einander, wie es Günther auf seiner Figur abbildet." Other writers have observed this irregularity, and the last of them (Schneider) has formulated the distribution of the parameres of both fins. He states (23, pp. 521–22), "bei der Brustflosse sitzt dorsalwärts am zweiten bis elften Gliede des Hauptstrahls, und zwar an der distalen Gelenkfläche, je ein Seitenstrahl. Ventralwarts sitzen am zweiten Gliede des Hauptstrahls hinter einander fünf Seitenstrahlen, am dritten und vierten Gliede je zwei, an den folgenden einer. Bei der Bauchflosse tragen die Glieder des Hauptstrahls ventralwärts je einen Seitenstrahl, dorsalwärts je zwei Seitenstrahlen." I have taken some pains to test the reliability of this very definite statement, and am in a position to assert with equal assurance that *the* only constant character as yet recognized is the attachment of one ray to the preaxial border of each pectoral mesomere (*cf.* figs. 5 & 6). Even in so modified a fin as that of fig. 5, where several of the parameres are branched and two are directly confluent, this rule holds; and in no regular pectoral fin yet examined has an exception to it been found. I give below a table of average distribution of the parameres of those segments dealt with by Schneider, calculated out from observations made upon eight pectoral and ten pelvic fins.

Pectoral fin.

	Postaxial.				Preaxial.
	Seg. ii.	iii.	iv.	v.	ii.
Schneider	5	2	2	1	1
Observed	3·5	1·9	1·6	1·3	1

Pelvic fin.

	Postaxial.	Preaxial.
	Seg. ii.	ii.
Schneider....	1	2
Observed	2·1	2·5

Further comment upon the pectoral member may be deferred until later. Concerning the ten pelvic fins examined by me, I may add that in eight the second mesomere bore preaxially two parameres (figs. 3 & 7); in a ninth three; in a tenth four. In most cases two postaxial rays were present (fig. 7). One fin, interesting beyond this, bore (fig. 2, right hand, as drawn) preaxially two rays, postaxially four, that being a precise reversal in duplicate of the condition observed by Schneider. In no case have I observed the distribution recorded by him.

The parameres of all the fins alluded to were, for the most part, rod-like and segmented; but in not a few instances they were branched or otherwise modified (*cf.* figs. 1, 5, 7). Reflection upon the facts recorded concerning them, to say the least, shakes our trust in the supposed regularity of their distribution. That, however, can no longer be asserted, in view of the truly remarkable condition of one pair of fins, which belonged to a fish in all respects normal and healthy (fig. 2). Günther first directed attention to the sickle-shaped contour of the *Ceratodus* fin, and all subsequent observers are agreed as to the asymmetry of its two lobes. Schneider states (23, p. 521):—" das zweite Glied des Hauptstrahls zerfällt durch eine Längsgrube in zwei Stücke. Das eine Stück behält die Richtung des Hauptstrahls, das andere Stück divergirt mit demselben und zwar bei der Brustflosse dorsalwärts, bei der Bauchflosse ventralwärts." And further, " Die Seitenstrahlen der dorsalen Hälfte der einen Flosse entsprechen derjenigen der ventralen Hälfte der anderen." A cursory glance at the pair of fins now under consideration (fig. 2 [1]) is sufficient to show how erroneous is this deduction. That Schneider has accurately represented the facts for the animals at his disposal, I have no doubt; but that his conclusions are incapable of a wider application is here proven.

[1] I was at one time under the impression, from an examination of Davidoff's figures (7, pl. 9. figs. 6 & 7), that he had been dealing with a similar pair of fins; but I am no longer in doubt. His drawing of the fin-skeleton of fig. 7 is not in accord with the description given, as regards the pelvis and basal mesomere. He, moreover, states emphatically (p. 127), " die Zahl der ventralen resp. medialen Reihe [referring to the parameres] entspricht genau der Zahl der Gliedstücke des Stammes, während diejenige der dorsalen resp. lateralen Reihe fast genau um das Doppelte grösser ist?"

Fig. 2 represents the ventral aspect of the pair of fins afore named, as they lay in life. They were attached to the pelvic cartilage (*pl.*) by a fibrous buffer, identical with that described by Davidoff (7, p. 124). The free end of the hip-girdle terminated in front in a pointed extremity (*processus impar* of Davidoff), which, as already observed by Günther (14, p. 535) and that author (7, p. 124), was bent towards the left side. I figure this (fig. 2 *a*), as its distortion is here much more marked than in any specimen yet drawn.

According to Schneider (23, p. 521) "Die Curve, welche der dorsale Rand jeder Flosse beschreibt, ist verschieden von der Curve des ventralen Randes. Nun ist der dorsale Rand der einen Flosse congruent mit dem ventralen Rande der anderen." In the specimen here figured, the two fins were sickle-shaped; the inner half of the preaxial border of the left one was straight, as represented in the figure. It will be observed that as they lay flattened out, their free ends were both directed towards the animal's right side; the excavated border, which imparts to the fin-lobe its sickle-shape, was preaxial for the right fin, postaxial for the left. When applied to the sides of the body, the apex of the former looked dorsally, that of the latter ventrally. The contour of the *Ceratodus* fin is variable; occasionally its opposite margins are symmetrical with respect to the axis; but the differences in symmetry between these two fins more than cover those which I have observed between any two members at my disposal. Turning now to the supporting skeleton, it will be seen that the second mesomere bears, as Schneider has pointed out, an accessory lobe (his "anderes Stück" referred to above). That, however, instead of being symmetrical, as he claims it to be, is, in this specimen, unsymmetrical to the utmost—for the right fin it is postaxial, for the left one preaxial. Further comment is needless, as the drawing which I give speaks for itself. Thus far the characters of the pelvic fin, as defined by Schneider, are seen to be inconstant and untenable: more than that, however; for, in that the preaxial lobe of the one fin corresponds almost to a degree (with the exception of one feature, to which I shall return) with the postaxial lobe of its fellow and *vice versâ*, there are embodied in the two the more important differences held by him to exist between the pectoral and pelvic members.

Schneider goes on to say (p. 523), "wenn man die symmetrische Stellung der vorderen und hinteren Flosse in Betracht zieht, so leuchtet die Aehnlichkeit des ersten Gliedes des Hauptstrahls mit Humerus und Femur des zweiten Gliedes des Hauptstrahls mit Ulna-Radius und Tibia-Fibula ein." I have shown above that the characters of this "zweites Glied" are inconstant for the pelvic fin. Its accessory lobe is present on that side on which the parameres are stoutest, be it preaxial or postaxial; and examination of the specimen under my hand suggests unmistakably that it has arisen as the result of coalescence between the second mesomere and the confluent bases of the two proximal parameres. The well-known lobe of the pectoral member (*cf.* figs. 5 and 6, *mt.*), first accurately described by Huxley (19, p. 49), to which Schneider likens that of the pelvic fin, is constant in its relationships and invariably postaxial. I emphatically deny that structural similarity of the second mesomere of the fore and hind fins suggested by him, while I desire to lodge a protest against the unqualified assertion that (23, p. 523) "das Problem der Entwickelung von Arm und Bein, welches gegenwärtig so vielfach behandelt worden ist, wird dadurch . . . . seiner Lösung einen Schritt naher geführt."

The great variation here demonstrated in the relative number and calibre of the parameres of opposite sides of the normal pelvic fin at least shows that the numerical differences existing between them and those of the so-called irregular fin described at the outset are insignificant. What now of the "branching," to which attention was originally directed by Haswell (15, p. 7)? In the fin furnished by him all the rays not indicated in the drawing (fig. 1) are simple and unbranched, though somewhat unusually elongated. Many of them are transversely segmented. The question resolves itself into this—Can the irregularities represented in fig. 1 as it stands be shown to exist in a more normal fin? Bifurcation of the terminal portion of one or more parameres is no exceptional feature. Günther (14) and Davidoff (7) have both described it for the pelvic fin, and I figure an example (fig. 7) in which it had attained a marked development. Fig. 5 shows that it is no new peculiarity for the pectoral fin also[1]. I have seen a dichotomy of the pectoral paramere in one other case, and that in a fin in all other respects normal. The transverse segmentation of the axis of Haswell's fin (fig. 1) is not a whit more remarkable than that of fig. 7; while in the fin there represented, as in the pectoral one of fig. 5, irregularities of the preaxial parameres existed which far exceed in abnormality (if such it may be termed) anything forthcoming in the first-named specimen. Briefly stated, Haswell's fin differs most conspicuously from that of the more constant type in respect to the longitudinal cleavage of the axis. This phenomenon has already been recorded by Haswell, and that in a fin which recalls the one here described (15, pl. 1. fig. 6). Albrecht has figured and described (Sitzungsb. d. könig̣ preuss. Akad. Berlin, vol. xxxii. p. 545, 1886) a specimen of *Protopterus* (*P. annectens*) in which the distal half of the axis of the left pectoral fin had similarly bifurcated[2].

Haswell (15, p. 8), commenting upon the "branching" process which he first described, asserts the belief that "it is reasonable to

[1] I found, on examining this specimen minutely, that many of the parameres terminated in small nodules such as are represented at *. On comparison with the other specimens dissected by me, I am convinced that similar terminal segments existed in two cases, but that, owing to their delicate nature, they had been for the most part torn away in the process of dissection. The free ends of the rays from which they had been thus removed presented a characteristic truncated appearance, identical with that represented in some of the rays so carefully drawn by Davidoff (7). Putting all together, I incline to the belief that the terminal nodules in question are of fairly general occurrence.

[2] The deductions which he has drawn from the study of this fin appear to me no less unwarrantable than those of Schneider alluded to above.

regard it as an instance of atavism, and so pointing back to a pre-existing condition in which the fin-skeleton consisted of branching jointed cartilaginous elements supporting a cutaneous expansion considerably broader than that of the fin of the living *Ceratodus forsteri*." If, as therein suggested, the typical paramere has arisen from a confluence of branching-elements, such as exist to-day among some Elasmobranchs, and if it be that the mesomeres have been formed by the fusion of the basal ends of the parameres as they now stand, each mesomere would be morphologically double, and the longitudinal cleavage of this axis would thereby receive an intelligible interpretation. I am doubtful as to the probability of such a process having been involved, but, in the absence of any data upon the development of the fin, I put forward the suggestion as a possible means of accounting for the apparent irregularity. In support of this conception of the origin of the parameres, it may be stated that their reduction in number is proportionate to the thickening of the fin border. Schneider says (23, p. 521) that "die Seitenstrahlen der dorsalen Hälfte der einen Flosse entsprechen derjenigen der ventralen Hälfte der anderen." I find, however, that when (as in the left-hand fin of fig. 2—right-hand one of the drawing) that lobe which is generally thickened remains thin, its supporting rays are more numerous and of smaller calibre than usual. When, on the other hand, as was also the case in the fin represented, the usually thin lobe becomes thickened, its supporting rays get less numerous in proportion as they become more powerful. Stated otherwise, these facts go far to prove that the thickening of one or other of the fin-borders is mainly due to confluence and subsequent increase in calibre of the parameres. Suggestive, indeed, in view of all this is the occasional bifurcation of a linear series of postaxial parameres, such as is represented in fig. 7.

Perusal of the foregoing pages will show conclusively that Haswell's "branching" fin is, when compared with those of a number of other individuals, little, if at all abnormal. There yet remains for consideration that cartilage (*r*, fig. 1) which, as I have stated, is connected with the proximal mesomere; and it has now to be inquired if a representative thereof is forthcoming in a more typical fin. After long searching I found an unmistakable representative of it, and that in none other than the left fin of the remarkable pair represented in fig. 2. Fig. 3 is a drawing of the upper third of the same. The postaxial lobe was supported, as has been already stated, by a series of delicate parameres, of which there were two to each of the ray-bearing mesomeres figured, with the exception of the first and third (*cf.* fig. 2). The preaxial lobe was, contrary to the general rule, supported by a series of larger and more powerful parameres; of these there was one to each of the above-named segments, with the exception of the first. None of the parameres showed the slightest trace of branching.

Proximally to the postaxial rays there lay the cartilage, *r*, of fig. 3. This element was relatively far smaller than was that of the specimen first described (fig. 1), and its relationships to the basal mesomere were the less definite of the two. It was here segmented into two pieces, while it was much more intimately connected with the two adjacent parameres than was the case in the former example. These two fins (figs. 1 and 3) stand alone, among those which I have examined, with respect to the great increase in number of the parameres of the postaxial lobe, and that also bears the cartilage now in question. If, as Haswell suggests (15, p. 8), this duplication of rays is reversionary to a "a pre-existing condition in which the fin-skeleton consisted of branching, jointed, cartilaginous elements," the only conclusion which seems to me justifiable is that the appearance of this new element amounts to that of the reappearance of one which has been lost. Haswell has described an individual (15, figs. 6 and 7) in which the cartilage in question appears to have been present on both sides; and it is instructive to remark that in both fins the rays of the postaxial series were, as with my specimens, the more numerous. I have already stated that in the fin described at the outset (fig. 1), the whole skeleton was, with the exception of the bar in question and the basal mesomere, very slight and leaf-like. This simplification of structure, so suggestive of the reversion claimed by Haswell, is seen in the basal mesomere itself. That was (fig. 1, *m.p.*) much thinner and more flattened than is usual, and it bore but one processus muscularis (*tb.*) instead of the three described by Davidoff (*cf.* 7, pl. 8). All the foregoing facts point to the conclusion that the newly described cartilage exists only in fins whose postaxial rays remain little modified. There is, therefore, good reason to regard it, let its homology prove to be what it may, as atavistic. It has disappeared in the normal fin, under a confluence of the parameres of its own side, and a consequent thickening of the postaxial fin-lobe.

III. *The Pectoral member of* Ceratodus *compared with the Pelvic one of the same and the Pectoral one of the Plagiostomes.*

Haswell, reviewing (15, p. 5) the well-known observations and hypotheses of Balfour (1), Thacher (24, 25), and others, which led them to dissent from the interpretations of Gegenbaur and Huxley, says that they, together with the facts which he brings forward, seem to place it beyond a doubt that the limb of *Ceratodus*, "so far from representing a primitive and generalized type, is, as, indeed, we should expect from various other points in the organization of the animal, in reality highly specialized, and to be regarded as derivable from such simple limb-skeletons as those of the *Selachii*." In this he was anticipated by Balfour (1) whom he quotes. Balfour wrote (p. 669), when criticizing Huxley's position, the leading tenets of which he supported so far as the identification of the chief constituents of the fin-skeleton go, "I should be much more inclined to hold that the fin of *Ceratodus* has been derived from a fin like that of the Elasmobranchs, by a series of steps similar to those which Huxley supposes to have led to the establishment of the Elasmobranch fin, but in exactly the reverse order"[1].

The researches of Huxley and Balfour have proved that the propterygium of Gegenbaur (figs. 9 and 10, *pt.*) represents, throughout the Elasmobranch series, but one or more preaxial rays. It is the most variable of the three basal elements of the Shark's fin, and most observers are now agreed as to its morphological unimportance. The above-named writers are further at one in their estimate of the morphological value of the Elasmobranch meso- and metapterygia (*ms.*, *mt.*, figs. 9 and 10). That they disagree, however, upon at least one vital issue is well known, and the balance of opinion holds to-day that the solution of the 'archipterygium' question is to be sought in a reconciliation between their views.

Huxley has described and figured (19, p. 48) the maximum development yet observed for the so-called propterygium of the *Ceratodus* pectoral fin. That structure cannot be definitely recognized in the pelvic fin. The determination of Huxley (19), Balfour (1), and v. Rautenfeld (22), which regards the axis of the *Ceratodus* fin as the mesopterygium, is too familiar to call for comment here. It must suffice to state that I accept it in the main, if not wholly, and assume for the present that the entire axis has the value which Huxley first assigned to it.

It is at this point necessary to discuss, more fully than heretofore, the nature of the differences between the pectoral and pelvic fin-skeletons of *Ceratodus*. Schneider has asserted (23, p. 521) that "die Seitenstrahlen der dorsalen und ventralen Hälfte der Flossen sind ungleich," also that the "Seitenstrahlen der dorsalen Hälfte der einen Flosse entsprechen derjenigen der ventralen Hälfte der anderen." There is an undoubted tendency towards the assumption of the condition which he thus formulates for *Ceratodus*, and it seems to me probable that a common determining cause may have led up to it and the condition realized in *Protopterus* (*cf.* Schneider, p. 524); but the definition no longer holds invariable for the former animal, in view of the facts thus far adduced. I have already stated that the presence of one preaxial paramere in connexion with each mesomere is a constant character of the *Ceratodus* pectoral fin, and I turn now to the distribution of the postaxial rays. I have given on p. 7 the average distribution for eight pectoral fins examined. The minimum observed was, taking the mesomeres in order of succession from within outwards, 3 . 1 . 2 . 1, the maximum 4 . 2 . 2 . 2. In no case have I observed five rays in attachment with the second mesomere, as stated by Schneider. Of the eight specimens examined, the second mesomeres of five bore each three rays; the third and fourth of seven each two; and the fifth of six each one. It is thus certain that variation in the distribution of the postaxial parameres (*cf.* fig. 6) is, beyond doubt, far

[1] Günther originally advanced a somewhat similar opinion (14, p. 534), but he conceived of the process as having gone on along lines as yet incapable of support.

less marked than with the pelvic member; but the fact which stands out most clearly is that the second mesomere invariably bears the greatest number of these rays. They are carried (figs. 5 and 6, *mt.*) upon a special lobe of the axial cartilage ("das divergirende Stück" of Schneider) already alluded to. The free border of this lobe slopes, in every case examined by me, gradually towards the proximal mesomere (*m.p.*), and it is, moreover, in all, marked off from the body of the second mesomere by a deep furrow (indicated in the figs. by a dotted line).

I now proceed to discuss its homology, and having arrived at the conclusions to be formulated in the sequel through a comparison with the pectoral fin of *Cestracion*, I pass at once to the consideration of that.

Gegenbaur and Huxley are both agreed that the base of the *Cestracion* fin is supported by two cartilages (fig. 10) held by them to represent the mesopterygium (*ms.*) and the metapterygium (*mt.*) of other Selachians. Most recent writers have adopted their views (*cf.* Hubrecht and Sagemahl in Bronn's 'Klassen und Ordnungen des Thier-Reichs,' vol. vi. part 4, Pisces). Huxley, instituting a comparison (19, p. 50) between the corresponding fins of *Cestracion* and *Notidanus*, regards them as representative of the transition stages in the shortening of the *Ceratodus*-like "archipterygium," by which he concludes the typical fish-fin has arisen. Gegenbaur (9, p. 148) likens the *Cestracion* fin to that of *Acanthias*, and says "das Propterygium fehlt gänzlich."

Huxley, holding further that the propterygium (preaxial ray) of *Cestracion* is removed from the shoulder-girdle, as in *Ceratodus*, asserts that in *Scyllium* (pp. 50–52) "the further shortening of the axis gives rise to still greater changes. The axial cartilage (*mesopterygium*) is relatively small; but the enlarged postaxial cartilage (*metapterygium*) has extended upwards along the postaxial face of the first, until it has not only reached the articular surface of the pectoral arch, but furnishes a large part of the articular cavity. In like manner the proximal preaxial ray (*propterygium*) has ascended along the preaxial face of the axial cartilage, until it also is able to furnish a facet which completes the anterior part of the cup for the condyle of the pectoral arch." He holds therefore that the pectoral fins of *Notidanus*, *Cestracion*, and *Scyllium* represent, in the order enumerated, the successive steps in the modification alluded to above, and he, in accordance with the statements quoted concerning the propterygium and metapterygium, relegates the two former fins to his category of the "unibasal" type, as distinguished from that of the latter animal, which he holds to typify the "tribasal" one predominant among the Plagiostomes (*cf.* table which accompanies his essay).

From an examination of the fins of two young Cestracions, I can state without further hesitation that the mesopterygium of the adult is (as Mivart has suspected, 21, p. 477) a compound of the pro- and mesopterygia. Fig. 9 represents one of the fins referred to. The animal died at the period at which the two (*ms.* and *pt.*)

were beginning to unite. The propterygium (*pt.*) is seen to compose fully the anterior third of the whole mass, its base being made up of two segments, the proximal one of which contributes nearly half the articular cup, entering at least as fully into the formation of the same as does its representative in *Scyllium* (*cf.* Huxley, 19, p. 48, fig. 10). In the adult fin (fig. 10) the original boundary line between the pro- and mesopterygia is represented by a groove indicated in Huxley's figure (here reproduced) by a dotted line.

The pectoral fin of *Cestracion* is thus shown to conform to the Selachian type, being identical most nearly with that as represented by *Acanthias* (*cf.* Gegenbaur, 9, pl. 9. fig. 4, and Mivart, 21, pl. 77. fig. 2). *Cestracion* must, on the evidence now forthcoming, relinquish its position in the series established by Huxley; it must, to say the least, change places with *Notidanus*. The main articulation of the fin of the last-named fish is established, as is well known, through the agency of the mesopterygium. Gegenbaur originally described a basal preaxial bar in *Notidanus*, and he homologizes it (9, p. 140) with his propterygium. This enters, if anything, more fully into the articulation with the shoulder-girdle than does its representative in *Cestracion*. There is connected with its distal end, in *Hexachus*, a smaller piece (*cf.* Gegenbaur, *op. cit.* pl. 9. fig. 1) which appears to represent the second segment of *Cestracion*, reduced, as an outcome of the great expansion of the front border of the mesopterygium. Mivart has suggested (21, p. 444) that the mesopterygium represents a coalescence of the pro- and mesopterygia; but I am inclined, upon careful examination of the specimen under my hand, to dissent from that view.

The metapterygium of *Notidanus* enters into a feeble but definite connexion with the pectoral arch, such as is not the case in *Cestracion*. That the fins of these two genera differ from those of some of the Sharks is indisputable, but they do so to an insignificant degree, incapable in itself of supporting the "unibasal" type; that, in face of the facts here adduced [1], rests upon an insufficient basis.

Returning now to *Ceratodus*; the lobe which, in the pectoral fin, carries the 3–5 proximal postaxial parameres (figs. 5 and 6 *mt.*) is, as has been stated previously, marked off from the adjoining mesomere by a deep furrow.

Günther observes (14, p. 532) that the conjoined mass shows, in "horizontal section," lines of "the former divisions" into what he holds to correspond to the "three carpals" (pterygia) of most Plagiostomes. This has been denied by Huxley (19, p. 47). Setting aside this difference for the moment, I desire to call attention to the similarity of the furrow described above to that which

[1] When, moreover, it is considered that in the pectoral fin of *Polypterus*, which Huxley relegates to the "tribasal" category, the mesopterygium is (as Gegenbaur pointed out, 10, p. 139) excluded from articulation with the limb-girdle, the statement that (p. 55) "the mesopterygium is the proximal piece of the axial skeleton, which constantly retains its primary articulation with the pectoral arch," must needs be modified.

marks off the propterygium from the mesopterygium in the adult *Cestracion*. On a comparison of the two, I submit, with some degree of confidence, the opinion that the postaxial lobe of the second mesomere of *Ceratodus* (figs. 5 and 6, *mt.*) is the homologue of the Elasmobranch metapterygium. Comparison of that lobe and its attached rays (fig. 6) with the metapterygium of *Cestracion* and its rays (fig. 9) reveals a striking similarity, even in detail, between the two. Did the metapterygium of the Shark unite, as does its propterygium, with the axial plate *ms.*, it would be difficult indeed to find a distinction between the first named and that which, in *Ceratodus*, I claim as its homologue.

The homology which I here seek to establish bears out, with certain modifications, Balfour's view cited that "the fin of *Ceratodus* has been derived from a fin like that of the Elasmobranchs." That observer first recognized (1, p. 668) that the metapterygium (his *basipterygium*) is morphologically the most important and, phylogenetically, the most primitive of the basal elements; while he suspected (*ibid.*), but did not demonstrate the fact, that that structure is formed by the coalescence of rays. Huxley had already asserted this belief, in dealing with the metapterygium of *Notidanus* (19, p. 50), which he regarded as being "formed by the coalescence of the axial ends of the postaxial rays" (presumably on the shortening of the fin axis). Dohrn has recently substantiated the deductions of Thacher, Mivart, and Balfour under this head, in having found that the metapterygium is (8, p. 174), in both pectoral and pelvic fins of the Shark, like the basal bar of the median fins, made up of "unpaare Knorpelstrahlen, die anfänglich oder jede Verbindung mit anderen Skelettelementen bleiben." He reiterates the statement on p. 182 in the words "was als Basipterygium beschrieben ist, stellt nur die verschmolzenen, wei sehr nah an einander leigenden, Basen der Flossenstrahlen dar und existirt nicht unabhängig von diesen."

In face of the above facts, my view demands that a primary distinction shall be demonstrated between the second pectoral mesomere in *Ceratodus* and that lobe which I hold to represent the metapterygium. In Günther's original specimen (fig. 8) the said lobe was not represented in that which is now known to be its typical form, while the rays (*r*) which are usually attached thereto were for the most part independent. The proximal two of these appear to have been somewhat smaller than usual, but it is highly interesting to note that the two distal ones were uniting at their bases to form a plate-like structure (*mt.*) which showed no signs of confluence with the adjacent mesomere. This plate corresponds in its mode of origin with the metapterygium (basipterygium of Balfour), as defined by the above-named authors, and, in its relationships to the rest of the fin-skeleton, with the lobe now under consideration. I regard its condition as there represented to be indicative of the primary independence which my interpretation necessitates.

Günther goes on to say (p. 532) that he found "lines of the former divisions" of the second mesomere of this specimen preserved, in the shape of tracts of white connective tissue. Huxley denies the existence of these, as has previously been stated; but let them be present or not, it is certain, should Günther's observation hold good, that they cannot indicate the original lines of separation between pro-, meso-, and metapterygia, as now understood.

IV. *On the proximal Postaxial Elements of the* Ceratodus *Pelvic Fin.*

The cartilage which I have already described (figs. 1 and 3) as directly connected with the postaxial border of the basal mesomere of the *Ceratodus* pelvic fin is ray-like, but relatively powerful, in one of the two specimens (fig. 1). In the other (fig. 3) it is altogether smaller and segmented into but two pieces, instead of into three, as in the former specimen. While it here meets the distal end of the proximal mesomere, it is much more intimately connected with the second piece of the axis than in the former specimen; but on the supposition that the cartilage is homologous in both fins, its condition in fig. 3 is precisely that which would result from a further reduction of that of fig. 1, such as there is good ground to believe, for reasons previously alleged, has actually gone on. In the second specimen the cartilage in question is further interesting, in that it bears one and is in close connexion with a second of the proximal parameres.

In the specimen figured by Günther (14, pl. 36. fig. 4) already referred to (p. 5), the proximal piece of the axis bears two cartilages. Fig. 4 is a reproduction of his drawing. The distal cartilage is ray-like, and stands related to the base of the proximal mesomere as does an ordinary postaxial paramere to the corresponding border of a typical mesomere. The proximal cartilage appears to have been free of the basal piece altogether. It is, as shown in the figure, plate-like, and I have little doubt but that it was formed by the confluence of the basal ends of at least the two rays which it carries. These skeletal elements, as they stand in Günther's specimen, combine the characters of those of the two described by me (figs. 1 & 3). The postaxial parameres are, as in my specimens, much simpler than usual, and the whole series of lateral rays are in his fin more uniformly distributed than in general. The basal plate is (fig. 4, *mt.*), like the corresponding bar of fig. 1, in near relationship with the proximal mesomere, although but loosely connected therewith; while it agrees with the corresponding element of fig. 3 in giving attachment to a couple of rays. Comparing the proximal postaxial elements of my two specimens and Günther's figure with the corresponding region of the pectoral fin-skeleton, and reflecting that the typical metapterygium is formed by a confluence of the basal ends of the rays of that region, I incline to the belief that the vestiges in question represent that lobe of the fore limb which I claim as the metapterygium, together with its associated rays.

Should the cartilages now under discussion have the morphological value which I am seeking to establish for them as probable, the well-known views of Gegenbaur (10, 11), and Huxley (19) will receive refutation, proportionate to the support furnished for those more especially of Balfour, Haswell, and Dohrn already cited.

As stated previously, the cartilage *r* of fig. 1 is ray-like, but stouter and more powerful than that of any ordinary paramere.

In seeking light on this question, one naturally turns to *Polypterus*, the affinities between which and the *Dipnoi*, originally pointed out by Huxley (18), have nowhere been denied. The *Polypterus* pectoral fin is, as is well known, supported upon three basal elements. The mesopterygium (fig. 11, *ms.*) is held by all to represent that of the Plagiostomes, and no one has yet challenged Gegenbaur's determination (9, p. 148) of the homology between the elongated postaxial bar (*mt.*) of this fish and the metapterygium of the *Plagiostomes* and *Chimæroids*. Huxley says of this fin (19, p. 53) that "the Scyllium type is essentially preserved." Comparison of the *Polypterus* pectoral fin (fig. 11) with the pelvic fin of *Ceratodus* represented in fig. 1 would appear at first sight to suggest a homology between the basal postaxial bar (*r*) of the latter and the metapterygial bar (*mt.*) of the former. If this be justified, it would further appear, accepting the homology of the metapterygium of *Polypterus* with that of the *Elasmobranchii*, that the two fins might have been derived along a line of modification characterized by the assumption on the part of the metapterygium of a ray-like character, and by the subsequent elongation of the mesopterygial plate (*ms.*). The probable truth of the latter assertion seems to me very great indeed. The mesopterygium is, in *Polypterus* (fig. 11, *ms.*), already elongated beyond the limits met with elsewhere, displacing in the process the marginal rays. Continue that elongation, and there could only result a *Ceratodus*-like product. As concerns the former supposition, however, comparison of the fin-skeletons represented in figs. 1, 3, & 4 is sufficient in itself to show that the proximal postaxial ray of fig. 1 most probably represents the distal one of those related to the proximal mesomere of fig. 4. Comparison of the latter (fig. 4) with the proximal end of the pectoral fin of the same side of the same animal (fig. 8) shows unmistakably that in the plate-like structure resulting from the fusion of the basal ends of the two proximal parameres we have to deal with the last trace of the metapterygium, defining that, as must now be done, as a product of the confluence of the inner ends of the proximal postaxial rays, the distal ray being, from the nature of its relations therewith, one of the same series.

Consideration of the above facts renders the homology of the supposed metapterygium of *Polypterus* somewhat doubtful. Gegenbaur, when pointing to the same, realized the similarity between both pro- and metapterygia so-called by him (fig. 11, *pt.* and *mt.*) and the marginal rays[1]. He at first suggested (10, p. 139) the possibility that the exclusion of the mesopterygium from connexion with the

[1] The difficulty of interpretation of the supposed propterygium is greatly increased by the presence of the cartilage marked * in fig. 11,—by no means the least puzzling element in this fin. As will be seen, it is grafted upon the anterior border of the propterygial rod; from it, however, it is perfectly distinct in

shoulder-girdle may have been due to a displacement of the same by two rays. Should this be so, the metapterygium must there have disappeared, as from the *Ceratodus* pelvic fin, under the corresponding enlargement of the mesopterygial plate. The only alternative view possible is that the metapterygium does represent that of the Elasmobranchs. If this be so, comparison of the pectoral fin of *Polypterus* (fig. 11) with that of the Plagiostomes, as represented in *Scyllium*, where the mesopterygium is relatively small, would seem to show that the loss of connexion between the metapterygium and its rays has been to no small extent due to a displacement of the latter by the elongation of the expanding mesopterygium, no less than by the simplification in structure of the metapterygium itself. The last step in the former process would appear, indeed, to be retained in the living *Polypterus* (** fig. 11).

In the absence of embryological data further discussion of this difficulty would be fruitless. It is much more pertinent to observe that in both *Ceratodus* and *Polypterus* the initial step in the modification has been, in any case, one of elongation of the mesopterygium, and evidence has been adduced to show that in the *Dipnoi* (if not in *Polypterus* also) the metapterygium has been thereupon reduced and finally suppressed. The only traces of either it or its rays yet recorded in the *Ceratodus* pelvic member are forthcoming in fins whose postaxial parameres are more numerous and less specialized than is generally the case. If this simplification in structure of the most specialized portion of the pelvic fin-skeleton is, as I have attempted to show, reversionary to a condition which has been lost, the characters of those elements which reappear under the simplification, when compared with those to which they most nearly correspond in the pectoral fin, go far towards bearing out the presumed origin of the *Ceratodus* fin from a primarily expanded predecessor.

V. *On the Morphology of the Axis of the* Ceratodus *Fin.*

The entire axis of the *Ceratodus* fin is held by Huxley (19) Balfour[1] (1), and v. Rautenfeld (22) to represent an elongated

---

the two specimens examined by me. It has been figured by Wiedersheim (29, p. 199), but I have been unable to find a description of it. I think it not improbable that it may have been derived from the mesopterygium, the closely related lower anterior end of which may (as Wiedersheim has shown) insert itself between the supposed propterygium and the marginal rays. In the absence of embryological data further discussion of it would be useless.

[1] Baur has recently called attention (3, p. 6) to the fact that Gervais has priority over Humphrey in the enunciation of the hypothesis that the paired fins are dismembered portions of a lateral fold. Gervais writes (12):—"Si l'on considère que les rayons des nageoires impaires des poissons ont une analogie incontestable avec ceux dont la réunion formes les nageoires paires des mêmes animaux, c'est à dire leurs membres véritables, on est naturellement conduit à se demander s'ils ne seraient les homologues de ces dèrniers, et si l'état d'isolement dans lequel ils restent les unes par rapport aux autres, ne résulterait pas de ce que chacun d'eux ne conserve pas complètement ses rapports avec celui des segments osteodesmiques dont il est tributuire. Alors on pourrait les

mesopterygium, and by Gegenbaur (11) to represent the metapterygium. The points of difference between the two sets of observers are so well known that recapitulation of them would be superfluous here. I incline most nearly to Huxley's view, and hold that the axis represents mainly, if not wholly, the mesopterygium of the Sharks; but I regard its condition in the latter as typical of its earlier and more primitive state. I moreover think it not unlikely that the short-lobed fin of the *Crossopterygidæ* will prove to be of an earlier type of structure than that of the elongated one of the living *Dipnoi*. Extended observations along the lines already laid down by Traquair, in his Monograph on *Tristichopterus* (27), are greatly to be desired. That the elements described by him are probably, and that those described by Goldfuss (13) and Kner (20) in *Xenacanthus* are certainly, homologous with those of the axis of the *Ceratodus* fin, I fully believe, and we have here the foundation of a line of study which must soon yield fruitful results[1]. Wiedersheim is the only worker who, to my knowledge, has offered an opinion upon the last named. He says (29 p. 195), speaking of the *Ceratodus* fin, "dass dieser Organisationsplan der Brustflosse auch bei untergegangenen Fischgeschlechtern eine Rolle gespielt haben muss, steht unzweifelhaft fest und ich möchte dabei nur an den aus der Permformation stammenden *Xenacanthus decheni* erinnern."

There can no longer be much doubt that the confluence so frequently seen between one or more rays and the mesopterygium of the Elasmobranchs represents the last trace of the process by which that structure is formed (*cf.* Dohrn, cited on p. 15). This granted, it becomes a question as to how far the axis of the *Ceratodus* fin, as here defined, represents a further extension of this fusion of primarily parallel rays or an elongation of the mesopterygial plate, as it exists in the Sharks. The fact that irregularity in distribution of the parameres is generally accompanied by that of the segmentation of the axis in *Ceratodus* (*cf.* especially figs. 1, 5, & 7), shows that there is an intimate connexion between the two; and this is the more obvious on reflection that Davidoff has shown (7, p. 145) that the segmentation of the axis does not stand in constant relationship to the muscular attachments[2]. It is moreover inconceivable, if

regarder comme autant de rayons membraux restés libres, et ils seraient les homologues de ceux qui, par leur asservation, donnent naissance aux membres proprement dits sur d'autres points du corps."

[1] I look with great satisfaction upon the work now being done in this direction by Smith Woodward (*cf.* P. Z. S. 1886). It is time that some such check should be kept upon the deductions of the embryologist (*cf.* Baur, Morph. Jahrb. vol. viii. p. 453).

[2] He writes, "Da wir auch an der Muskulatur eine den einzelnen Segmenten der Stammreihe entsprechende Gliederung fanden, zo gewinnt diese Ansicht an Wahrsheinlichkeit, obwohl immerhin noch einzuwenden ist, dass die physiologische Bedeutung dieser Gliederung eine nur äusserst minimale sein kann, dass ferner auch die Zwischensehnen der Stammuskulatur in gar keiner näheren Beziehung zu den Segmenten der Stammenreihe stehen." I could find no difference between the muscles of the fin represented in fig. 6 and those described by him.

the *Ceratodus* fin has arisen as an elongation of a primarily expanded predecessor, that such a fusion of the approximated ends of the rays could have resulted from that simple process. I am of opinion that the distal portion of the mesopterygium of *Ceratodus* has arisen on an elongation of a pre-existing plate, by a process such as is seen at its earliest phase in *Polypterus*.

A difficulty, however, arises with respect to the basal mesomere of *Ceratodus*, which, if it represents the proximal end of the mesopterygium, differs from that of all other fishes in forming (in the pectoral fin, at any rate) the sole support for the base of the fin. Gegenbaur, who has paid considerable attention to this matter, at first acquiesced (10) in Huxley's belief in the close relationship between *Polypterus* and the *Dipnoi*. Commenting upon the pectoral fin of the former animal, he writes (p. 138) "ausser den Selachiern bei denen die zweieilige Form des Archipterygium in die einzeilige übergeht, besitzt vielleicht nur noch *Polypterus* unter den lebenden Ganoïden das primäre Archipterygium im Flossenskelete." He goes on to advance the view that the fin of *Polypterus* represents a shortened-up derivative of the *Ceratodus* type; but finally he reverts to his original position, holding, chiefly on account of the loss of connexion between the mesopterygium and shoulder-girdle, and of the great structural difference between the pectoral and pelvic fins, that (p. 140) "demnach kann ich das genannte Skelet von *Polypterus* nicht unmittelbar auf das primäre Archipterygium beziehen, sondern leite es, wie jenes der anderen lebenden Ganoïden, von der secundären, nur *eine* Reihe von Radien besitzenden Form ab."

The pelvic fin of *Ceratodus* appears, at first sight, to be exceptional in the possession of a well-developed mesopterygium. Davidoff has brought forward good evidence to show that the element hitherto regarded among *Ganoids* and *Teleostei* as the pelvic girdle is (5. p. 125, and 6. p. 433) homologous with the basal piece of the *Ceratodus* fin, and he terms it the basal segment of the metapterygium. He has shown good reason for believing that the true pelvis is seen for the last time among the *Osteichthyes* in *Polypterus*, where it is represented by two or three vestigial cartilages (*cf.* 6. p. 462, pl. 21, and Wiedersheim, 28) lying immediately in front of the applied ends of the basal pterygia of opposite sides. Upon careful consideration, I am disposed to accept his interpretation as it applies to the Ganoids and Teleostei, but I am more dubious about it as applying to the Dipnoi.

Examination of either of the paired fins of *Ceratodus* in relation to the limb-girdle appears, at first sight, to favour Huxley's view that the whole fin-axis answers to the Selachian mesopterygium. If this be so, that element must, in elongating, have carried down with it the metapterygium, and the propterygium if present.

Balfour, criticizing Huxley's view that the basal mesomere is the proximal piece of the axial skeleton of the limb of *Ceratodus*, says (1, p. 669), "The entirely secondary character of the mesopterygium and its total absence in the young embryo *Scyllium* appear to me as conclusive against Huxley's view, as is the character of the embryonic fin against that of Gegenbaur."

Examination of the pectoral fin of *Ceratodus* shows that the elements which I hold to represent the metapterygium and its rays (figs. 5, 6, & 8, *mt.* & *r.*) are related to the postaxial border of the second mesomere. There is at most a bare suggestion of a relationship to the proximal mesomere (*m.p.*). In the hind limb this is otherwise, for those parts of the skeleton which most nearly repeat the characters of the presumed metapterygium of the fore limb are unmistakably connected (figs. 1 & 4) with the proximal mesomere. If they really represent the metapterygium and its rays as they occur among the lower fishes, it is, I think, not unlikely, p .tting together these facts and those recorded by Davidoff, that while the metapterygium has for the most part disappeared, the proximal mesomere may, after all, turn out to represent the proximal end of that structure as defined by Huxley, early differentiated and segmented off.

The above suggestion, should it be substantiated, would explain the fact that the proximal mesomere of *Ceratodus* is the only constituent of the fin-axis whose characters are constant. It would simplify our conceptions of the fins of the Ganoids and Dipnoi, and bring into harmony the supposed divergent modifications of the fins of opposite extremities; while it would show the pelvic member to be, on the whole, less modified than is usually thought. I am disposed to think, moreover, that it receives support from the absence of preaxial rays in connexion with the basal mesomere of *Ceratodus*; from the complete exclusion of the mesopterygium from connexion with the shoulder-girdle in *Polypterus*; and from the condition of the pelvic fin of that animal, already alluded to, no less than from the marked tendency towards an increased development of the proximal end of the pectoral metapterygium among the living *Ganoids*.

Still more suggestive is the condition of the basal elements of a *Protopterus* pectoral fin represented in fig. 8 *a*. Wiedersheim has (as I have already mentioned, p. 5) shown that the proximal piece of the pectoral fin-skeleton of this animal bears ray-like elements. He describes a smaller distinct ventral (postaxial) one and a larger dorsal (preaxial) one, which is confluent with the main piece (proximal mesomere as compared with *Ceratodus*). I have examined two specimens; in one of them the latter is much smaller than in his example, while in the other (fig. 8 *a*) there is no trace of it. I can only conclude therefore that it is a lobe of the basal mesomere, variable in character. Not so with the former; that is in both perfectly distinct, being separated from the basal mesomere by a fibrous tract, such as subdivides any two segments from each other. In that specimen which was destitute of the preaxial process (fig. 8 *a*) its characters are still further noteworthy. It is elongated and shows traces of subdivision into two pieces, the basal one of which is swollen and enlarged in common with the proximal mesomere (*m.p.*), and from that it appears most clearly to have been derived. The second segment of the axis is in relation with both the proximal mesomere and the swollen basal piece referred to; and the whole condition of the parts is such as would have resulted did the proximal mesomere and its related lateral elements represent a shortened-up metapterygium.

Beyond this, the pelvic member of *Ceratodus* differs most conspicuously from that of the Plagiostomes and Osteichthyes in the presence of an elongated mesopterygium. Balfour first showed (1, pp. 666–7) that the development of the pelvic fin of the Shark is arrested at a comparatively early stage. He and subsequent writers regard the enlarged preaxial ray, which Huxley would hold to represent the mesopterygium, as the propterygium. He has also called attention to the fact that the mesopterygium is not there represented; and the only anticipation of that structure forthcoming among the Plagiostomes, known to me, is the comparatively insignificant one described by Haswell (16. p. 23, pl. i. fig. 3) for *Heptanchus indicus*.

VI. *On the Homologies of the Chimæroid Fin-skeleton, as compared with that of* Ceratodus.

Huxley, discussing the morphology of the Chimæroid pectoral fin, insists (19, pp. 52–53) upon the close relationship which it bears to that of *Ceratodus*. The former fin is, as is well known, supported upon two basal elements, both of which are in intimate connexion with the pectoral girdle. The postaxial of these is held by all to represent the metapterygium.

As to the preaxial cartilages:—Huxley (19, pp. 52–53), whose view demands that the mesopterygium "constantly retains its primary articulation with the pectoral arch," completely reverses Gegenbaur's determination (9, p. 145), and regards the smaller basal one as the mesopterygium, and the larger ray-like distal one which it bears as the propterygium. Mivart, on the other hand, insists (21, p. 478) on the absence of the mesopterygium, and regards both preaxial elements as homologous with the propterygium. Comparison of the fin of *Chimæra* with that of the Selachians, as represented in *Hexanchus*, appears to me to warrant his view.

It is interesting, here, to recall Huxley's remarks upon the metapterygium, when dealing with *Chimæra*. Having asserted the belief that the metapterygium of *Notidanus* is "formed by the coalescence of the axial ends of the postaxial rays," he goes on to say (p. 53), "the metapterygial cartilage cannot, in *Scyllium*, at the same time represent coalesced postaxial rays, as the analogy of *Notidanus* would suggest, and the second joint of the axial skeleton as the analogy of *Chimæra* .... indicates." Did the mesopterygium exist in *Chimæra* in the form so constant among the Plagiostomes —that of a fusion of the basal ends of the rays interposed between the pro- and metapterygia—he could, in comparing the Chimæroid and *Ceratodus* fins, only have come to the conclusion formed by me (p. 15), in describing the second pectoral mesomere of the latter.

The pelvic fin of the Chimæroid is in an exceptionally interesting condition. Its postaxial border is supported by a cartilage, admitted by all to represent the metapterygium (fig. 12, *mt.*). This appears to be produced out into a preaxial lobe, which is regarded by Davidoff (4. p. 470, pl. 28. fig. 3, and pl. 29. fig. 18), who last described it, as consisting of a single piece answering to the propterygium.

It also recalls most closely that lobe from which Balfour held (1, p. 667) that both pro- and mesopterygia are derived. In a young Chimæroid pelvic fin examined by me (fig. 12), the lobe in question is seen to be formed by the fusion of three preaxial rays, and careful examination has shown that the last traces of an original separation between it and the metapterygium (indicated in the drawing by a dotted line) exist. Did that persist, the fin would correspond in all essential respects with the pectoral member, as I have defined it; and I hold that this preaxial lobe is neither more nor less than the propterygium [1]. Mivart comments (21, p. 465) upon the "close resemblance" between the pectoral and pelvic fins of the Chimæroids. Comparing the pelvic fin of these animals (*Callorhynchus*) with the pectoral ones of *Acanthias* and *Scymnus*, he concludes (p. 456) that the basal cartilage represents, in the former, all three pterygia fused into one. The considerations put forward above, taken together with the fact that the mesopterygium never appears in the Plagiostome's pelvic fin, beyond the insignificant degree observed by Haswell, appear to me to negative this view.

The facts now under notice suggest, but do not prove, that the mesopterygium is never represented at all in the Chimæroids; and that with respect to that feature those fishes stand on a lower platform than do the living Plagiostomes. Moreover, if the preaxial cartilages of their pectoral member represent the propterygium, as I believe, an absolute structural identity is proven between the pectoral and pelvic fins of the group. Both would appear to have been derived from the fins of an ancestor in which the mesopterygium was not differentiated; and if so, that element must have been of comparatively late origin.

Davidoff has pointed to the existence of structural similarities between the hip-girdles of *Chimæra* and *Ceratodus* (7, pp. 142–3); and if the magnificent array of structural affinities between the two, so successfully demonstrated by Huxley (19), have the weight which he assigns to them, I think it more than probable, if, as I have suggested, the basal mesomere of *Ceratodus* is a derivative of the metapterygium, that the paired fins of the Dipnoi may have arisen, side by side with those of the Plagiostomes, from some such form as is to-day represented by *Chimæra*—the fusion of the rays to form the mesopterygium having gone on independently, the intercalation of that structure between the applied bases of the pro- and metapterygia, so characteristic of the Plagiostomes, having been a comparatively late process.

[1] The free ray represented at * in fig. 10 has been described by Davidoff (*op. cit.* p. 471). The spur-like outgrowth of the same, which I think may not improbably represent the coalesced vestige of a second similar one, was not present in his specimen.

If the above suggestion should prove to have weight, the condition of the basal parts of the *Polypterus* fin, in which the mesopterygium is in no way in connexion with the shoulder-girdle, can only be a lowly one.

It may not be inappropriate here to call attention to the conception lately put forward by Baur (2, p. 663) concerning the morphology of the cheiropterygium. He returns to Gegenbaur's first position, and maintains that the limb of the land-animal has been derived directly from the ichthyopterygium. In that case the *Ceratodus* fin, as it stands, can only represent the initial phase in a line of modification of the ichthyopterygium, culminating in *Protopterus* (to include *Lepidosiren*. *Cf.* Ayers, Jenaische Zeitschr. vol. xviii. p. 479, 1885, and Schneider, *op. cit.*).

Davidoff claims that the *Ceratodus* pelvic fin (7, p. 127) "trotz der Einfachheit des Ganzen, sich bedeutend komplicirter gestaltet, als bei den früher bearbeiteten Fischen." He uses the words in a physiological sense, it is true, but that in face of his concluding statement that (p. 160) "das Endergebnis aber besteht darin, dass von der Ceratodus-Extremität sich diejenige der Haie ohne Schwierigkeiten ableiten lässt." This is, in my opinion, far from proven.

VII. *Conclusions.*

1. That the characters of the skeleton of the *Ceratodus* paired fins are inconstant, except for those of the preaxial parameres of the pectoral fin and the basal mesomere of both pectoral and pelvic fins.
2. That a metapterygium is always present in the fore limb, in a reduced condition and usually confluent with the second mesomere.
3. That traces of what appears to represent a metapterygium are occasionally to be met with in the hind limb, under conditions which point to atavism.
4. That the basal mesomere of the *Ceratodus* fin may conceivably have been derived from the metapterygium.
5. That the structural features of both paired fins of the Chimæroids are identical, and characterized by the absence of a mesopterygium.
6. That the paired fins of the Plagiostomes and Dipnoi have, in all probability, arisen independently from a type of fin most nearly represented by that of the living Chimæroids.
7. *Proven incidentally.*—That the basal cartilage of the *Cestracion* pectoral fin, usually regarded as the mesopterygium, is a compound of the pro- and mesopterygia of other Plagiostomes.

VIII. *List of Authorities referred to.*

1. Balfour, F. M.—On the Development of the Skeleton of the Paired Fins of Elasmobranchii. Proc. Zool. Soc. 1881, p. 656.
2. Baur, G.—Ueber das Archipterygium und die Entwicklung des Cheiropterygiums aus dem Ichthyopterygium. Zool. Anzeiger, vol. viii. p. 663 (1885).

3. Baur, G.—Historische Bemerkung. Month. Internat. Journ. of Anat. & Hist. vol. iii. no. 1 (1886).
4. Davidoff, M. v.—Beiträge zur vergleichd. Anat. der hinteren Gliedmasse der Fische. Morph. Jahrb. vol. v. p. 450 (1879).
5. Davidoff, M. v.—Continuation of the above. Morph. Jahrb. vol. vi. p. 433 (1880).
6. Davidoff, M. v.—Ueber das Skelett der hinteren Gliedmasse der Ganoidei holostei und der physostomen Knochenfische. Morph. Jahrb. vol. vi. p. 125 (1880).
7. Davidoff, M. v.—Beitr. zur vergleichd. Anat. der hinteren Gliedmasse der Fische. Morph. Jahrb. vol. ix. p. 116 (1883).
8. Dohrn, A.—Studien zur Urgeschichte des Wirbelthierkörpers. IV. Mittheilung. aus der Zoolog. Stat. zu Neapel, vol. v. p. 102 (1884).
9. Gegenbaur, C.—Untersuchg. zur vergleichd. Anat. der Wirbelth. Heft 2. Brustfosse der Fische. Leipzig, 1865.
10. Gegenbaur, C.—Ueber das Archipterygium. Jenaisch. Zeitschr. vol. vii. p. 131 (1873).
11. Gegenbaur, C.—Zur Morphologie der Gliedmaassen der Wirbelth. Morph. Jahrb. vol. ii. p. 396 (1876).
12. Gervais, P.—Mémoire sur la comparaison des membres chez les animaux vertébrés. Ann. d. Sci. Nat. sér. 3, Zoologie, vol. xx. p. 21 (1853); also De la comp. des Membres chez les Animaux vertébrés. Paris, 1853.
13. Goldfuss.—Beitr. zur vorweltlichen Fauna des Steinkohlen Gebirges. Bonn, 1847.
14. Günther, A.—Description of *Ceratodus*. Phil. Trans. vol. clxi. p. 511 (1871).
15. Haswell, W. A.—On the Structure of the Paired Fins of *Ceratodus*, with Remarks on the general Theory of the Vertebrate Limb. Pr. Linn. Soc. New S. Wales, vol. vii. p. 2 (1882).
16. Haswell, W. A.—Studies of the Elasmobranch Skeleton. Pr. Linn. Soc. New S. Wales, vol. ix. p. 71 (1884).
17. Howes, G. B.—On some Abnormalities of the Frog's Vertebral Column. Anat. Anzeiger, vol. i. p. 277 (1886).
18. Huxley, T. H.—Preliminary Essay upon the Systematic Arrangement of the Fishes of the Devonian Epoch. Mem. Geol. Survey, dec. x. p. 1 (1861).
19. Huxley, T. H.—On *Ceratodus forsteri*, with observations on the classification of Fishes. Proc. Zool. Soc. 1876, p. 24.
20. Kner, R.—Ueb. *Orthacanthus Dechenii*, oder *Xenacanthus dechenii*. Sizb. d. Kais. Akad. d. Wiss. Wien, vol. lv. Abth. 1, p. 540 (1867).
21. Mivart, St. Geo.—Notes on the Fins of Elasmobranchs. Trans. Zool. Soc. vol. x. p. 439 (1879).
22. Rautenfeld, E. v.—Morph. Untersuchg. über das Skelet der hinteren Gliedmassen von Ganoid. und Teleost. Dorpat, 1882.
23. Schneider, A.—Ueber die Flossen der Dipnoi und die Sys-

tematik von *Lepidosiren* und *Protopterus*. Zool. Anzeiger, vol. ix. p. 521 (1886).

24. THACHER, J. K.—Median and paired Fins, a contribution to the history of vertebrate limbs. Trans. Connectic. Acad. vol. iii. p. 281 (1877).
25. THACHER, J. E. Ventral fins of Ganoids. Ibid. vol. iv. p. 233 (1878).
26. TRAQUAIR, R. H.—On the Restoration of the Tail in *Protopterus annectens*. British Assoc. Reports, 1871, pt. 2, p. 143.
27. TRAQUAIR, R. H.—On the Structure and Affinities of *Tristichopterus alatus*. Trans. R. Soc. Edinb. vol. xxvii. p. 383 (1876).
28. WIEDERSHEIM, R.—Ueber das Becken der Fische. Morph. Jahrb. vol. vii. p. 326 (1881).
29. WIEDERSHEIM, R.—Lehrbuch der vergleichd. Anat. der Wirbelthiere. Zweite Auflage. Jena, 1886.
30. WIEDERSHEIM, R.—Das Skelet und Nervensystem von *Lepidosiren* (*Protopterus*). Jenaische Zeitschr. vol. xiv. p. 155 (1880).

IX. DESCRIPTION OF THE PLATES.

PLATES I.–III.

With the exception of fig. 2, all are drawn in the same relative position. The postaxial (internal) border looks towards the left hand.

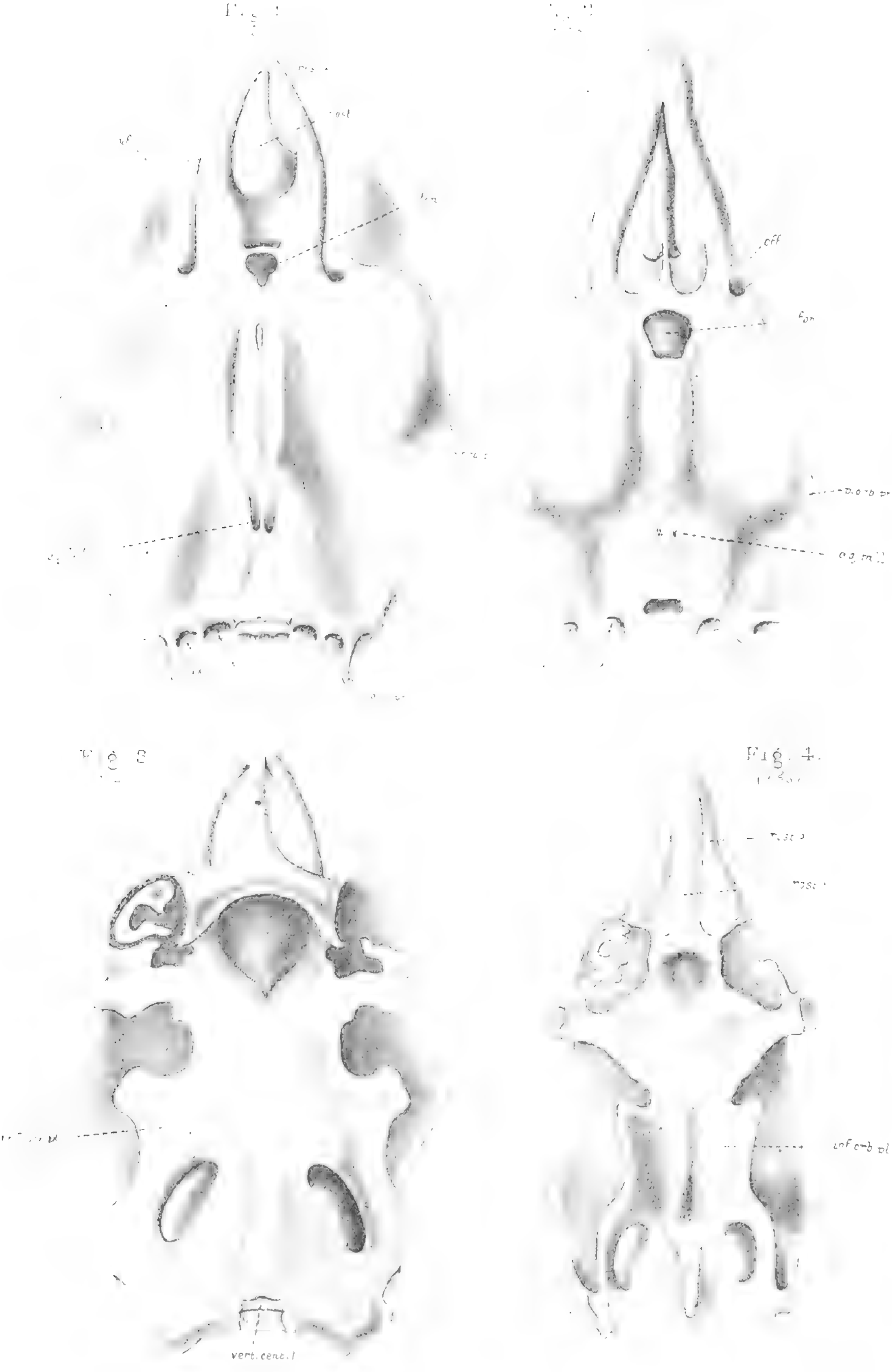
Fig. 1. A "branching" pelvic fin of *Ceratodus*. Right side, dorsal aspect. Nat. size.
2. The two pelvic fins of a second specimen. Ventral aspect. ×1½.
2*a*. The anterior portion of the pelvic girdle of the same. Nat. size.
3. The proximal third of the left fin of fig. 2. Ventral aspect. Nat. size.
4. Proximal third of a right pelvic fin; indicated as seen from the ventral aspect, for sake of comparison with figs. 1 and 3. (After Günther.) Nat. size.
5. The left pectoral fin of fig. 2. Ventral aspect. Nat. size.
6. Proximal portion of the corresponding fin of a fourth specimen. Ventral aspect. Nat. size.
7. Proximal portion of the left pelvic fin of the same specimen. Ventral aspect. Nat. size.
8. The proximal third of the left pectoral fin of a fifth specimen. Drawn to same scale as figs. 5 and 6. (After Günther.)
8*a*. Basal portion of a left pectoral fin of *Protopterus*. ×4.
9. The left pectoral fin of *Cestracion philippi*. Young ♀, dorsal aspect. Half nat. size.
10. The basal portion of a similar fin; same aspect. Adult. (After Huxley.) Reduced to the same scale as fig. 9 for sake of comparison.
11. The left pectoral fin of a young *Polypterus*. Ventral aspect. ×2.
12. The left pelvic fin of a young *Chimæra* (*C. monstrosa*), ♂. Ventral aspect. ×1½.

In figs. 5 and 7 the parameres not represented in full were all rod-like and unbranched.

The dotted lines in figs. 9 and 12 represent lines of fusion observed; those in figs. 5, 6, and 10 are inferred.

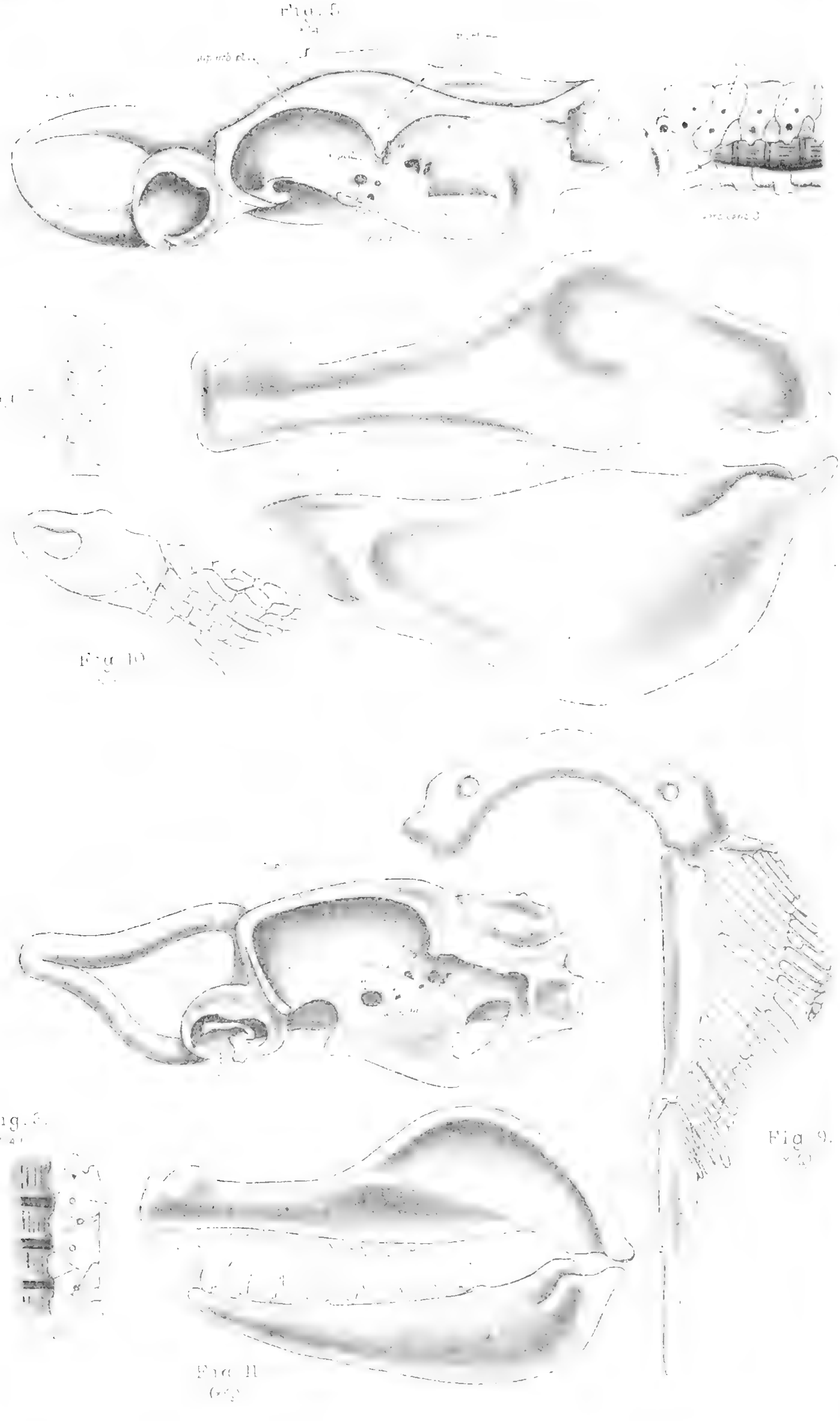
Reference Letters.

cp. Base of clasper. *f.* Inter-articular ligament. *m.p.* Proximal mesomere. *ms.* Mesopterygium. *mt.* Metapterygium. *pl.* Pelvic girdle. *pr.* Preaxial fin-border. *ps.* Postaxial fin-border. *pt.* Propterygium. *r.* Metapterygial rays.



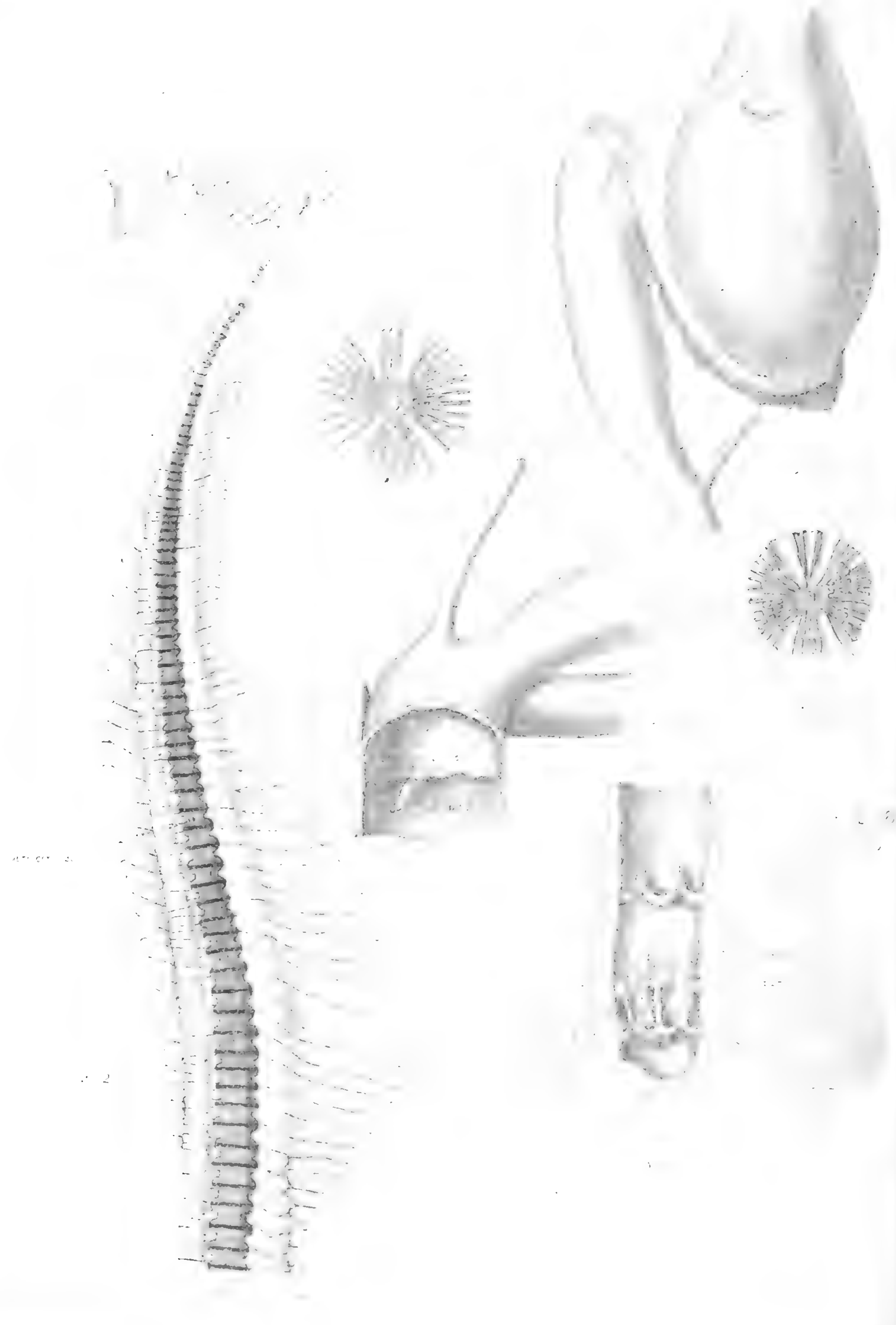
T. J. P. delt. ad. nat.
Parker & Coward cromo. ad.
West Newman & Co imp.

Figs. 1 & 3, Carcharodon rondeletii. Figs. 2 & 4, Lamna cornubica.

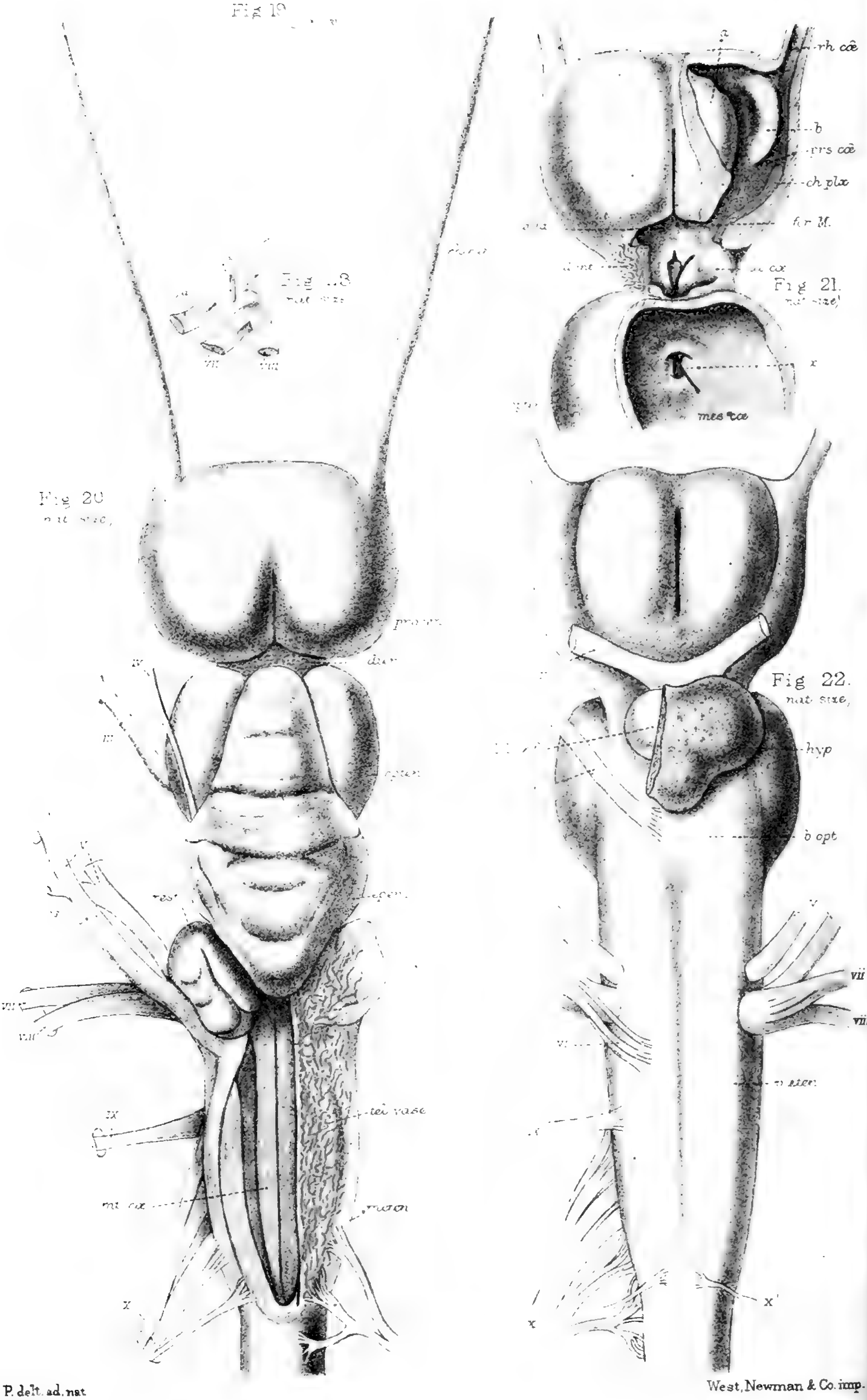


T. J. P. del. ad nat.
Parker & Coward chromolith.

Figs. 5-10. Carcharodon rondeletii. Fig. 11. Lamna cornubica.



Parker & Coward chromolith



T. J. P. delt. ad. nat.
Parker & Coward chrom. lith.

West, Newman & Co. imp.

Carcharodon rondeletii.

Fig. 24.

Fig. 25

Fig. 29
(nat. size)

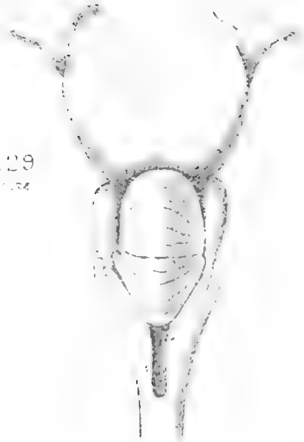


Fig. 27.
(nat. size)

Fig. 28.

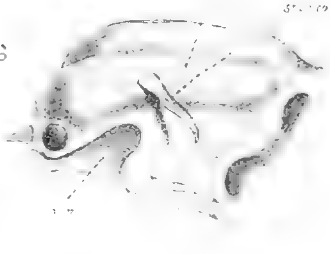


Fig. 26
(nat. size)

Carcharodon rondeletii (foetus)

2. Notes on *Carcharodon rondeletii*. By T. Jeffery Parker, B.Sc., C.M.Z.S., Professor of Biology in the University of Otago, New Zealand.

(Plates IV.–VIII.)

[Received November 1, 1886.]

Contents.

Dr. Günther states, in his 'Study of Fishes,' published in 1880, that nothing is known of the anatomy, habits, and reproduction of this, the most formidable of all Sharks, and that no opportunity should be lost in obtaining information about it.

As no fewer than four specimens of *Carcharodon rondeletii* have been caught in the neighbourhood of Dunedin during the last six years, upon all of which I have been able to make some observations, I have decided to put these upon record, in spite of the fact that they are, from a variety of circumstances, detached and imperfect, and are very far from giving anything like a complete account of this very interesting Selachian.

The following enumeration of the specimens which have come under my notice is given for convenience of reference.

Specimen A.—Male, 10 ft. (3 metres) long. Caught at Moeraki, about 40 miles north of Dunedin, early in 1881. The viscera, including the heart, were removed before bringing the fish to Dunedin. The skeleton was prepared and is now in the Otago University Museum.

Specimen B.—Female, 12 ft. 6 in. (3·8 metres) long. Caught in Otago Harbour early in 1885. This specimen was also eviscerated, only the heart being left. Its skeleton was prepared and sent to the Colonial and Indian Exhibition[1].

Specimen C.—Female, 19 ft. (5·7 metres) long. At the beginning of the present year two large Sharks were reported in the Lower Harbour, and several attempts to catch them were made by the local fishermen. After one or two failures (the Shark on one occasion having broken away with a large hook in its mouth) the larger of the two was caught and exhibited in Dunedin. After it had been on view for a few days I bought it for the museum, and was able to make some observations on its external anatomy, in spite of the advanced state of decomposition. This specimen was stuffed, and is now in the Otago University Museum.

[1] This specimen is now in the Natural-History Museum, South Kensington.

Specimen D.—Female, 17 ft. (about 5 metres) long. The second specimen referred to in the preceding paragraph was caught about a fortnight later than the first, and was also brought entire to Dunedin for exhibition. The funds of the museum would not allow of its purchase, and indeed my assistants were at the time so fully occupied with the preparation of the larger specimen, that it would have been impossible for them to undertake a second task of similar magnitude; so that all I could do was to be present when, on the third day after capture, the viscera were removed, and to make some notes on those organs which were too much decomposed in the former specimen.

Specimen E.—Fœtus (female), 55 cm. long. For this I am indebted to Mr. E. P. Ramsay, F.L.S., Curator of the Australian Museum, Sydney.

I may also mention that, as I am informed by my friend Prof. A. P. Thomas, a specimen of *Carcharodon*, fully 30 ft. long, was caught at Auckland a few months ago. It would seem, therefore, that in spite of its apparent scarcity in museums, *Carcharodon rondeletii* must be a tolerably common species in the Southern Seas.

1. *External Characters.*

As the small specimen described by Smith, in his 'Zoology of South Africa,' appears to be the only one of which careful measurements have been taken, it seems advisible to give a fairly complete series of measurements of specimen C, the largest which has come under my notice.

	centim.
Total length from tip of snout to tip of upper lobe of tail-fin (following the curve)	577
Total length in a straight line	552
From tip of snout to 1st dorsal fin (anterior border)	202
From tip of snout to anterior border of pectoral fin	155
From posterior border of pectoral to anterior border of pelvic fin	152
From posterior border of pelvic to anterior border of ventral (anal) fin	60·8
From posterior border of ventral (anal) to root of caudal fin	40·4
Girth immediately cephalad of 1st dorsal fin	296
Height of first dorsal fin	45·6
Breadth ,, ,, at base	53
Height of second dorsal fin	7
Breadth ,, ,, at base	8
Length of pectoral fin, along anterior border	103
Breadth ,, ,, at base	58
Length of pelvic fin, along outer border	30
,, ,, ,, inner border	41
Breadth ,, ,, at base	19
Height of ventral (anal) fin	11
Breadth ,, ,, ,, at base	9

	centim.
From tip of snout to centre of eye	23
,, ,, ,, upper angle of nostril	22
,, ,, ,, centre of mouth	30
,, ,, ,, 1st gill-slit (dorsal end)	116
From centre of eye to spiracle	33
Width of mouth-aperture, in a straight line	58
Height of 1st gill-slit	64
Width of flattened caudal region (*vide infra*), measured with calipers	42
Height of ditto, measured with calipers	18·5
Height of caudal fin from tip of dorsal to tip of ventral lobe	146
Height of dorsal lobe of ditto, measured along anterior border from root to tip	106
Height of ventral lobe, similarly measured	95

The skin is dark grey above, white tinged with pink below, the latter colour being evidently due to blood in the skin and not to the presence of any special pigment. The under surface of the snout is dark, not white and pink as in Smith's specimen.

The snout is considerably less pointed than in *Lamna*, or than in the young specimen figured by Smith. The eye is also markedly smaller in proportion to the size of the head than in *Lamna* (*cf.* description and figures of skull, *infra*, p. 32 and Plates IV. and V. figs. 1–5 and 11).

The form of the caudal region is remarkable, and is not adequately described in any of the books at my disposal, in which it is merely stated that the tail is provided with lateral ridges. It is more correct to say that the tail for a short distance in front of the caudal fin is strongly depressed, so much so that its width is more than double its height, a transverse section having the form shown in fig. 19, Plate VII.

It looks very much as if this curious modification must have the result of providing *Carcharodon* (and *Lamna*, in which the same structure obtains) with a combination of vertical and horizontal tail-fin, the latter—the flattened region just described—being developed as a means of enabling the fish to rise rapidly from great depths.

2. *The Teeth.*

Only the central tooth of each row in each jaw is symmetrical, all the others having their long axes directed outwards. The exposed portion of the upper middle tooth (specimen C) is 4 cm. in height, and 3·7 cm. wide at the base. In the lower middle tooth these dimensions are respectively 3·4 (height), and 3·2 (width at base). In both jaws the outer surfaces of the teeth are markedly flatter than the inner.

3. *The Skeleton.*

The vertebral column of *Carcharodon* has been fully described by

Hasse[1] and a briefer account of the entire skeleton is given by Haswell[2]. I shall therefore confine myself to a few points which do not appear to have been insisted on, mentioning especially such as seem to be important for comparison with *Lamna*.

a. *The Vertebral Column.*—In specimen A there are about 182 vertebral centra; at the end of the tail it becomes difficult to count them accurately. The centra agree with Hasse's description, except that I do not find the difference in the disposition of the radiating lamellæ of bone which that author gives as distinguishing the trunk- from the tail-vertebræ. Hasse describes and figures only two very thick dorsal lamellæ in the caudal vertebræ, between the origin of the neurapophyses: in my specimens there are three or four comparatively thin lamellæ as in the trunk-vertebræ (*cf.* figs. 13 and 14, Plate VI.).

One point not very clearly brought out by Hasse is the extreme irregularity in the segmentation of the neural tube and of the hæmal tube or ridges. These are, in the embryo, continuous cartilages[3], which undergo segmentation at a later stage than the centra, becoming divided into vertebral portions, the neur- and hæmapophyses, and intervertebral portions, the interneural and interhæmal pieces, or intercalaria. The irregular way in which this segmentation takes place in *Carcharodon* is very striking, and is well shown in figs. 7 and 8 (Plate V.), the former representing a portion of the neural tube seen from above, the latter a portion of one of the hæmal ridges seen from below. Occasionally the distal portion of a hæmapophysis becomes segmented off, forming a rib (fig. 8, *r*).

Another matter not touched upon by Hasse is the modification undergone by the vertebral column at its anterior and posterior extremities. Anteriorly there is no clear line of demarcation between skull and vertebral column. At the level of the third vertebral centrum (fig. 6, *vert.cent.* 3) the neural tube meets on each side with the corresponding hæmal ridge, forming a continuous lateral investment of cartilage over the first two centra, which are thus only visible from beneath. The continuous lateral cartilage thus formed passes insensibly into the exoccipital region of the skull, while the first and second centra pass into the basioccipital region, and the neural tube into the supraoccipital region. Thus, when the skull is separated artificially from the vertebral column in such a way as to leave intact the great parotic processes (fig. 1, *p.ot.pr*), the plane of section passes naturally between the second and third vertebral bodies, and the first two centra appear to be imbedded in the basis cranii (fig. 3).

It is also worthy of notice that in the first few vertebral segments the intercalary pieces (fig. 6, *i*) are small triangular processes

[1] Das natürliche System der Elasmobranchier. Jena, 1879.

[2] "Studies on the Elasmobranch Skeleton," Proc. Linn. Soc. N. S. W. vol. ix. (1884) p. 3.

[3] Balfour, 'Comparative Embryology,' vol. ii. p. 454. (Memorial edition, vol. iii. p. 550.

inserted between the bases of adjacent neural arches, the latter (*n.a*) forming the whole dorsal region of the neural tube; whereas in the remaining greater part of the column the intercalaria form actual interneural arches.

The tail-fin contains nearly three-fourths as many vertebræ as all the rest of the column, the 107th centrum being the first of the tail-fin (Plate VI. fig. 12, *vert.cent.* 107), recognizable by being the first to develop a hæmal spine. In this and the five following vertebræ the hæmal spine (*hæ.sp*) is a separate cartilage, quite distinct from the hæmapophyses; in the remaining tail-vertebræ the two are continuous. The hæmal spines gradually increase in length to the 120th vertebra, and then undergo progressive diminution: the longest, in specimen A, is 10 cm. in length.

The tail-fin is thus supported ventrally by hæmal spines: the small portion lying dorsad of the vertebral column, on the other hand, has its framework constituted by a series of cartilages (*ptg*) which are evidently not neural spines but *pterygiophores*[1] or cartilaginous fin-rays. These have no definite relation to the vertebral segments, one of them sometimes corresponding to a single vertebra, sometimes to two, and sometimes to three.

Hasse remarks that while intercalaria are absent in the hæmal tube in the caudal region, they are present in the neural tube, which has therefore double neural arches as in the trunk region. This is true only as far back as the 130th vertebra (*vert.cent.* 130), caudad of which intercalary pieces are absent and the neural arches consequently single.

In the 167th (*vert.cent.* 167) and following vertebræ, the neural and hæmal arches are united with one another on each side by a vertical bridge of cartilage, so that the middle portion of each centrum is hidden. From the 175th vertebra to the end of the series there are no longer distinct neural and hæmal arches, but simply an irregular vertical plate of cartilage, in which the last eight (?) vertebral bodies are imbedded. An examination of this region in the fœtal specimen (E) shows (Plate VIII. fig. 28) that these are all perfectly formed centra except the last, which is a somewhat irregular mass of bone, and appears to me to be a *demi-vertebra*[2], *i. e.* to represent the anterior half of a centrum formed in the posterior moiety of the last mesoblastic somite.

In the skeletons of A and B the neural and hæmal arches are entirely uncalcified; in the large specimen C there are small calcific patches on the anterior neural arches only; from about the 4th or 5th vertebra backwards the only calcifications are those of the centra.

b. *The Skull.*—The cranium is described in detail by Haswell[3], who gives figures of it from above and from the right side, which are, however, too small to show certain important details, such as the nerve-foramina. For this reason, and because of the desirability

[1] T. J. Parker, "On the Skeleton of *Regalecus argenteus*," Trans. Zool. Soc. vol. xii. p. 24, note.

[2] *Cf.* "Skeleton of *Regalecus*," p. 22.

[3] *Op. cit.*, Journ. Linn. Soc. N. S. W. vol. ix. p. 15.

of comparing the skull with that of the closely allied Porbeagle (*Lamna cornubica*), I give upper, under, and side views of the cranium of both Sharks, drawn to the same absolute length; in the side views the jaws also are shown (Plates IV. and V.).

Haswell says, "On comparing the skull of *Carcharodon* with a dried skull of *Lamna cornubica*, I can find little difference between the two." As a matter of fact the differences between the two crania are by no means inconsiderable, as Haswell would no doubt have found if his skull of *Lamna* had not been distorted by drying.

The main differences are dependent upon the much greater proportional size of the rostrum and of the orbits in *Lamna*. In *Carcharodon* the dorso-lateral arms of the rostrum (first labial cartilages, W. K. Parker[1]) are slightly curved, with a downward concavity, while the median ventral arm (prenasal cartilage) has a strong downward convexity, so that the three bars meet at a wide angle. All three bars are broad at the base, but narrow considerably in front, and are but slightly calcified, the distal portion of the entire rostrum being composed wholly of cartilage.

In *Lamna*, on the contrary, all three rostral bars have a marked sigmoid curve, and meet with one another at very acute angles. They are also much longer proportionally than in *Carcharodon*, much thicker, and are covered externally with a close mosaic of bony matter.

As already remarked, the eyes, and consequently the orbits, are proportionally much larger in *Lamna* than in *Carcharodon*; as a result of this, the orbital roofs (*sup.orb.pl*) in *Lamna* are strongly arched both antero-posteriorly and laterally, and the infraorbital plates (*inf.orb.pl*) inclined downwards at their outer ends. The whole cranium also, and especially the basal plate (*i. e.* the basis cranii proper *plus* the infraorbital plates), is much narrower than in *Carcharodon* (*cf.* figs. 3 and 4), and the parotic (*p.ot.pr*) and post-orbital (*p.orb.pr*) processes are less prominent.

In the fœtal specimen (Plate VIII. figs. 24 and 25) the rostrum is very slender, and its ventral or prenasal bar is perforated distally by a foramen. The anterior fontanelle (*font.*) is very large, and allows the cerebrum to be partly seen in a view from above. The auditory capsules are very prominent, and show clearly the elevations for the semicircular canals. The supraorbital plate is hardly developed, and the infraorbital plate is quite narrow.

To the outer surface of the auditory capsule of the fœtus, dorsad of the hyomandibular facet, a small rod of cartilage (Pl. VIII. fig. 26, *spir.cart.*) is attached by fibrous tissue. This appears to be the dorsal segment of the mandibular arch or spiracular cartilage. Unfortunately the specimen had been dissected by one of my assistants, as a help to the articulation of the adult skeleton, before I observed this cartilage, so that I was unable to make out its relations to the spiracle. No corresponding structure was found in the adult, but

[1] "On the Structure and Development of the Skull in Sharks and Rays," Trans. Zool. Soc. vol. x. (1877) p. 189. Parker and Bettany, 'Morphology of the Skull,' p. 35.

in so large a specimen a small cartilage imbedded in the immense jaw-muscles would be easily missed.

The foramina in the skull-wall have the same general disposition as in *Lamna* (*cf.* figs. 5 and 11, Plate V.), the main differences between the two being the greater proportional size of the optic foramen (*ii.*) in the latter genus, and the fact that the oculomotor foramen (*iii.*) is on the same level as the optic in *Carcharodon*, while in *Lamna* it is in the same horizontal plane as the ophthalmic peduncle (*op.ped.*). In both the carotid foramen (*cor.f.*) is a short distance caudad of the optic. Between and below the foramina for the 3rd (*iii.*) and the 5th (*v.*) nerves there is, in *Lamna*, a small aperture which does not seem to be represented in *Carcharodon*: possibly it transmits the 6th nerve. The glossopharyngeal and the vagus foramina (Plate IV. figs. 1 and 2, *ix.*, *x.*) are both large, the latter in particular being of immense size.

The jaws of *Carcharodon* (fig. 5) are chiefly remarkable for their great size, and especially for the extraordinary depth of the mandible. In *Lamna* (fig. 11) their proportional size is considerably less.

In another closely allied genus, *Alopecias*, the cranium has a more rounded form than in *Lamna*, and is similarly modified in accordance with the great size of the eyes. The rostrum is very thin and delicate, and is hardly at all calcified: its ventral or prenasal bar is perforated at its distal end by a vertical foramen. The jaws have about the same proportional size as in *Lamna*.

The gill-bearing arches of *Carcharodon* closely resemble those of *Lamna* and of *Scyllium*[1]. The hyomandibular and ceratohyal (Plate VIII. fig. 27, *c.hy*) are large and stout, and the tongue is supported by a flat basihyal (*b.hy*) having a convex anterior and an excavated posterior border. The first branchial arch consists of a flat, subtriangular pharyngohyal, a stout epibranchial, and a similar but longer ceratobranchial (*c.br.* 1) which articulates with the basihyal, there being no first hypobranchial. The next three arches have, in addition, a short rod-like hypobranchial segment (*h.br.* 2–4). Between the ventral or inner ends of the second hypobranchials (*h.br.* 2) is a small nodular basibranchial (*b.br.* 2). The second and third hypobranchials are subequal, the fourth (*h.br.* 4) is barely half the length of its predecessors. The fourth and fifth pharyngobranchials have undergone concrescence; the fifth ceratobranchial (*c.br.* 5) is, as usual, much larger than the corresponding segment in the preceding arches. The last arch has no hypobranchial, its ceratobranchial segment (*c.br.* 5) abutting against an elongated flattened plate (*b.br.* 5), rounded in front and pointed behind, and probably to be regarded as a fifth basibranchial.

To the inner face of the fifth ceratobranchial, near its dorsal end, a small irregular rod of cartilage is attached by fibrous tissue. Can this be the rudiment of a sixth branchial arch?

The gill-arches are but slightly calcified, even the hyomandibular and ceratohyal having only a thin crust of bony matter which does not extend to their extremities.

[1] W. K. Parker, *op. cit.*; Gegenbaur, 'Kopfskelet der Selachier,' Leipzig, 1872.

c. *The Skeleton of the Fins.*—In the shoulder-girdle I have nothing to add to Haswell's description. The pectoral fin of specimen A exhibits a concrescence of the proximal ends of the mesopterygial rays not shown in Haswell's figure. The intercalary pieces between the distal ends of many of the rays, referred to by Haswell, are evidently due to longitudinal division of the rays, one of which, in the specimen referred to, was distinctly bifurcated.

The pelvic girdle and fin are not figured by Haswell: I therefore give a figure of those of the male specimen A (Plate V. fig. 9). Haswell states that the outer extremity of the pelvic cartilage (*pu*) "is produced into a process with which no fewer than six rays articulate." In my specimen this process is apparently represented by a separate cartilage (*a*), which seems to be formed by the concrescence of the anterior rays, and to be serially homologous with the propterygium of the pectoral fin.

The first dorsal fin differs only in detail from that described and figured by Haswell, who says of the second dorsal and ventral (so-called anal) fins, that they "are very small, and consist of a few irregular rays without basal plates." I find, on the contrary, that both these fins (Plate V. fig. 10, and Plate VI. fig. 15) and especially the ventral (fig. 10) are quite typical examples of the concrescence of pterygiophores (radial cartilages) to form a basipterygium.

4. *Alimentary Organs.*

The stomach (specimen C) consists of a wide cardiac (Plate VI. fig. 16, *card.st.*) and a narrow tubular pyloric (*pyl.st.*) division. The cardiac division is about 115 cm. long and 75 cm. wide; the pyloric division 104 cm. long by 5 cm. wide. On the right side of the stomach, near its œsophageal end, are two blind pouches (*x.*).

The intestine (*int.*) is 109 cm. long from the pylorus to the origin of the rectal gland, and 26 cm. in diameter. The spiral valve is regularly disposed, makes 48 turns, and is slightly narrower than the semi-diameter of the gut, so that a narrow central passage is left, as in *Alopecias* and in some specimens of *Raia* [1].

The rectal gland (*rct.gl.*) is 30 cm. long by 3·5 cm. in diameter. The cloaca (fig. 17) is comparatively small, and is divided by a horizontal fold into two chambers, an outer (cl^2) receiving the oviducts (*ovd.ap.*), and an inner (cl^1) receiving the rectum (*rct*) and the urinary duct (*ur.ap.*).

The liver consists of two immense lobes, which fill all the ventral region of the abdominal cavity. In specimen C the gland was too much decomposed for its form and size to be made out, but in D (5 metres long) each lobe was about 135 cm. long, by 102 cm. wide, and fully 30 cm. thick. A gall-bladder is present.

The spleen and pancreas have the usual characters; the pancreas (Plate VI. fig. 16, *pan.*) consisting of a small ventral and a large

[1] T. J. Parker, "On the Intestinal Spiral Valves in the Genus *Raia*," Trans. Zool. Soc. vol. xi. p. 50.

dorsal lobe, and the spleen (*spl.*) being an elongated lobulated organ of deep red colour, attached all along the right border of the pyloric division of the stomach and continued on to the dorsal aspect of the cardiac division.

5. *The Heart.*

The heart is very large, having the following dimensions in specimen C.

	centim.
Greatest width of ventricle	19
,, length (antero-posterior)	15
,, ,, of conus arteriosus	10·5
,, width of conus arteriosus	5
,, ,, of auricle (moderately distended)	22
Width of sinu-auricular aperture	9
,, of auriculo-ventricular aperture	4·5
Thickness of wall of ventricle (about)	3·5

Its general structure is quite normal. The sinu-auricular valves are obliquely right and left; the auriculo-ventricular valves obliquely dorsal and ventral. The coronary veins open apparently by a single very large aperture situated in the sinus venosus immediately caudad and dorsad of the left flap of the sinu-auricular valve.

The conus arteriosus (Plate VI. fig. 18, *con.art.*) has three longitudinal rows, each of three valves, one row being dorsal, the others ventro-lateral. The posterior valves (v^1) are pocket-like and very thick; each is connected to the posterior face of the corresponding middle valve (v^2) by a strong *chorda tendinea*, which in the dorsal valve takes the form of a vertical membrane attached to the wall of the conus along its whole length, while in the ventro-lateral valves it is free except at the ends.

The middle valves (v^2) are very small and thick, forming knobs rather than pouches; their anterior edges are connected to the walls of the conus by several *chordæ tendineæ*. The anterior valves (v^3) are pocket-like and are in close contact with one another at their edges, whereas each of the middle and posterior valves is separated from its fellow by a considerable interval. The edges of each of the anterior valves are produced forwards, forming a firm attachment, but they have no *chordæ tendineæ*.

There are, as usual, too large coronary arteries placed right and left of the conus.

6. *The Urinogenital Organs.*

The ovary was too much decomposed in specimen C for anything to be made of it; in D it was quite small, so that the specimen must have been immature in spite of its size. The oviducts have the usual character; in D there was a considerable dilatation in the position of the oviducal gland in one oviduct, but only a very slight enlargement in the other. The oviducts open into the external compartment of the cloaca by papilliform terminations (Plate VI. fig. 17, *ovd.ap.*).

The urinary bladder (specimen C) is small and opens into the internal compartment of the cloaca by a small papilla (fig. 17, *ur.ap.*).

7. *The Brain.*

The brain could only be examined in specimen C, in which, as already mentioned, decomposition was far advanced before the fish came into my possession. As soon as the cranium could be removed, a saturated solution of corrosive sublimate was poured into the brain-cavity through the foramen magnum, so as to harden the brain *in situ*. Next day the roof of the cranium was sawn off, and the brain sketched from above (Plate VII. fig. 20); a plate of mica was then inserted beneath it, the nerves cut, and the organ transferred to strong alcohol with comparatively little shaking. By using these precautions, and thanks in great measure to the thickness of the pia mater, I was able to make a tolerably accurate examination of the brain, although all the softer abdominal viscera were hopelessly decomposed some days before the brain could be got at. The encephalon of the fœtal specimen E was also examined (Plate VIII. fig. 29).

The adult brain is about 13 cm. long from the anterior boundary of the prosencephalon (Plate VII. figs. 20–22, *prosen.*) to the posterior end of the metencephalon[1] or medulla oblongata (*meten.*); to this must be added about 12 cm., the length of the olfactory lobes (*rhinen.*), giving a total length of 25 cm. The greatest width, across the cerebrum, is about 3·5 cm. In the fœtus (fig. 29) the brain is nearly 5 cm. long by 2 cm. wide.

The main difference between the fœtal and the adult brain depends upon the elongation, in the latter, of the medulla oblongata and of the olfactory lobes. As will be seen by comparison of figs. 20 and 29, fully one half of the medio-dorsal region of the metencephalon is covered by the cerebellum in the fœtus, hardly more than one sixth of it in the adult. Again, in the fœtus, the olfactory bulbs are almost sessile upon the prosencephala, their crura being very short; in the adult, on the other hand, the rhinencephalic crura are of great length.

In a female specimen of *Lamna cornubica*, 135 cm. ($4\frac{1}{2}$ ft.) long, I find that the brain resembles that of the fœtal rather than that of the adult *Carcharodon*; the olfactory crura are comparatively short, not longer than the prosencephala, and fully one half of the metencephalon is covered by the cerebellum. In the fresh brain the optic lobes were so completely covered by the cerebellum as not to be visible in a view from above, but after hardening in corrosive sublimate the epencephalon had undergone a slight shrinking, allowing the lateral regions of the lobes to be seen. The vertical height of the entire brain is great in proportion to its width; probably in the adult *Carcharodon* the decomposed brain had spread out a good deal under the action of gravity.

In the metencephalon of *Carcharodon* the restiform bodies (fig. 20,

[1] Vide T. J. Parker, "On the Nomenclature of the Brain and its Cavities." 'Nature,' vol. xxxv. 1886, p. 208.

rest.) are large and folded. The metacœle or fourth ventricle (*mt. cœ.*) is covered by a thick tela vasculosa (*tel.vasc.*) and its floor is marked by five well-marked grooves.

The epencephalon or cerebellum (*epen.*) is large, divided into lobes by transverse sulci, and prolonged forwards so as to cover all the median portion of the mesencephalon as well as backwards over the anterior sixth of the metencephalon. It contains a large epicœle (cerebellar ventricle), which communicates by a comparatively small aperture or ostium with the metacœle.

The mesencephalon presents dorsally a pair of large optic lobes, or optencephala (*opten.*), and contains a spacious mesocœle (fig. 21, (*mes.cœ.*), on the middle of the floor of which is a small aperture (x) leading into the diacœle or third ventricle (*di.cœ.*). This apparently unusual arrangement no doubt indicates that the optic lobes have overlapped the posterior portion of the diencephalon.

The diencephalon (*dien.*) is short; its cavity, the diacœle (*di.cœ.*), is arched over posteriorly by a narrow bridge of nervous matter, but for the most part is covered in only by the thick vascular velum interpositum (*vel.int.*). On its floor is a longitudinal groove (y) leading both into the mesocœle and into the infundibulum, which is short and bears a large trilobed hypophysis or pituitary body (*hyp.*). No hæmatosac (saccus vasculosus) was apparent, and the conarium or pineal body was not observed. On the ventral surface of the diencephalon are small rounded lobi inferiores (*lob.inf.*).

In the fœtal brain, as well as in that of *Lamna*, the diencephalon is quite concealed in a view from above, the anterior faces of the optic lobes being quite vertical and in close contact with the posterior face of the cerebrum (fig. 29).

The cerebrum is a large, transversely elongated mass, consisting of the fused prosencephala or cerebral hemispheres (*prosen.*), the line of junction between which is marked both above and below by a distinct groove. Each prosencephalon is also divisible into a large dorso-lateral and a smaller ovoidal ventral lobe (fig. 22).

The cerebrum contains well-developed lateral ventricles or prosocœles (fig. 21, *prs.cœ.*), communicating each by a foramen of Monro (*for.M.*) with a small triangular space, the aula, lying immediately cephalad of the diacœle proper, and consisting of the cavity of the basi-cerebrum or unpaired portion of the protencephalon (embryonic fore-brain) left by the budding-off of the cerebral hemispheres.

A choroid plexus (*ch.plx.*) is continued into each prosocœle from the velum interpositum. On the inner wall of the cavity is a large ovoidal elevation (a), and a smaller one (b) occurs on its floor.

The rhinencephalon consists, as already stated, of a greatly elongated crus, and of a bulb in apposition with the olfactory sac. A cavity, the rhinocœle (*rh.cœ.*) is continued into the crus from the corresponding lateral ventricle.

The first four cerebral nerves present no special features of importance. The fifth, seventh, and eighth arise, as usual, close together, having between them four principal roots.

The trigeminal (figs. 20, 22, and 23, v) arises by two roots—an anterior and ventral (fig. 23, v^a), formed of two distinct strands, and a posterior and dorsal[2] (v^b), which arises mainly from the dorsal aspect of the metencephalon (fig. 20), immediately caudad of the corpus restiforme, but also receives a small bundle of fibres arising from the lateral region of the metencephalon, in common with the root of the eighth (*viii.*). The facial (*vii.*) has one main root formed of two strands, the ventralmost of which is intimately united with the single root of the auditory nerve (*viii.*).

Both dorsal and ventral roots of the fifth divide before leaving the skull, so that the nerve passes through the trigeminal foramen in four parts (fig. 20), each of which perforates separately the membrane of the foramen.

The sixth nerve (*vi.*) arises by three distinct roots, the posterior of which is very slender and soon unites with the middle root.

The vagus (*x.*) is an immense nerve arising by six lateral roots, of which the first four and the last two unite to form separate bundles, which leave the cranial cavity before joining into a common trunk. On the right side (fig. 20) the posterior root is double, and its hindmost factor arises at least 1 centim. caudad of the calamus scriptorius.

A short distance cephalad of the origin of the posterior root of the vagus there arises from the ventral aspect of the metencephalon a distinct though small root (x^1), formed by the union of several strands. This evidently corresponds with the nerve thus described by Balfour [3]:—"The main stem of the vagus at a short distance from its central end receives a nerve which springs from the ventral side of the medulla, on about a level with the most posterior of the true roots of the vagus. This small nerve corresponds with the ventral or anterior roots of the vagus described by Gegenbaur, Jackson, and Clarke (though in the species investigated by the latter authors these roots did not join the vagus, but the anterior spinal nerves). Similar roots are also mentioned by Stannius, who found two of them in the Elasmobranchs dissected by him; it is possible that a second may have been present in *Scyllium*, but have been overlooked by me, or perhaps may have been exceptionally absent in the example dissected."

As the nerve-roots in *Carcharodon* were made out while the tough pia mater was quite intact, I feel satisfied that no other ventral root of the vagus was present in my specimen. From the direction taken by the nerve it appears to join the vagus, not the spinal nerves; but it was unfortunately severed, as shown in fig. 22, when the brain was removed.

DESCRIPTION OF THE PLATES.

PLATE IV.

Fig. 1. Cranium of *Carcharodon rondeletii*, dorsal aspect, $\times \frac{1}{4}$.
2. Cranium of *Lamna cornubica*, dorsal aspect, $\times \frac{2}{5}$.

---

[2] This root properly belongs to the seventh, as shown by Balfour and Marshall.
[3] 'Elasmobranch Fishes,' p. 196 (Works, Memorial Edition, vol. i. p. 419).

Fig. 3. Cranium of *Carcharodon rondeletii*, ventral aspect, $\times\frac{1}{4}$.
4. Cranium of *Lamna cornubica*, ventral aspect, $\times\frac{2}{5}$.

References to Figs. 1–4.—*aq. fall*, aqueductus Fallopii; *font*, fontanelle; *inf.orb.pl*, infraorbital plate; *olf*, olfactory capsule; *p.orb.pr*, postorbital process; *p.ot.pr*, parotic process; *rost*^{d}, dorsal bar of rostrum; *rost*^{v}, ventral par of rostrum; *vert.cent.* 1, first vertebral body; *ix.*, glossopharyngeal foramen; *x*, vagus foramen.

Plate V.

Fig. 5. Cranium of *Carcharodon rondeletii* from the left side, with the upper and lower jaws, $\times\frac{1}{4}$. *car.f*, carotid foramen; *h.m*, facet for hyomandibular; *inf.orb.pl*, infraorbital plate; *olf*, olfactory capsule; *op.ped*, facet for ophthalmic peduncle; *p.orb.pr*, postorbital process; *rost*^{d}, dorsal, and *rost*^{v}, ventral bar of rostrum; *sup.orb.pl*, supraorbital plate; *ii.* optic foramen; *iii.* oculomotor foramen; *iv.* foramen for fourth nerve; *v.* trigeminal foramen; *vii.* facial foramen.

6. Anterior extremity of vertebral column of the same showing its junction with the cranium, $\times\frac{1}{4}$. *i*, intercalary cartilage; *n.a*, neural arch; *vert.cent.* 3, third vertebral body; *x*, vagus foramen.
7. Part of the neural tube of the same, from the dorsal aspect, $\times\frac{1}{4}$. *I*, intercalaria; *n. a*, neural arches.
8. Part of one of the hæmal ridges of the same, from the ventral aspect, $\times\frac{1}{4}$. *Hæ*, hæmapophyses; *i*, intercalaria; *r*, rib.
9. Hip-girdle and left pelvic fin of the same, $\times\frac{1}{4}$. *a*, propterygial cartilage; *bs.ptg*, basipterygium; *clp*, cartilage of clasper; *pu*, pubic bar.
10. Ventral (so-called anal) fin of the same, $\times\frac{1}{2}$.
11. Cranium of *Lamna cornubica* from the left side, with the upper and lower jaws, $\times\frac{2}{5}$. The reference letters have the same significance as in fig. 5.

Plate VI.

Carcharodon rondeletii.

Fig. 12. Posterior extremity of vertebral column, $\times\frac{1}{4}$. *Hæ*, hæmapophysis; *hæ.sp*, hæmal spine; *ptg*, pterygiophore or radial cartilage; *vert. cent.* 107, 130, & 167, the 107th, 130th, and 167th vertebral bodies.

13. Vertical section of a trunk vertebra, $\times\frac{1}{2}$.
14. Vertical section of a caudal vertebra, $\times\frac{1}{2}$.
15. The second dorsal fin, $\times\frac{2}{5}$.
16. The stomach and intestine, with the spleen and pancreas, from the ventral aspect, $\times\frac{1}{20}$. *b.d*, bile-duct; *card. st*, cardiac portion of stomach; *int*, intestine; *pan*, pancreas; *pyl.st*, pyloric portion of stomach; *rct*, rectum; *rct.gl*, rectal gland; *spl*, spleen; *x*, sac-like dilatations of stomach.
17. The cloaca with the rectal gland, urinary bladder, and extremities of the rectum and left oviduct, $\times\frac{1}{10}$. *cl*^{1}, inner, and *cl*^{2}, outer compartment of cloaca; *l.ovd*, left oviduct; *ovd.ap*, aperture of oviduct; *rct*, rectum; *rct.gl*, rectal gland; *ur.ap*, urinary aperture; *ur.bl*, urinary bladder.
18. The heart from the ventral aspect, the conus arteriosus being opened by a longitudinal incision, $\times\frac{1}{4}$. *aur*, auricle; *con.art*, conus arteriosus; *vent*, ventricle; v^1, v^2, v^3, the three rows of aortic valves.

Plate VII.

Carcharodon rondeletii.

Fig. 19. Transverse section of the caudal region, $\times\frac{1}{10}$.

20. The brain from the dorsal aspect, the tela vasculosa being removed on the left side, nat. size.
21. Anterior part of the brain with the cavities laid open from above, nat. size; a bristle (*x*, *y*) is passed from the mesocœle into the diacœle.

Fig. 22. The brain from the ventral aspect, nat. size.
23. The roots of the 5th, 7th, and 8th nerves, from the left side, nat. size.

References to Figs. 20–23.—*a*, elevation on inner wall of prosocœle; *aula*, remains of the cavity of the unpaired cerebral vesicle; *b*, elevation on floor of prosocœle; *b.opt*, basi-opticus (=ventral portion of mesencephalon); *ch.plx*, choroid plexus; *dien*, diencephalon (=thalamencephalon); *di.cœ*, diacœle (=third ventricle); *epen*, epencephalon (cerebellum); *for.M*, foramen of Monro; *hyp*, hypophysis cerebri; *mes.cœ*, mesocœle; *meten*, metencephalon (=medulla oblongata); *mt.cœ*, metacœle (=fourth ventricle); *opten*, optencephala (=optic lobes); *prosen*, prosencephala (=cerebral hemispheres), united into a single cerebrum; *prs.cœ*, prosocœle (=lateral ventricle); *rhinen*, rhinencephalon; *rh.cœ*, rhinocœle; *tel.vasc*, tela vasculosa; *vel.int*, velum interpositum; *i.–x.*, cerebral nerves.

Plate VIII.

Carcharodon rondeletii (fœtus).

Fig. 24. The cranium from the dorsal aspect, nat. size.
25. The cranium from the ventral aspect, nat. size. *font*, fontanelle; *a.s.c*, *p.s.c*, *h.s.c*, elevations of the anterior, posterior, and horizontal semicircular canals; *h.m*, facet for the hyomandibular.
26. Outer view of the right auditory capsule, nat. size. *h.m*, facet for the hyomandibular; *h.s.c*, elevation for the horizontal semicircular canal; *spir.cart*, spiracular cartilage.
27. The ventral region of the branchial skeleton, nat. size. *b.hy*, basihyal plate; *b.br.* 2, *b.br.* 5, basibranchial of the 2nd and 5th arches; *h.br.* 2, *h.br.* 4, hypobranchials; *c.hy*, ceratohyal; *c.br.* 1, *c.br.* 2, *c.br.* 5, ceratobranchials.
28. Posterior extremity of the vertebral column showing the last three true centra and the terminal demi-vertebra, ×5.
29. The brain from the dorsal aspect, nat. size.

3. On the Habits of the Tree Trapdoor Spider of Graham's Town[1]. By the Rev. Nendick Abraham.

[Received November 15, 1886.]

Among the very numerous species of Arachnida which are found through the Cape Colony there are several kinds of Trapdoor Spiders. There is a species which, for convenience, I have called the Tree Trapdoor Spider, about which I wish to give some notes. I have been unable to find any mention of this particular Spider in any of my books, or in any I have access to, and it has been until now unknown to our local or colonial naturalists, so far as I have been able to learn. Thinking it may be known to this Society, I have not presumed to name it; but having very carefully observed for many months this wonderful creature, I send you these notes.

Unlike other Trapdoor Spiders, these build their houses in trees. There are certain trees which are more favourable for building-purposes than others, though the trees chosen are various, but in each case the trees have a rough bark. The house is a very wonderful structure, though small, measuring not more than one and a half

[1] Communicated by Dr. A. Günther, F.R.S., V.P.Z.S., who stated that the Spider in question appeared to be *Moggridgia dyeri* (O. P. Cambridge, Ann. & Mag. Nat. Hist. (4) xvi. p. 319, pl. x. 1875).

inches in depth. The house is not a burrow, though the spider often takes advantage of holes and deep crevices; but usually it is constructed on the surface of the bark, especially if there are lumps or prominences near the chosen spot. The spider commences to build by weaving together pieces of bark and other substances found in the immediate neighbourhood of the proposed house. This part of the work is so skilfully carried out that, when complete, it is almost impossible to detect any difference between the house and the surrounding bark. I have often placed a piece of bark in the hand of a friend and asked that the house might be pointed out to me, and this often proves a very difficult task. I know of nothing in Nature to surpass this wonderful structure, so far as it is an imitation. I have had several of these spiders under observation for many months, both in their natural haunts and in captivity. Being anxious to know how the doors of their homes are constructed, their doors being the most wonderful part of the structure, I procured a piece of old stump from a tree and drilled several holes into it through the different kinds of surfaces presented on the bark. Into each of these holes I introduced a spider; they remainded quite quiet and almost motionless during the day at the end of the hole, but on visiting the stump the next morning, I could not find the holes until I had made a careful search. I then found that a beautiful door had been constructed over each opening, and that each door had been made to correspond with the immediately surrounding surface. One hole had been drilled through a growth of lichen; the door in this instance was made to correspond so perfectly that the lichen looked undisturbed, and only after careful inspection could the outline of the door be detected. In another instance some little pieces of wood, left by the drill on the border of the hole, were woven into the door. At first the covering to the opening is very thin, like paper, its thickness being increased by numerous layers of silk being added to the inside surface of the door. In this way the sides of the house are strengthened, the whole being very strong when completed. In a few trees where circumstances are favourable a number of these wonderful houses are to be found, but only by an experienced eye. In exploring an old tree some months ago, I found, high up in the tree, the remains of a large broken branch. This branch had been split down, and then torn or cut away, leaving a trunk attached to the tree, showing a transverse and a longitudinal section; this latter surface of the trunk had been softened by rain and atmosphere, and formed a splendid field for these spiders to build upon. On a surface measuring 18 inches by 9 I counted 20 houses, not all tenanted, some of the spiders having died or met with violent deaths at the hands of their enemies. I secured this trunk, and now have it in my possession. It is an interesting fact that this tree and nearly all the trees on which I have found the spiders grow in the High Street of Graham's Town, these trees being oaks and "Kaffer-booms." The spiders for years past have been able to look out of their little doors upon the busy world, and no one knew they were there, until an old friend of mine, who spends much time in smoking under one of these trees, saw an open trap, and drew my attention to it, and then they could be secreted no longer, for I searched every likely tree and made them my special care and study for some time.

I have in my possession two or three houses in which the doors have undergone modifications to meet the size of the spiders now residing in them. A small individual will sometimes take possession of the empty house of an adult; the new comer finds the door too large, so constructs another in such a way as to form a smaller opening; thus some houses have two doors: I send you a specimen.

On attempting to lift the doors of these houses, the spiders hold them down with great firmness. Knowing that naturalists are uncertain as to the means used by the ordinary Trapdoor Spiders for holding down the traps, I have taken special care to observe the mode adopted by those which inhabit the trees, and I find that the hooks of the mandibles, which are barbed, grasp the door, and the legs the side of the house. I am quite sure that this is the case, for I have observed carefully, and in one instance, when the spider held on tenaciously, I was enabled to fix open the door and observe with a lens, and then to lift out the "fangs," which were buried deep in the silken door. I have often found the doors fastened down and not held. They are fastened by strong weavings of silk, which must be broken before the door can be lifted; in all such cases the spiders do not appear to be active or to assist in keeping down the trap. Perhaps at such times the spider is engaged in changing its skin, and, in cold weather, hybernating.

Being anxious to see the spider capture its prey, I put a few grains of sugar near one of the doors. Two flies lighted on the sugar, and while they were regaling, the trap was thrown open with a slight click, the spider darted out, caught one of the flies and retired; the whole transaction was done with such rapidity and dexterity that the other fly, though nearly touching the captured one, was undisturbed and seemed to be quite unconscious of the fate of its companion. I have observed one other capture, and this also was carried out with the same extreme rapidity. The spiders are probably nocturnal in their habits, though I have never seen them out at night, but I know that the work of building goes on during the night. The captures I observed were during the day. It may be that they work at night to save themselves from detection from some of their enemies, and watch for prey both day and night.

The eggs are placed in a small silken bag at the bottom of the nest. When the eggs are hatched, the young live for several months a free life in the home of the parent, and are thus protected from the ants which infest the trees, until they are strong enough to build for themselves; this they do while they are yet very small, but not until they are several months old. The greatest enemies these spiders have are the ants; but the houses are so strong and so much like the natural bark that even the ants would not work them much damage if they did not catch them, or enter the house accidentally. On old trees I have found nearly all the houses without spiders, but many tenanted by other insects in various stages of transformation. Like other spiders, when one meets another there is a fight, which often ends in the death of both.

The spider itself is a very interesting creature. It is about five-twelfths of an inch in length; its legs are short, strong, and flattish. The head carries eight simple eyes; the maxillary palpi of the female are leg-like and hooked. There are four stigmata. The colour is nearly black. The abdomen is not large in proportion to the rest of the body, and bears at its extremity four spinnerets, two large and two small.

I send with this paper specimens of the houses and also of the spider. In all cases the houses do not look so well, neither are they so perfect as when fresh cut from the trees; this is partly owing to the shrinking and twisting of the bark in drying. If I can give any other information respecting this spider, or if it would be acceptable to you for me to send other accounts of personal observation, I shall be pleased to do what I can, according to the limited time I have for this, my favourite pleasure.

4. Notes on the Visceral Anatomy of certain Auks. By R. W. Shufeldt, C.M.Z.S. &c.

[Received November 12, 1886.]

About two years ago the Smithsonian Institution of Washington placed in my hands for anatomical description a fine collection of bird-skeletons, amounting to nearly a hundred in number, that had been collected by American explorers at different times and at several localities in the Arctic regions. My researches upon this material will quite fill a volume, and are illustrated by several hundred original drawings, the whole being in charge of the Smithsonian Institution for publication. When I received this collection it was accompanied by a few selected alcoholic specimens of Albatrosses and Auks, sent to me with them in order that I might obtain skeletons that were not to be found among the rest of the material, my work having chiefly to do with the osteology of the groups represented. Among the spirit-specimens of the Auks I found one of each of the two interesting forms known to us as *Brachyrhamphus marmoratus* and *Synthliborhamphus antiquus*, or the Marbled Murrelet and Ancient Murrelet respectively. These birds rarely fall into the hands of anatomists in such good condition as these were; and although I only needed their skeletons for the purpose I had in view at the time, I nevertheless took the pains to carefully remove certain parts of their visceral anatomy, and again placing these parts back in the alcohol, I have them now before me for examination.

My surprise was very great to find in these two forms, supposed to be very closely related generically, how very different the corresponding structures and organs occupying the chest and abdomen really were. Some of these differences will be readily appreciated by simply glancing at the drawings made of them, and which illustrate this paper.

When Forbes was with us and produced his admirable work upon the anatomy of the Tubinares which were collected during the voyage of H.M.S. "Challenger"[1], he found a great deal that was not only unique in the structure of Petrels, but in forms more or less nearly related to them. And I am of the opinion that when we come to examine carefully into the morphology of Arctic water-fowl, and more especially into that of their "soft parts," we shall discover much of interest, to say nothing of its importance as throwing light upon the organization of the types in question, as bearing upon the anatomy of the earlier forms of birds; for it is among these groups, as we know, that we find many of the more lowly members of the class in point of structure and organization.

This fact was never more forcibly brought to my mind than after reading Forbes's investigations and observing the points I am now about to describe.

In *S. antiquus* (fig. 1, p. 45) I find the lower larynx rather broad, and somewhat compressed from before backwards. The semirings of the bronchial tubes seem to be only partly formed in bone, while the last tracheal ring and the pessulus are completely ossified, the latter bar being V-shaped on the vertical section, with the apex above. What appears to me as most remarkable about this larynx is the mass of fat that overlies it in front, and extends on to its posterior aspect, where it becomes thinner. This fat completely covers the tracheo-laterales muscles, which are inserted on either side into the middle points of the last tracheal ring. The sterno-tracheales are very large and lie embedded in this mass of fat. These are the only tracheal muscles present.

Referring to *B. marmoratus*, fig. 2, we find the structure of the parts to be quite different. In the specimen before me, at least, there is an entire absence of fat from this part of the lower larynx. The anterior extremities of the lower tracheal ring, which is here, too, thoroughly ossified, do not meet so completely as they do in *S. antiquus*, or perhaps, more correctly speaking, this ring is roundly notched in front. *B. marmoratus* has a pessulus of a form corresponding very closely to the one described above for *S. antiquus*, but the tracheal tube above it is rather more cylindrical, and not so much compressed from before backwards. The lateral tracheal muscles seem to agree quite closely in these two Auks, both as regards their size and points of insertion into the mid-lateral parts of the last tracheal ring, where they dilate slightly as they become inserted. Some considerable difference, however, is to be noted in the sterno-tracheal muscles of *B. marmoratus*, as will be seen in the figure; they are given off much higher up on the trachea in this Auk, and are far slenderer than they are in *S. antiquus*.

Unfortunately I neglected to examine the condition of the carotids in these two Auks before removing the viscera, as I was intent upon not injuring their very brittle skeletons, which had become much softened by soaking so long in the partially dissolved fat that encased

[1] W. A. Forbes, Zool. Chall. Exp. vol. iv. pt. xi. p. 1.

the bodies of both of them. I will at once observe, however, that the form of the heart is quite different in these two birds, being not only smaller in *S. antiquus* than it is in the Marbled Auk or Murrelet, but apparently longer, and decidedly more pointed in the former than it is in the latter, wherein it is a thicker organ with a bluntly rounded apex (fig. 2).

Fig. 1.

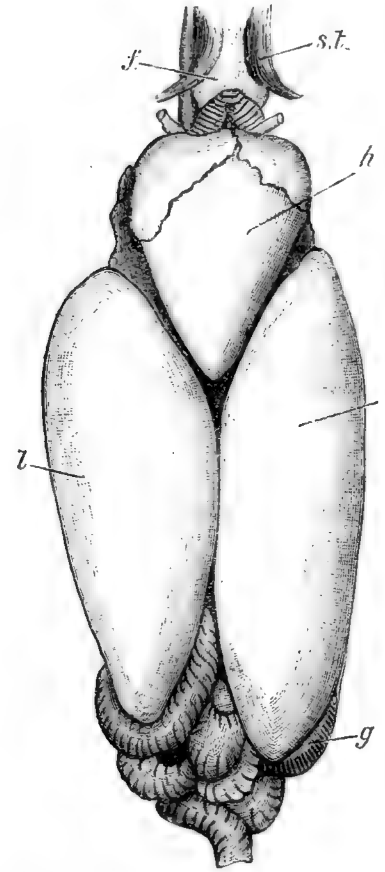


Fig. 2.

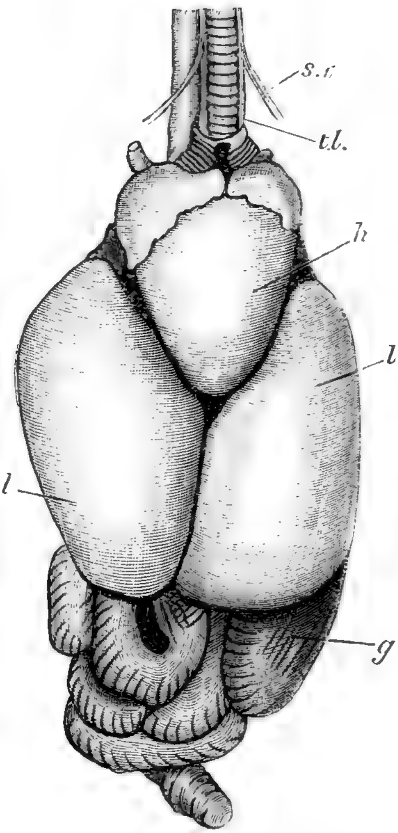


Fig. 1. Anterior aspect of the lower larynx, heart, and viscera of *Synthliborhamphus antiquus*. *f*, fat overlying in front of the lower larynx; *s.t*, sterno-trachealis muscle of the left side; *h*, heart; *l*, right lobe of liver; *l'*, left lobe of liver; *g*, gizzard.

Fig. 2. Same parts and aspect of the corresponding organs in *Brachyrhamphus marmoratus*; lettering the same as in fig. 1, with *t.l*, the left tracheolateralis muscle.

The figures are drawn life-size by the author, and are from the specimens of the Murrelets lent by the Smithsonian Institution.

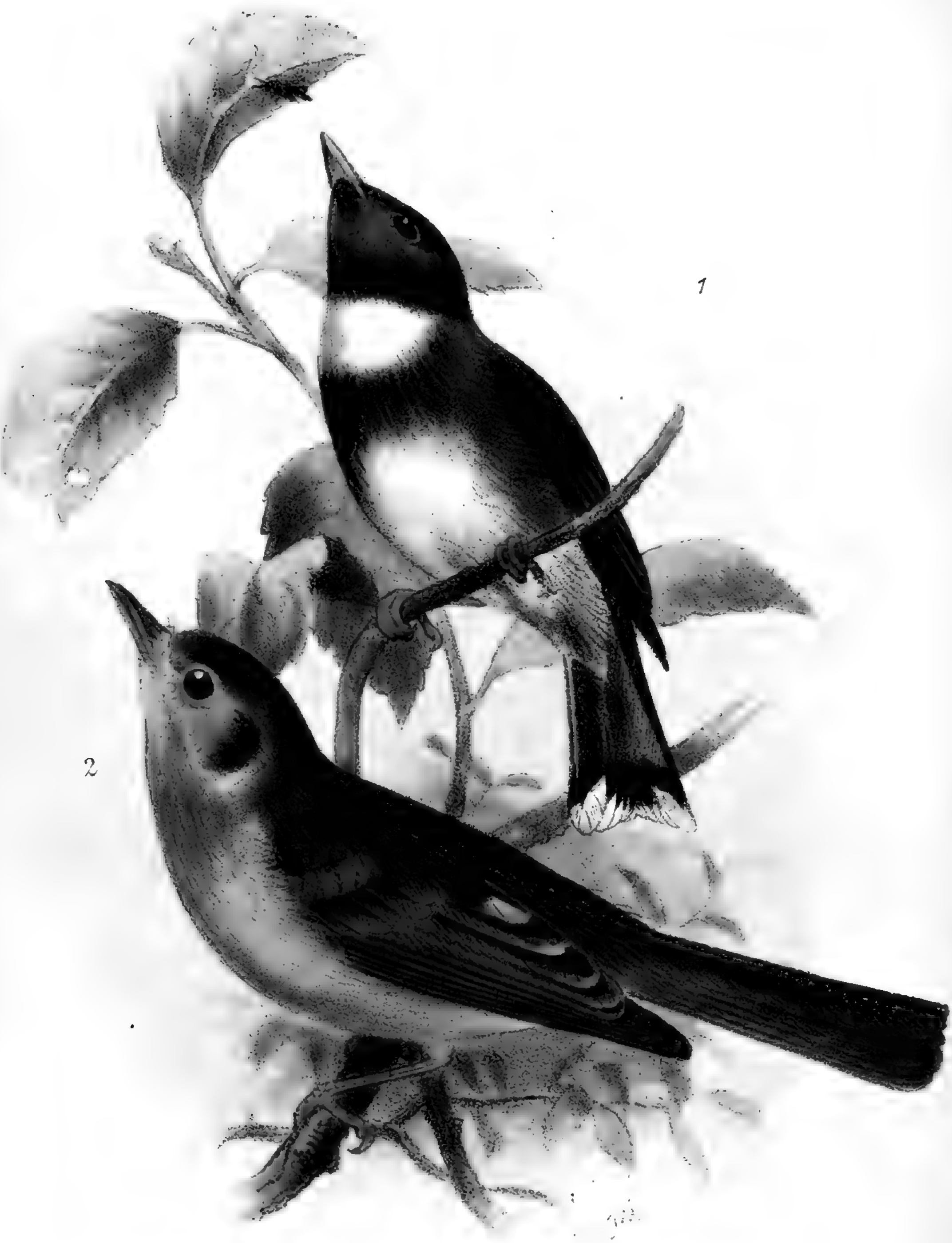
Extraordinary differences are to be observed in the livers of these two Murrelets, both as regards form and size. In each the left lobe is rather the larger, and descends somewhat further into the abdomen. But in *S. antiquus* the hepatic lobes are considerably longer and narrower than they are in *B. marmoratus*, and with more pointed extremities. In *S. antiquus*, too, the connecting band of hepatic tissue, joining the two lobes at the back and above, is far more extensive than it is in *B. marmoratus*; I fail to find any trace of a third lobe in either of these Auks.

Both of these Murrelets possess a large pear-shaped gall-bladder, lying, in either case, beneath the inferior edge of the right lobe of the liver. Likewise in each is the spleen well developed; but this organ in *S. antiquus* is long and subcylindrical in form, while in *B. marmoratus* it is shorter, thicker, and of a decidedly pyriform outline.

Macgillivray gives us a very good description, illustrated by three figures, of the proventriculus and gizzard of the Little Auk (*Mergulus alle*), which appears in the eighth volume of Audubon's 'Birds of America,' the royal quarto set. In the birds before me I fail to find the band of "glandules," arranged as a belt at the extremity of the proventriculus, at the entrance of the stomach. Nor is the œsophagus so thin as Macgillivray found it to be in *M. alle*: in other particulars, however, these Auks seem to be quite similar to it; for I find the inner coat of the elongated proventriculus and the lower part of the œsophagus thrown into strong longitudinal rugæ or folds, among which the surface is thickly studded with minute openings, which I take to be the mouths of the glandules. These rugæ are continuous with similar, longitudinal elevations in the gizzard; but in this latter cavity they are covered by a closely fitting corneous structure that readily peals off in the alcoholic specimens, leaving the rugæ in a condition precisely as we find them in the proventriculus and œsophagus. The gizzard and proventriculus are continuous and but faintly marked externally by a constriction which shows the ending of the latter and commencement of the former, while internally, as I say, the definition is made quite sharp by the corneous layer of the gizzard. The disposition of the muscles of this latter organ are somewhat differently arranged from what Macgillivray gives us in his figure of *M. alle*. The tendon from which the fibres radiated in the Murrelets above described is situated quite laterally, and nearly opposite the pyloric exit of the pouch; while in Macgillivray's drawing of the Little Guillemot, already referred to, this gastric tendon is centrally located as we see it in Pigeons and other birds. Both of my specimens had entirely empty gizzards, the cavities not even containing a few grains of coarse gravel, which is not an uncommon thing, I believe, in certain Auks.

The intestines of these Murrelets present us with nothing worthy of special remark, and I find a well-developed and large pancreas present in each. According to Macgillivray, in *M. alle* the rectal extremity of the intestinal tube becomes much enlarged and quite globular, while a short distance above it we find a pair of cæca of no great size. Unfortunately an accident happened to these parts in both of my specimens; but I presume much the same arrangement would obtain, as, so far as I know, all Auks are thus constructed in regard to this part of their economy.

If hereafter the differences I have pointed out are found to be



J. Smit lith. Hanhart imp.

1. EUSCARTHMUS APICALIS.
2. LEPTOPOGON OUSTALETI.

constant for the lower larynx, the heart, the spleen, and especially the livers of these two forms, they certainly constitute very excellent generic characters, especially when taken in connection with the additional ones found to exist in the skeletons. These latter I have elsewhere dealt with, but the work at present is in the hands of the Smithsonian Institution for publication.

When good opportunities occur in the future to examine the visceral organization of any of the Auks, I trust my fellow-labourers will avail themselves of them, and make full comparisons with the figures I have given above of *S. antiquus* and *B. marmoratus*, as well as test the correctness of my work in the present paper.

We stand sadly in need of series of alcoholic specimens of Arctic water-fowl in the vast majority of our museums.

5. Characters of new Species of Birds of the Family Tyrannidæ. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received November 30, 1886.]

(Plate IX.)

During the work which I am now engaged upon of preparing the Catalogue of the specimens of the birds of the family Tyrannidæ in the British Museum, I have met with a certain number of examples of this difficult group which are not, so far as I can make out, referable to described species. Of these, I beg leave to submit the following characters to the Society.

1. Tæniopterа holospodia, sp. nov.

Supra cinerea; fronte et superciliis curtis albescentibus; uropygio nigricante; alis caudaque nigricanti-cinereis; secundariorum externorum apicibus et rectricis utrinque extimæ pogonii externi margine externo albicantibus: subtus pallide cinerea, in ventre et crisso in albidum transiens; subalaribus albicanti-cinereis; rostro et pedibus nigris: long. tota 8·3, *alæ* 6·0, *caudæ* 3·7, *tarsi* 1·7.

Hab. Bolivia (*Bridges*).

Mus. Brit.

This species, established on two skins, obtained by T. Bridges in Bolivia, in the National Collection, is distinguished from the other *Tænioptera* by its uniform style of coloration, large size, and long wings. The specimens are both in moult.

2. Euscarthmus apicalis, sp. nov. (Plate IX. fig. 1.)

Supra olivaceus; pileo toto cum capitis lateribus dilute brunneis; loris macula albescente notatis; alis nigris, harum tectricibus dorso concoloribus, primariis et secundariis internis fulvescente, secundariis dorso proximis albo latius limbatis; cauda cinereo-nigricante olivaceo limbata, rectricibus omnibus vitta sub-apicali nigra, deinde fascia apicali alba præditis: subtus cinereus; gula brunnea, pileo concolore; plaga cervicali magna *antica alba, ventre medio albicante; lateribus olivaceis; tectricibus subalaribus albis, campterio flavicante; rostro brunneo, infra dilutiore; pedibus pallidis: long. tota* 3·8, *alæ* 1·8, *caudæ* 1·6.

Hab. Brazil.

Mus. Parisiensi.

A single skin of this well-marked species was presented to the Muséum d'Histoire Naturelle by M. Peichoto in 1854. It belongs to the group of *E. granadensis*, and has a similar large cervical spot, but is readily distinguishable from all its allies by its pale brownish head and the white tips to the tail-feathers.

I am much indebted to M. A. Milne-Edwards and the authorities of the Muséum d'Histoire Naturelle of Paris for allowing me to bring to England for comparison and identification some of the more difficult and obscure examples of the Tyrannidæ in that collection.

3. Pogonotriccus gualaquizæ, sp. nov.

"*Pogonotriccus gualaquizæ*, Scl. MS.," Tacz. et Berl. P. Z. S. 1885, p. 89.

Similis P. ophthalmico, *sed pileo obscure olivaceo, tectricibus auricularibus non nigro notatis, et colore subtus dilutiore diversus: long. tota* 4·0, *alæ* 1·9, *caudæ* 1·7. Fem. *mari similis.*

Hab. Æquatoria occ.

Mus. P. L. S.

The two examples of this species have long remained in my collection with the MS. name by which I now characterize them. They were obtained by Fraser at Gualaquiza, Ecuador, in January 1858, and are marked as male and female. Mr. Stolzmann procured a single example of the same bird at Mapoto, in the province of Ambato.

4. Leptopogon godmani.

Supra olivaceo-viridis, pileo obscure cinereo; loris, superciliis et capitis lateribus albicante mixtis; tectricibus auricularibus flavis macula terminali nigra præditis; alis nigricantibus flavicante bifasciatis, et hoc colore in secundariis externis limbatis; ceteris remigibus olivaceo marginatis; cauda cinerascenti-brunnea olivaceo limbata; subtus sulphureo-flavus, pectore et lateribus olivaceo tinctis; tectricibus subalaribus sulphureis; rostro obscure corneo, pedibus fuscis: long. tota 4·0, *alæ* 2·3, *caudæ* 2·0.

Hab. Æquatoria orientalis.

Mus. Salvano-Godmanico.

Two skins of this species were obtained at Sarayacu, Ecuador, by Buckley. It is most like *L. superciliaris* and *L. pœcilotus*, but differs in its smaller size, yellow wing-bands, and shorter, broader bill.

5. Leptopogon oustaleti, sp. nov. (Plate IX. fig. 2.)

Supra olivaceo-viridis, pileo concolore; linea circumoculari flava; macula auriculari nigra; alis caudaque obscure brunneis olivaceo limbatis; campterio flavo: subtus pallide flavidus olivaceo adumbratus, gula et ventre medio clarioribus; tectricibus sub-

alaribus pallide sulphureis; rostro superiore corneo, inferiore albido; pedibus fuscis: long. tota 4·7, alæ 2·5, caudæ 2·5.

Hab. Colombia interior.

Obs. Species ciliis oculorum flavis et macula auriculari insignis, rostro paulum latiore quam in speciebus hujus generis typicis.

I base this well-marked species on a single skin in the Paris Museum. There is no label of locality, but the preparation shows that it is a "Bogota" skin.

6. Phyllomyias berlepschi, sp. nov.

Supra obscure cinerea, dorso olivaceo tincto; loris albicantibus; alis caudaque obscure cinereis; tectricum alarium apicibus et secundariorum marginibus externis angustis albicantibus: subtus grisescenti-albida olivaceo leviter lavata; gula et ventre medio fere albis; subalaribus albis, vix flavicante tinctis; rostro obscure fusco; pedibus nigris: long. tota 4·2, alæ 2·2, caudæ 1·8.

Hab. Brasilia meridionali-orientalis.

Mus. P. L. S.

Obs. Affinis *P. griseo-capillæ*, sed crassitie minore, et colore supra pallidiore, necnon marginibus tectricum alarium albidis diversa.

7. Elainea hypospodia, sp. nov.

Supra fusco-cinerea, cauda concolore; pilei subcristati macula basali alba; alis nigris, tectricum alarium fasciis transversis duabus et secundariorum dorso proximorum marginibus externis albis: subtus dilute cinerea, in ventre et crisso et in tectricibus subalaribus alba; rostro fusco ad basin rufescente; pedibus nigris: long. tota 5·3, alæ 2·9, caudæ 2·5.

Hab. Venezuela.

In this bird, which belongs to the group of *E. payana*, there is no trace of olive or yellow on the plumage. The single specimen, obtained by Goering near Valencia in Venezuela, has been many years in my collection under the MS. name now published.

8. Elainea flavivertex, sp. nov.

Supra olivaceo-viridis, uropygio dilutiore; pilei subcristati macula basali flammea; alis nigricantibus flavicante bifasciatis, necnon secundariis flavicante extus marginatis; cauda fusca olivaceo anguste marginata: subtus cinerea, in gula albicantior, ventre flavicante; subalaribus sulphureis; rostro et pedibus obscure corneis: long. tota 4·6, alæ 2·3, caudæ 2·1.

Hab. Amazonia superior.

Obs. Affinis *E. gaimardi*, sed corpore subtus præcipue in pectore obscuriore, et crista flammea dignoscenda.

I base this species on a skin obtained by Mr. E. Bartlett on the Upper Ucayali, which has been long in my collection. A similar specimen from the same locality is in the British Museum, and a third from Elvira (*Hauxwell*) in the collection of Messrs. Salvin and Godman.

9. MYIOBIUS SUBOCHRACEUS, sp. nov.

Supra sordide olivaceo-viridis, uropygio paulo magis ochraceo; alis nigricantibus, tectricum alarium apicibus latis et secundariorum marginibus externis pallide fulvis; cauda obscure cinerea: subtus læte ochraceus, in rostro medio magis flavescens; subalaribus pallide ochraceis; rostro obscure fusco; pedibus nigris: long. tota 4·7, alæ 2·5, caudæ 2·6.

Hab. Bolivia.

Mus. S.-G.

Obs. Affinis *M. pulchro*, sed crassitie majore et colore subtus ochraceo diversus.

The specimen described is apparently a female of a third species of the group of *M. pulcher*, distinguished by its large size and the uniform ochraceous colouring below. There is just a faint appearance of a bright colour on the crown, so that the male would probably have a concealed orange crest. The bill is rather narrower and more elongated than in *M. bellus* and *M. pulcher*.

10. EMPIDONAX RIDGWAYI, sp. nov.

Supra obscure olivaceo-viridis, loris et oculorum ambitu albescentibus; alis schistaceo-nigris, tectricum alarium apicibus et secundariorum externorum marginibus externis albescentibus, ochraceo vix tinctis; cauda schistaceo-nigra; hujus rectricis externæ pogonio externo albido; infra sordide albus, in gula media clarior; ventre inferiore et crisso flavicante tinctis; subalaribus albis; rostro superiore obscure corneo, inferiore albido; pedibus nigris: long. tota 5·0, alæ 2·7, caudæ 23.

Hab. Colombia int.

Mus. P. L. S.

Mr. Ridgway marks this bird, which has been submitted to his examination, as "probably a new species, most like *E. trailli* in coloration, but with the outer web of the exterior rectrix white, as in *E. obscurus*." I propose to adopt this suggestion, which I quite agree with, and to call the species *Empidonax ridgwayi*, after one who has done so much good work in this group of birds.

The second, third, and fourth primaries are nearly equal and longest in this species. The first is shorter than the fifth, and very slightly longer than the sixth.

February 1, 1887.

Dr. St. George Mivart, F.R.S., Vice-President, in the Chair.

Mr. F. Day, F.Z.S., exhibited a specimen of a hybrid Pilchard, and a specimen of *Salmo purpuratus* raised in this country.

A series of specimens of Lepidopterous Insects, which had been bred in the Insect-house during the past season, was laid on the table, and the following report upon the subject, drawn up by Mr. A. Thomson, was read :—

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.*
—— *ricini.*
—— *pernyi.*
Actias selene.
Antheræa mylitta.
Cricula trifenestrata.

American.

Samia cecropia.
Telea polyphemus.
—— *prometheus.*
Actias luna.
**Dirphia tarquinia.*

African.

Gynanisa maia.
Antheræa cytherea.
*—— *menippe.*
—— *tyrrhea.*
**Saturnia terpsichore.*
Attacus mythimna.
**Actias mimosæ.*
Cirina forda.

Diurnal Lepidoptera.

European.

Papilio podalirius.
—— *machaon.*
Thais polyxena.
Parnassius apollo.
Euchloë cardamines.
Vanessa antiopa.
—— *atalanta.*
Vanessa levana.
**Melitæa maturna.*
Limenitis sibylla.
Apatura iris.
**Charaxes jasius.*
Lycæna corydon.

African.

**Papilio porthaon.*
*—— *policenes.*
*—— *colonna.*
**Papilio nireus.*
*—— *demoleus.*
*—— *morania.*

American.

Papilio cresphontes.
*—— *ajax.*
Papilio asterias.
*—— *turnus.*

Nocturni.

Smerinthus ocellatus.
—— *populi.*
Sphinx ligustri.
—— *convolvuli.*
—— *pinastri.*
Arctia caja.
—— *hebe.*
Chelonia villica.
Lasiocampa quercifolia.
*—— *pini.*

* Exhibited for the first time.

Deilephila euphorbiæ.
Chærocampa porcellus.
—— *elpenor.*
—— *nerii.*
Hemaris marginalis.
Macroglossa fuciformis.
Callimorpha dominula.
Saturnia pyri.
—— *carpini.*
**Eurymene dolobraria.*
Tryphæna fimbria.
Catocala fraxini.
—— *nupta.*

Of the Silk-producing Moths and their allies, *Dirphia tarquinia* from South America, and *Actias mimosæ, Antheræa menippe, Saturnia terpsichore,* and *Attacus mythimna* from South Africa, were all exhibited for the first time. Three specimens of *D. tarquinia*, so remarkable for the difference in the size and colour of the sexes, emerged in December last; and I have the honour to exhibit a pair this evening.

The two cocoons of *Actias mimosæ*, with one cocoon of *Attacus mythimna*, and one pupa each of *A. menippe* and *S. terpsichore* were brought to England by Mrs. Monteiro from South Africa, where she had been collecting insects. The two *Actias mimosæ* emerged in due course, but I am sorry to say were cripples. I managed, however, in the setting, to get them a little into shape. From the cocoon of *Attacus mythimna* and other two pupæ, fine specimens were obtained.

During the past season I succeeded for the first time in rearing one specimen of the Great Atlas Moth (*Attacus atlas*) in the Insect-house upon ivy. It was quite by accident that I discovered that the larvæ would eat ivy; and I was much surprised, in looking over the case in which the Atlas Moths were kept, to find *one* larva feeding upon the leaves of the ivy-plant that was *growing* at the bottom. I then tried the other larvæ, which I had feeding upon *Berberis vulgaris*, with ivy-leaves, and found that they ate them freely, and seemed to prefer them to the barberry; but I regret to say that the whole of the larvæ died in the last stage, although they grew to be as large as the one reared.

The Moth that was reared emerged on the 17th October, 1886, after being in the cocoon about six weeks, and although perfect in colour, is one third less in size than those obtained from the imported cocoons.

Attacus pernyi, A. cynthia, and *Samia cecropia* pair readily in confinement; also *Sphinx ligustri, S. pinastri, Deilephila euphorbiæ,* and *Chærocampa elpenor*; and I have reared all from the ova except *D. euphorbiæ.*

Of European Diurnal Lepidoptera, *Melitæa maturna* and *Charaxes jasius* were exhibited for the first time. The larvæ (14) of *C. jasius* were deposited in the Insect-house by Mr. J. H. Leech, F.Z.S., previous to his departure for Japan. These larvæ were then feeding upon *Arbutus unedo*; but as the supply of that food failed, I tried them with *Euonymus japonicus*, and succeeded in rearing 10 insects from the 14 larvæ upon it.

Of African Diurnal Lepidoptera, all the species named were ex-

* Exhibited for the first time.

hibited for the first time; and all the pupæ, with the exception of those of *Papilio demoleus*, were brought home by Mrs. Monteiro.

Of American Diurnal Lepidoptera, *Papilio ajax* and *Papilio turnus* were exhibited for the first time.

Amongst other insects that I obtained last year were a large number of the cocoons of, I believe, *Thyridopteryx ephemeriformis*. From these cocoons many male insects emerged and copulated with the females, which do not leave the cocoon, and the result was that some hundreds of young larvæ were produced. Of these only one survives, and I exhibit it this evening, in its curious covering. It has been reared upon young oak, raised from acorns. When the male insects first emerge from the cocoon, their wings are covered with a brownish hair, which makes them quite opaque, but on the slightest movement of the wings this at once disappears. A full description, together with figures, of this insect will be found in the First Annual Report of the U.S. States Entomologist, p. 147, by Mr. Charles V. Riley. As it is placed amongst the noxious insects by that gentleman, it is perhaps as well, in this case, that I did not succeed in rearing more than one of the larvæ.

In conclusion, I take this opportunity of thanking Mr. W. H. Edwards, of Coalburg, West Virginia, through whose kind assistance and interest I have been able to obtain many species of American insects.

The following papers were read:—

1. On the Anatomy of *Hydromys chrysogaster*. By Bertram C. A. Windle, M.A., M.D. (Dubl.), Professor of Anatomy in the Queen's College, Birmingham. (Communicated by Dr. Mivart.)

[Received December 20, 1886.]

The following notes are the result of an examination of a specimen of the above-named animal, obtained shortly after its death.

External Appearance.

Measurements (in centimetres).

Length from snout to tail	66·0
„ of tail	29·0
„ of head	7·0
Distance from snout to eye	3·3
„ „ eye to ear	2·1
Length of humerus	3·6
„ forearm	4·2
„ femur, from apex of great trochanter	5·0
„ leg	6·3
„ hand, to apex of claw of medius	3·5

Length of web of hand, deepest	....	·8
,, claw of hand, longest	....	·7
,, foot	....	7·8
,, web of foot (deepest at its narrowest part)	..	1·5
,, claw of foot, longest	....	1·0

The colour of the back is black with an admixture of golden-coloured hairs; the abdomen is covered with hairs of a dark golden colour, a narrow strip of flaxen hairs running longitudinally down the body from the lower part of the neck, ceasing at the lower third of the abdomen. The tail is black, save for its last fifth, which is flaxen-coloured. The hands (*vide* fig. 3) are armed with moderately strong claws, and the digital interspaces are webbed to a small extent. The feet (*vide* fig. 4) are armed with much stronger claws, and have considerably deeper webs in the interspaces. The soles of the feet are black, the palms of the hands of a lighter colour, and the dorsal surfaces of both are clothed with short golden hairs. The scrotum is large and covered with hair; it contains the testicles, which are easily to be returned to the abdomen.

Muscular System.

Panniculus.—The dorsal portion extends over the entire back as a thin sheet. It is especially strong and well-marked (1) over the head, especially the vertex, from which it passes into the cheeks and becomes connected with the roots of the large cheek-hairs; (2) in the scapular region and over the latissimus dorsi, with which it has some connections; and (3) over the back of the thighs, where it is associated in some degree with the hamstring muscles. The ventral part is attached to the inner aspect of the deltoid ridge under the deep portion of the pectoralis, and extends downwards from this attachment over the thorax and abdomen.

Muscles of the Head and Neck.—By the side of that portion of the panniculus which passes to the cheek there lies a slender muscle which, taking origin from the bone in front of the orbit, ends in a tendon which is inserted into the side of the cartilage of the nose (levator alæ nasi). There is a large elevator of the upper lip, separated from the panniculus by the numerous and large branches of the infraorbital nerve, and prolonged into the mucous membrane of the roof of the mouth as far as the middle line. In front of this is a dilatator naris. A small buccinator is present. Levator labii inferioris arises from the upper surface of the inferior maxilla just posterior to the incisors and descends, expanding considerably, to the skin below the jaw.

Masseter consists of three parts:—(1) arises by tendon from a prominent tubercle placed at the front of the lowest portion of the process of bone extending downwards from the zygoma to the superior maxilla and its alveolar portion. The muscular fibres connected with this expand and are attached to the edge and internal surface of the angle of the jaw. (2) arises from the lower margin of the zygoma, and is inserted into the lower jaw from its angle to about the position of the roots of the incisors. (3) arises partly from the under and inner part of the zygoma within the orbit, and partly from the superior maxilla anterior to the orbit; this last portion joining the rest by passing between the superior maxilla and the zygomatic process just mentioned. This 3rd part joins the anterior part of the 2nd. The remaining facial muscles call for no special notice.

Sterno-mastoid, which is larger than cleido-mastoid, is inserted by a small round tendon into the mastoid process. Cleido-mastoid takes origin from the inner part of the clavicle, and is attached under the last to the mastoid process.

Sterno-hyoid: both muscles are united into a single sheet without trace of median differentiation. The middle part is inserted much higher up than the two lateral, viz. in the angle between the two anterior bellies of the digastrics, the lateral fibres being attached below the tendinous part of the digastric and near the omo-hyoid. The omo-hyoid itself has no central tendon. Digastric has no true tendon, the central position connected with the hyoid being constricted and covered on its superficial surface with a few tendinous fibres. The two anterior bellies are connected with one another.

It may perhaps here best be noted that the two halves of the inferior maxilla are extremely movable upon one another, a quantity of fibrous tissue intervening at the symphysis so as to form a kind of fulcrum by means of which a scissors-like action of the extremely long inferior incisors is obtainable (*vide* fig. 5). The teeth are divaricated from one another partly by the action of the digastrics and partly by a transverse intermandibular muscle (fig. 5, *a*), which lies above the insertion of the digastrics and quite separate from them. It is placed at the upper part of the angle between the two halves of the maxilla, and is attached to the inferior surface of either. Approximation is produced, at least in part, by the masseter and especially by the part described above as 1. From this it appears that an interval could be produced between the two lower incisors during the opening of the mouth which would disappear with its closure. Murie and Bartlett[1], in a paper on the "Movement of the Symphysis of the Lower Jaw in the Kangaroo," give an excellent account of the mechanism of this movement in the Macropodidæ, and quote from Good's 'Book of Nature' a statement to the effect that a similar movement takes place in *Mus maritimus*, the African rat. In *Hydromys* there is no such development of the transverse fibres of the orbicularis oris as the above authors describe in *Halmaturus bennettii*; whilst the intermandibular muscle above mentioned is quite distinct from any of the other inframaxillary muscles, all of which are present in addition. The amount of divergence possible would be from $\frac{1}{8}$ to $\frac{1}{4}$ inch.

Muscles of Shoulder-girdle and Upper Extremity.—The two portions of the trapezius are quite distinct, the origin of the lower being partly from the lumbar fascia. There is a large occipital rhomboid, and rhomboidei major and minor form a single sheet without separation. Omo-cervicalis arises from the transverse

[1] P. Z. S. 1866, p. 28.

process of the atlas, and is inserted into the spine of the scapula and acromion process as far as its apex. Pectoralis major consists of two layers folded in upon one another so as to present a rounded anterior border without any trace of division. The superficial portion arises from the clavicle and from the sternum as low down as the upper part of the xiphoid cartilage. This part is inserted (1) as usual, (2) into a common tendon with the deltoid. The deeper portion arises from the cartilages of the true ribs from the third to the last. This is inserted by two distinct slips, one of which passes to the tip of the acromion process, and the second to the fascia of the shoulder-joint and to the humerus external to the biceps, and as low down as to the upper edge of the attachment of the superficial portion. As has been above observed, there is no trace of the duplicity of these muscular sheets at the edge; in fact it is only by dissecting carefully through the outer that the inner is reached. This inner sheet is obviously the pectoralis minor, and the condition present is one of extreme fusion of the two pectoral muscles; or, perhaps better, of complete tucking-in of the p. major to form p. minor.

Subclavius is strong and well-marked, a fact which corresponds with the comparatively small and freely movable clavicle. Serratus magnus and levator anguli scapulæ form a single undivided sheet. Latissimus dorsi sends down a fairly broad but very thin latissimo-condyloideus to the olecranon. Coraco-brachialis is inserted into the humerus (1) in the usual position; (2) from this point as far down as the upper part of the internal condyle. The long head of the triceps is very large and arises from rather more than one third of the axillary border of the scapula. Flexor profundus digitorum consists of two parts which unite under the annular ligament: the first arises from the internal condyle, the second from the radius, ulna, and interosseous ligament. There are three lumbricales, passing to minimus, annularis, and medius. Extensor communis digitorum sends a slip to each digit. Extensor indicis supplies that digit alone; and extensor minimi digiti sends tendons to minimus and annularis. Pollex has one extensor. There is no supinator longus.

Minimus has an abductor arising entirely from the pisiform, an opponens and a flexor brevis. The last arises from a small ossicle imbedded in the palmar fascia, slightly to the radial side of the centre of the palm and at its proximal portion. From this also arise the few fibres representing flexor brevis pollicis. This last diminutive digit has also on its outer side a few fibres representing abductor and opponens, and on its inner side an excessively rudimentary adductor. Minimus has an interosseous on its radial side; and each of the remaining digits has a pair lying in the same plane on its palmar surface.

Abdominal Muscles.—At the upper part of the abdomen, the three usual lateral muscles are present and distinct; at the lower portion, as the fibres of the internal oblique and transversalis run parallel and are closely connected with one another, there can hardly be said to be any true differentiation between them. From the aponeurosis of the external oblique a sheet of fascia passes down upon the large funicular process of peritoneum containing the testicle.

This represents the intercolumnar fascia of human anatomy. From the lower border of the combined internal oblique and transversalis a number of muscular fibres pass on to the same process and surround it as a series of rings nearly to its lower end. There is a large erector penis overlying the crus of either side, but no transversus perinei. The bulbus urethræ is double, and each half is overlaid by a muscular sheet which joins its fellow of the opposite side in a raphé on the lower surface of the penis; posteriorly the two halves unite behind the rectum, round which tube they form a kind of sling. In the angle between this last muscle (accelerator urinæ) and erector penis lies Cowper's gland. The psoas and iliacus muscles are both large and differ in no respect from the normal. There is no psoas parvus. Rectus abdominis is attached to the second rib.

Muscles of the Lower Extremity.—The exterior of the buttock is covered by a large sheet of muscle arising from (1) crest of ilium, (2) under the anterior superior spine of the ilium, (3) by means of an aponeurosis from all the vertebræ from the last lumbar to the last sacral inclusive. It is inserted into (1) the third trochanter at the middle of the femur; (2) the larger part into the fascia on the outer side of the thigh and leg and the upper part of the patella. As there is no separate tensor vaginæ femoris or sartorius, this muscular sheet would appear to represent these two in fusion with gluteus maximus. Gluteus medius is very large; its anterior fibres are inserted into the outer edge of the great trochanter, its posterior into the femur inferior and anterior to this process. Gluteus minimus arises from the concavity of the ilium, and is inserted by tendon into the upper part of the great trochanter. There is no separate or intrapelvic pyriformis; part of the fibres of the gluteus minimus arising from the edge of the sacrum close to the sacro-sciatic foramen appear to represent this muscle.

Biceps is very large, and arises (1) superficially from the upper caudal vertebræ by fascia; (2) deeper, from the tuberosity of the ischium. The two parts unite, and are inserted (1) by fascia into the outer part of the patella; (2) by tendon into the process near the head of the fibula; (3) by fascia into the whole of the front of the leg as far down as the back of the heel. Thus the entire of the thigh and leg below gluteus maximus is covered by this large muscular sheet.

Semitendinosus is single-headed and arises from the tuberosity and adjacent portion of the ischium; it is inserted into the crest of the tibia below the gracilis. Semimembranosus, which is very much smaller than either of the other hamstring muscles, is inserted into the upper part of the posterior aspect of the internal condyle of the femur.

Rectus femoris has a single tendon with a double attachment, viz. under the acetabulum and to the margin of the ilium. There is a scansorius arising from the entire of the anterior edge of the ileum.

Pectineus consists of two distinct parts—(1) Internal, which is thin and arises from the inner part of the linea ileo-pectinea, some of its fibres underlying the outermost of gracilis; this portion is inserted by a flat tendon into the back of the femur at the junction of its lower and middle thirds. (2) External, which is much thicker and rounded, arises from a prominent tubercle near the centre of the linea ileo-pectinea, and is inserted into the femur from the lower part of the lesser trochanter to the upper border of the internal part of the same muscle.

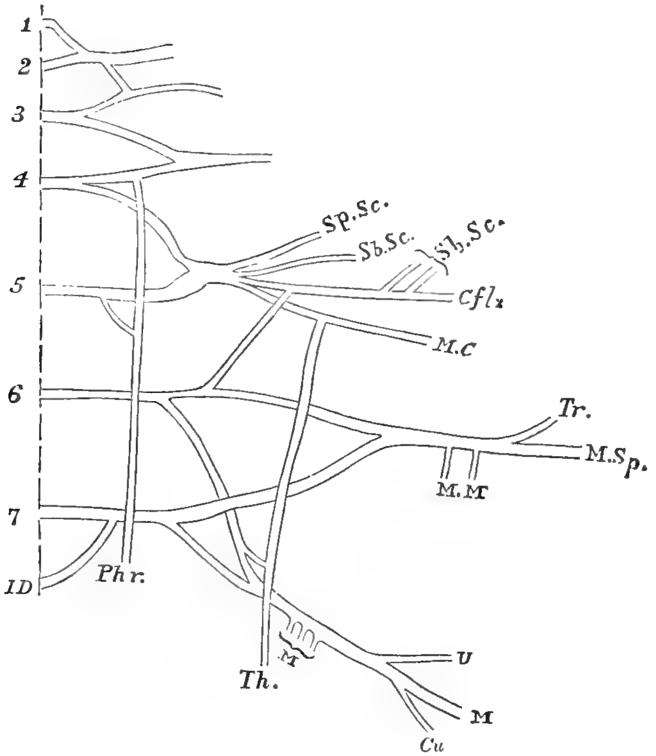
Gracilis is very large, and arises from the inner part of the linea ileo-pectinea, from the pubic crest, symphysis pubis and ramus of that bone, covering in the other adductors; it is inserted into the crest of the tibia, occupying nearly its upper half. Adductors longus, magnus, brevis, and quadratus are present; the lower fibres of magnus pass down as low as the head of the tibia.

Gastrocnemius is large and its heads are without sesamoids. It is joined by soleus, which is small, and fibular only in its origin. There is no separate plantaris, but the posterior part of the tendo Achillis passes over the back of the os calcis, to which by far the greater part of the same tendon is attached, to the sole of the foot. With this tendon are connected on its superficial surface a number of muscular fibres, from which and from a slight continuation on the deep surface of the fibres of the plantar portion of the tendo Achillis arise the four perforated tendons of the toes. There is no flexor longus hallucis as a separate structure. A large muscle occupies the whole of the internal and posterior portion of the leg; this ends in a single large tendon, which divides into five slips for the toes. Tibialis posticus is a small muscle with a long tendon; its belly lies under the upper part of flexor longus digitorum. There are peronei longus, brevis, quinti, and quarti. Tibialis anticus and extensor longus digitorum, which last has four terminal tendons for the four outer toes, are much fused. There is a small but distinct extensor proprius hallucis. Extensor brevis digitorum sends tendons to the four outer toes. There is a large popliteus. Hallux has an adductor which arises from the middle of the inferior surface of the os calcis, and ends in a long tendon which is inserted into the inner side of the head of the metatarsal; an opponens and a strong flexor brevis. Minimus has a strong abductor and an interosseal flexor brevis. Each of the remaining digits has a single muscular mass lying on the plantar aspect of its metatarsal without other trace of division than an incomplete median longitudinal fibrous intersection. This muscle is in each case inserted into the base of the first phalanx and into the superior surface of the fibro-cartilage lying over the metatarso-phalangeal articulation.

Nerve Plexuses.

Brachial Plexus (fig. 1).—The fourth cervical nerve divides into two portions, from the upper and smaller of which is derived the greater part of the phrenic. The lower portion joins the 5th, which has previously given a filament to the phrenic. The combined cord formed from 4 and 5 breaks up into four branches—supra- and subscapular (smallest), circumflex and musculo-cutaneous. Circumflex gives off a branch of communication to the upper part of the 6th nerve and also two subscapular branches. Musculo-cutaneous gives off the greater portion of the anterior thoracic nerve. The 6th nerve divides into two portions, an upper and lower. The combined cord formed by the 7th cervical and 1st dorsal also divides into two

Fig. 1.



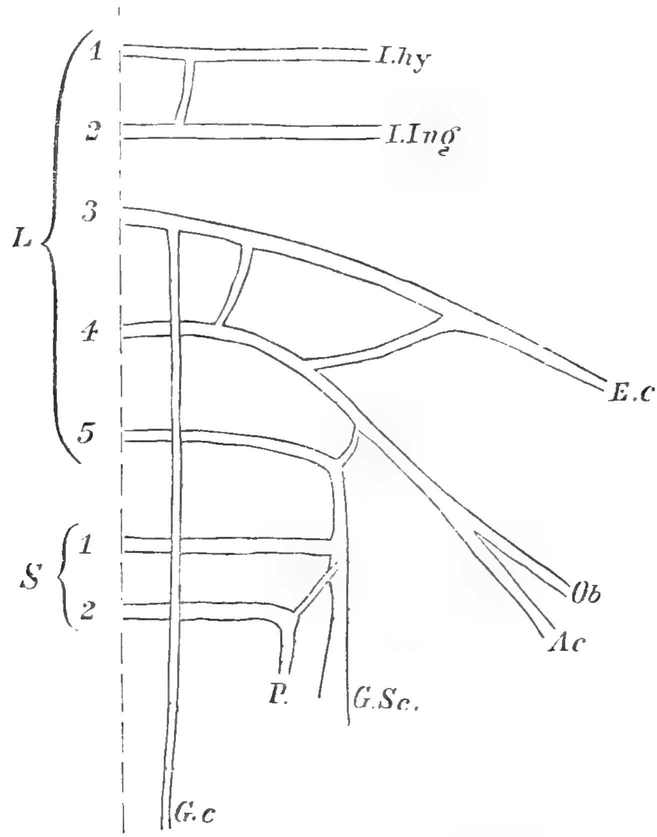
Cervical and brachial nerves. (Diagrammatic.)

1–7. Cervical nerves; *I.D.* 1st dorsal nerve; *Sp.Sc.* Suprascapular; *Sb.Sc.* Subscapular; *Cflx.* Circumflex; *M.C.* Musculo-cutaneous; *Tr.* Nerve to triceps; *M.Sp.* Musculo-spiral; *U.* Ulnar; *M.* Median; *Cu.* Internal cutaneous; *Phr.* Phrenic; *Th.* Anterior thoracic; *M.M.* Muscular branches.

portions, an anterior and a posterior. The upper part of the sixth, having received the branch from the circumflex, joins the anterior part of 7 + 1, and the combined trunk becomes musculo-spiral, having previously given off branches to the triceps and other muscles. The lower division of 6 joins the posterior of 7 + 1, having first given off a filament which joins the anterior thoracic. The large trunk thus formed, having given off some muscular branches, splits up into ulnar, median, and internal cutaneous.

Lumbo-sacral Nerves (fig. 2).—The 1st lumbar forms the ilio-hypogastric and the 2nd the ilio-inguinal. These nerves are connected with one another by a communicating branch, but have no junction with those below. The 3rd gives off genito-crural, a branch of communication with 4, and in conjunction with a branch from this last forms external cutaneous. The remaining portion of 4 with a branch from 5 forms a common trunk which divides into obturator and anterior crural. The great sciatic is formed by the greater part of the 5th lumbar, the whole of the 1st sacral, and a twig from the 2nd. The pudic nerve is formed from the remaining portion of the 2nd.

Fig. 2.



Lumbar and sacral nerves. (Diagrammatic.)

I.hy. Ilio-hypogastric; *I.Ing.* Ilio-inguinal; *E.C.* External cutaneous; *Ac.* Anterior crural; *Ob.* Obturator; *Gc.* Genito-crural; *G.Sc.* Great scaitic; *P.* Pudic.

Thorax.

The chief points of interest are as follows:—(1) Triangularis sterni is very large and well-marked. It ascends nearly as high as the upper margin of the sternum. (2) The diaphragm is in most respects in no way different from the ordinary condition. Its central tendon is, however, triradiate, consisting of three strips of fibrous tissue arranged somewhat like an arrow-head; one of these is directed towards the sternum, a second backwards and to the right, a third backwards and to the left, and the interval between these last is muscular.

(3) *Lungs.*—The left has three lobes, divided in a way similar to that of the right lung in the human subject. The right has five

lobes, the supernumerary pair being placed behind and below the others.

Alimentary Canal and Appendages.

Teeth.—The dentition is as described by Owen[1], I. $\frac{1}{2}$, M. $\frac{2}{2}$, the total number thus being smaller than that of any other Rodent. The incisors closely resemble those of the Common Rat.

The upper incisors are stouter and shorter than the lower; they are set closely together, their edges meeting at their inner angles, so as

Fig. 4.

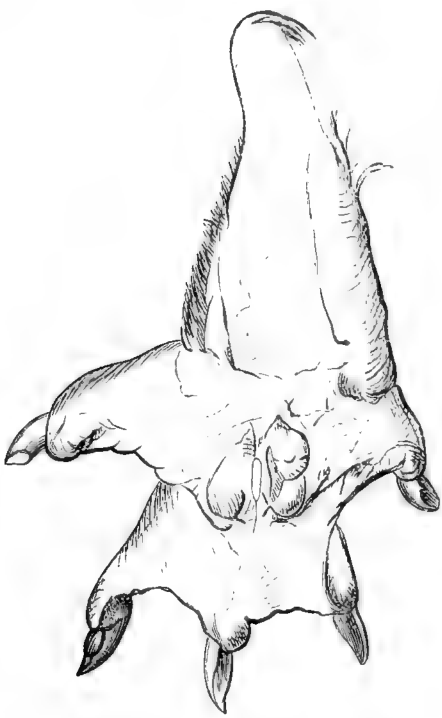


Fig. 3.

Fig 5.

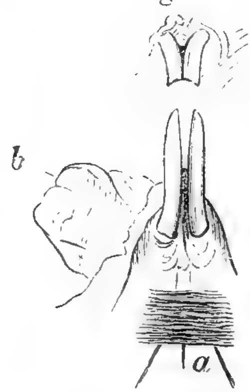


Fig. 3. Left hand of *Hydromys chrysogaster*. (Natural size.)
Fig. 4. Left foot of *Hydromys chrysogaster*. (Natural size.)
Fig. 5. Upper and lower incisors of *Hydromys chrysogaster*: *a*, intermandibular muscle; *b*, tongue.

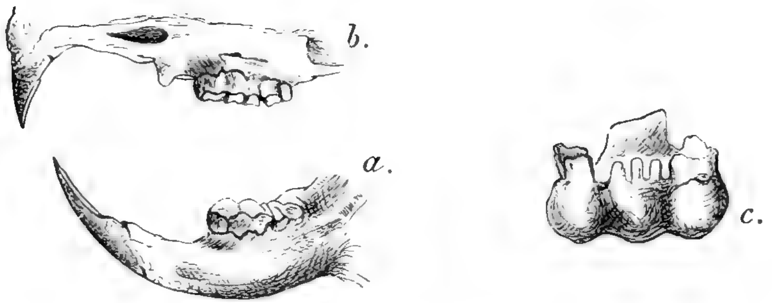
to enclose a wide angle (*vide* fig. 5). The portion projecting beyond the alveolus is 1·05 cm. in length. The first upper molar is a large tooth, consisting of two segments of nearly equal size and a third of lesser magnitude (*vide* fig. 6, *b* and *c*). It possesses three large fangs, one at either extremity and the third at the middle and on the lingual edge. At the opposite side of the tooth to this last are three

[1] 'Odontography,' vol. i. p. 410, and Comp. Anat. of Vert. vol. iii. p. 300.

excessively small points, each of which fits into a corresponding depression in the alveolus (*vide* fig. 6, *c*).

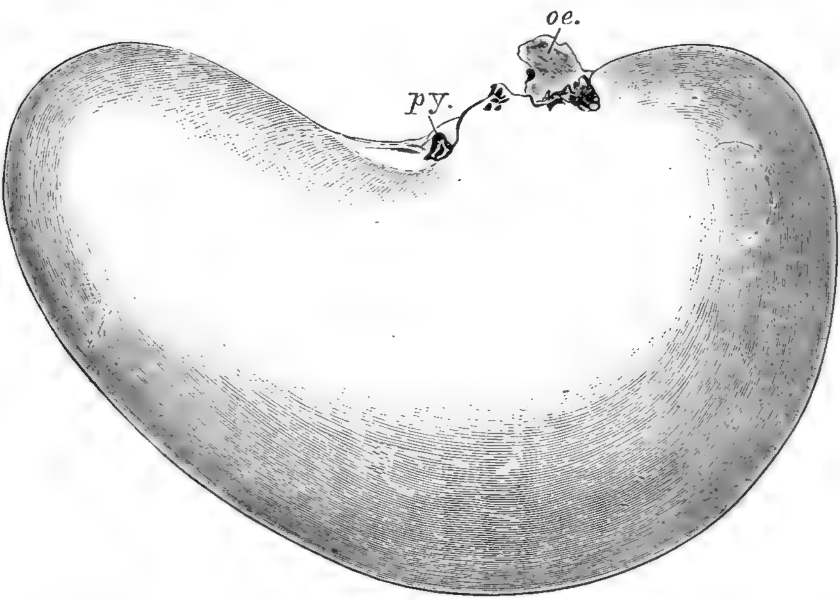
The second upper molar looks like one of the divisions of the first with an additional cusp attached to its antero-internal corner. It has three roots, two posterior with their surfaces placed external and internal, and one anterior with its surfaces anterior and posterior. The

Fig. 6.



Hydromys chrysogaster: *a*, lower jaw; *b*, upper jaw; *c*, upper molar (enlarged).

Fig. 7.



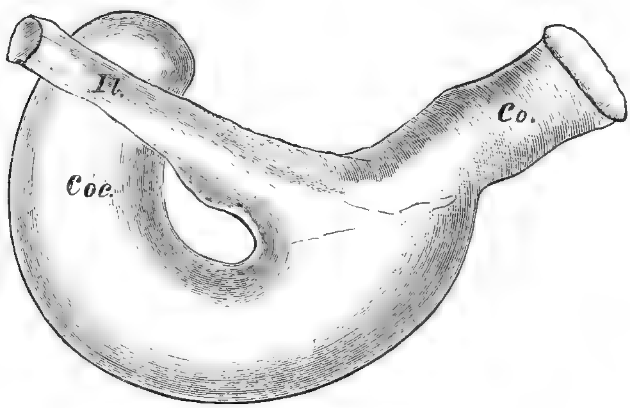
Stomach of *Hydromys chrysogaster*: *oe*, cardiac orifice; *py*, pyloric orifice.

lower incisors (*vide* figs. 5, 6, *a*) are of greater length (1·55 cm.) and of about the same breadth, but of less thickness (0·25 cm. as compared with 0·4 cm.) than the upper. Their power of approximation, due to the mobility of the two halves of the inferior maxilla, has already been dwelt upon. The lower first molars consist of two nearly similar segments placed one in front of the other; and the second are much the same in appearance but smaller (*vide* fig. 6, *a*).

Tongue.—4·6 cm. in length; it has an average breadth of 1·0 cm. It possesses a single large circumvallate papilla, situated at the centre near the posterior part. There is a small group of folia on either side in front of the anterior pillar of the palate.

Intestinal Canal.—The stomach is simple in structure, and the chief points to be remarked upon are the increase in size of the pyloric portion and the decrease in length of the part corresponding to that named in the human subject the lesser curvature (*vide* fig. 7). The small intestines measure 2 m. 89·5 cm.; the large 27·8 cm.; and the cæcum about 7·0 cm. This latter portion is quite simple and only slightly curved upon itself (*vide* fig. 8).

Fig. 8.

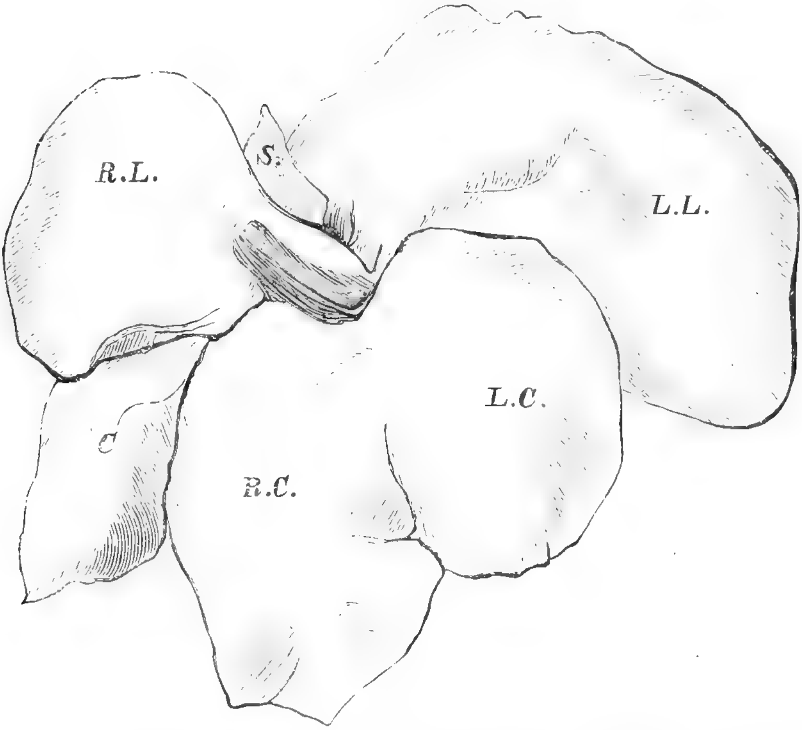


Cæcum of *Hydromys chrysogaster*. (Natural size.)
Co. Colon; *Il.* Ileum; *Coc.* Cæcum.

Liver.—This organ possesses six lobes. The right lateral is short and permits the caudate, which is comparatively long, to be seen upon the upper surface. It appears between the right central and lateral lobes. There is no gall-bladder (*vide* figs. 9 and 10).

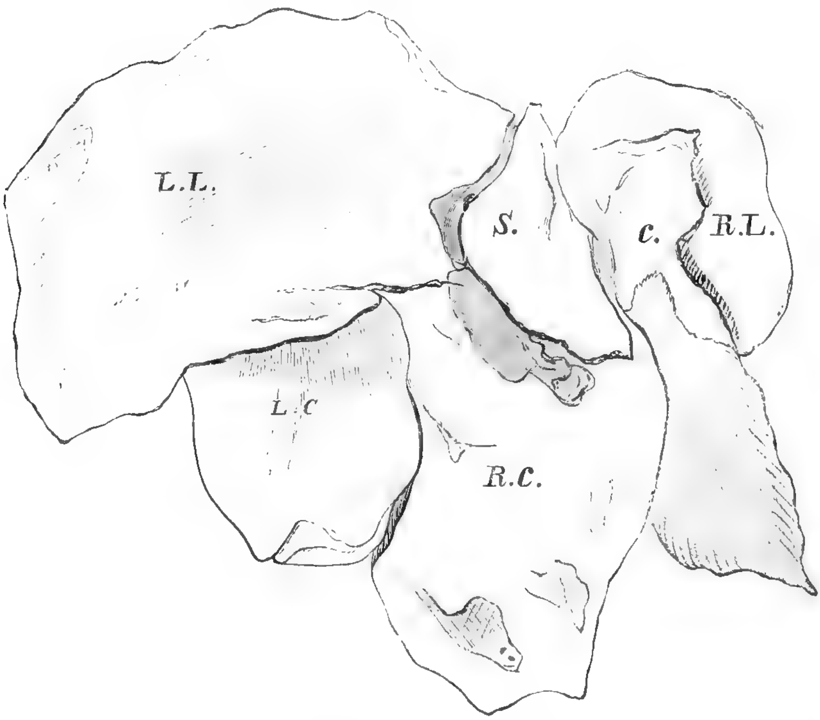
Genitalia.—The vesiculæ seminales are very long and narrow, extending a considerable distance above the bladder. Their length is 5·6 cm., average breadth about 1·0 cm. The testes are large and were, when the animal was examined first, placed in the scrotum. The length of each is 4·2 cm., circumference 6·2. In life these measurements would probably be larger, as they were made after the animal had been in spirit and water for a day or two. The globus major and minor are very distinct and united by a single tube which is perfectly straight. The length of major is 4·8 cm., minor 2·1. There is a small os penis (1·1 cm. in length), consisting of a somewhat square-shaped base with a tapering anterior portion. From each side of the base a small process descends, each of which lies on

Fig. 9.

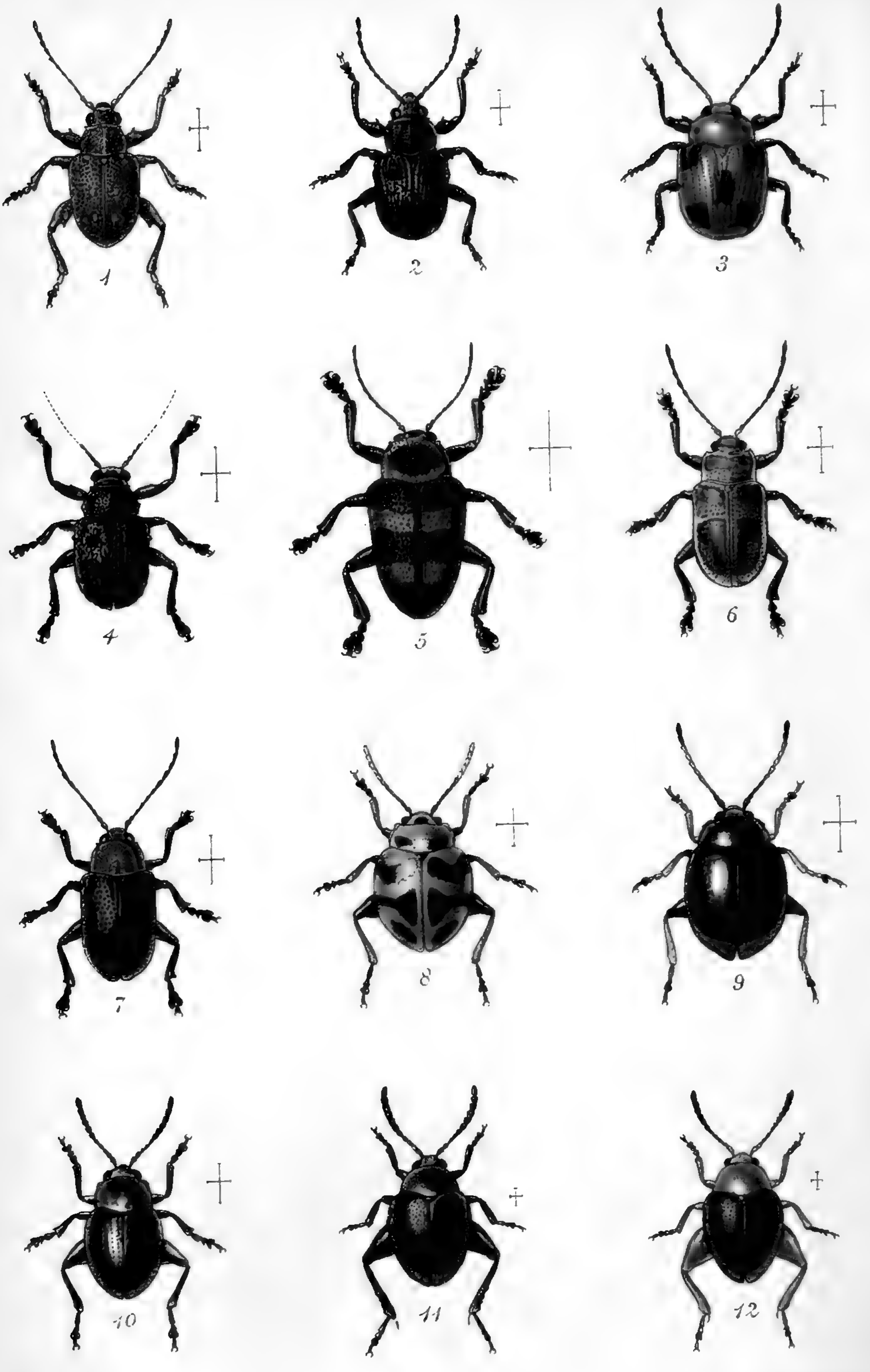


Superior surface of liver of *Hydromys chrysogaster*.
L.L. & *L.C.* Left lateral and central lobes; *R.L.* & *R.C.* Right lateral and central lobes; *C.* Lobulus caudatus; *S.* Lobulus Spigelii.

Fig. 10.

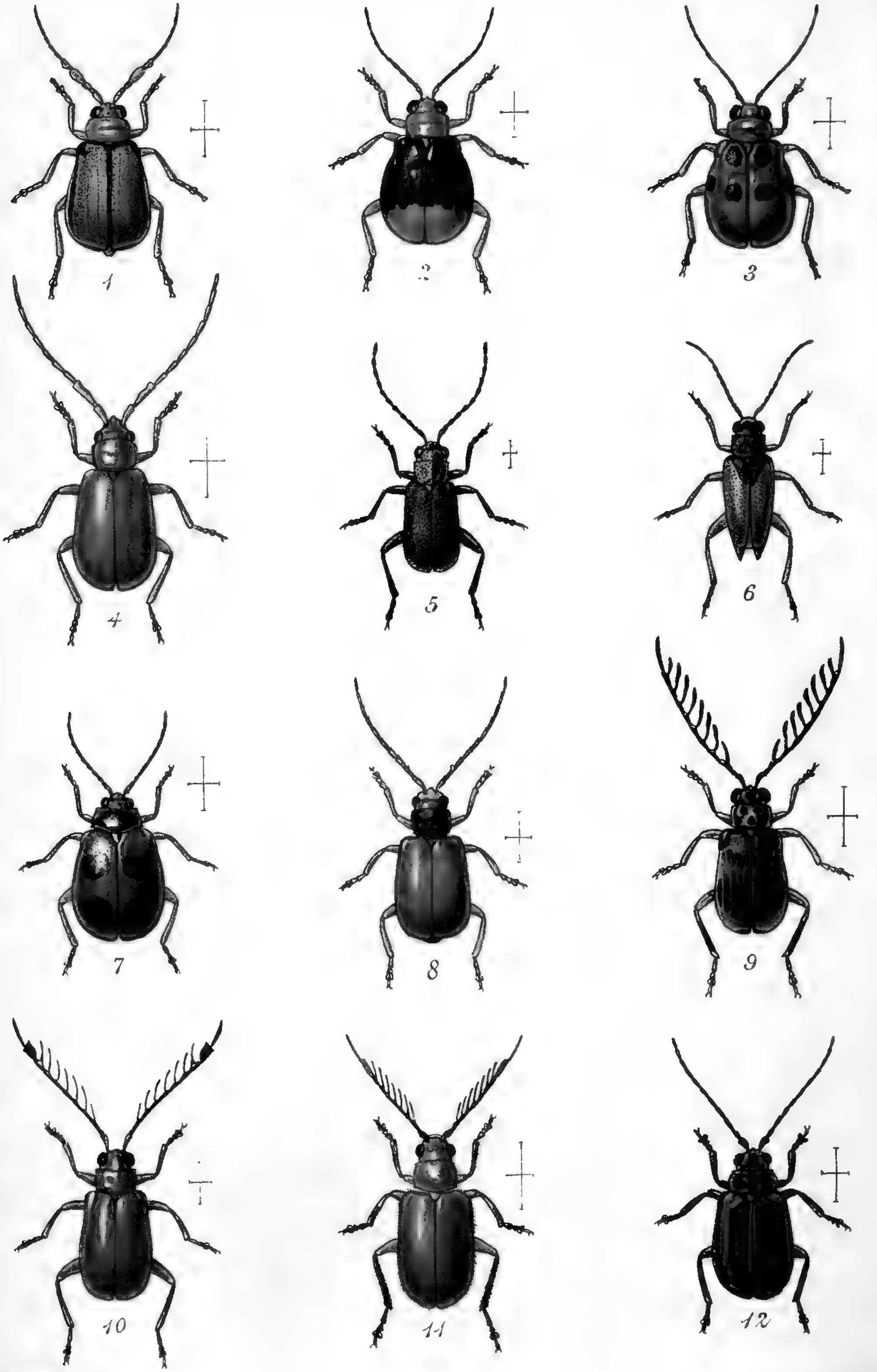


Under surface of liver.
L.L. & *L.C.* Left lateral and central lobes; *R.L.* & *R.C.* Right lateral and central lobes; *C.* Lobulus caudatus; *S.* Lobulus Spigelii.



W. Purkiss lith. Hanhart imp.

PHYTOPHAGOUS COLEOPTERA OF CEYLON.



W. Purkiss del.
Hanhart imp.

PHYTOPHAGOUS COLEOPTERA OF CEYLON.

one side of the urethra; at the anterior extremity of the bone is placed a small rod of cartilage ·8 cm. in length, which gives in the undissected state the impression that the bone is jointed in the centre.

There are none of the appendages connected with the glans which are present in some of the Rodentia. Cowper's glands are each of about the size of half a pea; their ducts are of considerable length.

I wish to express my acknowledgments to Mr. Hodson for his kindness in executing the accompanying drawings of the teeth of this Rodent.

2. Descriptions of the Phytophagous Coleoptera of Ceylon, obtained by Mr. George Lewis during the years 1881–1882. By Martin Jacoby, F.E.S.

[Received December 21, 1886.]

(Plates X. & XI.)

Since the year 1866, when Motschulsky published his descriptions of Ceylonese Coleoptera in the 'Bulletin de Moscou,' which included a good many species of the family Phytophaga, only solitary new species of that family have been made known from Ceylon. The present collection, obtained by Mr. George Lewis during the years 1881–82, although not very large in regard to numbers, is nevertheless remarkable and interesting on account of the many new genera which it contains, belonging principally to the subfamilies *Halticinæ* and *Galerucinæ*, in which the immense numbers of forms which are nearly always found in every fresh collection of importance, and which cannot be placed in any of the already known numerous genera, add not a little to the difficulties experienced by the monographer in their determination. Motschulsky's descriptions are unfortunately in many instances unrecognizable, being applicable to closely allied species and too short; and it is therefore probable that several of the species here described as new are identical with one or the other of Motschulsky's species; but even in that case their redescription will assist in their better recognition.

If one may judge by the present collection, the Coleopterous fauna of Ceylon seems yet to offer a rich field to a careful explorer, in interesting and beautiful forms.

Lema ceylonensis, sp. nov.

Fulvous; antennæ black, the two basal and the two apical joints fulvous; elytra metallic green or blue, with a deep fovea below the base, finely punctate-striate.

Length 2 lines.

Head entirely fulvous and impunctate, the space above the eyes moderately swollen and divided by a shallow groove. Antennæ rather more than half the length of the body, the third and fourth joints of equal length, the following more elongate. Thorax subquadrate, not longer than broad, moderately constricted at the sides, the basilar sulcation deep; surface with a few scarcely visible punctures. Scutellum fulvous. Elytra of a bright metallic yellowish green or blue, with a very deep fovea below the base, near the sutural margin, finely and rather remotely punctate-striate, the punctures obsolete towards the apex. The legs and tarsi fulvous, the posterior tibiæ slightly curved.

Bogawantalawa, 4900–5200 feet.

It will not be very difficult to recognize this species amongst the small metallic blue forms of Lacordaire's first section, with uninterrupted ninth elytral stria; the colour of the antennæ, which have sometimes the first three joints and the last fulvous, or the underside of the three or four terminal joints of that colour, the deep elytral fovea, and the fine and remotely placed elytral punctures, will help to distinguish *L. ceylonensis*; the lateral margin is accompanied by a deeper row of punctures and is costate towards the apex, but the other interstices between the punctures are perfectly flat, the reverse being the case with most of the allied species.

LEMA FULVICORNIS, sp. nov.

Subquadrate-ovate; fulvous; labrum black; thorax impunctate; elytra dark blue, deeply and regularly punctate-striate.

Length 3 lines.

Head with the interocular space strongly swollen and finely punctured, the lateral grooves very deep; the labrum and upper part of the clypeus black, the former with some transversely placed punctures. Antennæ rather more than half the length of the body, entirely fulvous, the fourth joint very slightly longer than the third, the following joints elongate, cylindrical, and not increasing in thickness. Thorax scarcely longer than broad, deeply constricted at the sides, the basilar groove also deep, the anterior angles slightly pointed but not tuberculate; the surface convex and swollen, without any punctures. Elytra broad, subquadrate, the shoulders moderately prominent, the base scarcely depressed, the punctuation deep and not very closely placed anteriorly, much more close and diminishing posteriorly, where the punctures themselves are placed in striæ and the interstices longitudinally costate. Underside fulvous, clothed with yellow pubescence; legs robust, entirely fulvous.

A single specimen.

L. fulvicornis seems closely allied to *L. præclara*, Clark, but differs in its much smaller general size, in the colour of the head and of the elytra. *L. cyanipennis*, Lac., is larger and the interstices between the punctures of the elytra are finely punctate. The present species may be further known by its broadly subquadrate shape.

LEMA CRASSICOLLIS, sp. nov.

Blackish blue below; upper part of head, the thorax, and the last two joints of the antennæ fulvous; elytra metallic blue, deeply foveolate below the base, finely punctate-striate, a small spot above the shoulders fulvous.

Var. The lateral margin and the apices of the elytra fulvous; femora testaceous below.

Length 2 lines.

Head finely punctured at the vertex, the parts of the mouth black. Antennæ more than half the length of the body, black, the last two joints fulvous, third and fourth short, of equal length, the fifth joint double the length of the preceding. Thorax not longer than broad, the anterior portion strongly swollen, its angles tuberculiform when seen from above, each angle furnished with a single hair; basal groove very deep; the surface entirely impunctate. Elytra with a deep fovea below the base near the suture, the basal portion above it raised; the surface rather deeply punctate-striate, the punctures not very closely placed and diminishing towards the apex, the interstices slightly transversely wrinkled, longitudinally costate near the apices; just above the shoulders at the basal margin, a small fulvous spot is placed. Legs black, the underside of all the femora fulvous. In the variety the entire lateral and apical margin of the elytra is of that colour.

The elytra in this species have the same deep fovea as in *L. ceylonensis,* but their punctuation is much stronger and the antennæ have no fulvous basal joints; the thorax also is much more swollen anteriorly; and the general coloration is different.

LEMA DIFFICILIS, sp. nov.

Below bluish black; head and thorax fulvous; antennæ black; elytra metallic blue, obsoletely depressed below the base, regularly and strongly punctate-striate, the interstices costate near the apices; legs fulvous, stained with piceous.

Var. Elytra fulvous, a sutural and lateral longitudinal band blue.

Length 2 lines.

Head with some fine punctures when seen under a strong glass; the vertex but little swollen, with the usual central groove, this latter short and superficial. Antennæ more than half the length of the body, black, the two lower joints stained with fulvous below, third and fourth of equal length. Thorax not longer than broad, the anterior angles pointed when viewed from above, the sides rather deeply constricted; surface with a deep basal transverse groove; the disk with two longitudinal rows of more or less distinct punctures, the sides with some punctures anteriorly only. Scutellum fulvous. Elytra with the base slightly raised and depressed below, the punctuation strong and regular, but more deeply impressed at the basal portion. Legs piceous, more or less stained with fulvous.

Dikoya.

L. difficilis cannot be considered a small variety of *L. coromandeliana,* on account of the absence of the anterior thoracic groove. *L. javana,* Lac., is distinguished by the blue head according to the author's description; in the present insect it is entirely fulvous; the thorax also is almost broader than long, and the anterior angles are projected into a small tooth or tubercle when viewed from above. In the variety the elytra are blue, with a broad discoidal and a narrow lateral longitudinal band, which in another specimen are just indicated, thus proving the identity with the type, with which they agree in every other respect: this variety seems to be closely allied to *L. rufo-ornata*, Clark, in which the elytra, however, are black and the underside fulvous.

Crioceris semipunctata, Fabr.

Kitulgalle, 1700 feet.

Two specimens, evidently females, were obtained by Mr. Lewis, which agree very nearly with the Malayan forms; the antennæ are very short and robust, and the terminal joints are transversely quadrate; the punctuation of the elytra is only visible anteriorly, no traces of any punctures are seen below the middle; below the shoulders, close to the lateral margin, a short and very deep row of punctures, interrupted in the middle, are seen—a character which I do not find mentioned by Lacordaire, with whose description the Ceylonese specimens agree in all other respects.

Diapromorpha quadripunctata, sp. nov.

Pale fulvous, finely pubescent below; the antennæ black, the four basal joints fulvous; thorax very minutely, elytra closely and distinctly punctured, each elytron with four black spots (2 2).

Length 3 lines.

Head impunctate, flattened between the eyes, and with an obsolete triangular depression; eyes slightly notched at their inner margin. Antennæ short, the third joint shorter and much thinner than the second, the fifth and following joints transverse. Thorax three times as broad as long, the sides slightly rounded and narrowed in front, the posterior margin straight at the sides, broadly truncate at the middle; surface with an obsolete transverse groove at each side, very finely and rather distantly punctured. Scutellum impunctate, its apex slightly raised. Elytra subcylindrical, distinctly lobed at the sides near the base, very closely and distinctly punctured, with some obsolete longitudinal smooth lines; each elytron with two black spots, placed transversely below the base and two others below the middle, in a line with the anterior spots, the outer one, however, being placed slightly higher; the first joint of the posterior tarsi distinctly longer than the second.

There is only a single specimen, evidently a female, before me.

Chlamys pallifrons, sp. nov.

Brownish black; basal joint of the antennæ testaceous; lower part of the face flavous; thorax elevated behind, closely granulate-punctate, spotted with fulvous in front and at the base; elytra distinctly punctured, with an oblique ridge at the middle of the disk, a shorter one at the shoulder, and several tubercles at the sides and apices.

Length 1 line.

Head closely granulate-punctate, black, the lower part of the face flavous. Antennæ dentate from the sixth joint, the two or three lower joints flavous, the rest black. Thorax strongly raised posteriorly into an undivided hump, extremely closely and finely granulate-punctate, black; the hinder portion of the elevation as well as some indistinct spots placed anteriorly, fulvous; a more distinct similarly coloured spot is placed at each side of the elevation. Scutellum transverse, its posterior margin emarginate. Elytra slightly constricted at the middle, of a more brownish colour, more strongly punctured than the thorax; each elytron with an indistinct ridge from the middle of the base to the apex and joined by a shorter one commencing at the shoulder; the subsutural ridge is joined to the suture at the middle by a short transverse elevation, and ends near the apex in a strongly raised longitudinal tubercle; three other small and rather indistinct tubercles are seen within the elytral constriction at the sides; the base of the femora is obscure fulvous; the rest and the underside blackish; the suture is dentate through its entire length.

A single specimen.

C. pallifrons resembles in general structure *C. spilota*, Baly, but is only half the size; the thorax is more finely punctured and devoid of raised lines and tubercles, while those of the elytra are also much less distinctly raised and the interstices much more finely punctured.

Exema ceylonensis, sp. nov.

Black; head strigose; thorax strongly raised behind, with six elevated longitudinal ridges; elytra strongly punctured, each elytron with an elevated ridge and about nine or ten tubercles; pygidium with three longitudinal carinations.

Length 1 line.

Head closely covered with longitudinal strigæ; antennæ black, the sixth and following joints transverse. Thorax strongly raised into a pointed hump, rather closely and distinctly punctured; each side with three longitudinal ridges, the middle pair running nearly parallel and not extending quite to the anterior margin, the second ridge strongly sinuate, the third the shortest and only extending to the middle of the thorax; there are a few short and obsolete elevations placed between the above-named ridges, connecting the latter here and there with each other. Elytra more deeply punctured than the thorax; each elytron with the following tubercles: one at the middle of the base, one at the shoulder, and another near the scutellum; two transverse short ridges placed near the suture, one at the middle, the other below the latter and connected by an oblique ridge which runs from the basal tubercle to a little distance from the apex; another, shorter, oblique ridge extends from the shoulder to the middle joining the subsutural one; a tubercle is placed near the apex close to the lateral margin, the suture is serrate through its entire length; the underside rugosely punctate.

This little species, of which only a single specimen is before me, differs from *E. malayana*, Baly, in having more elytral tubercles and two, not three, very obsolete longitudinal ridges, the one commencing at the shoulder joins the subsutural one, with which it forms an angle near the middle of the disk; the transverse and other shaped tubercles at and below the middle are very acutely raised and form sharp projections.

DEMOTINA THORACICA, sp. nov.

Greyish fuscous, closely pubescent; the apices of the tibiæ fulvous; thorax strongly rounded at the middle, obscurely marked with brownish bands; elytra covered with light grey pubescence, a spot at the base and two rows of similar spots below the middle, placed transversely, fuscous.

Length $1\frac{1}{2}$–2 lines.

Head closely punctured, covered with light grey pubescence, which is interrupted at the vertex by two more or less distinct longitudinal brownish bands; the anterior margin of the clypeus and the labrum fulvous, glabrous. Antennæ half the length of the body, slender, the terminal joints slightly thickened, the third and fourth joints equal, all the joints piceous or dark fuscous. Thorax transverse, strongly rounded and widened in the middle, the entire surface covered with whitish-grey pubescence, which assumes the shape of a longitudinal band at the sides; the latter with a round depression. Scutellum greyish pubescent. Elytra finely punctate-striate, clothed with greyish pubescence like the thorax; at the basal margin two fuscous or dark brown spots are seen, more or less distinct, and bounded at the sides by whitish bands; below the middle two transverse rows of similar spots are placed; all the femora are armed with a strong tooth; the sides of the elytra are furnished with short and stiff bristles.

Hadley, in Dikoya.

The thorax in the present species is much narrowed in front and at the base, giving more prominence to the middle; the pubescence of the upper surface is generally whitish grey, but sometimes of a more fulvous tint, and the fuscous spots are more or less distinct; in well-marked specimens they are often preceded by whitish spots, caused by the more thick pubescence in those places; in some specimens three oblique rows of obscure spots may be seen at each elytron besides those at the base, which are generally present.

DEMOTINA SEMIFASCIATA, sp. nov. (Plate X. fig. 1.)

Obscurely fuscous or piceous; finely pubescent; antennæ and legs dark fulvous; scutellum white; elytra closely and distinctly semipunctate-striate, with an obscure darkish transverse band below the middle; a spot at the base and four or five others below the middle, white; femora strongly toothed.

Length 2–3 lines.

Head clothed with yellowish pubescence at the vertex, which hides the punctuation; epistome impubescent, distinctly punctured, fulvous; eyes entire; palpi slender. Antennæ filiform, fulvous, the third and fourth joints slender, nearly equal, the terminal joints very slightly thickened. Thorax twice as broad as long, the lateral margin distinct, the anterior angles produced into a short tooth; surface covered with yellowish, slightly curved hairs like the head. Scutellum pentagonal, clothed with thick white pubescence, margined with piceous. Elytra wider than the thorax; closely and distinctly punctate-striate and pubescent like the thorax, between the shoulders and the scutellum at the basal margin a white spot is placed, four or five others limit the obscure dark transverse band below the middle. Underside thickly covered with white scale-like pubescence. All the femora armed with a strong tooth; intermediate tibiæ emarginate at the apices; claws bifid.

Galle, Balangoda.

The shape and colour of this species are subject to considerable variation, some specimens being much more robust and broader than others. The elytral obscure band is just visible with the naked eye in most instances, and the spots which limit it above and below are variable in number, white or yellowish, and composed of close and thick pubescence; there are generally three placed above, and two below the elytral band. It is possible that *Heteraspis albostriata*, Motsch., may refer to this species, but the description of this author is too vague to recognize the species with certainty.

DEMOTINA LEWISI, sp. nov.

Fuscous or dark piceous, covered with yellowish scale-like pubescence; basal joints of the antennæ fulvous; scutellum whitish; elytra closely punctate-striate, each elytron with two more or less distinct rows of white spots.

Length 2 lines.

Antennæ more than two thirds the length of the body, the third and fourth joints equal, the five terminal joints slightly thickened. Thorax twice as broad as long, the sides strongly rounded, the surface closely and finely rugose-punctate like the head. Scutellum thickly clothed with whitish pubescence. Elytra closely covered with yellowish scale-like pubescence, the punctuation distinct, close and arranged in rows; each elytron with two stripes of whitish pubescent spots, of which one is placed at a little distance and close to the suture, the other at the middle of the disk and extending from the shoulder to the apex; besides the pubescence single short black and stiff bristles are seen on the surface of the elytra. Legs dark fulvous, the femora with a distinct tooth.

Galle.

D. lewisi is smaller than the preceding species, the thorax is not depressed at the sides and without any stripes or other marks as in *D. thoracica*; the elytra are differently marked and without the transverse rows of spots as in the last-named species; the punctuation of the elytra in *D. lewisi* is also much deeper and stronger: from *D. semifasciata* the absence of the elytral band sufficiently separates the present species.

DEMOTINA CEYLONENSIS, sp. nov.

Broadly ovate, robust; fuscous, clothed with fulvous pubescence; the three or four lower joints of the antennæ fulvous; elytra with a transverse whitish band at the middle, the apical portion spotted.

Length 2 lines.

Galle.

Broader and more robust than *D. thoracica,* and the pubescence fulvous instead of whitish. The elytra, instead of finely and distantly punctate-striate, are here strongly and closely punctured, and a transverse band, composed of thick white pubescence, is placed at the middle; this band is narrowed towards the suture and is, in one specimen, followed by a broad black denuded space, while the apical portion is variegated by white and fulvous pubescence; in another specimen, which I refer to the same species, the transverse band is only indicated and the space below it shows some small fuscous spots, alternated by white and fulvous pubescence. The present species resembles somewhat *D. fasciata,* Baly, but is more robust and the thorax is less transverse, the pubescence shorter and differently placed.

XANTHONIA FLAVOPILOSA, sp. nov.

Narrowly elongate; pale fulvous, covered with fine silky flavous pubescence; terminal joints of the antennæ dusky; elytra extremely minutely punctured.

Length $1\frac{3}{4}$–2 lines.

Head extremely finely punctured, covered with rather long yellowish hairs; the anterior margin of the epistome nearly straight; eyes entire, scarcely sinuate within. Antennæ nearly as long as the body in the male, the third and fourth joints nearly equal. Thorax one half broader than long, transversely depressed across the disk, the sides strongly rounded, the lateral margin obsolete; the surface clothed, like the elytra, with rather long silky yellow pubescence, extremely finely punctured; femora unarmed; tibiæ entire; claws bifid; the anterior margin of the thoracic episternum subconcave.

Galle, Dikoya.

This species is larger than *X. placida,* Baly, from Japan; the thorax is more transverse and flattened, and the punctuation of the upper surface is much more finely impressed, and only visible under a strong lens; the pubescence is also longer.

NEPHRELLA ELONGATA, Baly.

I do not think I am wrong in referring the two specimens contained in this collection to Baly's species, with the description of which they agree perfectly, except in one respect in regard to the punctuation of the upper surface. In the specimens before me the thorax and elytra, which are of an obscure fuscous, are closely covered with fine fulvous pubescence, which totally obscures any punctuation. Mr. Baly speaks of the thorax as not very deeply punctured, and of the elytra as finely wrinkled, of which I am not able to see a trace. It is therefore possible that the specimens obtained by Mr. Lewis represent a distinct species; but as they closely agree in all the other characters pointed out by that author, I have abstained from describing them as new. The type of *Nephrella* seems unfortunately to have been lost, as it is not contained in Mr. Baly's collection now in the British Museum. I may add, further, that the head and thorax in Mr. Lewis's specimens show a fine central raised ridge, of which Mr. Baly says nothing.

CHRYSOLAMPRA PUNCTATISSIMA, sp. nov.

Æneous; antennæ and legs piceous; head and thorax extremely closely and finely punctured; elytra strongly transversely strigose, finely punctured near the suture only.

Var. Dark purplish blue, subopaque.

Length 3–4 lines.

Head extremely finely and closely punctured, the anterior margin of the clypeus emarginate at the sides and middle; labrum fulvous. Antennæ slender, the terminal joints very slightly thickened, the two basal joints generally fulvous, the rest piceous. Thorax twice as broad as long, the sides rounded, tuberculate at the anterior angles; surface rather convex, as closely and a little more distinctly punctured than the head, the interstices slightly rugose at the sides; scutellum dark purplish, impunctate, as broad as long. Elytra subcylindrical, the entire disk covered with strongly raised transverse rugosities, which near the apices form single tubercles; the space near the base and at the suture remotely and finely punctured, the latter accompanied near the apex by one or two longitudinal costæ. Legs piceous or dark fulvous; the anterior femora dilated at the middle and with a more or less distinct tooth; anterior thoracic episternum concave.

Galle.

Principally distinguished by the very close punctuation of the head and thorax.

PAGRIA COSTATIPENNIS, sp. nov. (Plate X. fig. 2.)

Subquadrate-ovate; bronze-coloured; three or four basal joints of the antennæ fulvous; head rugose-punctate; thorax longitudinally strigose and deeply punctured, subcylindrical, convex; elytra longitudinally costate, the interstices deeply punctured.

Length $1\frac{1}{2}$–$1\frac{3}{4}$ line.

Head coarsely rugose-punctate, deeply sulcate above the eyes; anterior margin of the epistome concave-emarginate; labrum and palpi fulvous, the latter slender. Antennæ more than half the length of the body in the male, shorter in the female; the third and fourth joints slender, of equal length and about one half longer than the second joint, the terminal joints obscure piceous. Thorax twice as broad as long, the disk strongly swollen, the sides deflexed anteriorly, the entire surface closely and strongly elevate, reticulate and strigose, the interstices forming deep punctures and foveas. Scutellum subpentagonal, its surface longitudinally depressed. Elytra subquadrate-ovate, broader at the base than the thorax, with a distinct depression below the base, which interrupts the longitudinal costæ, which latter are entire from there to the apices, those at the sides being frequently broken and shorter, and the interstices coarsely rugose and wrinkled. The legs are piceous, the apices of the tibiæ and the tarsi obscure dark fulvous.

Galle.

A closely allied but distinct species belonging to this genus has been described by Walker in the 'Annals and Mag. of Nat. Hist.' for 1858 as a *Curculio* and a *Rhynchites*, with which it has of course nothing in common; that species, I believe also from Ceylon, is contained in the collection of the British Museum. I have placed the present species in M. Lefèvre's genus *Pagria* (Bull. de France, 1884), on account of the sulcation above the eyes, although the convex shape of the thorax and its rounded sides differ from that of the species described by M. Lefèvre; but as the angulate and rounded margins of the thorax are both met with in the genus *Nodostoma*, it would not be wise to establish another genus on that character only, the more so as all other structural characters peculiar to *Pagria* are present in the species here described.

NODINA SUBDILATATA, Motsch.

A specimen named as above and contained in the collection of Mr. Baly agrees with those obtained by Mr. Lewis. The description given by Motschulsky is too superficial and almost useless, and it is therefore on the authority of Mr. Baly that I refer the present species to that of Motschulsky. *N. subdilatata* seems to me to possess but little affinities in regard to structural characters to those species described subsequently by Mr. Baly and placed in *Nodina*. *Pagria*, Lefèv., seems the proper genus in which to place the present species, as it agrees in general shape, the armed femora, and the orbital grooves, as well as in most other details, with that genus. I give here a renewed description of the species before me.

Subquadrate-ovate; black, above metallic green or æneous; basal joints of the antennæ, the base of the posterior femora, and the tibiæ and tarsi fulvous; thorax closely and deeply punctured; elytra with basal depression, strongly punctate-striate.

Length 1–1½ line.

Head deeply but not closely punctured, deeply sulcate above the eyes; epistome more closely punctured; labrum and palpi fulvous. Antennæ more than half the length of the body, the four basal joints fulvous, the rest black; the second joint thickened, the third and fourth joints slender, of equal length, the others slightly thickened. Thorax one half broader than long, subcylindrical, convex, the sides rounded; the surface closely covered with deep and round punctures, slightly transversely sulcate near the anterior margin. Elytra with a distinct depression below the base, very deeply punctate-striate, the interstices at the sides and near the apices costate, the punctuation much less deeply impressed below the middle; femora dark æneous, their apices more or less fulvous, tibiæ and tarsi light fulvous; the four posterior tibiæ emarginate near the apices; claws appendiculate; femora with a very minute tooth; prosternum broader than long, strongly punctured.

Variable in size and colour and allied in regard to the latter to *Nodostoma jansoni*, Baly, and *N. tibiale*; the distinct elytral depression will separate the species from the former, and the very closely punctured thorax from the last-named species. It is quite possible that *Noda viridiænea*, Schönh., refers to the present species.

RHYPARIDA LÆVICOLLIS, sp. nov.

Obscure fulvous; eyes closely approached; head and thorax impunctate; elytra with a subbasilar depression, strongly punctate-striate; femora dilated into a strong triangular tooth.

Length 2 lines.

Head impunctate; eyes very large, the space dividing them narrower than their diameter, their inner margin deeply notched; epistome separated from the front by a few punctures only. Antennæ nearly as long as the body, fulvous, the fourth joint longer than the third, this longer than the second joint, the following slightly thickened, the apices of the joints stained with fuscous. Thorax transverse, the sides rounded, the angles distinct, the surface entirely impunctate or with a few microscopically fine punctures. Elytra with a distinct depression below the base, the latter somewhat swollen, the surface deeply punctate-striate at the anterior portion, more finely punctured towards the apices; the anterior and posterior femora dilated into a strong triangular tooth, the intermediate femora minutely dentate; claws bifid.

Galle.

R. lævicollis may be recognized by the large and closely approached eyes and the impunctate thorax, in connection with the strongly dentate femora; the elytra have the basal portion more distantly punctured than the rest of the surface, and the shoulders are entirely devoid of punctuation, but bounded within by a deep line of closely approached punctures, the latter being more widely placed below the elytral depression; the general colour varies from pale to dark fulvous, the sides and the suture being sometimes stained with piceous. No species of *Rhyparida* has, to my knowledge, hitherto been recorded from Ceylon.

RHYPARIDA QUINQUEMACULATA, sp. nov. (Plate X. fig. 3.)

Rufous; the last eight joints of the antennæ and the legs black; thorax sparingly and finely punctured; elytra regularly punctate-striate, a sutural spot at the middle, another at the shoulder, and a third near the apex of each elytron black; femora toothed.

Length 2 lines.

Head with a deep fovea at the vertex, not visibly punctured; the epistome separated from the face by a slight transverse depression. Antennæ half the length of the body, black, the three lower joints fulvous, the third and fourth joints slender, of equal length, the following joints slightly depressed and shorter. Thorax transversely convex, about three times as broad as long, the sides rounded; the surface very finely and sparingly punctured, rufous, with a small obscure piceous spot at the sides. Elytra with a distinct transverse depression below the base, the punctured striæ very distinct anteriorly, less so posteriorly; each elytron with a square-shaped black spot at the shoulder, a triangular one near the apex, and a common sutural elongate spot near the middle; sides of the breast and the legs black; all the femora with a small tooth; claws bifid.

Dikoya.

A single specimen.

Nodostoma bituberculatum, sp. nov.

Testaceous; the terminal joints of the antennæ black; thorax strongly and closely punctured, angulate below the middle; elytra strongly punctate-striate anteriorly, each elytron with two tubercles placed at the shoulders.

Length 1 line.

Head very strongly and remotely punctured; the epistome not separated from the front. Antennæ nearly as long as the body; the second joint not much shorter than the first, the fourth joint slightly longer than the third. Thorax twice as broad as long, narrowed in front, the sides angulate near the base; the surface strongly and closely rugose-punctate, without an anterior transverse groove. Elytra very slightly depressed below the base, the punctuation almost entirely absent near the apices; the humeral callus in shape of an elongate tubercle, which is followed immediately below by another smaller tubercle, the space between these latter and the lateral margins deeply depressed; underside of a more fulvous tint; femora with a minute tooth.

Dikoya.

The small size, closely and strongly rugose thorax, and the lateral tubercles of the elytra will help to separate the present species from its many congeners.

Nodostoma bipunctatum, sp. nov.

Testaceous; thorax angulate at the sides, finely punctured; elytra indistinctly punctured below the middle, the sutural and lateral margins and a spot below the base on each elytron black.

Var. Elytra entirely black.

Length 2 lines.

Head with a few fine punctures between the eyes; the epistome not separated from the face; eyes distinctly sinuate. Antennæ slender and filiform, the apical joints not thickened, testaceous, the fourth joint distinctly longer than the third. Thorax short, narrowly transverse, greatly widened towards the base, the sides subangulate close to the latter; the surface with a narrow transverse groove in front of the anterior margin, rather closely and finely punctured. Scutellum obscure fulvous or piceous; its apex broadly rounded. Elytra with a deep depression below the base, distinctly punctured above this depression only, the rest of the surface obsoletely punctate, the interstices very slightly raised; the sutural and lateral margins narrowly black, the latter accompanied by a row of deep punctures. Legs testaceous; all the femora armed with a small tooth.

Dikoya.

Amongst the many described species of *Nodostoma, N. bipunctatum* may be known by the very short and transverse thorax in connection with the coloration.

NODOSTOMA IMPRESSIPENNE, sp. nov.

Entirely testaceous; the last seven joints of the antennæ black; head and thorax distantly punctured; elytra with a deep basal depression, the latter strongly, the rest finely punctate-striate; legs very long.

Length $1\frac{1}{2}$ line.

Head strongly but very remotely punctured; the epistome not separated from the face. Antennæ slender, scarcely shorter than the body, the four lower joints testaceous, the rest black, the third and fourth joints slender, equal. Thorax not more than twice as broad as long, the sides angulate near the base, obliquely narrowed towards the apex and slightly rounded before the middle; the surface with a transverse groove in front of the anterior margin, very strongly but remotely punctured. Elytra narrowed posteriorly, with a deep transverse depression below the base, testaceous, the sutural and lateral margin narrowly fulvous; the punctuation deep within the depression, very fine at the rest of the surface; there is also a row of deep punctures placed close to the lateral margin and below the shoulders; underside and the legs testaceous; all the femora armed with a small tooth.

Galle.

Closely allied to *N. fairmairei*, but the thorax is longer, less transverse, and more strongly and remotely punctured, and the legs are much longer in *N. impressipenne.*

NODOSTOMA LEWISI, sp. nov.

Testaceous or fulvous; the apical joints of the antennæ black; head remotely, thorax very closely and strongly punctured, subangulate near the base; elytra nearly impunctate below the middle, the sutural and the lateral margins black.

Var. The disk of the thorax more or less piceous.

Length 1–$1\frac{1}{4}$ line.

Head with a few punctures; the epistome more strongly and closely punctured, not separated from the front. Antennæ two thirds the length of the body, the four lower and the base of the following joints testaceous, the terminal joints black. Thorax transverse, strongly narrowed in front, the sides distinctly angulate near the base, the surface very strongly or subrugosely punctured. Elytra with a distinct depression directly below the base, the latter distinctly punctured, the punctuation gradually disappearing below the depression; the lateral margin narrowly, the sutural more broadly, black, this colour widened in some specimens towards the base at the suture. Legs with a very minute tooth.

Dikoya.

N. lewisi resembles somewhat *N. consimile*, Baly, from Japan; but that species has shorter and entirely fulvous antennæ, the thorax is less transverse and less strongly punctured, while the elytra have the punctures deeper and more prolonged posteriorly. Whether *N. triangulare*, Motsch., also from Ceylon, is referable to the species described here it is impossible to say, on account of the short and insufficient description. The black sutural stripe is in some specimens very narrow, in others widened towards the suture.

Nodostoma tuberosum, sp. nov. (Plate X. fig. 4.)

Dark brown; head closely punctured; thorax strongly rugose-punctate, the sides angulate near the base; elytra entirely covered with longitudinal and transverse tuberosities.

Length 3 lines.

Head closely and distinctly, the vertex more remotely, punctured; epistome not separated from the face, its anterior margin perfectly straight; the surface covered with some short silvery pubescence. Antennæ with the first three joints fulvous (the rest wanting). Thorax transverse, narrowed in front, the sides distinctly angulate near the base; the surface entirely covered with deep and round punctures, the interstices sparingly clothed with short hairs. Elytra closely covered with strongly raised tubercles, placed irregularly at the sides, but arranged in longitudinal rows at the disk; the interstices with some deep punctures; the shoulders prominent and in the shape of an oblique, smooth, strongly raised tubercle.

A single specimen is contained in my collection. *N. tuberosum* is not difficult to recognize, on account of the wart-like tubercles covering the entire surface of the elytra.

Nodostoma lefevrei, sp. nov.

Dark fulvo-piceous, the base of the femora fulvous; thorax transverse, angulated at the base, very closely punctured; elytra with deep basal depression, strongly longitudinally costate, the sides transversely rugose.

Length $2\frac{1}{2}$ lines.

Head closely punctured at the vertex and at the sides, the epistome separated from the face by two deep foveæ at the sides, its anterior edge tridentate, the surface scarcely visibly punctured; labrum fulvous. Antennæ slender, the third and following joints elongate. Thorax very transverse, three times broader than long; the sides strongly angulate near the base, the posterior angles produced into an acute tooth; the surface with a transverse groove near the anterior margin, very closely punctured, with some smooth and raised spaces irregularly distributed. Scutellum nearly black, impunctate. Elytra with a deep basal depression, very strongly costate at the inner portion of the disk, the interstices regularly punctate-striate, the sides transversely rugose and wrinkled; the colour lighter fulvous near the suture, darker at the sides; femora with a minute tooth, their base pale fulvous.

A single specimen (coll. Jacoby).

N. lefevrei differs from *N. tuberosum* in the much more transversely shaped and finely punctured thorax, the strongly costate elytra and their coloration.

NODOSTOMA CLYPEATUM, sp. nov.

Pale testaceous; apical joints of the antennæ fuscous; clypeus strongly punctured; thorax angulate below the middle, strongly punctured at the sides only; elytra with basal depression, the latter distinctly, rest of the disk nearly obsoletely, punctured.

Length 1 line.

Head nearly impunctate at the vertex; the epistome strongly but very remotely punctured, not separated from the front; the space above the insertion of the antennæ obliquely grooved. Antennæ slender, nearly as long as the body, testaceous, the three or four terminal joints fuscous or black. Thorax twice as broad as long, strongly narrowed in front, the sides distinctly angulate near the base, surface without an anterior groove, strongly punctured at the sides only, the middle of the disk with a few fine punctures only. Elytra with a very distinct subbasilar depression, the base itself with a few remotely placed punctures arranged in lines which extend more or less distinctly to the middle; below the latter the punctuation is almost entirely wanting; femora with a minute spine.

Galle.

Principally distinguished by the nearly impunctate vertex, the strongly punctured epistome and sides of the thorax, in connection with its general small size; the absence of a transverse anterior groove at the thorax will further assist in the recognition of *N. clypeatum*.

NODOSTOMA LONGICORNE, sp. nov.

Fulvous; legs testaceous, the knees obscure piceous; antennæ as long as the body; thorax very finely punctured, angulate behind the middle; elytra strongly punctate-striate, with basal depression, the lateral margins anteriorly black.

Var. Elytra entirely fulvous.

Length 2–2½ lines.

Head finely and rather remotely punctured; the epistome separated from the front by a slight transverse depression, with a few deep punctures; palpi testaceous. Antennæ as long as, or slightly longer than, the body, fulvous, the apical joint darker, the fourth joint rather longer than the third. Thorax transverse, strongly narrowed in front, the sides distinctly angulate near the base, the surface with a deep and punctured transverse sulcation near the anterior margin, very finely and rather remotely punctured, the lateral margin narrowly piceous. Elytra not broader at the base than the thorax, with a deep subbasal depression, very strongly and deeply punctate-striate anteriorly, more finely towards the apices, the interstices slightly convex, more distinctly so at the sides, the lateral margin anteriorly rather broadly piceous or black, this colour extending slightly across the elytral depression, but being narrowed posteriorly along the lateral margin. Legs long and slender, testaceous, the knees obscure piceous; the femora armed with a small tooth.

The variety, which I believe is a female, is of larger size, the elytra are less strongly punctured and entirely dark fulvous; the terminal joints of the antennæ are also stained with fuscous; but in all other respects this specimen agrees with the type. *N. longicorne* may be distinguished from numerous other similarly coloured species by the long antennæ and the finely punctured head and thorax.

Nodostoma fairmairei, sp. nov.

Pale testaceous; antennæ (the two or three basal joints excepted) black, tarsi stained with piceous; thorax strongly and remotely punctured; elytra with basal depression, strongly punctured anteriorly, more finely towards the apices.

Length $1\frac{3}{4}$–2 lines.

Head remotely but strongly punctured, the epistome not separated from the face. Antennæ two thirds the length of the body, the first joint short and dilated, the third and fourth thin and of nearly equal length, the others slightly thicker. Thorax scarcely twice as broad as long in the male, the sides subangulate below the middle, narrowed in front, the surface strongly punctured at the sides and anteriorly, the interstices slightly rugose. Elytra subcylindrical, parallel, distinctly depressed below the base, the punctuation rather strong anteriorly, gradually diminishing posteriorly. Legs rather long; the femora armed with a small tooth; the extreme apices of the tibiæ and the tarsi stained with piceous.

Dikoya.

N. fairmairei differs from *N. obliteratum* in the much stronger punctuation of the head and thorax, the shorter and nearly black antennæ, and in the similarly coloured apices of the tibæ.

Nodostoma obliteratum, sp. nov.

Pale flavous; antennæ as long as the body; head and thorax with a few fine punctures, the latter angulate near the base; elytra with basal depression, very finely punctured anteriorly, the punctures nearly obsolete below the middle.

Length $1\frac{1}{2}$–2 lines.

Head with a few scarcely visible punctures; the epistome not separated from the front; jaws piceous. Antennæ slender, fulvous, the terminal joints more or less stained with fuscous. Thorax nearly three times as broad as long, the sides strongly narrowed in front, distinctly angular near the base; surface with a distinct narrow groove close to the anterior margin, very finely and sparingly punctured. Elytra slightly broader at the base than the thorax, the sides parallel, the shoulders moderately prominent, the subbasilar depression distinct but not deep, the punctuation much more distinctly visible anteriorly than posteriorly, where only traces of it can be seen under a strong lens; femora armed with a small tooth.

Dikoya.

DERMORRHYTIS CUPREA, sp. nov.

Bronze-coloured; antennæ and legs nearly black; thorax subremotely and strongly punctured, margined with green; elytra distantly punctate-striate, the sides transversely rugose below the shoulders.

Length 3–3½ lines.

Head strongly rugosely punctured at the vertex; the epistome much more closely punctured and separated from the face, its lower edge straight; labrum and jaws piceous. Antennæ filiform, two thirds the length of the body, the third and three following joints piceous, slender, and of equal length, the others slightly thickened and nearly black. Thorax not more than twice as broad as long, the sides obsoletely angulate before the middle, nearly straight from there to the base, the margin slightly dentate or sinuate, metallic greenish; rest of surface strongly and remotely punctured, the punctuation more close and strong at the sides, where the interstices are partly rugose and forming transverse wrinkles. Elytra cupreous, with more or less metallic greenish reflections, very distantly and strongly punctate-striate at the disk, the sides very strongly transversly rugose and wrinkled. Prosternum dilated posteriorly, broad; the anterior margin of the thoracic episternum concave.

D. cuprea may be recognized by the distant punctuation of the elytra, the general cupreous colour of the upper surface, and the nearly black legs. The punctuation of the thorax differs according to the sex, and is sometimes more closely arranged; while in some specimens the middle of the disk represents a nearly smooth longitudinal space; the anterior angles are rather prominent, and the shape of the thorax is less transverse than in the other allied forms.

DERMORRHYTIS CEYLONENSIS, sp. nov. (Plate X. fig. 7.)

Greenish or brownish æneous, below obscure piceous; antennæ and legs fulvous; head and thorax closely and rather finely rugose-punctate; elytra punctate-striate, the interstices anteriorly and at the sides transversely strigose.

Length 2½–3 lines.

Head closely rugose-punctate, the space between the antennæ furnished with a smooth tubercle; labrum fulvous. Antennæ slender, two thirds the length of the body, fulvous, the terminal joints sometimes stained with piceous, third joint slightly longer than the fourth. Thorax scarcely twice as broad as long in the male sex, more transverse in the female, the sides very slightly rounded or obsoletely angulate before the middle, the anterior angles acute and slightly produced; surface closely rugose-punctate like the head, metallic green, the extreme lateral margin reddish cupreous anteriorly. Elytra much more remotely and more strongly punctured than the thorax, the interstices strongly raised and forming transverse strigæ anteriorly and at the sides, as well as at the apices, the lateral margin bright aureous-cupreous. Legs dark fulvous or obscure piceous.

Dikoya.

Easily distinguished by the densely rugose-punctate thorax and the cupreous margin of the latter and of the elytra.

DERMORRHYTIS LEWISI, sp. nov.

Greenish or brownish cupreous; basal joints of the antennæ and the legs obscure fulvous; head and thorax closely and strongly punctured; elytra strongly punctate-striate, the interstices transversly strigose throughout.

Length $2\frac{1}{2}$–3 lines.

Head closely rugose-punctate, the epistome not separated from the face; labrum fulvous. Antennæ very slightly thickened at the apical joints, the third and fourth joints equal, the five or six lower joints fulvous, the others fuscous. Thorax transverse, the sides nearly straight, the surface closely and strongly punctured, the interstices everywhere transversly rugose. Elytra subcylindrical, slightly narrowed behind, punctured like the thorax, but the interstices transversly raised and extending across the entire surface; underside covered with fine silky-white pubescence.

Dikoya.

The straight sides of the thorax, in connection with the transversely rugose interspaces of the same part, and those of the entire disk of the elytra, will help to distinguish this species principally from *D. piceipes*, Baly.

DERMORRHYTIS ORNATISSIMA, Baly. (Plate X. fig. 6.)

Dermorrhytis fasciato-rutilans, Lefèvre.

Balangoda.

This species, of which the two above names are synonymous, seems to vary greatly in regard to size and coloration; all the specimens contained in my collection are devoid of any cupreous spots on the thorax. In the present collection the specimens obtained by Mr. Lewis are much smaller, and have a broad transverse reddish-cupreous band occupying nearly the entire disk of the thorax.

DERMORRHYTIS VARIABILIS, sp. nov.

Greenish æneous below; above metallic green, the shoulders, sides, and apices of the elytra reddish cupreous; head and thorax remotely punctured, the interstices flat; elytra punctate-striate, the sides transversely strigose; basal joints of the antennæ and the legs fulvous.

Var. Above brownish cupreous.

Length 2–$2\frac{1}{2}$ lines.

Head rather flattened, finely and moderately closely punctured, the interstices slightly rugose anteriorly only; the epistome not separated from the face, its anterior margin nearly straight; labrum fulvous. Antennæ longer than half the length of the body, the five terminal joints slightly dilated, black, the others fulvous. Thorax nearly twice as broad as long, the sides straight and slightly subangulate or dentate; surface remotely and distinctly punctured, the interstices not raised. Elytra punctate-striate at the inner disk, irregularly and more strongly punctured at the sides, where the interstices are transversely and strongly raised; the apex of each elytron is simply punctate-striate and the interstices are flat.

Galle.

The smaller size, remotely punctured thorax, and the colour of the upper parts distinguish this species from its allies.

DERMORRHYTIS IGNEOFASCIATA, Baly. (Plate X. fig. 5.)

MELASOMA DIVISI, sp. nov.

Fulvous; terminal joints of the antennæ and the scutellum black; elytra distinctly punctured, testaceous, the suture and a longitudinal band on each elytron, divided at its posterior portion, metallic greenish.

Length 2 lines.

Head extremely finely punctured, longitudinally depressed at the middle. Antennæ short, the six terminal joints transversely shaped and black, the others fulvous. Thorax more than three times broader than long, slightly narrowed in front, the sides but little rounded, the posterior margin broadly rounded at the middle and slightly produced; the surface with a few minute punctures at the sides. Scutellum black. Elytra rather strongly and closely punctured, the shoulders prominent, the lateral margin slightly thickened and the space in front impunctate; at the middle of the disk a broad metallic green band is placed, commencing at the base and extending with its inner division below the middle, the outer portion being prolonged in a narrow stripe to the apex of each elytron, where it is joined to the similarly coloured sutural margin. Legs more or less stained with piceous.

A single specimen.

HALTICA (GRAPTODERA) (?) NIGRIPENNIS, sp. nov.

Flavous; thorax transverse, impunctate, the transverse groove not extending to the sides; elytra black, extremely finely and closely punctured.

Var. Antennæ and legs piceous.

Length 2 lines.

Head impunctate, the frontal tubercles obsolete, scarcely raised. Antennæ half the length of the body, the second joint very short, the five following joints slightly triangularly shaped and widened, the rest more elongate. Thorax twice as broad as long, the sides rather rounded at the middle, the angles obsolete, surface entirely impunctate, impressed near the base with a shallow transverse groove not extending to the sides. Scutellum flavous. Elytra nearly parallel, very finely punctured (in one specimen impunctate), black; the first joint of the posterior tibiæ as long as the two following joints together; claws appendiculate; the anterior coxal cavities open.

The present species has certainly not many of the typical characters peculiar to *Graptodera*; the more transverse thorax, the different shape of its groove, and the general colour seem to point to an allied but different genus.

Enneamera ceylonensis, sp. nov.

Testaceous; a spot at the vertex and the scutellum black; head and thorax impunctate; elytra scarcely visibly punctured, testaceous, a triangular-shaped spot at the base and a narrow transverse band below the middle reddish fulvous.

Var. Elytra entirely dark fulvous.

Length 2 lines.

Head broader than long, impunctate, a large spot at the vertex black; frontal tubercles obsolete; labrum piceous. Antennæ entirely pale fulvous, the second and third joints short, the rest transversely dilated. Thorax three times as broad as long, widened at the middle, the sides nearly straight, narrowed in front, the anterior angles slightly thickened and distinct; the surface entirely impunctate, pale testaceous. Scutellum black. Elytra microscopically finely punctured, very convex and rounded, of a yellowish colour, a transverse triangular-shaped band at the base, not quite extending to the sides, and marked with a more or less distinct black spot at the shoulder, reddish fulvous; the narrow band behind the middle of a more piceous colour; the outer margin of the posterior tibiæ with a row of small black teeth or spines.

Besides the above-named fulvous variety, which does not vary in other respects from the typical form, I possess a specimen in my collection (also from Ceylon) in which the posterior band of the elytra is divided into two small spots.

Phyllotreta discoidea, sp. nov.

Head, thorax, and the abdomen fulvous; antennæ, the breast, and legs black; elytra scarcely visibly punctured, testaceous, all the margins narrowly black.

Length $1\frac{1}{2}$ line.

Head impunctate, fulvous, the frontal tubercles transverse, narrow and very distinct. Antennæ half the length of the body, black, the third joint smaller than the second, the following ones gradually thickened. Thorax transversely quadrate, the sides slightly rounded; the surface rather flat, with a very obsolete and shallow depression at the middle of the sides, entirely impunctate. Scutellum black. Elytra parallel, not covering the pygidium, their surface only visibly punctured when seen under a strong lens, testaceous or yellowish, margined with black, the sutural margin generally narrowed near the base. Breast and legs black, the anterior femora slightly stained with fulvous below; the abdomen, with the exception of the last segment which is black, fulvous.

Bogawantalawa.

P. discoidea may be recognized by the small third joint of the antennæ, which is smaller than the second (an exceptional structure as a rule), and by its general coloration.

APHTHONA CEYLONENSIS, sp. nov.

Ovate; obscure piceous; antennæ, the apices of the tibiæ, and the tarsi testaceous; thorax transverse, very finely punctured; elytra more distinctly and very closely punctate.

Var. Entirely obscure testaceous.

Length $\frac{1}{2}$ line.

Head impunctate; the frontal tubercles narrowly transverse. Antennæ closely approached, nearly as long as the body, testaceous, the terminal joints more or less stained with fuscous, the third and the two following joints nearly equal, smaller and thinner than the second, the following ones slightly thickened. Thorax much broader than long, the sides slightly rounded, the anterior angles oblique; the surface rather closely and finely punctured, the interstices extremely finely alutaceous. Elytra distinctly widened at the middle, rather convex, the shoulders rounded, closely and very distinctly punctured, the interstices somewhat rugose; the legs piceous, the tibiæ more or less testaceous; the first joint of the posterior tarsi as long as the two following together.

Horton Plains.

This very small species seems to vary much in regard to colour from nearly black to testaceous, and several intermediate degrees are before me. The ovate, anteriorly and posteriorly narrowed shape of the elytra and their close punctuation, as well as that of the thorax, and the small size of the insect will help in the recognition of *A. ceylonensis.*

APHTHONA LEWISI, sp. nov.

Fulvous; antennæ with the fifth to the tenth joints black; thorax finely and subremotely punctured; elytra black or piceous, very closely punctured.

Length 1 line.

Head impunctate, shining, fulvous. Antennæ two thirds the length of the body, the four basal joints fulvous, the following six black, the apical joint fulvous. Thorax twice as broad as long, the sides straight, slightly converging towards the apex, the anterior angles obliquely truncate, forming a distinct angle before the middle; the surface covered throughout with very fine but not very closely placed punctures. Scutellum obscure fulvous. Elytra nearly parallel, subcylindrical, the shoulders distinct but not prominent, the surface more distinctly and more closely punctured than the thorax; underside and legs fulvous.

Bogawantalawa.

A. lewisi may be known by the general coloration, the finely punctured thorax, and the colour of the antennæ, which agree in all the specimens before me.

APHTHONA PROXIMA, sp. nov.

Obscure piceous; the five or six basal joints of the antennæ fulvous;

thorax finely punctured; elytra more distinctly and closely punctate, the interstices slightly rugose.

Length 1 line.

Head impunctate, the frontal tubercles distinctly raised. Antennæ nearly as long as the body, rather robust, the second joint nearly as stout as the first, but shorter; the three following joints more slender, of equal length, the following slightly thicker. Thorax transverse, the anterior angles oblique, notched before the middle, the sides straight, slightly converging outwards; the surface finely and rather closely punctured. Elytra with a shallow depression below the base, somewhat closely and rugosely punctured, the punctuation visible to the apices; legs short and robust.

Balangoda.

A. proxima is extremely closely allied to *A. sordida*, Baly, from Japan, and may possibly be identical with that species; but the depression of the elytra below the base in the Ceylon specimens does not permit me to refer them to that species, as I cannot see a similar depression in *A. sordida*, of which I possess several specimens. The antennæ in the present insect seem to vary rather in colour, and in one of the specimens, which I look upon as a variety, having been taken together with the others, the third and the fifth joints of the antennæ are fulvous, the others black; in this specimen the elytral depression is also much more marked (the base being slightly raised) than in the others.

Aphthona vicina, sp. nov.

Ovate, convex; black; the third and one or two following joints of the antennæ flavous; thorax finely and remotely punctured; elytra more distinctly and closely semipunctate-striate.

Length $\frac{1}{2}$ line.

One half smaller than *A. proxima*, the thorax much less transverse, finely granulate, and the punctuation much more distant; the elytra without any basal depression, very closely punctured; the legs entirely black. *A. nigrita*, Motsch., is described as "fere glabra" with pale legs. *A. obscurata*, Motsch., is much larger, also described as glabrous with testaceous tibiæ and tarsi. In the present insect the two first joints of the antennæ as well as the terminal ones are black, the intermediate joints more or less flavous.

Dikoya.

Aphthona dorsalis, Motsch.

The description of the author, "Glabra, rufa, capite, thorace elytrisque dorso nigris, corpore subtus subinfuscata," agrees very nearly with two specimens before me. The antennæ (the terminal joint excepted) and the legs are, however, testaceous, and the posterior femora have their posterior portion black; this is not mentioned by Motschulsky. There are also very fine punctures visible at the elytra, when examined under a strong lens. It is therefore doubtful whether I am rightly referring these specimens to the present species.

Obtained at the Horton Plains.

EUCYCLA CEYLONENSIS, sp. nov.

Fulvous; antennæ black, the basal joint fulvous; thorax closely punctured, with or without a black basal spot; elytra strongly punctate-striate, the interstices finely punctured, black, the suture narrowly and the apices more broadly fulvous.

Var. *a*. Black, the first five joints of the antennæ flavous.

Var. *b*. Smaller; piceous, the elytra fulvous.

Length 1–1½ line.

Head nearly impunctate, fulvous. Antennæ with the first joint long and slender, curved, the second short and thick, the four following joints still shorter and nearly equal in length, the rest widened and compressed. Thorax more than twice as broad as long, the posterior margin broadly produced at the middle, the sides straight; the surface distinctly and very closely punctured, fulvous, sometimes with a central black spot widened at its base. Scutellum obscure fulvous. Elytra very convex, black with a greenish tint, strongly and regularly punctate-striate, the interstices very finely and sparingly punctured, the apices, in shape of a triangular spot, and the suture very narrowly and rather obscurely fulvous; anterior coxal cavities open.

The slender and elongate first joint of the antennæ, the lobed thorax, punctate-striate elytra, and general rounded and convex shape seem to me to place the present insect in Baly's genus *Eucycla*. *Thrylæa* of this paper has the general appearance and the punctate-striate elytra of the present insect, but may be known by the less transverse thorax and the much shorter basal joint of the antennæ.

LONGITARSUS LONGICORNIS, sp. nov.

Ovate, convex; obscure testaceous; antennæ much longer than the body; thorax impunctate; elytra scarcely visibly punctured; the apices of the posterior tibiæ piceous.

Length 1 line.

Head rather broader than long, entirely impunctate; the frontal tubercles scarcely indicated; labrum and palpi piceous. Antennæ one half longer than the body, entirely testaceous, the third joint distinctly shorter than the fourth. Thorax about one half broader than long, the sides slightly rounded and constricted near the base, the anterior angles obliquely truncate, the surface entirely impunctate. Scutellum broader than long. Elytra ovate, narrowed near the base and the apices, extremely minutely punctured, only visible under a very strong lens, of a darker colour than the thorax; underside and legs testaceous; the apical half of the posterior femora piceous; the first joint of the posterior tibiæ rather longer than the three following joints together.

Bogawantalawa.

The very long antennæ, ovate shape, and the nearly impunctate upper surface are the distinguishing characters of *L. longicornis*. In one specimen the legs are of an entirely testaceous colour, but all the other characters are the same as in the type.

PARLINA FULVA, sp. nov.

Oblong-ovate, fulvous; apical joints of the antennæ, the tibiæ, and tarsi piceous; thorax impunctate; elytra closely punctured.

Var. Entirely fulvous.

Length 2 lines.

Head impunctate, the frontal tubercles small but distinct, the carina short; the penultimate joint of the palpi thickened, the apical one short, acutely pointed. Antennæ nearly as long as the body, the second joint short, the following joints nearly equal in length, the four basal ones fulvous, the rest more or less piceous. Thorax transverse, three times broader than long, the sides rounded and narrowly margined, the angles rather blunt, scarcely prominent, the surface with a transverse distinct groove near the base, not extending to the sides, scarcely visibly punctured or entirely impunctate. Scutellum triangular. Elytra without basal depression, closely and finely but distinctly punctured. The posterior tibiæ mucronate; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate. Prosternum narrow; the anterior coxal cavities open.

Parlina was established by Motschulsky for the reception of a species of *Haltica* having the general characters of the genus *Lactica*, with which it agrees in the open coxal cavities and thoracic groove. The typical form (*P. trancisa*), which was also obtained by Mr. Lewis, differs from the species described here in its more general oval shape and more transverse thorax; it agrees well enough with the description of the author to leave little doubt about the identity of the species. In *Parlina* the thoracic groove is placed close to the posterior margins and is bounded at the sides by a short, not very distinct perpendicular groove. *P. fulva*, of which several specimens are before me, differs in the almost entirely fulvous colour, in the much less transverse thorax, and in the narrower prosternum as well as in the more oblong shape. Chapuis seems to have overlooked the present genus, as he makes no mention of it in his 'Genera des Coléoptères.'

From *Lactica* the type of *Parlina* differs in the much more transverse thorax and its sinuate groove, the latter not being bounded by a lateral depression.

HYPNOPHILA VIOLACEIPENNIS, sp. nov.

Ovate, very convex; black; basal joints of the antennæ and the posterior tibiæ obscure testaceous; thorax scarcely visibly punctured; elytra dark violaceous, punctate-striate.

Length $\frac{3}{4}$ line.

Head impunctate; the frontal tubercles obsolete. Antennæ with the last five joints transversely dilated, black, the five lower joints testaceous. Thorax transverse, three times as broad as long, the sides straight, the base with a very short longitudinal groove at each side; the surface with a few very minute punctures, visible only under a strong lens. Scutellum piceous. Elytra very strongly convex, narrowed and rather pointed at the apices, each elytron with nine or ten rows of distinct punctures. Posterior tibiæ dilated at the apices, the latter furnished with a row of bristles and below with a long fulvous spine; claws simple.

A single specimen.

HYPNOPHILA APICIPENNIS, sp. nov.

Black; base of the antennæ, the head, thorax, and legs rufous; elytra strongly punctate-striate, the apices fulvous.

Length $\frac{1}{3}$ line.

Head impunctate; antennæ with the last five joints transversely dilated, black, the others fulvous. Thorax nearly three times broader than long, transversely convex, rufous, shining, impunctate, the basal margin with a short longitudinal groove at each side. Elytra subglobose, very convex, strongly punctate-striate, their apices fulvous, this colour extending also partly to the sides. Claws simple.

The single specimen obtained, like the following, is glued to a card, so that I cannot say anything about the underside. It is smaller than *H. violaceipennis,* but seems to possess all the characters of *Hypnophila.*

HYPNOPHILA RUGICOLLIS, sp. nov.

Black; head and thorax very finely rugose and wrinkled; elytra dark purplish, distinctly punctate-striate.

Length $\frac{1}{3}$ line.

Head finely rugose; antennæ black, of the same structure as in the preceding species. Thorax more than twice as broad as long, the sides deflexed; the surface entirely covered with fine longitudinal rugosities, giving it an opaque appearance; a small longitudinal indentation is placed on each side at the basal margin, and a lateral groove extends close to the lateral margin, the latter appearing somewhat thickened and shining. Elytra ovate, very convex and pointed at the apices, the punctures regular and moderately deep and placed in striæ, the single punctures being very closely approached. Legs black, the posterior femora very strongly incrassate, their tibiæ straight and armed at the apex with a long and distinct spine; the first joint of the posterior tarsi nearly as long as the three following joints together; claws simple.

A single specimen.

MANOBIA APICICORNIS, sp. nov.

Piceous or black; head, thorax, and legs fulvous; antennæ black, the four lower and the last joint fulvous; elytra black, their apices fulvous, strongly punctate-striate.

Var. *a.* Entirely fulvous.

Var. *b.* Obscure piceous; the tibiæ fulvous.

Length 1 line.

Head impunctate, the frontal tubercles strongly raised, of an elongate triangular shape, bounded behind by a deep transverse groove, which extends to the inner margin of the eyes. Antennæ nearly as long as the body; the 4 or 5 lower joints obscure fulvous, the five following ones black, the apical joint reddish fulvous; the third and fourth joints equal. Thorax transversely subquadrate, the sides straight, the posterior margin slightly lobed, the anterior angles obliquely truncate and slightly thickened; surface with a deep, strongly sinuate, transverse groove near the base, extending nearly to the posterior angles, the latter produced into a tooth; the disk impunctate, the groove itself with some punctures; scutellum fulvous. Elytra with a well-marked basilar depression, the shoulders prominent, the disk strongly punctate-striate, the punctuation diminishing towards the apices, the interstices slightly costate near the sides. Prosternum rather broad; the anterior coxal cavities open.

M. apicicornis resembles greatly several species from the Malayan regions which served me for the establishment of the present genus; their general appearance is that of a small species of *Crepidodera*, from which the open coxal cavities and the strongly sinuate thoracic groove separates *Manobia*. In *M. apicicornis*, which seems to be a very variable species, the apices of the elytra are pale fulvous, while the last joint of the antennæ is of a more reddish colour; this is constant in all the specimens before me, and separates the species from its allies.

Crepidodera hirtipennis, sp. nov.

Oblong-ovate; black; antennæ and tarsi flavous; thorax rugose-punctate; elytra strongly punctate-striate, the interstices costate, and clothed with long white pubescence.

Length $\frac{1}{2}$ line.

Head not visibly punctured, with some single long white hairs. Antennæ a little shorter than the body, the third and the two following joints equal, slightly shorter than the second but not so stout; terminal joints slightly thickened, the apical one fuscous, the rest flavous. Thorax rather more than twice as broad as long, the sides nearly straight, the disk strongly rugose-punctate, transversely grooved near the base. Elytra with regular rows of deep punctures, the interstices strongly costate, and furnished with long white single hairs. Legs black, tarsi flavous.

Of this small and interesting little species there is only a single example before me. As the specimen is carded, I am not able to say anything about the state of the cavities or other characters of the underside, and have placed it at present in *Crepidodera* on account of the thoracic groove and punctate-striate elytra. The following species, of which also only a single specimen was obtained, is still smaller. Both agree in the almost equally stout femora of all the legs, which leaves it doubtful whether these species would not equally well find their place amongst the Galerucinæ.

Crepidodera minuta, sp. nov.

Entirely pale fulvous; head impunctate; thorax very closely punctured ; elytra regularly punctate-striate, the interstices scarcely raised.

Length ½ line.

Rather smaller and narrower than the preceding species; the thorax twice as broad as long, the sides slightly narrowed towards the base, nearly straight, the surface extremely closely and distinctly punctured, the basal groove distinct and placed close to the posterior margin ; elytra rather paler than the thorax, the punctures larger and arranged in regular rows ; all the femora thickened, the posterior ones scarcely more incrassate than the others.

SEBAETHE SUTURALIS, sp. nov.

Testaceous, terminal joints of the antennæ fuscous; head and thorax impunctate ; elytra very finely and closely punctured, a more or less distinct sutural stripe, narrowed behind, piceous.

Length 1½–2 lines.

Head not longer than broad, impunctate; the frontal tubercles strongly raised, transverse and nearly contiguous ; carina short but distinct. Antennæ closely approached, two thirds the length of the body, the first three joints pale testaceous, the rest fuscous, the third joint one half longer than the second, but slightly shorter than the fourth joint. Thorax narrow, three times as broad as long, the sides slightly rounded and narrowly margined, the anterior angles thickened, the surface somewhat convex and entirely impunctate. Scutellum rather broad, impunctate. Elytra slightly widened towards the middle, their apices rounded, the sides with a narrow margin ; the disk very finely and moderately closely punctured, obscure testaceous like the rest of the body, with a narrow posteriorly constricted sutural piceous stripe not extending to the apices; the posterior tibiæ longitudinally channelled ; the first joint of the posterior tarsi as long as the two following joints together.

Dikoya.

Smaller than *S. pallida*, Jac., the sides of the thorax less strongly rounded, and the surface without depressions ; further distinguished by the sutural stripe; this latter is, however, in some specimens scarcely visible, in others strongly marked. The colour of the antennæ and that of the tarsi is also subject to variation, being sometimes obscure piceous and in some instances testaceous ; the impunctate thorax, the coloration of the elytra, in connection with the size, will help to separate *S. suturalis* from its allies.

SEBAETHE CEYLONENSIS, sp. nov.

Oblong-ovate, obscure testaceous ; thorax impunctate, the sides strongly rounded ; elytra extremely closely and finely punctured.

Length 2½–3 lines.

Head impunctate ; the eyes very large, divided by a space not broader than their diameter ; the frontal tubercles broadly trigonate, bounded behind by a deep groove. Antennæ two thirds the length of the body, the joints slender and elongate, with the exception of the second, of nearly equal length. Thorax nearly three times as broad as long, the sides rounded and narrowly margined. Elytra widened towards the middle, very closely and finely punctured; the prosternum narrow but distinct.

Bogawantalawa.

S. ceylonensis entirely resembles in regard to colour the unicolorous variety of *S. suturalis*, but differs in being of much larger size and in having the sides of the thorax much more rounded; the antennæ have their joints also much more elongate, and the punctuation of the elytra is finer and more closely placed. As the four specimens before me all agree in the above characters, I must consider the species specifically distinct from the preceding. *S. pallida*, Jac., from Celebes, is another very closely allied species, but differs in the depressions of the thorax, the fulvous labrum, and the shorter antennæ.

Sphæroderma orientalis, sp. nov.

Piceous; the three basal joints of the antennæ fulvous; above reddish fulvous; thorax very finely punctured; elytra closely and finely semipunctate-striate.

Length 1 line.

Head impunctate; the frontal tubercles distinct; lower part of the face prominent, the anterior edge of the clypeus straight. Antennæ about half the length of the body, black, the three lower joints fulvous, the second thinner and rather smaller than the preceding, the terminal joints gradually thickened. Thorax transverse, three times broader than long, the sides straight, the posterior margin distinctly sinuate at each side, the median lobe slightly produced and rounded, the surface finely and evenly punctured. Scutellum small. Elytra very convex and distinctly narrowed towards the apices, the shoulders not prominent, the surface very closely and somewhat more distinctly punctured than the thorax, the punctuation arranged in semiregular rows. Legs piceous. Prosternum longer than broad. Elytral epipleuræ broad, nearly extending to the apices.

Galle.

I am unable to say whether the present species is identical with one or the other described by Motschulsky. In some specimens the thorax is more or less stained with piceous.

Chabria (gen. nov. Halticinorum).

Anterior coxal cavities open. Body ovate, rounded, very convex. Antennæ widely separated, filiform, slightly thickened towards the apical joints. Thorax narrowly transverse, four times as broad as long, the sides rounded. Scutellum triangular. Elytra irregularly punctured, convex, strongly deflected towards the apices, their epipleuræ broad and continued below the middle. Posterior femora strongly incrassate; tibiæ not channelled, the posterior ones with a distinct spine; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate. Prosternum narrow but distinct, longer than broad, its base slightly widened and rounded.

The general appearance of the insect for which I am obliged to propose the present genus has much the appearance of a species of *Chrysomela* on account of the ovate and strongly convex shape and the very transversely shaped thorax; the space between the insertion of the antennæ is much greater than is the case in the majority of the *Halticinæ*, while the strongly incrassate posterior femora leaves no doubt as to the proper place of the genus amongst the latter family.

CHABRIA NIGROPLAGIATA, sp. nov. (Plate X. fig. 8.)

Black; antennæ and the tibiæ flavous; above fulvous or flavous, a spot at the vertex, two at the thorax, two transverse bands at the elytra, and a triangular spot near the apices of the latter black.

Length $2\frac{1}{2}$ lines.

Head impunctate, the vertex with a black spot (sometimes wanting); palpi piceous as well as the apices of the jaws; antennæ entirely flavous or fulvous, scarcely half the length of the body, the third joint about one half longer than the second, the terminal joints gradually and slightly thickened. Thorax more than three times broader than long, the sides rounded, the anterior angles obliquely truncate (in one specimen more pointed), the surface with a few scarcely visible punctures, fulvous, with a black spot of variable shape placed on each side at the base. Scutellum black, or with the base only of that colour. Elytra very convex, rounded towards the middle and pointed at the apices, their surface scarcely or not visibly punctured; each elytron with a broad concave-shaped band near the base, not quite extending to either margin; another transverse band is placed at the middle, each end being widened, and a triangular-shaped spot near the apex. Underside and the femora and tarsi black.

Bogawantalawa.

CHABRIA APICICORNIS, sp. nov. (Plate X. fig. 9.)

Piceous; antennæ testaceous, the two apical joints black; thorax and elytra minutely punctured; the posterior tibiæ and the tarsi testaceous or flavous.

Var. The basal joints of the antennæ piceous.

Length $2\frac{1}{2}$–3 lines.

Head rather broader than long, impunctate, the frontal tubercles almost entirely absent, the space between the antennæ broad, divided at the base by a rather deep groove and bounded behind by another transverse groove; clypeus broad, scarcely narrowed above, and forming a single piece with the face; labrum transverse, with a row of fine punctures; palpi incrassate at the penultimate joint, the apical one acute and conical. Antennæ half the length of the body, the third and fourth joints equal, the following slightly widened at their apices, the two or three terminal joints black, the others testaceous. Thorax with the sides very strongly rounded and narrowly margined, the anterior angles entirely obsolete and oblique and indicated only near the middle by a thickened rounded fovea; the surface scarcely visibly punctured. Elytra very convex, deflexed and pointed at the apices, without any basal depression or prominent shoulders, the surface punctured like that of the thorax. Body below coloured like the upper surface; the tibiæ and the tarsi more or less distinctly flavous.

Dikoya, Bogâwantalawa.

Phælota (gen. nov. Halticinorum).

Body ovate, convex, subcylindrical, pointed posteriorly. Antennæ rather distant, gradually thickened at the terminal joints. Thorax transverse, the sides rounded, the anterior angles thickened and obliquely rounded, the disk without depression. Elytra punctate-striate. Anterior tibiæ unarmed; the posterior ones with a very short spine, somewhat widened at their apices, and with a short and shallow longitudinal depression or groove; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate. Prosternum broad, its base truncate. Mesosternum of the same shape but half the size. Anterior coxal cavities closed.

Phælota, like *Chabria*, has much the general appearance of a species of *Chrysomela*; from *Chabria* it differs in the shorter antennæ, the punctate-striate elytra, and the closed coxal cavities.

Phælota semifasciata, sp. nov.

Fulvous or piceous; above obscure greenish æneous varied with fulvous; thorax minutely punctured, the disk greenish; elytra regularly punctate-striate, greenish æneous, the interstices alternately more or less obscure fulvous.

Var. Above and the legs entirely fulvous (immature ?).

Length 2 lines.

Head with a few minute punctures; eyes large; frontal tubercles transversely trigonate, nearly contiguous; the carina indistinct; labrum more or less fulvous. Antennæ half the length of the body, the five lower joints fulvous, the rest black, the apex of the terminal joint fulvous; the second to the fifth joints short, nearly equal, the six terminal ones thickened, slightly longer than broad. Thorax transverse, the anterior margin nearly straight, the posterior one and the sides slightly rounded, the anterior angles much thickened and obtusely rounded, the surface minutely punctured, greenish æneous, the margins more or less fulvous. Elytra very convex, subcylindrical, and pointed at the apices, strongly punctate-striate. Legs piceous or fulvous, more or less stained with greenish æneous.

Bogawantalawa.

In some specimens the elytra show alternate longitudinal bands of æneous and fulvous.

Pexodorus (gen. nov. Halticinorum).

Body ovate, widened behind; palpi slender, filiform. Antennæ filiform, the second joint short, the third and fourth joints equal.

Thorax narrowly transverse, three times as broad as long. Scutellum triangular. Elytra with a more or less distinct basal depression, semipunctate-striate, their epipleuræ not continued below the middle; the four anterior tibiæ unarmed, the posterior ones with a small spine; the first joint of the posterior tarsi as long as the two following ones together; claws appendiculate. Prosternum distinct; the anterior coxal cavities closed.

Pexodorus will enter Chapuis's eighth group, the *Oxygoninæ*, on account of the closed coxal cavities and the narrow transverse thorax. From *Oxygona* the genus is distinguished by the short ovate general shape of its body and the elytral epipleuræ, which are obsolete below the middle.

PEXODORUS CEYLONENSIS, sp. nov. (Plate X. fig. 10.)

Black or metallic green; the basal joints of the antennæ, the four anterior legs, and the posterior tibiæ testaceous; thorax impunctate; elytra finely and closely punctate-striate.

♀ (?). Elytra with deep basal depression; antennæ entirely testaceous; all the femora and the posterior tibiæ black.

Length $1\frac{1}{2}$–2 lines.

Head rather broader than long; the frontal elevations ovate, but little raised and small; eyes entire, of oblong shape; clypeus rather flat; labrum obscure fulvous. Antennæ two thirds the length of the body, testaceous, the three or four apical joints fuscous. Thorax rather more than three times as broad as long, the posterior margin slightly rounded, the sides narrowly margined, nearly straight, the anterior angles somewhat broad and slightly produced, furnished as well as the posterior ones with a single hair; the surface entirely impunctate. Elytra widened towards the apices, with a shallow basal depression; the surface finely and very closely punctate-striate; the posterior femora strongly incrassate, piceous, the others and the tibiæ and tarsi testaceous. Prosternum narrow; mesosternum much broader, its base slightly emarginate.

Dikoya.

I am not quite sure whether I rightly refer two specimens, which differ from the others in the very deep elytral depressions and differently coloured legs, to the female sex. In the absence of other distinguishing characters it is as well to regard them as such. Some specimens are of a metallic greenish or bluish colour and the antennæ are entirely flavous; in others the colour of the latter is nearly black; but I cannot discover any other differences of importance.

PHILOGEUS (gen. nov. Halticinorum).

Ovate, convex, subcylindrical. Anterior coxal cavities open; eyes large; palpi robust; antennæ with dilated apical joints. Thorax transversely subquadrate, with a shallow transverse groove near the base, the anterior angles oblique, notched before the middle. Elytra finely punctate-striate, not depressed below the base. Posterior femora strongly incrassate, their tibiæ dilated at the apices, with a shallow longitudinal groove, armed with a spine; the first joint of the posterior tarsi rather longer than the two following joints together; claws bifid; prosternum longer than broad, very distinct; mesosternum transversely subquadrate.

The insect for which I am obliged to establish the present genus has quite the appearance of a small species of *Typophorus* amongst the Eumolpinæ. From any other genus of the present family, especially from *Manobia*, Jac., *Philogeus* may be distinguished by the dilated and flattened posterior tibiæ in connection with the thoracic groove and the dilated antennæ, as well as by the bifid claws, which is a character of rare occurrence amongst the Halticinæ.

Philogeus fulvipennis, sp. nov.

Fulvous; head, antennæ, thorax and the legs black; thorax impunctate; elytra very finely punctate-striate, fulvous.

Length $1\frac{1}{2}$ line.

Head impunctate, the frontal tubercles obsolete; the carina acutely raised; antennæ closely approached, nearly as long as the body, the third and fourth joints equal, slightly longer than the second, which is thickened, the sixth to the tenth joints gradually and distinctly widened, pubescent, the terminal one of usual size, often fulvous. Thorax about one half broader than long, the sides straight, the posterior margin slightly and broadly rounded, the anterior angles forming an obtuse tooth before the middle; the surface scarcely visibly punctured, with an obsolete sinuate transverse groove near the base extending some way upwards at the sides; scutellum rather broad, its apex rounded. Elytra extremely finely and rather distantly punctate-striate, their apices rounded.

Dikoya.

Amphimeloides (gen. nov. Halticinorum).

Subovate, convex. Antennæ separated, inserted immediately below the eyes, short, their apical joints widened. Thorax transverse, the sides angulate before the middle. Elytra irregularly punctured. Posterior femora strongly incrassate, their tibiæ dilated and slightly longitudinally sulcate near the apices, the latter armed with a long spine. Claws appendiculate. Prosternum very narrow but distinct. Anterior coxal cavities open.

From all other genera of Halticidæ with the exception of *Amphimela* the present genus differs by the broad space dividing the insertion of the antennæ, while the open coxal cavities will distinguish the genus from *Amphimela* proper.

Amphimeloides dorsalis, sp. nov.

Fulvous; the apical joints of the antennæ, the posterior femora, and the breast piceous or black; thorax scarcely visibly, elytra more distinctly and closely punctured, each elytron with a broad longitudinal black band, abbreviated posteriorly.

Length 1 line.

Head impunctate, without transverse groove or frontal elevations; the clypeus not separated from the face, which forms a plane surface;

labrum piceous; palpi long and slender. Antennæ inserted close to the inner margin of the eyes, scarcely extending in length to the base of the thorax, the second joint short and thickened, the third more slender and longer, the rest gradually widened and transversely shaped; black, the four basal joints fulvous. Thorax at least three times broader than long, pale fulvous, the sides straight and forming a distinct angle before the middle, the posterior margin evenly and moderately rounded; the surface without depressions, smooth and nearly impunctate. Scutellum broadly ovate, black. Elytra convex, subcylindrical, closely and distinctly punctured, fulvous, each elytron with a broad black band commencing at the middle of the base and extending below the middle, the outer margin deeply concave at the middle. Legs fulvous, the posterior femora piceous as well as the sides of the breast.

The elytral band is slightly widened at the apex, and approaches gradually towards the suture without, however, touching the latter.

TEGYRIUS (gen. nov. Halticinorum).

Ovate, subcylindrical. Antennæ slender, filiform, the third joint slightly longer than the second. Thorax transversely subquadrate, the surface transversely but obsoletely grooved near the base. Elytra convex, broader than the thorax, without depressions, finely and semiregularly punctured. Posterior femora strongly incrassate, their tibiæ dilated and longitudinally channelled, their apices with a small spine; the first joint of the posterior tarsi as long as the three following joints together. Claws appendiculate. Prosternum broad, subquadrate. Mesosternum broader than long, its base concave-emarginate. Anterior coxal cavities open.

Tegyrius has the general shape and appearance of *Philogeus*, but differs in the filiform antennæ, the much longer metatarsus of the posterior tarsi, and in the appendiculate, not bifid, claws. From *Longitarsus* the genus may be distinguished by the transverse sinuate groove of the thorax and the broad prosternum.

TEGYRIUS METALLICUS, sp. nov.

Black; antennæ, legs, the posterior femora excepted, testaceous; above metallic greenish æneous; head and thorax impunctate; elytra very finely semipunctate-striate.

Length 1 line.

Head impunctate; the frontal tubercles and the carina very narrow and rather indistinct. Antennæ nearly as long as the body, the fourth joint one half longer than the third, the second thickened. Thorax scarcely twice as broad as long, the sides straight, the anterior angles obliquely truncate and slightly thickened, the basilar transverse groove sinuate, not very deep and not extending to the sides; the disk entirely impunctate. Elytra convex, subcylindrical, without basal depression, the shoulders not prominent, the apices rounded; surface very closely and minutely punctured, the punctuation arranged in semiregular rows; the anterior tarsi, the posterior femora, and the inner side of the posterior tibiæ blackish.

The antennæ and the legs in this species are subject to variation in colour; sometimes the first two joints of the antennæ are stained with piceous as well as the legs and tarsi, the latter in other specimens being entirely testaceous with the exception of the posterior femora.

Alytus (gen. nov. Halticinorum).

Body ovate, pointed behind. Head not longer than broad; fronta tubercles strongly raised; antennæ as long as or longer than the body, the second and third joints nearly equal. Thorax subquadrate, the angles not produced, the surface with a distinct transverse groove near the base, extending to the posterior angles. Scutellum trigonate. Elytra ovate convex, pointed posteriorly, regularly punctate-striate. Posterior femora strongly incrassate, their tibiæ with a distinct spine; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate. Anterior coxal cavities open. Prosternum narrowly elongate, much longer than broad; mesosternum distinct, subquadrate.

In its general appearance the insect, for the reception of which I am obliged to establish the present genus, resembles a species of *Longitarsus*, from which the distinct transverse groove of the thorax and the short metatarsus of the posterior legs separate it; the punctate-striate and the ovate and strongly pointed elytra are further characteristic of *Alytus*. A single species is before me.

Alytus ceylonensis, sp. nov.

Fulvous or testaceous; posterior femora piceous; the disk of the thorax impunctate, the groove punctured; elytra strongly punctate-striate.

Length $\frac{3}{4}$–1 line.

Head impunctate, the frontal tubercles strongly developed, elongate; the third joint of the antennæ thinner than the second, but scarcely longer, the following joints more slender and elongate. Thorax transversely quadrate, slightly constricted at the base, the sides nearly straight, the angles rather obtuse, the surface entirely impunctate, the transverse groove closely punctured. Elytra ovate, convex, widened at the middle, fulvous; each elytron with about ten rows of regular and distinct punctures, the first row very short. Legs testaceous, the apices of the posterior femora piceous.

The general colour of the upper surface is dark fulvous, very shining, the thorax and the legs being of a paler tint. The elytra are strongly narrowed at the base and at the apices, so that the thorax is broader than the elytra at the base.

Thrylæa (gen. nov. Halticinorum).

Body rounded, subovate; eyes rather large; frontal tubercles in shape of oblique narrow ridges. Antennæ rather short, the terminal joints thickened. Thorax transverse, the anterior angles obliquely truncate, the surface without transverse groove, the basal margin with a short perpendicular groove. Elytra distinctly punctate-striate; their epipleuræ very broad, concave, and continued to the apices; posterior femora strongly thickened; tibiæ not channelled, the posterior ones with a short spine; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate. Prosternum broad, one half longer than broad. Mesosternum transversely quadrate. Anterior coxal cavities open.

The rounded convex shape, the short perpendicular basal grooves of the thorax, in connection with the punctate-striate elytra, the broad prosternum, and open coxal cavities separate this genus.

THRYLÆA VARIABILIS, sp. nov.

Reddish fulvous; head, thorax, and the legs black; thorax distinctly punctured; elytra strongly punctate-striate, dark fulvous.

Var. Fulvous; elytra black, the suture and the apices fulvous.

Length 1 line.

Head impunctate, the clypeus thickened; labrum margined with fulvous. Antennæ about half the length of the body, black, the apices of the first five joints stained with fulvous; the second joint as thick, but half the size of the first, the third and the two following joints nearly equal, shorter and thinner, the rest more flattened and dilated. Thorax transverse, rather more than twice as broad as long, the sides straight, the anterior angles oblique forming a thickened angle before the middle; surface finely but distinctly and not very closely punctured, black. Scutellum fulvous. Elytra rounded, strongly and regularly punctate-striate, the interstices with a few fine punctures, slightly convex near the sides and apices, the shoulders thickened and somewhat prominent. Legs black; tarsi piceous.

Bogawantalawa.

MORYLUS (gen. nov. Halticinorum).

Body ovate. Antennæ slightly widened at the terminal joints, the third and fourth joints equal. Thorax transverse, without depressions, the anterior angles oblique. Scutellum broader than long. Elytra irregularly punctured, their epipleuræ extending below the middle. The posterior femora strongly incrassate, their tibiæ deeply longitudinally channelled, armed at the apices with a small spine; the anterior tibiæ unarmed. Claws appendiculate. Prosternum very broad. Mesosternum more than twice as broad as long. Anterior coxal cavities open.

Morylus agrees with *Sebaethe*, Baly, in the deeply sulcate posterior tibiæ, but differs in the shape of the thorax, the sides of which are straight, not flattened or margined, and in the broad prosternum.

MORYLUS FULVIPENNIS, sp. nov.

Black, head and thorax impunctate; elytra fulvous, depressed below the base, very closely and distinctly punctured; legs black.

Length $1\frac{1}{4}$ line.

Head entirely impunctate, the frontal elevations in shape of narrow oblique ridges, which continue between the antennæ; the lower part of the face concave; the penultimate joint of the palpi transversely quadrate. Antennæ rather robust, more than half the length of the body, black; the first joint thick and rather short, the second as thick but one third shorter, the two following joints elongate and thinner, the rest gradually and moderately dilated, longer than broad. Thorax rather more than twice as broad as long, widened at the middle, the sides perfectly straight, the anterior angles obliquely cut, forming a tooth before the middle, the surface not visibly punctured. Elytra slightly widened towards the middle, broadly and rather obsoletely depressed below the base, the shoulders somewhat prominent; the surface very closely and distinctly punctured, reddish fulvous.

IVALIA (gen. nov. Halticinorum).

Body very convex, ovate. Antennæ with the seven last joints transversely dilated. Thorax transverse, without grooves. Elytra irregularly punctured; the posterior femora strongly incrassate; posterior tibiæ stout, widened behind, deeply channelled, the edges armed with several teeth, the apices with a long spine. Claws appendiculate. Prosternum narrowly elongate; mesosternum very transversely shaped, widened at the middle. Anterior coxal cavities open.

I am obliged to propose the present genus for the reception of some small species of Halticidæ having the general shape and appearance of *Apteropeda*, but differing from that and the allied genera placed by Chapuis in his 16th group by the irregularly punctured elytra and the appendiculate claws.

IVALIA VIRIDIPENNIS, sp. nov. (Plate X. fig. 12.)

Reddish fulvous; terminal joints of the antennæ black; elytra metallic green, finely and closely punctured, their apices very pointed.

♀ (?). Larger, more rounded, the apices of the elytra fulvous.

Length $\frac{3}{4}$–1 line.

Head impunctate, fulvous; the frontal tubercles obsolete; palpi long and rather slender, the apical joint piceous. Antennæ black, the four lower joints testaceous, the third and fourth joints small, equal, the following transversely dilated, pubescent. Thorax nearly three times as broad as long, widened at the middle, the sides nearly straight, the angles obsolete; surface extremely finely punctured, fulvous. Elytra ovate, strongly narrowed and pointed at the apices, the surface very closely punctured. Legs fulvous; the posterior tibiæ with three or four teeth at their margins.

Bogawantalawa.

In the specimen which I consider to be the female of this species the general shape is more robust, and the elytra have their extreme apices of a fulvous colour; the teeth at the tibiæ are not so plainly marked; but other differences of importance I cannot find.

IVALIA METALLICA, sp. nov. (Plate X. fig. 11.)

Black or piceous below; the four basal joints of the antennæ testaceous; thorax metallic blue or greenish, finely punctured; elytra metallic purplish or cupreous, closely punctured.

Length 1 line.

Head impunctate; the frontal tubercles feebly raised. Antennæ black, the last seven joints transversely dilated, the others obscure testaceous. Thorax transversely subcylindrical, widened towards the middle, the surface finely granulate and punctured, with an obscure longitudinal impression near the lateral margin. Scutellum triangular, piceous. Elytra very convex, narrowed behind, of a reddish metallic cupreous colour, very closely and irregularly punctured. Legs black, the tibiæ rather lighter, the posterior ones armed with three or four teeth; their apices with a long fulvous spine; claws appendiculate.

Bogawantalawa.

This species is of the same shape as the preceding, with which it has further all the structural characters in common; the different coloration sufficiently distinguishes it.

IVALIA FULVIPENNIS, sp. nov.

Black; head and thorax impunctate; elytra dark fulvous, very closely and irregularly punctured.

Length 1 line.

Head broader than long. Antennæ short, robust, the three lower joints obscure fulvous, the rest black. Thorax three times as broad as long, the sides nearly straight, surface entirely impunctate, black. Scutellum black. Elytra rounded, very convex, dark reddish fulvous, closely punctured, the interstices somewhat rugose or wrinkled. Legs piceous, the tibiæ more or less obscure fulvous.

DEMARCHUS (gen. nov. Halticinorum).

Body ovate; pubescent. Antennæ filiform, the third joint more than double the length of the second; palpi robust. Thorax transverse with an anterior and posterior transverse depression. Scutellum subpentagonal. Elytra pubescent, finely rugose, their epipleuræ disappearing below the middle. Tibiæ simple, unarmed; the first joint of the posterior tarsi not longer than the second; claws obsoletely bifid. Anterior coxal cavities open. Prosternum scarcely visible. Mesosternum narrow and pointed.

The single specimen before me, upon which I am obliged to establish the present genus, resembles in general appearance a species of the genus *Sebaetha*, from which the simple tibiæ, transversely impressed thorax, and the pubescent elytra will at once distinguish it. The posterior femora are moderately but very distinctly incrassate.

DEMARCHUS PUBIPENNIS, sp. nov.

Testaceous; head rugose; thorax shining, nearly impunctate; elytra obscure fulvous, the basal and the lateral margin obscure piceous.

Length 2 lines.

Head finely rugose at the vertex, the frontal tubercles distinct, nearly square-shaped and smooth; labrum piceous. Antennæ nearly as long as the body, testaceous, the third and following joints elongate, nearly equal in length and much longer than the second joint. Thorax more than twice as broad as long, the sides rounded at the middle, narrowed near the anterior angles, the latter slightly prominent; the surface shining, scarcely visibly punctured near the side, with a short anterior and posterior transverse groove and a small anterior fovea as well as an obsolete oblique posterior lateral depression. Scutellum obscure fulvous. Elytra closely pubescent, very finely rugose-punctate, the basal margin and the sides to below the middle obscure piceous or fuscous, the rest of the surface very obscure fulvous. Legs and underside testaceous; the claws indistinctly bifid.

SPHÆROPLEURA (gen. nov. Halticinorum).

Body strongly rounded and convex. Antennæ filiform, the first joint slender, the second and following joints nearly equal and shorter. Thorax subhemispherical, without depression. Elytra punctate-striate, their epipleuræ very broad and concave, continued to below the middle; the posterior femora strongly dilated; the four posterior tibiæ mucronate; the first joint of the posterior tarsi as long as the two following joints united; claws appendiculate. Prosternum narrow, deeply longitudinally channelled. Mesosternum deeply emarginate at its apex. Anterior coxal cavities closed.

Sphæropleura agrees in shape, which resembles that of a species of *Coccinella*, with *Sphærophyma*, Baly, *Argopistes*, Motsch., and *Homelea*, Jac. It differs from the first-named genus in the much less strongly dilated posterior femora, the longer and not dilated tibiæ, and the smaller eyes, also in the want of a thoracic median lobe. From *Argopistes* this genus may be separated by the filiform antennæ and the punctate-striate elytra; and from *Homelea* by the much more strongly incrassate posterior femora, the latter in *Homelea* being only about one half thicker than the rest of the thighs, and the mesosternum strongly transverse and of different shape, and the elytra irregularly punctured.

SPHÆROPLEURA TRICOSTATA, sp. nov.

Piceous below; antennæ, tibiæ, and tarsi testaceous; head and thorax impunctate, black; elytra finely punctate-striate.

♀. Each elytron with three short but distinct costæ near the apex.

Var. Elytra fulvous.

Length $1\frac{1}{2}$ line.

Head entirely impunctate; the frontal tubercles very small and indistinct; labrum fulvous. Antennæ about half the length of the body, testaceous, the terminal joint fuscous. Thorax subhemispherical, more than three times as broad as long, the sides straight, the angles not produced but distinct. Elytra wider at the base than the thorax, very convex and rounded, the punctuation very fine at the middle of the disk, much more distinct towards the sides; of the three costæ placed near the apex in the female, the first is shorter than the others, but none extend to the end of the elytra nor to the middle. The shoulders are but little prominent, and between them and the lateral margin of the elytra there is a broader impunctate space extending to the middle, the lateral margin itself being accompanied by a row of deep punctures. The legs are subject to some variation in colour, being sometimes dark fulvous, but the anterior tibiæ seem to remain testaceous.

Aulacophora stevensi, Baly. (Plate XI. fig. 1.)

Testaceous; head and thorax impunctate; elytra finely punctured; a sutural and submarginal narrow stripe, as well as their extreme apices, black.

♂. The fourth joint of the antennæ strongly swollen and elongate.

Length 3 lines.

Head rather swollen at the vertex, impunctate, the frontal tubercles narrowly transverse. Antennæ more than two thirds the length of the elytra, entirely testaceous, the second joint extremely short, the third and fifth joints triangularly dilated in the male, the fourth greatly enlarged in the same sex, the rest of nearly equal length and slender. Thorax transverse, the sides rather deflexed and widened towards the apex, the surface with a deeply impressed transverse groove near the base, impunctate. Scutellum black. Elytra rather convex and gradually widened posteriorly, extremely finely and rather closely punctured, a narrow sutural stripe extending to the apices and round the latter, and another equally narrow stripe near the lateral margin, commencing at the base and abbreviated before the apex of each elytron, black. Legs and underside entirely testaceous.

The female only differs from the male in having simple antennæ.

Bogawantalawa.

Aulacophora nigripeta, Duviv. (Plate XI. figs. 2, 3.)

Phyllobrotica hirtipennis, sp. nov.

Obscure piceous or black below; basal joints of the antennæ, the head, thorax, and the femora fulvous; elytra obscure testaceous, finely rugose and pubescent, the margins narrowly fuscous.

Length $1\frac{1}{2}$ line.

Head impunctate; the frontal tubercles distinct but small; palpi robust. Antennæ two thirds the length of the body, piceous, the three basal joints fulvous. Thorax transverse, the sides slightly constricted at the base, the disk rather deeply transversely depressed, impunctate. Elytra very obscure pale or darker testaceous, sometimes fuscous, the suture and the lateral margin at the shoulders darker; the surface slightly rugosely punctured and moderately closely covered with stiff whitish hairs; their epipleuræ extremely narrow. Tibiæ unarmed, fuscous; the first joint of the posterior tarsi as long as the two following joints together; the anterior coxal cavities open.

Nuwara Eliya.

The legs are sometimes entirely fulvous, but generally the femora only are of that colour.

PHYLLOBROTICA MARGINATA, sp. nov.

Testaceous; the basal joints of the antennæ, the head, and thorax fulvous; scutellum black; elytra testaceous, very finely rugosely punctate, the sutural and lateral margins narrowly black.

Length 2 lines.

Head impunctate; the frontal tubercles trigonate, strongly raised. Antennæ nearly as long as the body, the third joint double the length of the second, the following ones nearly equal to the third joint, the three basal ones fulvous, the rest fuscous. Thorax transverse, more than twice as broad as long, the anterior and posterior margin straight and parallel; the surface rather deeply transversely depressed, impunctate, shining, fulvous like the head. Scutellum black. Elytra parallel, extremely finely punctured and rugose, the extreme lateral and sutural margins black; their epipleuræ very narrow. Legs slender, the tibiæ unarmed; the first joint of the posterior tibiæ as long as the two following joints together; claws appendiculate; anterior coxal cavities open.

P. marginata differs somewhat from the more typical species of the genus in the more transversely shaped thorax and the distinct, although very narrow elytral epipleuræ. In the absence of other marks of distinction, I have placed the species in *Phyllobrotica*.

MIMASTRA CAPITATA, sp. nov.

Narrowly elongate; testaceous; antennæ and the breast black; vertex of the head metallic greenish; thorax impunctate, depressed at the disk; elytra finely punctured and rugose, with a metallic green gloss, the margins narrowly greenish black.

Length 2–3 lines.

Head impunctate at the vertex, the latter very finely granulate, metallic green or æneous; lower part of the face testaceous; the labrum obscure piceous. Antennæ longer than the body, the second joint extremely short, the others very elongate and of nearly equal length; black, sometimes the basal joints obscure fulvous. Thorax square-shaped, the disk deeply transversely depressed, impunctate, testaceous or fulvous, the lateral margins more or less stained with dark greenish. Elytra finely transversely rugose and closely punctured; testaceous, stained with metallic greenish, the latter colour more distinct at the basal margin; the suture and the lateral margins also narrowly dark æneous, which colour extends also to the epipleuræ; the underside either entirely or partially black. Legs fulvous, the tarsi generally fuscous; the first joint of the posterior tarsi as long as the three following joints together; tibiæ unarmed. Anterior coxal cavities open.

Dikoya.

Except in the greater length of the posterior metatarsus, this species does not differ in any other material way from its allies.

MIMASTRA ROBUSTA, sp. nov.

Below piceous or blackish; above fulvous; antennæ and legs flavous; thorax impunctate, obsoletely depressed; elytra very minutely punctured.

Length $2\frac{3}{4}$ lines.

Head impunctate, not longer than broad; the frontal tubercles in shape of narrow transverse ridges; the anterior margin of the clypeus straight; extreme apices of the jaws black. Antennæ slender, nearly as long as the body, flavous, the two apical joints slightly fuscous, the third joint slightly shorter than the fourth. Thorax subquadrate, scarcely more than one half broader than long, the sides narrowed towards the base, the angles not prominent, the surface feebly impressed at the middle, impunctate. Elytra rather flattened, the base scarcely or feebly raised, the surface very finely and rather closely punctured, the punctuation here and there arranged in rows; elytral epipleuræ continued below the middle. Legs rather short and stout, flavous; tibiæ unarmed; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate. Anterior coxal cavities incomplete. Underside blackish, with a slightly metallic bluish gloss.

Although the general shape of this species is less elongate and the thorax less transversely shaped than is the case with most of the other representatives of the genus *Mimastra*, it would scarcely be deemed sufficient to establish on these differences alone another genus, as, moreover, the open coxal cavities and the unarmed tibiæ are characteristic of the present genus.

GALERUCELLA VIRIDA, sp. nov.

Oblong, rather convex; testaceous; antennæ, tibiæ, and tarsi fuscous; above pale green, closely punctured; the head, thorax, and the elytra narrowly margined with flavous.

Length 4 lines.

Head very finely and closely punctured, with a fine longitudinal central groove, the vertex green, the sides narrowly flavous; the anterior margin of the clypeus straight; labrum and palpi piceous. Antennæ inserted just above the lower edge of the clypeus, about half the length of the body, fuscous, the third joint one half longer than the second, the following ones slightly longer. Thorax three times as broad as long, the sides and the anterior margins nearly straight, the posterior angles slightly oblique; surface finely pubescent, closely and finely punctured, obsoletely depressed near the base and at the sides, green, opaque; the lateral margins narrowly flavous, the anterior angles with an elongate narrow piceous spot. The apex of the scutellum broadly truncate, the surface finely punctured, pale green. Elytra more evenly and finely punctured than the thorax, covered with short yellowish pubescence, the lateral margins narrowly flavous, the disk pale green. Underside and legs testaceous; the knees, tibiæ, and the tarsi fuscous or piceous. Tibiæ unarmed; claws bifid; anterior coxal cavities open.

A single specimen.

GALERUCELLA CEYLONENSIS, sp. nov. (Plate XI. fig. 12.)

Testaceous; apical joints of the antennæ fuscous; head and thorax rugose-punctate, the former with one, the latter with three black spots; elytra pale fulvous, finely pubescent, a narrow sutural and a broad lateral stripe bright green.

Length 3–3½ lines.

Head closely rugose-punctate, testaceous, with a large triangular black spot at the vertex. Antennæ slender, filiform, two thirds the length of the body, black or fuscous at the terminal joints, the basal ones, varying in numbers, fulvous; third joint longer than the fourth. Thorax more than twice as broad as long, the sides strongly rounded at the middle, the anterior angles produced into an acute point; surface transversely and strongly depressed, more strongly rugose-punctate than the head, testaceous, with a large black spot at each side, and another one, mesially constricted, at the middle. Scutellum testaceous, broad, its apex truncate. Elytra slightly widened behind, closely covered with fine silky whitish pubescence; a very narrow sutural stripe, not quite extending to the apices, and another very broad one, commencing at the scutellum and extending to the apical margin of each elytron, bright green, the rest of the surface as well as the extreme lateral margin testaceous. Legs of the same colour, the upperside of the femora and that of the tibiæ more or less distinctly marked with a piceous stripe, sometimes the legs are entirely of that colour. Claws bifid.

Kitukgalle.

Galerucella lateralis, sp. nov.

Ovate, slightly widened posteriorly, testaceous; antennæ, a spot at the vertex and three at the thorax, fuscous; elytra closely punctured and pubescent, obscure greenish, the lateral margins narrowly testaceous.

Length 2¾–3 lines.

Head finely rugose, pale brownish or testaceous, a triangular spot at the vertex and the central narrow groove fuscous; the anterior margin of the clypeus thickened. Antennæ nearly as long as the body, the third joint very long and slender, all the others shorter but equally slender, the second joint very short. Thorax more than three times as broad as long, the sides narrowed towards the apex, slightly sinuate, the anterior angles produced into a very small tooth, the posterior ones oblique and sinuate at each side; the disk with a transverse depression at the sides and a longitudinal impressed central line, sculptured like the head and sparingly clothed with very short pubescence; a spot at each side, and another near the anterior margin at the middle, fuscous. Scutellum fuscous. Elytra rather convex, much more distinctly and closely covered with white hairs, extremely finely and closely rugose-punctate, obscure dark greenish, opaque, the lateral margins obscure pale testaceous. The sides of the breast, the femora above, and the outside of the tibiæ piceous. The first joint of the posterior tarsi scarcely longer than the following one; claws bifid; anterior coxal cavities open.

Kitukgalle.

In one specimen the thorax is almost entirely fuscous, owing probably to discoloration. At once distinguished from *G. ceylonensis* by the much more transverse and finely punctured thorax as well as by the uniform obscure, not metallic green, colour of the elytra.

GALERUCELLA CROTCHI, sp. nov.

Obscure testaceous, finely pubescent; the head with one, the thorax with three fuscous spots; elytra metallic green, finely rugose and pubescent, the sutural and lateral margin narrowly purplish.

Length $2\frac{1}{2}$ lines.

Head minutely punctured, with an indistinct central longitudinal groove, the vertex with an obscure large fuscous spot. Antennæ half the length of the body, testaceous, the terminal joints stained with fuscous, the third joint shorter than the fourth. Thorax twice as broad as long, the sides rounded, narrowed at the base, surface finely pubescent, with an obsolete transverse lateral and a deeper longitudinal central depression, the sides and the central groove fuscous. Scutellum fuscous. Elytra covered with rather long grey pubescence, bright metallic green, narrowly margined with purplish, the surface finely rugose-punctate. The tibiæ unarmed, the first joint of the posterior tarsi nearly as long as the two following joints together. Claws bifid; anterior coxal cavities open.

Galeruca ænescens, Fairm., from Central China, seems to be closely allied to the present species, but differs in the equal length of the third and fourth joints of the antennæ and in the traces of longitudinal costæ of the elytra, also in the different shape of the thorax.

GALERUCELLA MARGINATA, sp. nov.

Obscure testaceous; antennæ, tibiæ, and tarsi black; head and thorax strongly punctured, shining, the thorax with five black spots; elytra very finely punctured and pubescent, obscure testaceous, a narrow longitudinal stripe near the lateral margin blackish.

Length $3\frac{1}{2}$ lines.

Head closely rugose-punctate, the vertex obscure fuscous. Antennæ more than half the length of the body, black, slender, the third joint the longest. Thorax more than twice as broad as long; the sides subangulate at the middle, the anterior angles slightly dentate; the surface closely impressed with larger and smaller punctures, the sides with a deep round fovea, the middle with an obscure longitudinal depression, the latter of black colour, a similar-coloured spot is placed close to the lateral margins, making in all five spots placed transversely across the disk. Elytra rather convex, very finely and closely punctured and covered with short whitish pubescence; a narrow lateral stripe commences at the shoulder and is abbreviated a little distance from the apex of each elytron; the first joint of the posterior tarsi as long as the two following joints; claws bifid.

A single specimen.

XENARTHRA MIRABILIS, sp. nov. (Plate XI. fig. 9.)

Elongate, parallel; subdepressed, testaceous; antennæ piceous, pectinated, 12-jointed; head with three, thorax with five piceous spots; elytra finely punctured, sparingly pubescent, the base and a broad transverse band below the middle greenish piceous.

Length 3 lines.

Head impunctate, a triangular spot at the middle of the vertex, and another smaller one at each side, piceous; eyes prominent; the frontal tubercles distinct, but rather small. Antennæ as long as the body, piceous, the apices of all the joints testaceous, the first joint curved and slender, the second one extremely small, entirely testaceous, the eight following joints with long and slender appendages, the tenth much longer and broader than the preceding ones, the terminal joints long and slender. Thorax twice as broad as long, the sides slightly rounded at, but somewhat constricted below, the middle, the posterior margin evenly rounded, the anterior one nearly straight; the surface obsoletely transversely depressed, entirely impunctate, with a narrow longitudinal band at the sides and three spots, placed triangularly at the middle, piceous. Scutellum triangular, testaceous. Elytra with two deep foveæ below the base, the punctuation rather fine and placed in close, very irregular rows, the interstices slightly convex and furnished with rows of stiff testaceous hairs; a narrow transverse band at the base, the interior of the subbasilar depressions, and a broad transverse band below the middle, consisting of longitudinal bands joined together, greenish æneous or piceous; the elytral epipleura and the breast of the same colour. Tibiæ slightly stained with piceous at their apices; the latter unarmed; the first joint of the posterior tarsi as long as the three following joints together; claws appendiculate; anterior coxal cavities closed.

Bogawantalawa.

The genus *Xenarthra* was established by Mr. Baly on an insect likewise from Ceylon, and described in the 'Journal of Entomology' for 1860. The curiously shaped and deeply pectinated antennæ, consisting of 12 or even 13 joints, will without difficulty allow the genus to be recognized at first sight. Closed anterior coxal cavities and unarmed tibiæ seem to show the place of *Xenarthra* to be amongst the *Platyxanthinæ* of Chapuis. There is unfortunately only a single specimen of this handsome species before me, and being fixed upon a card I am not able to say with certainty to which sex it belongs. Mr. Baly evidently also only knew the male sex of his species, and it is possible that the female insect differs in the shape of the antennæ. In the present insect a close examination of these parts proves them to consist of 13 joints, the terminal one or appendage being here much longer than in any other Phytophagous insect with which I am acquainted.

Chapuis has described a species of *Xenarthra* from Abyssinia of which I possess a specimen; this species, however, belongs to an entirely different genus.

XENARTHRA LEWISI, sp. nov. (Plate XI. fig. 10.)

Entirely testaceous, the two last joints of the antennæ black.

Thorax with two deep depressions, impunctate; elytra very finely and closely punctured, sparingly pubescent.

Length $2\frac{1}{2}$ lines.

Head impunctate, with a deep triangular fovea between the eyes. Antennæ as long as the body, the third to the ninth joints furnished with slender and long appendages, the tenth triangularly widened and compressed, emarginate at its outer side, the eleventh and twelfth joints simple. Thorax twice as broad as long, the sides constricted near the base, the surface with a transverse groove at each side nearly extending to the middle, entirely impunctate. Scutellum triangular. Elytra parallel with a small depression immediately below the scutellum, extremely finely punctured, the interstices furnished here and there with single stiff hairs; the first joint of the posterior tarsi as long as the three following joints together.

Dikoya.

Xenarthra unicolor, sp. nov. (Plate XI. fig. 11.)

Elongate, subdepressed; testaceous; the extreme apices of the tibiæ fuscous; thorax square-shaped, impunctate; elytra scarcely visibly punctured, sparingly covered with long hairs.

Length 4 lines.

Head impunctate; palpi robust. Antennæ slightly shorter than the body, fuscous, the long appendages and the penultimate joint lighter, the latter thickened and elongate, as long as the following or terminal joint. Thorax scarcely broader than long, the sides nearly straight, slightly rounded before the middle; the surface with two very shallow depressions, occupying the middle of the disk, clothed with a few long hairs, entirely impunctate. Elytra with some very fine punctures arranged somewhat longitudinally, clothed with long single hairs; the intermediate tibiæ slightly curved; the first joint of the posterior tarsi as long as the three following joints together.

Colombo.

Of this species, which may be known by the larger size and the different structure of the terminal joints of the antennæ, only a single specimen is before me.

Luperodes quadripustulatus, Motsch.

Galle.

This species varies in the colour of the elytral pattern from fulvous to black. Motschulsky's description agrees very well with the specimens before me, but the legs in all of them are fulvous, the extremities of the tibiæ and the tarsi being fuscous only. Besides the six yellow spots of the elytra in plainly marked specimens, the apices of the same parts are also frequently yellow, in others the elytral margin is black or piceous, and the posterior yellow spot extends upwards at the sides, and unites with the one placed at the shoulder, thus reducing the yellow marks to a spot near the scutellum and a band at the sides, which increases greatly in width near the apex of each elytron. The antennæ have the third joint about one half longer than the second, which is very short. If I have rightly referred the present species to Motschulsky's insect, the closed anterior coxal cavities of *L. quadripustulatus*, as well as of the following species, would suggest rather the genus *Monolepta* or *Nadrana* for their reception, since the type, *Luperodes alboplagiatus*, Motsch., has *open* coxal cavities. It must, however, be left for the future to decide with certainty the proper place of these eastern forms.

LUPERODES PECTORALIS, sp. nov.

Ovate, convex; testaceous; the base of the head, antennæ, and the breast black; thorax transverse, impunctate; elytra very finely punctured, testaceous, a narrow transverse band at the base and the extreme margins black.

Length 2 lines.

Head impunctate, the basal portion as well as the labrum and the palpi black, the rest testaceous. Antennæ as long as the body, entirely black, the third joint very slightly longer than the second, both joints short. Thorax more than twice as broad as long, the sides straight, the posterior margin rounded; surface impunctate, without depression. Scutellum black. Elytra extremely finely and closely punctured, testaceous, sometimes stained with fulvous near the apices, the sutural and lateral extreme margins as well as a narrow transverse band at the base black. Legs fulvous or testaceous, the tarsi obscure fuscous. Breast black; abdomen testaceous. The first joint of the posterior tarsi half the length of the tibiæ.

Dikoya.

From *L. basalis*, Motsch., the present species differs in the entirely black antennæ and the similarly coloured elytral margins, also in the fulvous legs. The thorax is more transversely shaped than is usual in the species of this genus, but all other characters agree with *Luperodes*.

LUPERODES FLAVICORNIS, sp. nov.

Testaceous; breast dark fulvous; head and thorax impunctate; elytra extremely finely and closely punctured, reddish fulvous, the base obscure piceous.

Length 2 lines.

Head impunctate, transversely grooved between the antennæ; the latter slightly shorter than the body, entirely flavous, the second and third joints short, equal; the fourth as long or rather longer than the two preceding joints together. Thorax transverse, without depressions, rather more than twice as broad as long, the sides slightly, the posterior margin more strongly rounded, the angles not produced. Scutellum obscure testaceous. Elytra slightly widened posteriorly, dark fulvous, very minutely and closely punctured, the base with a narrow transverse obscure piceous band. Posterior tibiæ mucronate, their metatarsus longer than the three following joints together. Anterior coxal cavities closed.

The single specimen contained in this collection differs from *L. basalis*, Motsch., in the unicolorous antennæ, in the differently coloured head, legs, and the want of the sutural elytral band. *L. pectoralis*, Jac., differs in the black antennæ and tarsi as well as other particulars.

LUPERODES MULTIMACULATUS, sp. nov.

Testaceous; antennæ and the breast black; head with a black spot; thorax minutely punctured, with a black spot at each side; elytra ovate, finely punctured, the base and lateral margin anteriorly, a spot near the base, two others below the middle, one near the apex as well as the latter itself, black.

Length 2 lines.

Head impunctate, transversely grooved between the eyes, the latter large; the vertex with a large round black spot; labrum black; antennæ slender, the third joint one half longer than the second. Thorax transverse, rather more than twice as broad as long, the sides and the posterior margin rounded; the surface extremely minutely punctured, testaceous, the sides with an elongate black spot placed close to the lateral margin. Scutellum black. Elytra slightly widened at the middle, extremely finely punctured and wrinkled, the basal and lateral margins at the anterior half as well as the epipleuræ black; each elytron with a small black spot at the shoulder, a larger and more elongate one near the scutellum, two similar spots placed close to each other near the suture below the middle (one slightly above the other), and a fifth, narrow and elongate spot near the lateral margin and at a little distance from the apex, the latter also black at the extremity. Breast black; abdomen and the legs fulvous; the metatarsus of the posterior tibiæ as long as half their length. Anterior coxal cavities closed. Elytral epipleuræ very narrow below the middle.

A single specimen.

LUPERODES RUFICOLLIS, sp. nov.

Black; head and thorax rufous; elytra black, very minutely punctured.

Length $1\frac{1}{2}$ line.

Head impunctate, bright rufous; labrum and palpi piceous. Antennæ black, the basal joint piceous, its base testaceous, the second and third joints short, nearly equal. Thorax transverse, three times as broad as long, the sides straight, the posterior margin rather rounded, the surface extremely finely punctured. Scutellum black. Elytra exceedingly finely punctured, black. Legs slender; the tibiæ mucronate; the first joint of the posterior tarsi more than half the length of the tibiæ. Anterior coxal cavities closed.

LUPERODES ALBOPLAGIATUS, Motsch.

Dikoya.

PSEUDOCOPHORA BICOLOR, sp. nov.

Flavous; thorax deeply transversely depressed; elytra black, shining, obsoletely semipunctate-striate.

♂. Elytra with an oblong fovea below the scutellum, the anterior part of which is tuberculiform.

♀. Elytra simple.

Length 2 lines.

Head impunctate; palpi robust, the terminal joint thickened. Antennæ filiform, entirely flavous, the third joint slightly longer than the following ones. Thorax transverse, the sides straight at the base, slightly rounded before the middle, the anterior and the posterior margins perfectly straight, as well as the transverse groove at the middle of the disk, the latter impunctate. Scutellum flavous. Elytra slightly widened posteriorly, the punctuation arranged in rows, which are more distinct anteriorly and at the sides than towards the apices; the latter with a more or less distinct flavous margin or spot, the rest of the surface black, shining. Underside and legs flavous; elytral epipleuræ continued below the middle. Apical abdominal segment of the male trilobate, the intermediate lobe slightly prolonged.

Balangoda.

This species will enter the present genus, established by myself, on account of the prolonged elytral epipleuræ and the punctate-striate elytra. The male has the elytra deeply impressed below the scutellum (as is the case in *P. buquetti*); the anterior portion of this depression is raised in the shape of two tubercles. In *P. buquetti* these latter are placed *within* the fovea. The general aspect of *P. bicolor* is that of a species of *Aulacophora*.

LUPERUS NIGROMARGINATUS, sp. nov.

Black; thorax obsoletely impressed, impunctate; elytra extremely finely punctured, pale yellowish white, the margins narrowly black.

Var. *a*. Femora pale testaceous.

Var. *b*. Elytra black, the disk obsoletely paler.

Length $1\frac{3}{4}$–2 lines.

Head impunctate, transversely grooved between the eyes, the frontal tubercles scarcely divided. Antennæ black, nearly as long as the body, the third joint more than twice as long as the second. Thorax about one half broader than long, the sides straight, the posterior margin slightly rounded and sinuate; surface impunctate or extremely finely punctured, with a depression at each side. Scutellum black. Elytra slightly more distinctly punctured than the thorax, nearly white, the sutural and lateral margins narrowly black. Tibiæ mucronate; the first joint of the posterior tarsi longer than the three following joints together. The anterior coxal cavities open.

L. nigromarginatus seems subject to a good deal of variation in regard to colour; and it is probable that the form with pale elytra margined with black is the normal one, as even in the black specimens a faint paler disk of the elytra indicates the white portion of the type. In one specimen the rare instance of part colouring occurs, the left elytron being black, and the right one white with the black lateral margin.

ÆNIDEA ? HIRTIPENNIS, sp. nov.

Obscure testaceous; the two apical joints of the antennæ fuscous; thorax transverse, impunctate, biimpressed; elytra very finely semi-punctate-striate, sparingly pubescent.

Length $2\frac{3}{4}$ lines.

Head with a deep fovea between the antennæ, impunctate; terminal joint of the palpi thickened. Antennæ but slightly shorter than the body, fulvous, the two or three terminal joints darker, second joint very short, the third nearly three times as long, and longer than the following joints. Thorax at least twice as broad as long, the sides very slightly constricted at the base, a little rounded before the middle, the angles not produced; the surface impunctate, with a rather deep oblique impression at each side. Scutellum triangular. Elytra without basal depression, very finely and somewhat regularly punctured, the interstices here and there obsoletely raised and sparingly clothed with rather long and stiff hairs; elytral epipleuræ broad, continued below the middle. Tibiæ unarmed; the first joint of the posterior tarsi as long as the three following joints together. Claws appendiculate. Anterior coxal cavities closed.

Dikoya.

I have placed this species in *Ænidea*, with which it agrees in all essential points. It is, however, possible that I may have only female specimens before me, and that the male insect, like several others of the genus, may differ in the structure of the head. The pubescence of the elytra distinguishes *A. hirtipennis* from any of its allies.

CNEORANE PALLIDA, sp. nov.

Oblong, pale testaceous; antennæ obscure fuscous; thorax square-shaped, impunctate; elytra scarcely visibly punctured.

Length 2 lines.

Head entirely impunctate, the frontal tubercles distinctly raised, divided and bounded behind by a deep groove; palpi robust. Antennæ two thirds the length of the body, the second and third joints short and of nearly equal length, the fourth joint very slightly longer than the following ones, the three or four basal joints pale testaceous, the rest fuscous. Thorax slightly broader than long, all the margins straight; the surface very little convex, without depressions and punctures. Elytra rather convex, parallel and subcylindrical, the punctuation extremely minute and arranged for the greater part in closely placed rows. The tibiæ unarmed, the first joint of the posterior tarsi as long as the two following joints together. Claws appendiculate. Anterior coxal cavities open.

Bogawantalawa.

In this species the third joint of the antennæ is shorter than in *C. elegans*, Baly, and *C. fulvicollis*, Baly, being of the same length as the second joint; but in all other respects *C. pallida* agrees with its allies, and may be recognized by the uniform and very pale testaceous colour.

METRIOIDEA RUFIPENNIS, sp. nov. (Plate XI. fig. 8.)

Oblong; black; head, antennæ, and legs fulvous; thorax greenish black, obsoletely depressed; elytra rufous, very finely punctured.

♂. Face deeply excavated; the third joint of the antennæ curved and produced at the apex.

Length 3 lines.

Head rufous at the vertex, impunctate, deeply transversely grooved between the eyes; lower part of the face deeply excavated, the excavation bounded at the sides and above by several lobes which protrude beyond the impressed portion; the clypeus thickened; palpi moderately incrassate at the penultimate joint. Antennæ nearly as long as the body, fulvous, the second joint very short, the third curved and widened into a tooth at the apex, nearly as long as the following joints, the apical joints more slender than the rest. Thorax about one half broader than long, narrowed towards the base, greenish black, shining, the surface with an obsolete transverse depression at the sides near the base, impunctate. Scutellum rufous. Elytra very finely and rather closely punctured, rufous, their epipleuræ continued below the middle; tibiæ unarmed, the first joint of the posterior tarsi as long as the two following joints together. Claws appendiculate The anterior coxal cavities closed.

Kandy.

I have placed this species, of which I have evidently only the male insect before me, in the present genus on account of the closed coxal cavities, unarmed tibiæ, and the appendiculate claws; the proportionate length of the joints of the antennæ is, however, different than in *Metrioidea*, and it is possible that the present species is representative of a new genus.

OCHRALEA CEYLONICA, Harold (?).

Dikoya.

The descriptions of two species of *Ochralea* from Ceylon have been published by von Harold. With one of these the insect which I refer to the present species agrees in the main points. It is, however, smaller by one millimetre; the antennæ, with the exception of the two basal joints are fuscous, not testaceous, the third joint being slightly longer than the second. The elytra have the sides more or less stained with obscure fulvous, and the punctuation is exceedingly close, and consists of larger and smaller punctures. Without examining the type of *O. ceylonica* contained in the Berlin Museum, it is impossible to say whether the specimens before me represent that or an allied species. In regard to the genus *Ochralea*, Mr. Baly has drawn my attention to the state of the anterior coxal cavities, which according to Chapuis are supposed to be closed. A careful examination of several specimens proves this, however, to be erroneous, as the cavities are distinctly open. This character and the prolonged elytral epipleuræ will not allow *Ochralea*, according to Mr. Baly's opinion, to be separated from *Luperodes*, a genus which seems also to possess open cavities, although I have considered the latter in *Luperodes* as being closed. The whole question of open or closed coxal cavities requires yet careful study, as it is not improbable that intermediate degrees exist even in the same species, which makes the conclusion in regard to the state of the cavities uncertain.

HYPHÆNIA FLAVOFEMORATUS, Motsch. (?).

Closed anterior coxal cavities, unarmed tibiæ, a square-shaped thorax, and other characters peculiar to Baly's genus are present in an insect contained in this collection, which also agrees very nearly with Motschulsky's species, to which I will refer for the present this insect. The entire upper surface is metallic greenish or æneous. The antennæ are as long as the body, obscure piceous with the basal joints fulvous. The head is finely granulate, the lower part being testaceous; the thorax is square-shaped, with two impressions, finely granulate and punctured (Motschulsky gives the thorax as smooth). The elytra are finely rugose and punctured. The colour of the legs is flavous; sometimes the tibiæ and the tarsi are obscurely stained with fuscous. The femora are all of the same thickness, and the first joint of the posterior tarsi is as long as the two following joints together. Claws appendiculate. The underside is nearly black; and the entire shape of the insect is narrowly parallel with the elytra flattened along the sutural margin. The size of the insect is $1\frac{3}{4}$ line.

Dikoya.

DORYSCUS (gen. nov. Galerucinæ).

Body elongate, parallel; anterior coxal cavities closed. Antennæ filiform, the second joint small, the third double the length. Thorax subquadrate, strongly constricted at the base, the disk biimpressed. Elytra geminate punctate-striate, costate, and pubescent. Tibiæ mucronate; the first joint of the posterior tarsi as long as the two following joints together; claws appendiculate, those of the posterior tarsi very long and curved, united, but bifid at the extreme apices. Elytral epipleuræ narrow, but continued below the middle.

Whether the peculiar structure of the posterior claws in this genus is a sexual character only or to be found in either sex I am unable to say, having only two specimens before me, which agree with each other in every respect. The posterior claw seems to consist of a single piece only, being joined together except at the extreme apices, as is the case, but to a much smaller degree, in the genus *Lema*. In *Doryscus* they are very long and curved, while the claws of the four anterior legs are of normal size and appendiculate. The peculiar form of the thorax, in connection with the punctate-striate elytra and their pubesence, are characters which further distinguish the present insect.

DORYSCUS TESTACEUS, sp. nov.

Testaceous; the sutural and extreme lateral margin narrowly black anteriorly; head and thorax impunctate; elytra strongly geminate punctate-striate, the interstices longitudinally costate.

Var. Entirely testaceous.

Length 2 lines.

Head impunctate, the frontal tubercles rather flattened; palpi slender; antennæ two thirds the length of the body, testaceous, the apical joints obscure fuscous. Thorax about one half broader than long, the sides strongly narrowed or constricted at the base, obsoletely impressed at the sides, impunctate, the lateral margins furnished with some long hairs. Scutellum broader than long, testaceous or margined with piceous. Elytra clothed with some rather long and stiff hairs, strongly longitudinally costate at the sides, less strongly at the disk, the interstices impressed with two rows of distinct punctures, partly confluent and becoming single towards the apices. Underside testaceous, the breast sometimes darker. Legs moderately long, the claw-joint of the posterior tarsi very elongate, as long as the metatarsus.

PRIAPINA (gen. nov. Galerucinæ).

Narrowly oblong. Antennæ filiform, the third joint very small. Thorax transversely subquadrate, obsoletely grooved at the disk. Elytra closely semipunctate-striate. Legs slender, tibiæ with a spine; the metatarsus of the posterior tibiæ longer than the three following joints together; claws appendiculate.

I am obliged to establish this genus on account of the structure of the antennæ, in which the third joint of the male is so small as to be scarcely perceptible; the long first joint of the posterior tarsi and the mucronate tibiæ are further characters which will assist in the recognition of *Priapina*. The specimen being glued to a card, I am unfortunately not able to speak about the state of the anterior coxal cavities. There will, however, be no difficulty in recognizing the genus if the antennæ are examined. In *Luperodes*, a closely allied genus, the third joint in both sexes is very distinct, double the length of the second and scarcely shorter than the fourth.

PRIAPINA LONGICORNIS, sp. nov.

Fulvous or testaceous; head impunctate; terminal joints of the antennæ fuscous; thorax fulvous, rugosely punctured; elytra testaceous, the margins narrowly piceous, surface closely punctured.

♂. Antennæ longer than the body, the third joint minute.

♀. Antennæ slightly shorter, the third joint a little longer; elytra coarsely punctured.

Length 1 line.

♂. Head impunctate, fulvous, the frontal tubercles narrowly transverse; eyes rather large. The four lower joints of the antennæ testaceous, the others fuscous, the fourth joint longer than the three preceding ones together and longer than the following joints. Thorax twice as broad as long, the sides slightly narrowed towards the base, the angles not produced, the anterior and posterior margins straight; surface obsoletely transversely depressed, coarsely punctured. Scutellum piceous. Elytra testaceous, narrowly margined with piceous, very closely punctured, the punctuation arranged in semi-irregular rows. Legs rather long and slender.

In the female the third joint of the antennæ is nearly equal in length to the second, but the fourth joint, as in the male, is the longest, and the elytra are coarsely punctured; the general size is also larger and more robust.

Dikoya.

NEOCHROLEA (gen. nov. Galerucinæ).

Body oblong. Head longer than broad, the front excavated above and below the antennæ; the latter as long as the body, filiform, the second joint very small, the third the longest, thickened and emarginate below. Palpi thickened at the penultimate joint. Thorax transversely subquadrate, the disk obsoletely depressed. Elytra scarcely visibly punctured, their epipleuræ continued below the middle. Tibiæ mucronate. The first joint of the posterior tarsi a long as the two following joints together. Claws appendiculate Anterior coxal cavities closed.

Neochrolea seems allied to the genus *Macrima*, Baly, with which it agrees in the closed coxal cavities and the mucronate tibiæ; it differs in the long third joint of the antennæ and in the less transverse thorax, also in the shorter first joint of the posterior tarsi. The only specimen before me is evidently a male; and it is probable that the female wants the deep excavations of the head, as is often the case in similar structures in the sexes in other genera. *Ænidea*, Baly, differs in the unarmed tibiæ.

NEOCHROLEA CAVIFRONS, sp. nov. (Plate XI. fig. 4.)

Entirely testaceous; third joint of the antennæ emarginate below; head with a deep excavation; thorax nearly impunctate, the disk obsoletely depressed; elytra extremely finely and closely punctured.

Length 4 lines

Head longer than broad, impunctate, the space below the antennæ deeply excavated, the lower margin of this excavation forming a triangular and pointed flattened projection; the lower part of the face again deeply excavated; the anterior margin of the clypeus produced into two long points; the extreme apices of the jaws black; palpi thickened at the penultimate joint. Antennæ slightly longer than the body, fulvous, the second joint extremely short; the third elongate, thickened, and hollowed out at the lower margin; the following joints of half the length, equal. Thorax one half broader than long, narrowed towards the base, the sides very little rounded before the middle; the surface with a small depression at the middle of the disk, scarcely visibly punctured. Elytra rather convex, without basal depression, not more distinctly punctured than the thorax, testaceous like the rest of the insect.

Balangoda.

HAPLOTIA (gen. nov. Galerucinæ).

Narrowly elongate. Antennæ slender, filiform, all the joints with the exception of the second of nearly equal length; palpi with the penultimate joint thickened. Thorax square-shaped, obsoletely impressed, rugose. Elytra closely rugose (♂), or simply punctured

(♀); their epipleuræ continued below the middle. Legs slender and elongate; the tibiæ unarmed; the first joint of the posterior tarsi longer than the two following joints together; claws appendiculate. Prosternum invisible. The anterior coxal cavities closed.

The insect for the reception of which I am obliged to establish this genus seems allied to *Metrioidea*, Fairm., on account of the closed cavities and unarmed tibiæ; but differs in the proportionate length of the joints of the antennæ, the third joint in *Metrioidea* being described as a little longer than the second and shorter than the fourth; the first joint of the posterior tarsi is also longer than in *Metrioidea*. In the insect before me the female, on account of its different coloration, seems at first sight to constitute a different species. The general appearance of the present species is that of a *Luperus*.

HAPLOTIA VARIPENNIS, sp. nov. (Plate XI. figs. 5, 6.)

♂. Æneous; the base of the femora and tibiæ and the abdomen testaceous; head finely punctured in front; thorax and elytra rugosely punctate.

♀. Testaceous, head and thorax æneous; elytra irregularly punctured, testaceous with metallic gloss; a triangular space at the base, surrounding the scutellum, and the lateral margin æneous.

Length $1\frac{3}{4}$–2 lines.

Head broad, finely rugose at the anterior portion; labrum obscure fulvous. Antennæ a little shorter than the length of the body, black in the male, obscure fulvous in the female. Thorax square-shaped, very slightly narrowed at the base, the anterior angles acute, the posterior ones obsolete; the surface flattened, closely and irregularly rugose, of greenish bronzed colour like the head. Elytra of the same colour, sculptured like the thorax, sparingly covered with some stiff hairs. Legs more or less piceous or æneous, the base of the femora often testaceous, the posterior femora in the male extending to the apices of the elytra, but much shorter in the female.

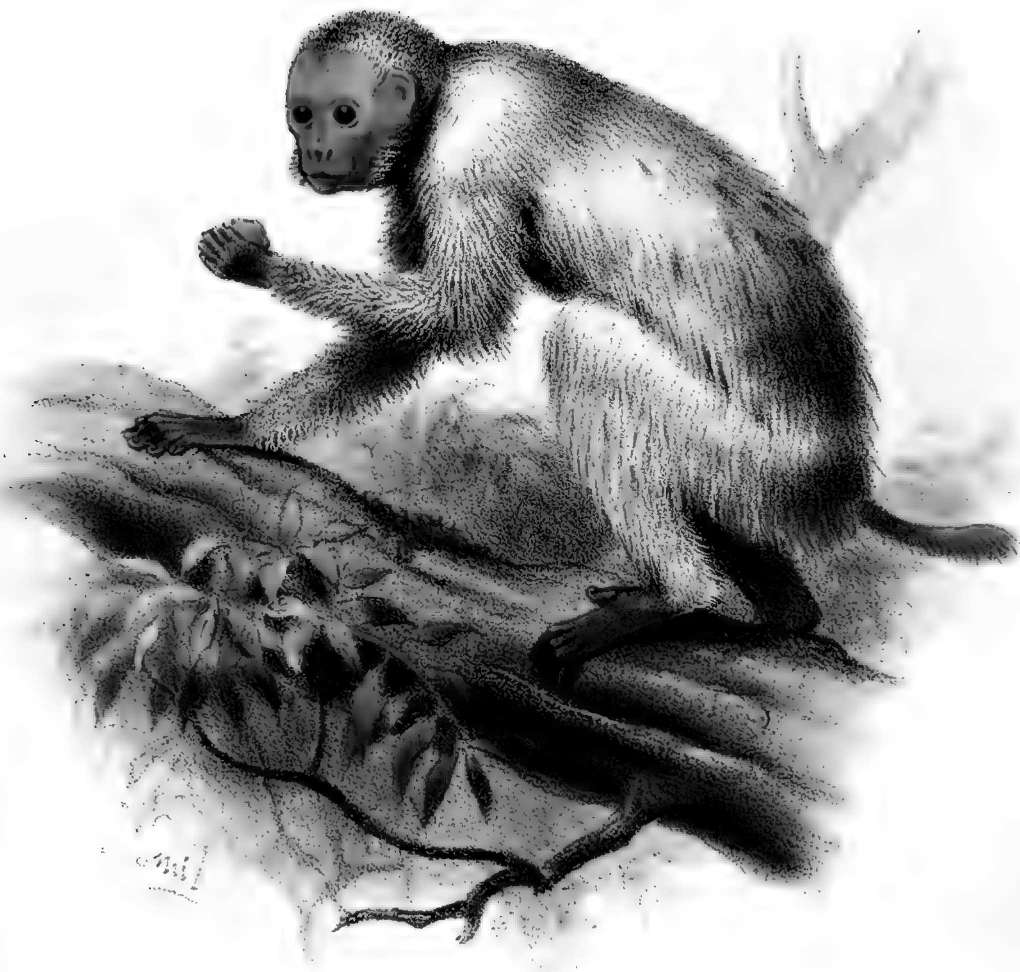
Nuwara Eliya.

The antennæ and the legs in the female are generally of a dark fulvous colour; the entire underside is testaceous, or sometimes slightly stained with æneous; the sculpture of the head and thorax agrees with that of the male. The elytra are, however, not rugose or very slightly so, but generally closely punctured and of a pale testaceous colour, slightly tinged with metallic greenish; the base has a well-defined triangular spot, extending from the shoulder to the suture, of metallic bronze colour, the lateral margin and apices of the elytra being similarly coloured. Some specimens show a small testaceous lateral margin of the thorax, and two more or less distinct depressions at the disk of the latter.

ANTIPHA NIETNERI, Baly. (Plate XI. fig. 7.)

Balangoda.

Typical and unicolorous unspotted forms.



J. Smit lith

Hanhart imp.

BRACHYURUS CALVUS.

EXPLANATION OF THE PLATES.

Plate X.

Fig. 1. *Demotina semifasciata*, p. 70.
2. *Pagria costatipennis*, p. 73.
3. *Rhyparida quinquemaculata*, p. 75.
4. *Nodostoma tuberosum*, p. 78.
5. *Dermorrhytis igneofasciata*, p. 83.
6. —— *ornatissima*, p. 82.
7. —— *ceylonensis*, p. 81.
8. *Chabria nigroplagiata*, p. 93.
9. —— *apicicornis*, p. 93.
10. *Pexodorus ceylonensis*, p. 95.
11. *Ivalia metallica*, p. 100.
12. —— *viridipennis*, p. 100.

Plate XI.

Fig. 1. *Aulacophora stevensi*, p. 103.
2, 3. —— *nigripeta*, p. 103.
4. *Neochrolea cavifrons*, p. 117.
5, 6. *Haplotia varipennis*, p. 118.
7. *Antipha nietneri*, p. 118.
8. *Metrioidea rufipennis*, p. 114.
9. *Xenarthra mirabilis*, p. 107.
10. —— *lewisi*, p. 108.
11. —— *unicolor*, p. 109.
12. *Galerucella ceylonensis*, p. 105.

3. Notes on *Brachyurus calvus*. By Frank E. Beddard, M.A., F.R.S.E., Prosector to the Society.

[Received January 13, 1887.]

(Plate XII.)

The accompanying drawing (Plate XII.) represents the external characters of the male *Brachyurus calvus* which died in the Society's Gardens on July 21 last year. I have taken the opportunity of comparing the structure of this species with the closely-allied *B. rubicundus*, which has been carefully described by Forbes in his memoir on the Ouakari Monkeys[1].

The genus *Brachyurus* contains three species[2], of which two, viz. *B. calvus* and *B. rubicundus*, agree very closely in external characters, and, as I shall presently show, in internal structure; while the third, *B. melanocephalus*, differs more in external characters from the other two than they do from each other.

Mr. Forbes has given a detailed account of the external characters of *B. rubicundus*, and the main external characters of all the species are referred to by Schlegel[3]. The general coloration of the back is a whitish grey, produced by a mixture of white and black hairs, the white predominating; passing from the dorsal to the ventral surface

[1] P. Z. S. 1880, p. 627.

[2] Schlegel' "*Pithecia alba*" was believed by Mr. Forbes to be identical with *B. calvus*.

[3] Muséum des Pays-Bas, 1876, p. 227 *et seq.*

the colour gradually assumes a fulvous-brown tint, the brown being darker in the pectoral region, where the brown hairs are very numerous, only a few white hairs being interspersed among them. The brownish tinge is also conspicuous on the arms, legs, and tail, particularly on the tail, on the posterior aspect of the thighs, and at the wrist and ankle. The top of the head is a greyish colour, gradually passing into brown anteriorly and at the sides, as in *B. rubicundus*; the hairs on the throat also resemble that species in their dark brown colour, and in being mixed with numerous black hairs; the general tint of the hair on the throat is a rich chestnut-brown, and is exactly similar to that of *B. rubicundus*.

With regard to the osteology, I find that the number of vertebræ in my specimen is C. 7, D. 13, L. 6, S. 4, Cd. 15, of which the last three are very minute and apparently ankylosed together. Forbes states in his paper that in *B. melanocephalus* there are 19 or 20 caudal vertebræ, on the authority of a specimen belonging to that species in the National Collection. The specimen in question (806 *b*) has certainly the 20 caudal vertebræ that Forbes has mentioned; but it does not present any recognizable differences from *Brachyurus calvus*, and indeed is entered in the Catalogue as belonging to that species.

It is not necessary to give much account of the visceral anatomy of this species, inasmuch as I have been unable to find any marked points of difference from *B. rubicundus*; the alimentary viscera presented a very close correspondence in the two species, as will be evident from the following notes.

The *tongue* resembles in every particular that of *B. rubicundus*, and, curiously enough, even the arrangement of the circumvallate papillæ corresponds in the two species. The correspondence is curious, because Mr. Forbes's description of the circumvallate papillæ reads almost as if he were referring to an abnormal condition. The circumvallate papillæ in the two species are disposed in the usual V-shape, but there is an additional papilla on the right side between the apical and basal papillæ, thus destroying the symmetry of the arrangement. In a specimen of *Macacus rhesus*, to which I am able to refer at the moment of writing, there are also four circumvallate papillæ; two are situated side by side, and symmetrically at the apex of the V, while the two others occupy the usual position.

Cæcum.—The cæcum measured 10 inches along the greater curvature; it is separated from the colon by a very marked constriction; it is not sacculated, and when fully distended with air was curved on itself into a little less than a circle; it is furnished with a well-developed median frenum which carries blood-vessels.

In examples of two species of *Callithrix* and in a *Pithecia* I have noted an identical structure in the cæcum.

The origin of this peritoneal fold is not exactly in the middle line at the lower extremity of the ileum, and the blood-vessel passes on to it over one side of the base of the ileum; the blood-vessel in fact exactly corresponds to that which is borne by one of the lateral folds in *Hapale*.

In *Hapale jacchus* the cæcum distended with air, dried and varnished, showed three folds of peritoneum running along its upper surface, as described by Prof. Flower[1] in *Ateles*; the *frenum* or median band is extremely short and bears no blood-vessel. The lateral folds arise precisely as is indicated by Prof. Flower, but one of them is much longer than the other and reaches nearly to the end of the cæcum, while the other does not reach so far as does the median frenum.

In *Midas rufimanus* a spirit-specimen of the cæcum showed the same three folds, which were, however, partially united together into an apparently single fold; this was easily separable into three layers—a median fold without blood-vessels, and two lateral folds, each bearing a blood-vessel.

4. List of Mammals from the Cameroons Mountain, collected by Mr. H. H. Johnston[2]. By Oldfield Thomas.

[Received January 4 ,1887.]

In order to complete the list of the zoological specimens collected by Mr. H. H. Johnston, I have been asked to contribute the names of the two Mammals he obtained. They are as follows:—

1. Anomalurus beecrofti, Fraser.

   a. Skin and skeleton, ♂. Cameroons Mountain, 8000 feet.

2. Mus univittatus, Peters.

   a. Skin, ♀. Cameroons Mountain, 8000 feet.

[1] Med. Times and Gazette, 1872.

[2] [Mr. Johnston's narrative of his ascent of the Cameroons Mountain last year, during which the collections described in this and the following communications were made, will shortly appear in the 'Graphic' with illustrations. Setting out from Victoria, opposite his residence on Mondole Island, Mr. Johnston proceeded by Bonjongo and Mapanja (3000 feet alt.) to Mann's Spring, where he encamped at an altitude of 7350 feet. Here the temperature ranged from 50° to 60° Fahr., and for the first week of his stay he lived in a perpetual rainfall. The forest-region ceases at about 7000 feet, and gives place to grassy downs, dotted with patches of woodland and varied by huge isolated boulders of rock and ancient lava-flows. Here a corresponding change in the flora and fauna takes place. Mr. Johnston tells us:—

"Mann's Spring is a favourite resort of birds, who alway affect the vicinity of water, and here especially they make the air musical with their twittering songs and mellow love-calls. As man is a rare visitant here, the birds are very bold and fearless, and appeared to welcome our coming for the chance scraps of food thrown in their way. Alas! they soon had to rue their over-confidence. They had put themselves in the power of one whose natural tender-heartedness and love of living things are overborne by his interest in science. Of all the pretty bird-forms which came to drink and sport and bathe by the brooklet, or which hovered about the balsam-blossoms, some of every kind must die to illustrate the ornithology of the Cameroons. And so my native collector and I were soon

5. On a Collection of Birds made by Mr. H. H. Johnston on the Cameroons Mountain. By Captain G. E. Shelley, F.Z.S.

[Received January 3, 1887.]

(Plates XIII. & XIV.)

Mr. H. H. Johnston, F.Z.S., well known for his researches on the Congo, and successful expedition to the heights of Kilimanjaro in East Africa, has now sent us some birds from a nearly equally elevated district of Western Africa; and I am pleased to find in this collection from the Cameroons Mountain an interesting proportion of new species. The collection, which has been sent to me for examination by the Cameroons Committee of the British Association, contains 36 skins referable to 18 species. Of these the following are new to science:—(1) *Poliopicus johnstoni*, (2) *Psalidoprocne fuliginosa*, (3) *Laniarius atroflavus*, and (4) *Ploceus melanogaster*.

Our previous knowledge of the avifauna of the higher part of the Cameroons Mountain is entirely derived from an article by Mr. G. R. Gray (Ann. Nat. Hist. 1862, x. p. 413) on the birds obtained by Capt. R. Burton during his ascent of the mountains in 1861–62[1]. In 1871 Mr. R. B. Sharpe (P. Z. S. 1871, p. 614) described a collection of birds made by Mr. Crossley in the Cameroons district; and in 1874 and 1875 Dr. Reichenow, in the 'Journal für Ornithologie,' published the results of his West-African Expedition of 1872, during which he visited the Cameroons river and penetrated up the mountain to a height of about 4000 feet. But neither Mr. Crossley nor Dr. Reichenow seemed to have obtained any specimens from the higher elevations to which Capt. Burton and Mr. Johnston have ascended.

1. Poliopicus johnstoni, sp. n.

a. ♂, October, 6000 feet.—A broad black forehead with a buff patch on each side of the base of the culmen; remainder of the crown and the nape red. Remainder of the upper parts, when the

---

engaged in skinning black and golden Shrikes, metallic-green and crimson-breasted Sunbirds, ruddy Chats, olive-green Warblers, dull grey Grosbeaks, and tiny, indefinite, insect-eating birds of blue-grey and russet-brown.

"In this forest, too, I shot flying Squirrels and small vole-like Rats. These were the only mammals we saw, except when, very rarely, we got a hurried glimpse of a red-coated, white-striped Antelope of the genus *Tragelaphus*."

From Mann's Spring Mr. Johnston transferred his camp to Hunter's Hut (8300 feet), in "a narrow peninsula of forest which pushes up the mountain-side," and subsequently to another spot situated at an elevation of 10,500 feet, whence the final ascent was made. He made the summit by boiling-point observation to be 13,760 feet, which is about 500 feet less than the usual estimation.—P. L. S.]

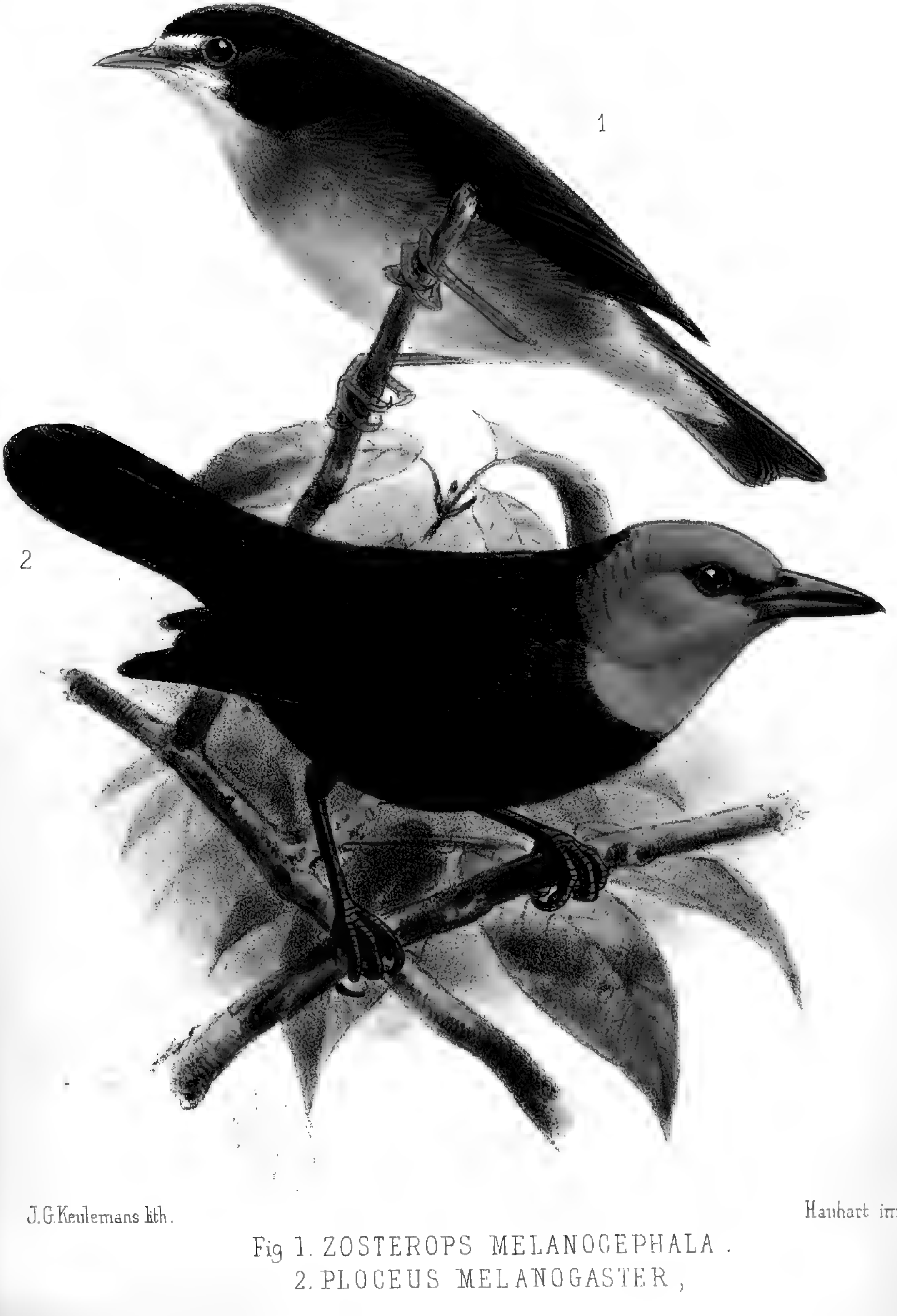
[1] See Burton's 'Abeokuta and the Cameroons Mountains.' 2 vols. 8vo. London, 1863.

J. G. Keulemans lith. Hanhart imp.

LANIARIUS ATROFLAVUS,

1

2



J. G. Keulemans lith.

Hanhart imp.

Fig 1. ZOSTEROPS MELANOCEPHALA.
2. PLOCEUS MELANOGASTER.

wings are closed, uniform olive-green, with the primaries and tail dark brown, slightly washed on the edges of the feathers with yellowish olive. The shafts of the quills and tail-feathers are brown above and yellow beneath. Sides of the head buffish olive. Under surface of the body uniform sulphur-yellow, with a very slight greenish shade, paler on the throat and fading almost into white on the chin. A few feathers on the sides of the lower throat show faint signs of dark shaft-stripes, which shaft-stripes become more strongly marked on the flanks and under tail-coverts. Under wing-coverts yellowish buff; under surface of the quills dark brown with pale yellowish shafts, and with from two to four large yellowish-buff spots on their inner webs, giving a barred appearance. Tail beneath more olive than above. Bill whitish, becoming dark towards the base; legs and feet dusky brown. Total length 6·6 inches, culmen 0·8, wing 3·45, tail 2·8, tarsus 0·7.

b. ♂, 6000 ft.—Perfectly similar in plumage to *a.* Total length 6·3 inches, culmen 0·7, wing 3·5, tail 2·7, tarsus 0·7.

This bird, which is closely allied to *P. ellioti* from the Gaboon and Congo district, is rather smaller. Its chief character, which shows no variation in Mr. H. H. Johnston's two specimens, is the almost entire absence of markings on the underparts, which parts in *P. ellioti* are strongly striped with brownish black in both sexes.

2. Indicator variegatus, Less.

Indicator variegatus, Reichen. J. f. O. 1875, p. 6, Cameroons; Sharpe in Dawson Rowley's Orn. Misc. i. p. 189.

♀, September, 7000 ft.

3. Corythaix meriani, Rüpp.

Corythaix meriani, Hartl. Orn. W.-Afr. p. 157; Sharpe, P. Z. S. 1871, p. 605, Cameroons; Schalow, J. f. O. 1886, p. 37.

♂, October, 5000 ft.

4. Psalidoprocne fuliginosa, sp. n.

♂, September, 9000 ft.—Entire plumage dark brown with no gloss. Quills, tail, and underparts slightly darker. Under wing-coverts brown, scarcely paler than the back. Bill black; feet brown. Total length from tip of bill to tip of tail 5 inches, culmen 0·2, wing 4·25, tail 3·1, tarsus 0·35.

♀, September, 9000 ft.—Perfectly similar in plumage, with the outer web of the first primary equally serrated. Total length 5 inches, culmen 0·2, wing 4·1, tail 2·7, tarsus 0·35.

In this species the tail reaches about to the tips of the wings but not further, and is only moderately forked; length of centre feathers 2·3 and 2 inches, of outer feathers 3 and 2·7.

It is probably nearest to *P. petiti,* from which it differs in the colour of the under wing-coverts, and the moderately forked tail not extending beyond the tips of the wings.

5. Trochocercus, sp.?

? *Trochocercus nitens*, Cass. Pr. Philad. Acad. 1859, p. 50; Sharpe, Cat. B. Brit. Mus. iv. p. 300.

? *Terpsiphone nigromitrata*, Reichen. J. f. O. 1874, p. 110; 1875, p. 24, Cameroons.

♂, September, 7000 ft.

The poor condition of this specimen prevents me from confidently determining what name really belongs to it. It is in all probability *T. nigromitratus*, which was found in the Cameroons, and which title Mr. Sharpe refers to *T. nitens*, Cass.

The following is a description of Mr. Johnston's specimen:—

There is no gloss on the plumage. Upper half of the head black and but slightly crested, neck and back dusky slate-colour; wings and tail black, with scarcely any signs of grey edging to the feathers. Sides of the head and upper throat dusky grey, nearly black; lower crop, throat, and flanks slate-colour; remainder of the under surface of the body white, shading into rufous buff on the under tail-coverts; thighs brownish slate-colour. Bill black; legs dark brown. Total length 4·8 inches, culmen 0·4, wing 2·45, tail 2·7, tarsus 0·65.

6. Laniarius atroflavus, sp. n. (Plate XIII.)

♂, October, 7300 ft.—Upper parts glossy black; feathers of the lower back fluffy, and some of them with a large rounded white subterminal spot more or less hidden by the overlying black feathers; the last feathers of the rump with broad buffish ends, forming a band at the base of the tail. Underparts deep yellow, paler on the upper half of the throat and chin, changing into rufous buff between the thighs and on the under tail-coverts; outside of the thighs black; axillaries yellow, under wing-coverts black. Bill and legs black. Total length 7 inches, culmen 0·7, wing 3·3, tail 3·2, tarsus 1·2.

♀, October, 7300 ft.—Differs only from the male in the flanks being dusky black. Total length 6·7 inches, culmen 0·8, wing 3·2, tail 3·1, tarsus 1·2.

This species is, I think, nearest to *L. sublacteus* (Cass.), which chiefly differs in having the entire underparts white.

7. Xenocichla tephrolæma (Gray).

Trichophorus tephrolæmus, Gray, Ann. Nat. Hist. 1862, x. p. 444.

Xenocichla tephrolæma, Sharpe, Cat. B. Brit. Mus. iv. p. 98.

♀, September, 7000 ft.; ♀, October, 7000 ft.

The type specimen was killed by Capt. R. Burton in the Cameroons Mountain at 7000 ft., so that the species would appear to be very local.

8. Callene isabellæ (Gray).

Cossypha isabellæ, Gray, Ann. & Mag. Nat. Hist. 1862, x. p. 443.

Callene isabellæ, Sharpe, Cat. B. Brit. Mus. vii. p. 17.

♂, September, 7000 ft.; ♂, October, 7000 ft.

This is another apparently very local species, also procured by Capt. R. Burton in the Cameroons Mountain at 7000 ft.

9. Pratincola axillaris, Shelley.

Pratincola axillaris, Shelley, P. Z. S. 1884, p. 556; 1885, p. 226.

♂, September, 8000 ft.; ♂, October, 8000 ft.

This is the second species of *Pratincola* recorded from the Cameroons; for the *P. salax*, Verr., of Gray's List, two specimens of which I have examined in the British Museum, has the axillaries and under wing-coverts white.

10. Zosterops melanocephala, Gray. (Plate XIV. fig. 1.)

Zosterops (Speirops) melanocephalus, Gray, Ann. & Mag. Nat. Hist. 1862, x. p. 444.

♀♀, September, 7000 and 8000 ft.

The type, which I have examined in the British Museum, came from 7000 ft. in the Cameroons Mountain.

11. Cisticola ruficapilla (Fraser).

Drymoica ruficapilla, Hartl. Orn. W.-Afr. p. 57; Reichen. J. f. O. 1875, p. 45, Cameroons.

Cisticola ruficapilla, Sharpe, Cat. B. Brit. Mus. vii. p. 248.

a. ♀, September, 7000 ft.; *b*. 8000 ft.

12. Cinnyris chalybeus (Linn.).

Cinnyris chalybeus, Shelley, Monogr. Sun-birds, p. 253, pl. 78.

♂, September, 8000 ft. Length of wing 2·2 inches, culmen 0·8.
♂, September, 7000 ft. Length of wing 2·3 inches, culmen 0·8.
♀, September, 7300 ft. Length of wing 2·0 inches, culmen 0·7.

The males have the abdomen, under tail-coverts, and under surface of the tail darker than in any South-African specimens I have seen, but all the other characters are perfectly similar. This is the first time the species has been recorded from the West-African subregion.

13. Cinnyris fuliginosus (Shaw).

Nectarinia fuliginosa, Hartl. Orn. W.-Afr. p. 43; Sharpe, P. Z. S. 1871, p. 30, Cameroons; Reichen. J. f. O. 1875, p. 30.

Cinnyris fuliginosus, Shelley, Monogr. Sun-birds, p. 275, pl. 86.

a. Not labelled.

14. Anthus pyrrhonotus (Vieill.).

Anthus gouldii, Hartl. Orn. W.-Afr. p. 73.

Anthus pyrrhonotus, Sharpe, Cat. B. Brit. Mus. x. p. 555.

♂, October, 1000 ft. Length of wing 3·4.

Mr. Sharpe writes (*loc. cit.*):—" In Western Africa a small dark race occurs from the Niger to Senegambia, while the representative form of the Gaboon and Congo region is subspecifically distinct." Mr. Johnston's specimen I consider belongs to the "small dark race."

15. Coliuspasser capensis (Linn.).

Euplectes phœnicomerus, Gray, Ann. & Mag. Nat. Hist. 1862, x. p. 444, Cameroons.

Coliuspasser capensis, Shelley, Ibis, 1885, p. 359.

♂ ad., October, 11,200 ft.; ♂ ad., 10,000 ft.; ♂ ad., 8000 ft.; ♀, September, and ♂ juv., October, 8000 ft.; ♀, October, 10,000 ft.; ♂ juv., September, 9000 ft.

All these specimens belong to the small South-African race of *C. capensis*, which was separated by Dr. Cabanis under the name of *Orynx approximans*.

I wish here to correct an error I made in last year's 'Ibis,' p. 350, where I included W. Africa in the range of the closely allied *C. xanthomelas*. It has never yet been found on that side of the continent.

16. Ploceus melanogaster, sp. n. (Plate XIV. fig. 2.)

♂, September, 8000 ft.

Head and entire throat bright yellow; a band through the eye, sides of the neck, entire body, wings, and tail black. Total length 5 inches, culmen 0·65, wing 2·6, tail 2·2, tarsus 0·8.

The bill is comparatively long and slender. The whole bird so closely resembles in size and form *P. nigricollis*, Vieill., that I expect the female will be found to have a black crown.

This very distinct species may at once be recognized by its entirely black body and yellow throat.

17. Crithagra burtoni (Gray).

Strobilophaga burtoni, Gray, Ann. & Mag. Nat. Hist. 1862, x. p. 445, Cameroons.

♂ ♂, October, 9000 ft.; ♀, 9000 ft.

As this is the first time the male has been sent to this country, I would observe that it is similar in plumage to the female.

18. Sterna macrura, Naum.

Sterna brachypus, Hartl. Orn. W.-Afr. p. 255.
Sterna hirundo, Dresser, B. Eur. viii. p. 255, pl. 579.
Sterna macrura, H. Saunders, P. Z. S. 1876, p. 650.

♂, October, sea-shore.

6. List of the Reptiles collected by Mr. H. H. Johnston on the Cameroons Mountain. By G. A. Boulenger.

[Received January 8, 1887.]

1. Varanus niloticus (L.). 2000 feet.
Hab. Whole of Africa south of the Atlas.

2. Chamæleon owenii, Gray. 2000 feet.
Hab. Cameroon, Fernando Po, Gaboon.

3. Urobelus gabonicus (A. Dum.). 2000 feet.
Hab. Old Calabar to Gaboon.

4. Naia haie (L.). 2000 feet.
Hab. Whole of Africa south of the Atlas.

5. Dendraspis angusticeps (Smith). 2000 feet.
Hab. South Africa; West Africa as far north as the mouth of the Niger.

7. On the Mollusca collected at the Cameroons Mountain by Mr. H. H. Johnston. By Edgar A. Smith.

[Received January 12, 1887.]

All the specimens collected by Mr. Johnston were from an altitude of from 7000 to 8000 feet. Of the seven species one only appears to be new. This is not surprising, as Dr. Buchholz made fine collections in very much the same region some years ago, which were described by Dr. E. von Martens[1].

The species are:—

1. *Vaginula pleuroprocta*, Martens.
2. *Helicarion plicatulus*, Martens.
3. *Helix* (*Trochonanina*) *percarinata*, Martens.
4. *Stenogyra retifera*, Martens.
5. *Stenogyra oleata*, Martens.
6. *Streptostele buchholzi*, Martens.
7. *Gibbus* (*Edentulina*) *johnstoni*, sp. nov.

The first two species were met with by Buchholz at Aburi on the Gold Coast, the next four at Bonjongo in the Cameroons Mountain.

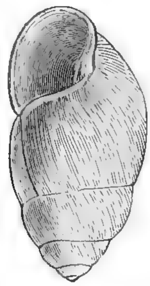
The following is a description of the new species of *Gibbus*:—

Gibbus (Edentulina) johnstoni.

Testa anguste umbilicata, ovata, subtenuis, nitida, grisea; anfractus $6\frac{1}{2}$, *celeriter crescentes, convexi, superiores regulariter arcuatim et confertim striati, penult. et ultimus obsolete striati; apertura inverse auriformis, albida, longit. totius* $\frac{2}{5}$

[1] Monatsb. Akad. Wiss. Berlin, 1876, pp. 253–274.

æquans; labrum tenue, anguste reflexum; columella oblique contorta, expansa, umbilicum semiobtegens. Longit. 30 *millim., diam.* 16.



Gibbus (Edentulina) johnstoni.

This is a smaller species than *G. martensi*, Smith, or *G. insignis*, Pfeiffer. It is also much more finely striated than the former and of a different shape, and has no plication on the columella as in the latter, which is an imperforate shell.

8. On some Coleopterous Insects collected by Mr. H. H. Johnston on the Cameroons Mountain. By Charles O. Waterhouse.

[Received January 31, 1887.]

The following Coleoptera were obtained by Mr. H. H. Johnston at altitudes from 8000 to 10,000 feet on the Cameroons Mountain:—

1. Scarites rotundicollis, Murray.

2. Two female examples of a Lamellicorn, apparently one of the Trichiidæ; 7 lines long, black, with deeply impressed striæ on the elytra. It is very desirable to look for the male of this insect, which would doubtless be quite different in colour and perhaps in form.

3. Batomene multispinis, Bates (Ent. Mo. Mag. xxi. 1884, p. 15), described from the Cameroons.

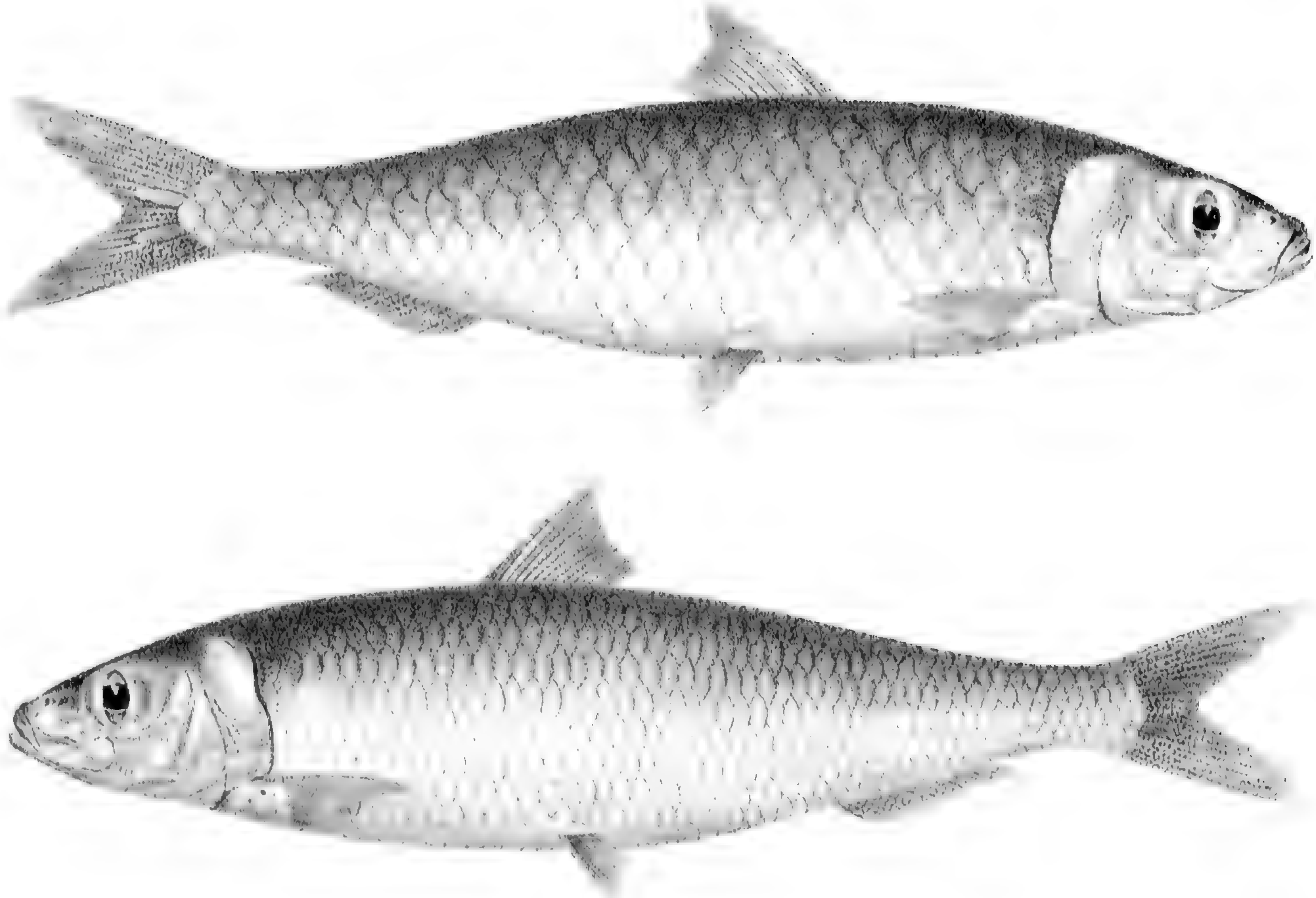
4. Temnoscelis biemarginatus, Chevr. A single specimen in the British Museum from Old Calabar.

5. A species of *Otiorhynchus* closely resembling the European *O. bisulcatus*, but having the humeral angles slightly prominent, and the disk of the thorax with a short ridge.

6. Epilachna, sp.? (In pieces.)

From "Cameroons Mountain, 2000 feet, Oct. 1886:"—

7. Ceratorhina torquata, F. A common West-African species.



J. Smit lith. Hanhart imp.

HYBRID BETWEEN PILCHARD & HERRING

9. On a supposed Hybrid between the Pilchard (*Clupea pilchardus*) and the Herring (*C. harengus*), and on a specimen of *Salmo purpuratus*. By F. Day, C.I.E.

[Received February 1, 1887.]

(Plate XV.)

In the month of September, 1886, I received from Mr. Dunn, of Mevagissey, in Cornwall, a hybrid Pilchard, and in December a second; also the information that he had seen several, but that the scales had been injured in the remainder. The great interest in these fishes is that, although to a great extent the head most nearly resembles the Pilchard, the scales on the sides of the body show most remarkable differences—in the example which I propose describing consisting of 32 rows along the body and 8 rows in depth on the right side, whereas those along the left side are 51 in number and 10 rows in depth.

Hybrids among the British Clupeidæ have been observed; thus the *Alosa squamopinnata* of Couch has been considered by Dr. Günther to be a cross between the Pilchard and one of the Shads.

A cross between a Pilchard and a Herring would apparently be rather remarkable, as Mr. Dunn found the eggs of the former floating; however, I was informed by Professor Steindachner that those of the Sardine sink; and as these are generally accepted as varieties of one species, it still seems doubtful whether the eggs float or sink. While, looking at the form of the head, it may be that the male Pilchard element had been prepotent in both fishes.

The specimen figured (Plate XV.) has the following characters, and closely agrees with the second example, which is slightly longer, except that the size of the scales is reversed on the two sides of the body, being largest on the left side in the latter.

D. 17. P. 15. V. 8. C. 23. L. l. right side 32; left side 51. L. tr. right side 8; left side 10.

	inches.
Entire length	8·5
Length of head	1·7
Length of caudal fin	1·5
Length of pectoral fin	1·0
Height of body	1·7

Eyes: diameter 0·4 of an inch, 0·5 inch from end of snout, and 0·35 inch apart. The head is very similar to that of the Pilchard on the right side, while on the left the raised ridges on the opercles, although very distinct, are not so well marked as upon the opposite side. The form of the body is that of the Pilchard. *Gill-rakers*: 61 in the lower branch of the outer branchial arch, the longest being 0·35 inch, or not so long as the orbit. In a Herring the number of gill-rakers in the same position was found to be 48, and two thirds as long as the eye; in a Sprat 35, also two thirds as long as the orbit; and in a Pilchard 71, longer than the eye. Thus these appendages in number in the hybrid (61) were less than in the Pilchard (71), but more than in the Herring (48) or in the Sprat (35); while their length did not quite equal that of a normal Pilchard. As to the character of these gill-rakers in the Pilchard, Sprat, and Herring: in the first the lateral denticulations are very minute, a little larger in the Sprat, and largest in the Herring; to which last those in the hybrid had the greatest affinity. *Fins.*—In the hybrid the distance from the end of the snout to the commencement of the dorsal fin was 3·4 inches, the entire extent of the base of the fin being inserted midway between the snout and the root of the caudal fin; lower lobe of the caudal the longer; anal rays almost hidden by the scales. *Scales.*—The number of scutes 22 before and 14 behind the base of the ventral fin; they are weak. As regards the scales, two large rows exist just behind the head on the left side, and the remainder resemble to a great extent those of the Herring, but with the semicircular striæ of the Pilchard. The scales on the right side are similar to those normally seen in the Pilchard. The number of scales along the body in Pilchards is from 29 to 30, in about 8 vertical rows, 17–18 scutes before the ventral fin and 14 behind it; in the Sprat 47 scales along the body in 13 rows, 21–23 strong scutes before the ventral fin and 11–12 behind it; in the Herring the numbers of rows of scales along the body vary from 53–60, and there are 13 scutes behind the ventral fin. *Colours.*—On the left side was seen the beautiful purplish-golden hues of the Herring, but on the right side were the silvery colours of the Pilchard.

SALMO PURPURATUS.

This specimen, which is 8·5 inches long, died at South Kensington in August 1885. It was one of the fishes raised from the eggs brought over from Canada by Mr. Wilmot in 1883, which were described in the Society's 'Proceedings' for 1884, p. 24. Originally imported as supposed eggs of the Salmon, the edge of the adipose dorsal fin in the fry showed the orange tints of a Trout, while the par-bands were from 7 to 10 and averaged $8\frac{1}{4}$. It is interesting, because specimens have been turned into the Thames, and were asserted to be *Land-locked Salmon*, which is an error of identification.

10. Notes on the *Peripatus* of British Guiana. By W. L. SCLATER, B.A., F.Z.S.

[Received January 31, 1887.]

During my recent stay in Demerara I was fortunate enough to procure a considerable number of specimens of a species of *Peripatus*. This singular form was first discovered in British Guiana by Mr. im Thurn, who sent examples home to Prof. Moseley. But the bottle containing the specimens was broken before arriving in England, and the contents were dried up. Of the *Peripati* which I obtained twenty individuals were brought to England alive, but were unfortunately found to be much affected by the cold, and were therefore killed and preserved immediately on arrival. I also brought with me four other specimens that had been preserved in British Guiana.

All the specimens which I obtained were females, and all of them contained embryos. All the specimens examined, both large and small, including those taken from the uterus, were found to have 30 pairs of legs, and of course a pair of oral papillæ. In this respect they differ from the form of Caraccas described by Ernst, in which, as he states, the young ones have only 29 pairs of legs, while the adult specimens possess 31 pairs. The colour of the Demeraran *Peripatus* is a dark brick-red above and pinkish below with a dark suffused median line on the dorsal surface, such as Ernst (25) described in his specimens. The antennæ are very much darker than the rest of the body, in fact they are quite black. The body, as in all other forms of *Peripatus*, is divided into numerous rings by lines of small warts, about 10 to 12 rings going to each segment; the legs and antennæ are also ringed, and the former bear the usual pair of hooks.

In the living animal the colour is intermediate between the colour of the two specimens now exhibited—that preserved in spirit being of a darker, and that preserved in Pereney [1] fluid being of a lighter hue, than that of the living animal. The adult specimens vary from 2·25 to about 2·50 inch in length. It is useless to give exact measurements, since not only do the animals contract when preserved in spirit, but even the living animals vary greatly in size at different times.

The question as to what species the Demeraran *Peripatus* should be referred is by no means an easy one. Specimens of *Peripatus* have been obtained from the following places in the West Indies and South and Central America:—

(1) St. Vincent's, W. I.; with 33 pairs of legs. Guilding (1).
(2) Cayenne; with 29 pairs of legs. Audouin and Milne-Edwards (2)
(3) Lake of Valencia, Venezuela. Wiegmann (4).
(4) Chili. Gay (12).
(5) St. Thomas, W. I. Moritz (5).
(6) Colonia de Tovar, Venezuela. Grube (11).
(7) Santarem, Amazons; 31 pairs of legs. Moseley (22).
(8) Nicaragua. Belt (17).
(9) Caraccas, Venezuela. Ernst (25).
(10) Trinidad (2 species). Kennel (30) and (31).
(11) Island of Marajo, Amazons. Branner (34).
(12) Dominica. Bell (28).
(13) Porto Rico. Peters (23).

P. torquatus, a species discovered by Kennel (31) in Trinidad, and described by him, is easily distinguished by its large size (15 mm.), the number of its pairs of legs (41–42), and by its yellow

[1] Pereney fluid is a hardening fluid composed of chromic acid ·5 p. c. sol., 3 parts; nitric acid 10 p. c. sol., 4 parts; spirit 90 p. c., 3 parts.

collar. *P. blainvillii*, the species described by Gay from Chili, seems also to be distinct, as posessing only 19 pairs of legs.

All the other forms from the above-mentioned localities, including Kennel's second species from Trinidad, seem, so far as one can judge from the descriptions, to resemble one another very closely, except as regards slight variations in the number of pairs of legs. Thus Guilding's species (*P. juliformis*) is described as possessing 33 pairs of legs; while the form from Caraccas is said by Dr. Ernst to have 31 pairs in the adult, and only 29 when first born. All my specimens from Demerara of all ages agree in having 30 pairs of legs.

Another point in which the Demeraran form seems to differ from the other forms described is that the colour of the antennæ is black. This point is not specially mentioned in the descriptions of the other American *Peripati*.

I have also examined the examples of *Peripatus* in the British Museum. Of all the examples of the genus in the National collection there is only one specimen which seems to resemble my form; it is that labelled "*Peripatus* from Dominica, found under logs." The animal in question was obtained in Dominica and presented to the British Museum by the late Mr. G. F. Angas, C.M.Z.S., and has been noticed by Prof. F. Jeffrey Bell (28).

The *Peripatus* from Dominica resembles the Demeraran form in the following points:—the black antennæ; the general colour, so far as can be judged from the spirit-preserved specimens; the number of legs (30 pairs); and also in another point which I have not hitherto mentioned, but which seems to offer characters useful for distinguishing the various species: this is the shape of the slits on the under surface of the feet.

In all the American specimens examined by me at the British Museum this slit is split-shaped; but in my specimens and in that from Dominica the openings are in many cases rounded, and sometimes have attached to them a bladder-shaped appendage, as mentioned by Prof. Bell (28).

It seems to me therefore that there are only three species of *Peripatus* yet satisfactorily determined in South America.

1. *P. torquatus*, Kennel, from Trinidad.
2. *P. blainvillii*, Gay, from Chili.
3. *P. edwardsi*, Blanchard (=*juliformis*, Guilding?), from Cayenne, British Guiana, Venezuela, Nicaragua, and several of the West-India Islands.

To these three species must be added a fourth, from Dominica and British Guiana, distinguished by the following points:—

(1) The black antennæ.

(2) Thirty pairs of feet and one pair of oral papillæ.

(3) The darker and redder colour; the other forms being a dirty brown colour as far as can be seen in the spirit specimens.

(4) The rounded openings to the foot-pits.

(5) The black marking in the median dorsal line in these forms, which is much more definite than in any of the others from South America.

I do not give a name to this Dominican and British-Guianan *Peripatus,* since I understand that Mr. Sedgwick is about to publish a monograph on the species of the genus *Peripatus,* and will include in his work a description of the specimen from Dominica in the British Museum.

All the specimens of *Peripatus* obtained by me were found, with one exception, in the grounds round Mr. im Thurn's house, Maccasseema, on the Pomeroon River. Maccasseema is situated on the top of a sand-hill about 30 feet above the river, and is surrounded on all sides by the swampy forest, except in front, where it faces the river. The specimens were all found under rotten logs of wood, or under the decaying stalks of the Cokerite Palm (*Maximiliana martiana*). I never saw one actually in the rotten wood, as has been described by some previous observers.

The single exception was found about a mile from Maccasseema, up a creek running into the river Pomeroon. This individual was also found under a more or less rotten log close to an Indian house.

Specimens of *Peripatus* were exceedingly scarce, and it took a long time to collect even the few I brought home.

I should mention that examples of *Peripatus* have also been obtained in Demerara by Mr. Quelch, the Curator of the Georgetown Museum, who found them about twenty miles from Georgetown on the Hoorubea Creek (36).

In offering these preliminary notes on this most interesting animal, I have not entered into further details, because Prof. Moseley and Mr. Sedgwick are about to publish an account of the different species of *Peripatus,* and will incorporate their observations on the present form into their work. But before concluding I must express my thanks to Mr. im Thurn for all the help he gave me in my collecting, more especially for allowing me the use of Douglas, the captain of his Indian boat's crew, as collector, for to his sharp eyes I owe most of my specimens.

APPENDIX.

The numbers appended to the authors' names in this paper refer to the following list of publications, which forms, I believe, a nearly complete bibliography of original works on *Peripatus.* To most of the titles I have added a few remarks explaining the contents of the memoirs. The publications that I have not been able to examine at first hand are marked with an asterisk.

(1) Guilding, L. Mollusca Caribbaeana; an account of a new genus of Mollusca. Zool. Journ. ii. pp. 443–444, pl. xiv. 1826.

Contains the original description of the genus *Peripatus* and species *P. juliformis,* found by the author in the forests of St. Vincent. The author considered it an aberrant form of slug. A fair coloured plate is given.

(2) Audouin et Milne-Edwards. Classification des Annélides, etc. Ann. Sc. Nat. xxx. pp. 411–414, pl. xxii. 1833.

The authors show that *Peripatus* must be placed among the "Annélides Errantes." The specimens described were obtained from the River Appronague, in Cayenne.

(3) Gervais, P. Études pour servir à l'histoire naturelle des Myriapodes. Ann. Sc. Nat. (2) vii. pp. 35–60. 1837.

The author believes *Peripatus* to be a transitional form between the Myriapods and Chætopods; he also quotes a MS. description by Blainville of a second species (*P. brevis*) from the Cape of Good Hope.

(4) Wiegmann, A. F. A. Einige Bemerkungen über Guilding's *Peripatus*. Arch. f. Nat. (Wiegmann), iii. pp. 195–200. 1837.

Description of certain specimens of *Peripatus* from the Lake of Valencia, in Venezuela.

(5) Moritz, C. Noch einige Worte über *Peripatus*, Guild. Arch. f. Nat. (Wiegmann), v. pp. 175–176. 1839.

Remarks on the habits and life-conditions of specimens of *Peripatus* found in St. Thomas.

(6) De Blainville. Dictionnaire des Sciences Naturelles. Supplément, tom. i. p. 237. Paris, 1840.

In his article "Animal" de Blainville institutes a special division, "Les *Malacopodes*" of his Type ii. "Entomozoaires," for the genus *Peripatus*.

(7) Milne-Edwards, H. Note sur le *Péripate juliforme*. Ann. Sc. Nat. (2) xviii. pp. 126–128. 1842.

The author reiterates his opinion of the Annelidan nature of *Peripatus*.

(8) Blanchard, E. Recherches sur l'organisation des Vers. Ann. Sci. Nat. (3) viii. pp. 119–149. 1847.

On pp. 137–141 is given the history of the four species known at that time—*P. juliformis, edwardsi, blainvillii*, and *brevis*. The form is considered by the author to be related to Annelids.

(9) Quatrefages, A. de. Mémoire sur la famille des Hermelliens. Ann. Sci. Nat. (3) x. pp. 5–58. 1848.

Quatrefages (p. 56) considers *Peripatus* to be a worm of aberrant form, distinctly related to this group (e. g. *Hermellea*).

(10) Milne-Edwards, Quatrefages, et Blanchard. Recherches anatomiques et zoologiques fait pendant un voyage sur la côte de Sicile, part iii. p. 61, pl. i. fig. 2. Paris, 1849.

Blanchard forms a new species (*P. edwardsi*) for the reception of Milne-Edwards's form from Cayenne; he also mentions Gay's species, *P. blainvillii*, afterwards described (12), and gives some account of its anatomy.

(11) GRUBE, E. Untersuchungen über den Bau von *Peripatus edwardsii*. Müller's Arch. Anat. Phys. 1853, pp. 322–360, Taf. ix., x. 1853.

A description of the anatomy of *Peripatus* from specimens obtained at Colonia de Tovar, in Venezuela.

(12) GAY, C. Historia fisica y politica de Chile. Fauna, Vol. iii. Atlas, Annelides, Lam. iii. fig 2. 1854.

On page 58 is a description of a new species (*Peripatus blainvillii*), with 19 pairs of legs, from Chile. In the Atlas, it may be observed, this species is figured with varying numbers of pairs of legs, in one case 30 and another 29.

(13) QUATREFAGES, A. DE. Histoire Naturelle des Annelés. Tome ii. Paris, 1865. 8vo.

On page 675 is an account of the genus *Peripatus* and of the species then known.

(14) GRUBE, E. Reise der österreichischen Fregatte Novara. Zool. Theil ii. Anneliden. Wien, 1867.

Description of *P. capensis* found near Constantia at the Cape. See p. 4, pl. iv. figs. 3, 4*a*.

(15)* SANGER. Description of a *Peripatus* from Australia. Transactions of the Russian Assembly of Naturalists, held at Moscow in 1867. Moscow, 1869.

Description of *P. leuckarti* from Australia, and of the anatomy of *P. capensis*, in Russian.

(16) LEUCKART. Bericht üb. Leist in d. Naturgeschichte der Niederen Thiere während der J. 1868–1869. Arch. f. Nat. (Troschel), xxxv. pt. 2, pp. 277–278. 1869.

A *résumé* of Sanger's paper, containing an account of the anatomy of *Peripatus capensis* and of the new species from Australia, *Peripatus leuckarti.*

(17) BELT, T. The Naturalist in Nicaragua. 8vo. London, 1874.

Mention is made (p. 140) of *Peripatus* in Nicaragua, though not by name. The specimen procured by Belt was afterwards identified by Prof. Moseley (22).

(18) MOSELEY, H. N. On the Structure and Development of *Peripatus capensis*. Phil. Trans. clxiv. pls. lxxii.–lxxv. pp. 757–782; and Proc. R. S. xxii. pp. 344–350. 1874.

General account of the anatomy and development of the Cape species of *Peripatus* from specimens obtained during the 'Challenger' Expedition.

(19) HUTTON, F. W. On *Peripatus novæ-zealandiæ*. Ann. Mag. N. H. (4) xviii. pl. xvii. pp. 361–369, 1876; also *op. cit.* (4) xx. pp. 81–83, 1877; and *op. cit.* (5) i. pp. 204–206, 1878.

Description of the New-Zealand species of *Peripatus*, with an account of its habits and anatomy, and a few words on its development.

(20) Moseley, H. N. Remarks on Observations by Capt. Hutton, Director of the Otago Museum, on *Peripatus novæ-zealandiæ*, with notes on the Structure of the Species. Ann. Mag. N. H. (4) xix. pp. 85–91. 1877.

A criticism of Hutton (19), with additional remarks on several points in the anatomy of *P. novæ-zealandiæ* not mentioned by him.

(21) Balfour, F. M. On certain Points in the Anatomy of *Peripatus capensis*. Proc. Cambr. Phil. Soc. iii. pp. 266–269; Quart. J. Micr. Sc. xix. pp. 431–433. 1879.

Description of the renal segmental organs and of certain points in the anatomy of the nervous system of *Peripatus*.

(22) Moseley, H. N. Notes on the Species of *Peripatus*, and especially on those of Cayenne and the West Indies. Ann. Mag. N. H. (5) iii. pp. 263–267. 1879.

Contains a history of the genus and a discussion as to the number of species in South America; also notes on two specimens, one from Santarem, on the Amazons; the other from Nicaragua, collected by Mr. Thomas Belt (17).

(23) Peters, W. Ueber die Arten von *Peripatus*. SB. nat. Fr. Berlin, 1880, pp. 28–29. 1880.

A short account of the species then known (four), and remarks on the variation of the number of pairs of legs. Records the existence of specimens in the Berlin Museum from Porto Rico, Surinam, and Venezuela.

(24) Peters, W. Die Variation der Fusszahl bei *Peripatus capensis*, Grube. SB. nat. Fr. Berlin, 1880, pp. 165–166. 1880.

Records the variation in the number of pairs of legs in a series of *Peripatus* from the Cape of from 22 to 17 pairs.

(25) Ernst, A. Some remarks on *Peripatus edwardsii*, Blanch. Nature, xxiii. pp. 446–448. 1881.

An account of specimens found at Caraccas, in Venezuela.

(26) Moseley, H. N., and Sedgwick, A. Note on a discovery, as yet unpublished, by the late Professor F. M. Balfour, concerning the existence of a Blastopore, and on the Origin of the Mesoblast in the Embryo of *Peripatus capensis*. Proc. R. S. xxxiv. pp. 390–393. 1882.

(27) Balfour, F. M. The Anatomy and Development of *Peripatus capensis*; edited by Prof. H. N. Moseley and A. Sedgwick. Quart. J. Micr. Sc. xxiii. pp. 213–259, pls. xiii.–xx. 1883.

Description of the anatomy and some account of the development, with a coloured plate, of *P. capensis*.

(28) Bell, F. J. Note on a *Peripatus* from the Island of Dominica, West Indies. Ann. Mag. N. H. (5) xi. p. 388. 1883.

(29) Gaffron, E. Beiträge zur Anatomie und Histologie von *Peripatus*. Zool. Beitr. (Schneider), i. Taf. vii.–xii. pp. 33–60. 1883. Also *tom. cit.* Taf. xi., xii., xiii., pp. 145–162. 1885.

Account of the anatomy and more particularly the histology of *Peripatus edwardsii* from Trinidad, with 32 pairs of legs.

(30) Kennel, J. Entwicklungsgeschichte von *Peripatus*. Zool. Anz. vii. pp. 531–537. 1883.

A preliminary notice, containing a description of *P. torquatus* from Trinidad.

(31) Kennel, J. Entwicklungsgeschichte von *Peripatus edwardsii*, Blanch., und *Periptaus torquatus*, n. sp. Theil I. Mit Taf. v. bis xi. Arbeit. zool.-zoot. Inst. Würzburg, vii. pp. 95–228. 1885. Theil II. Mit Taf. i. bis vi. Arbeit. zool.-zoot. Inst. Würzburg, viii. pp. 1–93. 1886.

An account of the development of the American species of *Peripatus*, which are characterized by the absence of food-yolk in the ova, and by the presence of a (so-called) placenta. The specimens examined were obtained from Trinidad.

(32) Sedgwick, A. On the Fertilized Ovum and Formation of the Layers of the South-African *Peripatus*. Proc. Roy. Soc. xxxix. pp. 239–244. 1885.

Preliminary account of no. (33).

(33) Sedgwick, A. The Development of the Cape Species of *Peripatus*. Part I., with pls. xxxi., xxxii. Quart. J. Micr. Sc. xxv. pp. 449–446. 1885. Part II., with pls. xii.–xiv. Quart. J. Micr. Sc. xxvi. pp. 175–212. 1886.

The first part contains the first mention of *P. balfouri*, distinguished by having 18 pairs of legs; it also contains an account of the generative organs, segmentation, and general development of the embryo. Part II. contains a further account of segmentation and early stages.

(34) Branner, J. C. *Peripatus* in the Island of Marajo, Amazons. Nature, xxxiv. p. 496. 1886.

(35) Horst, R. On a specimen of *Peripatus*, Guild., from Sumatra. Notes Leyd. Mus. viii. pp. 37–41, pl. ii. figs. 1–5. 1886.

Description of a specimen of *Peripatus* with 24 pairs of claw-bearing legs, from Sumatra.

(36) Quelch, J. J. *Peripatus* in Demerara. Nature, xxxiv. p. 288. 1886.

(37) Stuhlmann, F. Die Reifung des Arthropodeneis. Pp. 1–128, Taf. i.–iv. Freiburg-i.-B. 1886. 8vo.

Account of the ovary and ovarian ovum of *P. edwardsii*. Pp. 89–93.

February 15, 1887.

Prof. W. H. Flower, LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1887:—

The total number of registered additions to the Society's Menagerie during the month of January was 38. Of these 6 were by birth, 21 by presentation, 5 by purchase, 1 by exchange, and 5 were received on deposit. The total number of departures during the same period, by death and removals, was 119.

The most noticeable additions during the month were:—

1. Two Blakiston's Owls (*Bubo blakistoni*) from Japan, presented by J. H. Leech, Esq., F.Z.S., January 20th, new to the Society's Collection.

Mr. Leech informs me that he procured the two specimens in question from Mr. H. Henson of Hakodate, Yesso. Mr. Henson had bought them from a native hunter, who took them for young eagles, which are common in Yesso. Their exact locality is the lakes 20 miles north of Hakodate, and this is a new locality for the species, of which, Mr. Leech believes, only four specimens were previously known[1].

Mr. J. H. Gurney, F.Z.S., has kindly furnished me with the following notes upon these birds:—

"Blakiston's Eagle-Owl appears to belong to the Bubonine genus (or subgenus) *Pseudoptynx* of Kaup, instituted by that author for the reception of *P. philippensis* (Gray), and readily distinguished from *Bubo* in having the toes bare, although the tarsi are feathered.

"*P. philippensis* is a native of the island of Luzon, from which I have seen specimens, and was figured by the late Lord Tweeddale in the Society's 'Transactions,' vol. ix. pl. xxv. fig. 2.

"The only other species of the genus is *P. gurneyi*, Tweed., from the island of Mindanao, which was figured by Lord Tweeddale in the 'Proceedings' of the Zoological Society, 1878, pl. lviii.

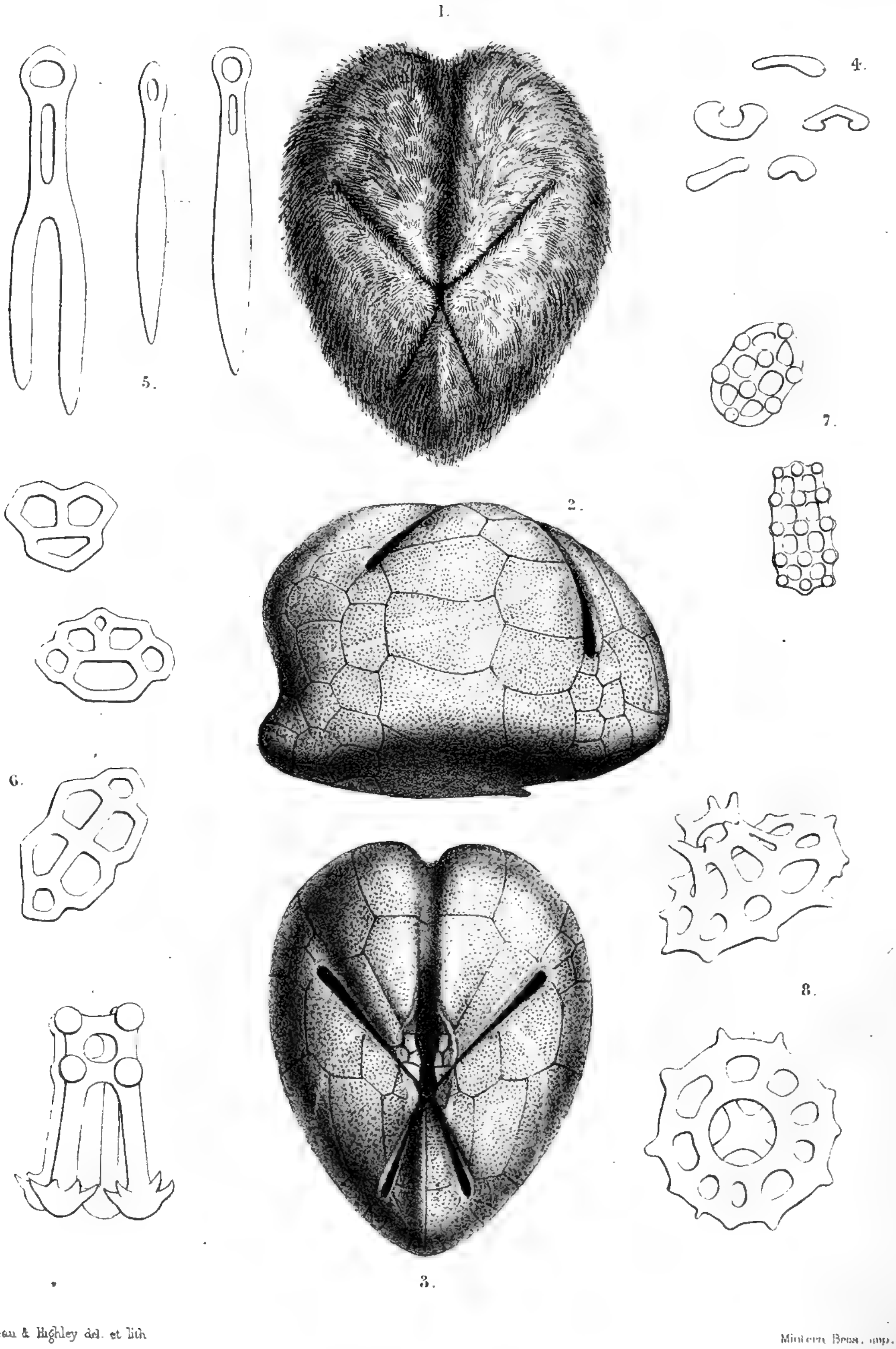
"The localities inhabited by the three species of the genus *Pseudoptynx* appear to indicate that they form a natural group, geographically as well as structurally."—J. H. G., Feb. 26, 1887.

2. Three Hooker's Sea-lions (*Otaria hookeri*), presented by the Hon. W. J. M. Larnach, C.M.G., Minister of Marine of New Zealand, received the 26th January.

Sir F. D. Bell, the Agent-General for New Zealand, informs me that these animals, which were captured at the Auckland Islands by Capt. John Fairchild, Master of the New-Zealand Government steamer 'Hinemoa,' were originally four in number (two males and two females), but that one died on the voyage.

It is very difficult to settle the species of *Otaria* without reference to the form of their palates and dentition; but, judging from the

[1] *Cf.* Seebohm, 'Ibis,' 1884, pp. 42, 183, pl. vi.; id. P. Z. S. 1883, p. 466.



Berjeau & Highley del. et lith. Mintern Bros. imp.

ECHINODERMS OF THE ANDAMAN ISLANDS.

locality and their appearance, these Sea-lions must be referred to the species of the Auckland Islands, upon which Mr. J. W. Clarke, F.Z.S., made his valuable communication in 1873 (see P. Z. S. 1873, p. 750), and should be called *Otaria hookeri*.

The largest male is nearly equal in bulk to our old male *O. jubata*, but has much shorter front flippers and rather longer external ears.

3. A Blue Penguin (*Eudyptula minor*), from Cook's Straits, New Zealand, presented by Mr. Bernard Lawson, January 26th, being the first example of this interesting little Penguin that has been received by the Society.

The following papers were read:—

1. Report on a Collection of Echinodermata from the Andaman Islands. By F. Jeffrey Bell, M.A., Sec. R.M.S., Professor of Comparative Anatomy and Zoology in King's College, London.

[Received January 18, 1887.]

(Plate XVI.)

Dr. John Anderson, F.R.S., Superintendent of the Indian Museum, Calcutta, was lately kind enough to excite the interest of Col. Cadell, V.C., in the marine zoology of the Andaman Islands, which are at present under his charge, and to present to the British Museum the collections thus made. The following contains a report on the Echinoderms, which Dr. Anderson has asked me to draw up.

The condition in which the specimens reached England reflects great credit on Mr. Booley, who made the collections for Dr. Anderson.

There are in all fifty species of Echinoderms, of which no less than twenty-two are Holothurians; the bulk of what follows will treat chiefly of these interesting but difficult forms, which are abundantly found in the Eastern seas. Of the Asteroids, *Linckia lævigata* was exceedingly abundant, there being twenty examples of it, and one only of *L. pacifica*: of these twenty examples, one was four-rayed. *Scytaster novæ-caledoniæ* was not rare; *Culcita* was represented by handsome species. Of two of the most difficult genera, *Linckia, Astropecten*, there is in each case a single example of a form unknown to me; I cannot associate either with a described congeneric form, but, on the other hand, I am not satisfied that they are the representatives of "new species."

Among Ophiuroids, the only noteworthy point is the complete absence of *Ophiothrix* from the present collection. There is but one Crinoid.

It is to be regretted that it is impossible for me to compare the results of a collection at Mergui with that now before me, my report on the Holothurians collected by Dr. Anderson being as yet the only portion of the account of Echinoderms which has appeared in the

Journal of the Linnean Society[1]; with the contents of this paper the reports of Prof. Duncan, Dr. H. Carpenter, and Mr. Sladen on the other groups of Mergui Echinoderms should, on their publication, be consulted.

I have tried to arrange the information to be given in the shortest and clearest way possible, giving first a list of the species, then remarks on those to which it is important to direct special attention.

I. Crinoidea.

1. Antedon, sp.

II. Asteroidea.

2. Acanthaster echinites, *E. & S.*
3. Fromia indica, *Perrier.*
4. —— tumida, *Bell.*
5. Linckia lævigata, *L.*
6. —— pacifica, *Gray.*
7. Scytaster novæ-caledoniæ, *Perrier.*
8. Culcita grex, *M. Tr.*
9. —— schmideliana, *Retz.*[2]
10. —— sp. ("Randasia granulata.")
11. Astropecten polyacanthus, *M. Tr.*
12. —— sp.
13. Archaster typicus, *M. Tr.*

III. Ophiuroidea.

14. Pectinura gorgonia, *M. Tr.*
15. Ophiolepis annulosa, *M. Tr.*
16. Ophiocoma scolopendrina, *Lamk.*
17. Ophiocoma æthiops, *Lütken.*
18. Ophiomastix annulosa, *M. Tr.*
19. Ophiarachna incrassata, *M. Tr.*

IV. Echinoidea.

20. Phyllacanthus verticillatus, *Lmk.*
21. Diadema setosum, *Gray.*
22. Astropyga radiata, *Leske.*
23. Toxopneustes pileolus, *Lamk.*
24. Echinometra lucunter, *Leske.*
25. Colobocentrotus atratus, *L.*
26. Echinoneus cylostomus, *Leske.*
27. Metalia sternalis, *Lamk.*
28. Moira stygia (*Lütken, MSS.*), *A. Ag.*

V. Holothurioidea.

29. Chirodota rufescens, *Brandt.*
30. Haplodactyla andamanensis.
31. Pseudocucumis acicula, *Semper.*
32. Muelleria mauritiana, *Q. & G.*
33. —— miliaris, *Q. & G.*
34. Holothuria albida.
35. —— atra, *Jäger.*
36. —— cadelli.
37. —— impatiens, *Forskal.*
38. Holothuria lineata, *Ludwig.*
39. —— maculata, *Brandt.*
40. —— marmorata, *Jager.*
41. —— monacaria, *Lesson.*
42. —— papillata.
43. —— vagabunda, *Selenka.*
44. Stichopus chloronotus, *Brandt.*
45. —— variegatus, *Semper.*

In addition, there are five specimens belonging to as many species of *Holothuria* as to which I must reserve an opinion till I have, as I hope to have soon, a larger series before me.

Crinoidea.

Antedon, sp.

This *Antedon* is represented also in the collection made at Mergui

[1] J. L. S. xxi. p. 25; the whole of vol. xxi. of that Journal will be devoted to the fauna of Mergui.

[2] Prof. Lovén assures me that I was quite wrong in ascribing to Bruzelius the tract that bears his name (Ann. N. H. (5) ix. p. 166).

by Dr. Anderson; and Dr. Herbert Carpenter, F.R.S., has promised to discuss its relations to *A. palmata* in the report on the Crinoids of Mergui which he has in preparation.

Asteroidea.

Acanthaster echinites.

M. de Loriol has lately pointed out[1] that the species of *Acanthaster* found at the island of Mauritius is not, as has been supposed, *A. echinites*; a comparison of his description and Mauritian specimens with the figures of Ellis and Solander and examples from the Andamans will be sufficient to show the student the distinctness of the species.

As the difference has only lately been pointed out, and the confusion cleared up, it is as yet too early to say whether *A. echinites* belongs to the eastern, and *A. mauritiensis* to the western side of the Indian Ocean, or whether their areas of distribution overlap.

Fromia indica.

I have elsewhere[2] given my reasons for regarding this species, described by Prof. Perrier as six-rayed, as being normally quinqueradiate; a five-rayed specimen in the present collection has R equal to 33, and $r=9$.

With it are two specimens which possibly belong to a different species of the same genus; they are smaller and are still quite spiny.

Culcita schmideliana.

There is a very remarkable specimen which I fancy I am hardly wrong in describing in detail; another is of the more ordinary character.

Almost round; the apices of the ambulacra just touch the equator, so that R is almost exactly equal to r; the ambulacra narrow rapidly after reaching the actinal periphery. The ordinary arrangement of the adambulacral spines is as follows:—In the innermost row four subequal spines, beside which there may be a fifth smaller; outside of and touching these there may be one large or two smaller spines, and either one or both occupy as much of the side of the groove as do the four spines internal to them; outside of the second there is a third row which is more irregular, especially in the region of the actinostome. All the spines are stout, and more or less rounded at the tip. The interambulacral area, which is thickly covered with flat-headed grains, is almost perfectly triangular in shape; the number of grains in a patch varies; the patches are more closely packed in the middle than at the sides of the interambulacral triangle, and scattered among them are the ordinary granules. Peripherally the patches of grains cease somewhat rapidly; a band, bare of patches, but granular and with sparsely scattered tubercles,

[1] Mém. Soc. Phys. Genève, xxix. no. 4, p. 6.
[2] Proc. Zool. Soc. 1882, p. 123.

separates them from the poriferous area; this last extends down to the edge of the actinal surface.

On the abactinal surface there are scattered tubercles and large poriferous patches; over the whole there is a uniform granulation; no pedicellariæ were detected.

The madreporic tubercle is large and prominent.

Colour, in spirit, light yellow, the poriferous patches darker.

Measurement round the equator 560 mm.; height 75 mm. along the longest axis.

The most interesting points with regard to this species are such as bear on its relation to the Echinoidea. Those who accept the old doctrine of Cuvier and Duvernoy, restored in these days by Prof. Haeckel, which explains the constitution of the Echinoderm by the hypothesis that it consists of several fused persons, have found in *Culcita* the form that seemed to show how the free arms of the Starfish might pass into the compact form of the Urchin. This theory of Echinoderm constitution does not recommend itself to me; and the present species seems to justify the hesitation which one feels in accepting it.

While in flattened or irregular Echinoids there is a tendency for the ambulacra to shorten towards the aboral pole, here the tendency is for the shortening to be towards the mouth. In other words, the most extreme Asterid which we know, though it has a remarkable general resemblance to an Echinoid, is, in its essential morphological points, further from it than is a typical Asterid.

CULCITA GREX.

With a little hesitation I refer a single specimen to this species; the variability of the forms of the genus *Culcita* is obviously very great, and a careful revision of the species with the aid of a large number of specimens is a pressing necessity. The collection in the National Museum is not yet sufficiently large to justify me in undertaking the task.

CULCITA, sp.

There are two specimens of what would, a short time ago, have been set down as *Randasia granulata*. As, however, M. de Loriol has lately shown, the form so called by the late Dr. Gray is really a young stage of *Culcita*. It will be remembered that Prof. Perrier has expressed himself in a similar sense. Further series are required before the several stages of each species can be accurately defined.

ECHINOIDEA.

DIADEMA SETOSUM.

I am really very doubtful as to the specific identity of two small specimens, the spines of which are banded light and dark, and present the characters of Dr. Gray's "*Calmarius annellata*," with the adult large black-spined forms which are assumed by *D. setosum*. However, I have not sufficient evidence to justify me in attempting to refute the conclusions formulated by Mr. Alex. Agassiz in his 'synonymy' of this species. The larger specimens collected are magnificent examples of this interesting species.

MOIRA STYGIA. (Plate XVI. figs. 1–3.)

Being in some doubt as to whether I had before me the species described by Dr. Lütken, I sent the drawings here given to that accomplished zoologist with the request that he would compare them with the type in the Copenhagen Museum. Dr. Lütken writes:—"The specimen from Zanzibar is much smaller than your figure [which bore the mark $\times 1\frac{1}{2}$]—24 mm. in length and 14 mm. in height. The anterior lateral ambulacra are more bent, the posterior shorter than in your figure; the posterior excavation of the shell below the periproct less crested than in your figure. But these differences might be those of age." The most striking difference to which this obliging communication directs attention is the great difference in the proportion of height to breadth; however, in a specimen from an unknown locality, which I am inclined to place also in this species, the proportion of height to length is about the same, for it is as 37 to 30, whereas in the Andaman species it is as 33·5 to 27; and the very same is true also of the specimen whose dimensions are given in the 'Revision of the Echini,' where the height is to the long diameter in the ratio of 40 to 49·5.

The other dimensions of the Andaman specimen are:—Breadth 28·5; length of antero-lateral ambulacrum 13; of the postero-lateral ambulacrum 10; length of anal area 4; breadth of do. 3 millim.

It is now for the first time figured, and is the first specimen of the genus that has been shown with the spines on.

The discovery of this species at the Andamans extends its range, though not indeed in any unexpected way; hitherto specimens have been known only from the Red Sea and Zanzibar.

HOLOTHURIOIDEA.

HAPLODACTYLA ANDAMANENSIS. (Plate XVI. fig. 4.)

Body elongated, tapering posteriorly; the skin of a slightly reddish-grey hue, darker above than below.

Tentacles? (retracted).

The body-wall is thin; the ossicles of the œsophageal ring are elongated, rather stout, deeply grooved on the outer surface; the radials are longer than the interradials, and have a bifurcated distal tail. One Polian vesicle. Genital tubes numerous, long, well developed, purple in colour. Lungs extend to anterior end of body, two well but unequally, and one poorly developed lung-trunk; the last does not extend far forwards. Biscuit-shaped or dumbbell-like spicules (Plate XVI. fig. 4).

By the forms of its spicules it is distinguished easily from *H. molpadoides*, and by them and the tapering of the hinder end from *H. australis*.

Pseudocucumis acicula. (Plate XVI. fig. 5.)

A single specimen of this rather rare species, the spicules of which I have had figured, as their representation seems to be more satisfactory than those of Prof. Semper.

Muelleria miliaris.

Some of the specimens which I associate under this name differ from *M. lecanora* in that the region of the anus is not lighter than the rest of the dorsal surface; on the other hand, the sharp distinction between the dark brown of the bivial and the light colour of the trivial surface is an indication of affinity to *M. lecanora.* Considering the closeness of the resemblances and the slightness of the differences between *M. miliaris* and *M. lecanora,* I feel inclined to suggest that the species should be united. One specimen is of a uniform chocolate-brown colour.

Holothuria albida. (Plate XVI. fig. 6.)

Body elongated, tapering somewhat at either end; tentacles darker (? twenty); suckers sparse, scattered. Body-wall thin; œsophageal ring very feeble; Polian vesicle double; lungs poorly developed. The specimen examined had no genital tubes.

The largest specimen was 180 millim. long, had a greatest width of 35 millim., and was 18 millim. wide in the region of the anus.

The flat plates are very irregular in form; the turriform bodies have a single connecting bar, and are knobbed at the narrower end, or where the bar is developed; at the wider end there are also knobs, and these are surrounded by rather coarse spines (Plate XVI. fig. 6).

The position of this species in the keys of Lampert cannot as yet be exactly determined, owing to the retracted condition of the tentacles; it clearly belongs to the group of "Aspidochirote Formen mit Stühlchen und glatten Schnallen," and those in which the Schnallen are irregular. Like *H. immobilis,* it has two Polian vesicles; but it differs in colour, in the arrangement of its suckers, and the form of its spicules. Like *H. pardalis,* it has a number of regular plates, but it wants the characteristic marking of that species, and is of much larger size than any known examples.

Holothuria cadelli. (Plate XVI. fig. 7.)

Body rounded, tapering posteriorly, dark above, lighter below; prickly papillæ, not so numerous or prominent as in *H. squamifera,* frequently but not always with a white circular base. Body-wall thin.

Tentacles (retracted); œsophageal ring small and inconspicuous, the anterior region so contracted that the disposition of the Polian vesicles cannot be certainly made out. Cuvierian organs in the form of rather numerous stout cæcal tubes from half to one inch in length. Lungs well developed. Genital tubes numerous and extensive.

The flattened spicules are (Plate XVI. fig. 7) of the type of those found in *H. albiventer,* but the knobs are more numerous, and there are more than three pairs of holes; from that species it is to be at once distinguished by the absence of the remarkably modified turciform spicules. On the whole, it stands nearest to *H. scabra*, but is distinguished by its speckled and less dense integument, and the absence of the median ventral groove. A specimen 160 millim. long has the greatest circumference 40; one 140 millim. is only 10 millim. round at the anus.

Three smaller specimens differ from the more matured, two by a larger amount of orange in their coloration, and the third by the greater stiffness of the skin.

HOLOTHURIA MARMORATA.

I have had great difficulty in coming to a definite conclusion as to the name to be given to the specimens now associated as *H. marmorata*; the complete absence of a circular disposition of the pigmentation prevents their association with *H. argus*; on the other hand, the comparatively small size of the œsophageal ring is against their affinity with *H. marmorata*. I believe the fact of the matter is that Dr. Théel is justified in his supposition that these two species and some others are but varieties or various stages of a variable and widely distributed species which grows to a great size.

HOLOTHURIA PAPILLATA. (Plate XVI. fig. 8.)

Twenty tentacles. Body elongated, may be wider in its hinder than in its two anterior thirds; prominent scattered dorsal papillæ, which are larger and more closely packed anteriorly than posteriorly; five or more small papillæ around the anus.

Suckers on central surface only, arranged in two irregular rows, which unite posteriorly; each sucker is placed on a yellowish papilliform process. Colour dark slate-grey above, lighter below.

Body-wall thin, the parts of the œsophageal ring are small, the ampullæ long; one large Polian vesicle. Genital tubes short and numerous. Apparently no Cuvierian organs. The only calcareous deposits are in the form of stools (Plate XVI. fig. 8).

Notwithstanding these numerous negative characters, the large size and well-developed papillæ must make this a very conspicuous species.

It may be 280, 320 long, and 60, 80 millim. broad.

EXPLANATION OF PLATE XVI.

Figs. 1–3. *Moira stygia*, × 1½.
Fig. 1. With spines, and from the side.
2. Test denuded, to show the arrangement of the plates.
3. Test from above, to show the disposition of the ambulacra.
4. Spicules of *Haplodactyla andamanensis*.
5. Spicule of *Pseudocucumis acicula*.
6. Spicules of *Holothuria albida*.
7. Spicules of *Holothuria cadelli*.
8. Spicules of *Holothuria papillata*.
Figs. 4–8 × 500.

2. On a Collection of Reptiles and Batrachians made by Mr. H. Pryer in the Loo Choo Islands. By G. A. Boulenger, F.Z.S.

[Received January 28, 1887.]

(Plates XVII. & XVIII.)

Our Corresponding Member Mr. H. Pryer has presented to the British Museum an important series of Reptiles and Batrachians, formed by him during a recent visit to the Loo Choo Islands. This being the first herpetological collection from that group of islands that has reached Europe, its interest in exceptionally great. The North-Pacific Exploring Expedition, under Capt. J. Rogers, U.S.N., visited the Loo Choo Islands in 1854–55, and a collection of Reptiles was made, upon which Hallowell reported (Proc. Acad. Philad. 1860, p. 490 *et seq.*). Unfortunately, owing to the imperfection of his descriptions, little more than a score of new names was gained by that author's contribution. Now that actual specimens are at hand, identification of most of Hallowell's specimens has become possible; and it is my pleasant duty to furnish diagnoses of those species together with a list of the others collected by Mr. Pryer, among which are two entirely new.

REPTILIA.

Lacertilia.

1. Gecko japonicus, D. & B.

? *Hemidactylus marmoratus*, Hallow. *l. c.* p. 491.
? *Hemidactylus inornatus*, Hallow. *l. c.* p. 492.

2. Ptychozoon homalocephalum, Crev.

The unique specimen in the collection, a male, though in other respects agreeing with the Indo-Malayan specimens, is remarkable for having only eight præanal pores.

3. Japalura polygonata, Hallow. (Plate XVII. fig. 1.)

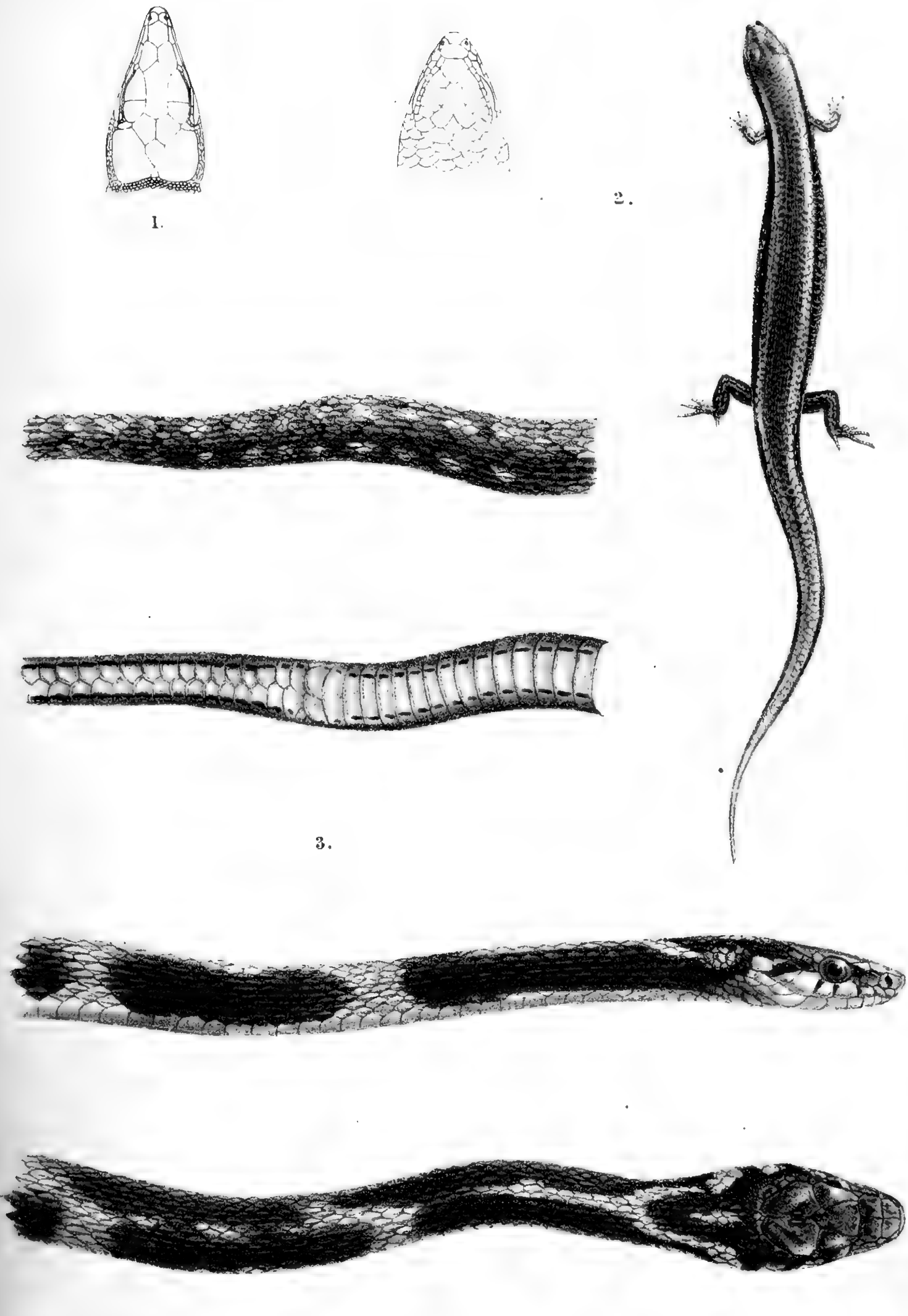
Diploderma polygonatum, Hallow. *l. c.* p. 490.

As was to be expected, this species is closely allied to *J. swinhonis*, Gthr. It differs in having the tibia constantly shorter than the skull, fewer labials as a rule, and in coloration. The number of upper and of lower labials is six or seven, very rarely eight. The hind limb, stretched forwards, reaches between the commissure of the mouth and the anterior border of the orbit. Adult yellowish green above, the interspaces between the scales black; throat and nuchal crest of males bright yellow; females with broad black cross bands on the back; tail, in both sexes, annulate with black; young more greyish, with black cross bands on the back.

P. Smit del. et lith.

Mintern Bros. imp.

1. JAPALURA POLYGONATA
2. TACHYDROMUS SMARAGDINUS.



1. 2. 3.

Peter Smit del. et lith.

Mintern Bros. imp.

1. TACHYDROMUS SMARAGDINUS.
2. LYGOSOMA PELLOPLEURUM. 3. TROPIDONOTUS PRYERI.

	♂. millim.	♀. millim.
Total length	292	215
Head	24	18
Width of head	15	12
Body	58	50
Fore limb	38	33
Hind limb	65	52
Tibia	20	16
Tail	210	147

The species is represented by numerous specimens in Mr. Pryer's collection.

4. Tachydromus smaragdinus, sp. n. (Plate XVII. fig. 2, and Plate XVIII. fig. 1.)

Head long as in *T. sexlineatus*, its width being contained nearly twice in its length. A series of granules, usually incomplete, between the supraoculars and the supraciliaries; a small shield usually (19 cases out of 26) separates the large anterior supraocular from the loreal; temporal scales obtusely keeled, much smaller than in the other species, 10 to 15 on a line between the orbit and the tympanum. Dorsal shields strongly keeled, in eight to ten longitudinal series, the three outer series on each side largest and equal; eight longitudinal series of large, strongly keeled, mucronate ventrals, and three or four series of smaller ones on each side. Præanal shield usually longitudinally divided in the female, entire in the male. One inguinal pore on each side. Emerald-green above; a pale yellow streak along each side, from the upper lip to the groin; males usually with a broad grey or bronzy lateral band above the yellow streak; lower surfaces greenish yellow.

	♂. millim.	♀. millim.
Total length	187	207
Head	12	13
Width of head	6·5	7
Body	38	42
Fore limb	20	20
Hind limb	27	27
Tail	137	152

Numerous specimens.

5. Lygosoma pellopleurum, Hallow. (Plate XVIII. fig. 2.)

Lygosaurus pellopleurus, Hallow. *l. c.* p. 496.

Body elongate, limbs short; the distance between the end of the snout and the fore limb is contained twice in the distance between axilla and groin. Snout very short, obtusely acuminate. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal; frontonasal broader than long, forming a broad suture with the rostral and a still broader one with the frontal; præfrontals very small and widely separated; frontal short, in contact with the first supraocular only, followed by a long and narrow single frontoparietal resembling a second frontal [1], angular posteriorly and in contact with the interparietal; latter in the middle between four small parietals, the posterior pair of which are in contact behind; four supraoculars, first in contact with the frontal and the frontoparietal, second and third in contact with the frontoparietal; seven supraciliaries; fourth upper labial below the centre of the eye. Ear-opening small, horizontally oval, without projecting lobules. 24 scales round the middle of the body, subequal; dorsals rather strongly, laterals feebly tri- or quinquecarinate. Præanal scales not enlarged. Limbs widely separated when adpressed; the length of the hind limb equals the distance between the fore limb and the nostril. Digits short, cylindrical: subdigital lamellæ smooth, 10 under the fourth toe. Tail a little longer than head and body. Reddish brown above, dark brown on the sides; a black lateral band, commencing from the eye; sides with fine whitish shafts; belly dirty white, spotted with dark brown; lower surfaces of tail plumbeous grey, spotted with black.

	millim.
Total length	125
Head	9
Width of head	6·5
Body	48
Fore limb	10
Hind limb	16
Tail...........................	68

A single specimen is in the collection.

Ophidia.

6. Ablabes semicarinatus, Hallow.

Eurypholis semicarinatus, Hallow. *l. c.* p. 493.

Scales in fifteen rows, without apical groove, with a very feeble keel along their anterior half. Rostral rather broader than deep; nostril between two nasals; præfrontals about twice as long as internasals; frontal much longer than broad, as long as or slightly longer than internasals and præfrontals together; loreal at least twice as long as deep; one præ- and two postoculars; eight upper labials, fourth and fifth entering the eye, seventh largest; temporals 1+2; five lower labials in contact with gulars. Ventrals 187–192; anal divided; subcaudals 72–82. Olive above, the scales lighter in the centre; the lower scale on each side yellowish, margined with olive or black; in some specimens four rather indistinct dark brown

[1] The very singular shape of this shield misled Hallowell as to the homologies of the head-shields of this Lizard. Therefore his internasal = frontonasal; frontonasal = frontal; frontal = frontoparietal; interparieto-frontoparietal = interparietal; frontoparietals = anterior parietals.

longitudinal bands on the hinder half of the body; upper lip, ventrals, and subcaudals uniform yellowish.

Several specimens, the largest measuring 77 centim.

7. Tropidonotus pryeri, sp. n. (Plate XVIII. fig. 3.)

Dentition syncranterian. Form slender, as in *T. saurita*. Tail one third of the total length. Head and eye moderate. Scales in 19 rows, all strongly keeled. Ventrals 176–180; subcaudals 121–128. Internasals truncated in front, more than half as large as the præfrontals; one præ- and three postoculars; loreal a little broader than deep; normally eight upper labials, fourth and fifth entering the orbit; usually two temporals in the first row. Anterior part of body with large alternating black elongate spots, separated by a narrow zone of pale olive on the vertebral line, by broader yellowish vertical bars on the sides. Head dark olive, above spotted or marbled with black; lip yellowish, the sutures between the anterior upper labials black; an oblique black streak across the (normally) seventh upper labial; a yellow spot, surrounded with black at the extremity of the jaws. Hinder part of body with a series of black dorsal spots and a lateral series of light spots. Lower parts yellowish, the hinder part of the body with a series of black streaks along each side of the ventrals, becoming confluent into a lateral black line on the subcaudals.

Four specimens, the largest measuring 93 centim. The stomach of one contained a *Rana gracilis*.

8. Platurus fasciatus, Daud.

9. Bothrops flavoviridis, Hallow. *l. c.* p. 492.

Upper and lower head-scales smooth; upper very small, seven or eight in a transverse series between the supraoculars, which are large; nasal divided; eight upper labials, third and fourth largest, second bordering the loreal pit. Scales small, 35 across the middle of the body; laterals smooth, the others feebly keeled. Ventrals 230; anal entire; subcaudals, 75 pairs. Yellowish green above, with symmetrical blackish markings; lower parts pale yellow, with pale olive spots confluent into two bands on the anterior part of the belly.

A single specimen, 525 millim. long.

BATRACHIA.

Ecaudata.

1. Rana gracilis, Wiegm.

2. Rhacophorus viridis, Hallow.

Polypedates viridis, Hallow. *l. c.* p. 500.

? *Hyla cyanea*, Hallow. *l. c.* p. 494.

Closely allied to *R. schlegeli*, Gthr., from which it differs in the longer hind limb, the tibia measuring half the length of head and body; when the limb is stretched forwards, the tibio-tarsal articulation reaches between the eye and the nostril. The inner metatarsal tubercle is smaller than in *R. schlegeli*, and quite flat.

A single specimen, measuring 53 millim. from snout to vent.

3. Microhyla fissipes, Blgr.

Caudata.

4. Molge pyrrhogastra, Boie, var. ensicauda, Hallow.

Triton subcristatus (ensicauda), Hallow. *l. c.* p. 494.

These specimens (ten in number) appear sufficiently different from the Japanese typical form to warrant a varietal distinction. The head is proportionally somewhat broader, the digits shorter, and the tail, in the female, longer. The lower parts are yellow (not red), immaculate or more or less spotted with black; digits yellow inferiorly (black in the typical form). Upper parts black, in some specimens with scattered small yellowish or pale green spots; sometimes a yellowish vertebral streak.

	♂. millim.	♀. millim.
Total length	115	158
From snout to cloaca	53	70
Head	13	15
Width of head	12	14·5
Fore limb	20	21
Hind limb	20	23
Tail	62	88

EXPLANATION OF THE PLATES.

Plate XVII.

Fig. 1. *Japalura polygonata*, p. 146.
2. *Tachydromus smaragdinus*, p. 147.

Plate XVIII.

Fig. 1. *Tachydromus smaragdinus*. Upper view of head, × 2.
2. *Lygosoma pellopleurum*; and upper view of head, × 2, p. 147.
3. *Tropidonotus pryeri*, p. 149.

3. On the small Mammalia collected in Demerara by Mr. W. L. Sclater. By Oldfield Thomas.

[Received January 29, 1887.]

(Plate XIX.)

The Mammalia obtained by Mr. W. L. Sclater during his recent visit to British Guiana consist of 13 specimens belonging to 8 species, of which one is new. All of them have had their exact localities and dates recorded, and are therefore of interest even when belonging to common species. The discovery of a new species of the

[illegible] del. et lith.　Hanhart imp.

HESPEROMYS (RHIPIDOMYS) SCLATERI

peculiar Dormouse-like subgenus *Rhipidomys* is a very interesting fact, and shows how much these small mammals have been neglected by the very numerous collectors who have worked in the different parts of Guiana. The following is a list of the species, with short notes by Mr. Sclater upon their habits, &c.

1. VESPERUGO (VESPERUS) HILARII, Geof.

a. Maccasseema, Pomeroon R., 15/12/86.

"Caught in the store-room in the daytime; apparently it was crawling about the place, and made no attempt to fly away."—*W. L. S.*

2. FURIA HORRENS, F. Cuv.

a. Maccasseema, 11/86.

"This was the common House-bat of Maccasseema and flew about the premises at dusk. The individual obtained was killed by Mr. im Thurn."—*W. L. S.*

3. RHYNCHONYCTERIS NASO, Wied.

a–d. Marakka, 20 miles up the Pomeroon, 15/12/86. *e.* Near Maccasseema, 5/12/86.

"These Bats cling most of the day to the stump of a tree overhanging the water, and when disturbed take short flights and again return to the same place."—*W. L. S.*

See also Dobson, Cat. Chiropt. B. M. p. 368 (1878), and im Thurn, 'Among the Indians of Guiana,' p. 115 (1883).

4. SACCOPTERYX LEPTURA, Schr.

a. Calicoon, close to the junction of the Essequibo and Mazaruni Rivers, 14/11/86.

"This Bat I knocked down about dusk, say 5.30 P.M., with a long stick, just outside the house. Several others were flying about, but I was unable to secure any more."—*W. L. S.*

In this specimen the wing-pouches are unusually large and distended, and from each of them there projects a prominent white frill of skin, which can apparently be exserted or withdrawn at pleasure. From the marked development of these organs, undoubtedly sexual in their nature, it may be inferred that the late autumn is the pairing-time of this species, at least in Guiana.

5. GLOSSOPHAGA SORICINA, Pall.

a, b. Pen Hope, 13/10/86. On the coast 20 miles east of Georgetown.

"This Bat was found in the house in considerable numbers."—*W. L. S.*

6. HOLOCHILUS (NECTOMYS) SQUAMIPES, Brandt.

a. Young. Pen Hope, 12/10/86.

"Caught in the cane-fields, and brought to me by a coolie."—*W. L. S.*

7. Hesperomys (Rhipidomys) sclateri, sp. n. (Plate XIX.)

a. ♀. Maccasseema. 11/86.

"I am sorry to say I cannot remember anything about the habits of this Rat; it was caught and brought to me by one of Mr. im Thurn's Indians, and of course did not live in the house."

Fur short, close, very soft and velvety. General colour uniform dark ashy grey, the tips of the hairs below white or pale rufous, line of demarcation not strongly marked; bases of all the hairs slate-coloured. Hairs on both fore and hind feet, including the fingers and toes, all dark brown or black. Ears, when laid forward, reaching just to the centre of the eye; no projection on their anterior border; their backs hairy, black. Tail long, uniformly black, thickly hairy, the hairs about 3 or 4 mm. long throughout, except just at the base, where they are shorter, and at the extreme tip, where they are 10 or 12 mm. long; the rings of scales well-marked, 15 or 16 to the centimetre. Mammæ 6, one axillary and two inguinal pairs. Interdental palate-ridges 6. Foot-pads broad, smooth, rounded; soles naked, quite smooth.

Skull exceedingly similar to that of *H. leucodactylus*, Tsch. (figured P. Z. S. 1884, pl. xliv. fig. 8), but rather longer and narrower, especially in the cranial portion, with the supraorbital edges more strongly developed, and with the incisors rather longer and heavier.

Dimensions of the type, an adult female in spirit:—Head and body 133 mm., tail 172, hind foot 33, forearm and hand 39, ear, above crown, 16, head 43, muzzle to eye 18·5.

Skull. Basal length 31·5, greatest breadth 19; nasals, length 12·8; length of molar series 6·4; back of incisors to front of m^1 10·2; palatine foramen, length 8·0; interorbital constriction 6·3.

This species, with which I am glad to connect the name of its discoverer and donor, is very closely allied, in all its essential characters, to *H.* (*Rhipidomys*) *leucodactylus*, Tsch.[2], but that species has its fur very much the nature, colour, and texture of that of the Common Rat; while in *H. sclateri* the fur is wholly different to this, being in fact more like that of certain of the smaller Opossums in its soft and velvety character. In *H. sclateri* the colour is also darker and more uniform than in *H. leucodactylus*, the tail is more uniformly bushy, and the feet, both fore and hind, differ by having black-haired instead of pure white toes.

The present is the first recorded occurrence of any member of the interesting Dormouse-like subgenus *Rhipidomys* in the region north of the Amazons and east of Colombia, and gives therefore a very important addition to the known range of the subgenus. Other species have been recorded from Central America, Ecuador, Peru, Bahia, and Minas Geraes, the nearest ally of *H. sclateri* being, as already noted, the Peruvian *H. leucodactylus*, Tsch.

[2] Faun. Peruana, p. 183, pl. xiii. fig. 2 (1844).

8. Didelphys murina, Linn.

a. Pen Hope. 12/10/86.

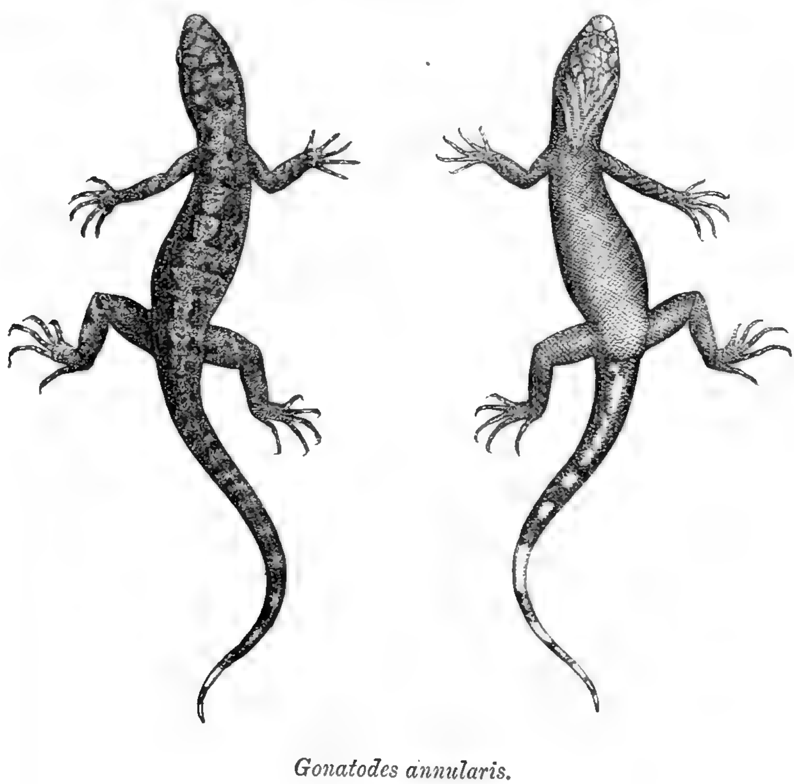
"Brought to me by a coolie at Plantation Hope, which is on the so-called east coast, *i. e.* about 20 miles along the coast east of Georgetown; it was caught, as I understand, in the cane-fields."—*W. L. S.*

4. On a new Geckoid Lizard from British Guiana. By G. A. Boulenger, F.Z.S.

[Received January 24, 1887.]

A small collection of Reptiles and Batrachians was formed by Mr. W. L. Sclater during his recent visit to Maccasseema (on the Pomeroon River) in British Guiana, and presented to the Natural History Museum. Small as the collection is, and from a comparatively well-explored district, it nevertheless contains a novelty, the small Lizard described below. The other species of which specimens were obtained are the following:—

Lizards: *Thecadactylus rapicauda*, Houtt.; *Anolis punctatus*, Daud.; *Ophryoessa superciliosa*, L.; *Uraniscodon umbra*, L.; *Cophias flavescens*, Bonn.; *Amphisbæna fuliginosa*, L.



Gonatodes annularis.

Snakes: *Typhlops reticulatus*, L.; *Geophis lineatus*, D. & B.; *Elaps lemniscatus*, L.

Batrachians: *Leptodactylus pentadactylus*, Laur.; *Bufo marinus*, L.; *Bufo typhonius*, L.; *Cœcilia gracilis*, L.

GONATODES ANNULARIS, sp. n. (Woodcut, p. 153.)

Closely allied to *G. albogularis*, D. & B. Snout longer than the diameter of the orbit, obtuse, the granules on its upper surface small, not larger than the dorsals. Supraciliary edge with a small projecting spine, as in most species of *Sphærodactylus*. Seven upper and four or five lower labials; a pair of small chin-shields behind the mental. No transversely enlarged subcaudals. Grey-brown above, with a series of large black spots along each side of the vertebral zone; head and limbs with black spots or marblings; tail with black annuli, alternating with white spots inferiorly; lower surfaces pale brown, throat with oblique dark-brown lines converging backwards.

	millim.
Total length	86
Head	11
Width of head	7
Body	29
Fore limb	15
Hind limb	19
Tail	46

Two female specimens.

5. On the Structure of a new Genus of Lumbricidæ (*Thamnodrilus gulielmi*[1]). By FRANK E. BEDDARD, M.A., F.R.S.E., Prosector to the Society, Lecturer on Biology at Guy's Hospital.

[Received February 15, 1887.]

I owe the specimens of the worm described in the present paper to the kindness of Mr. W. L. Sclater, F.Z.S., who collected them for me during his recent visit to British Guiana.

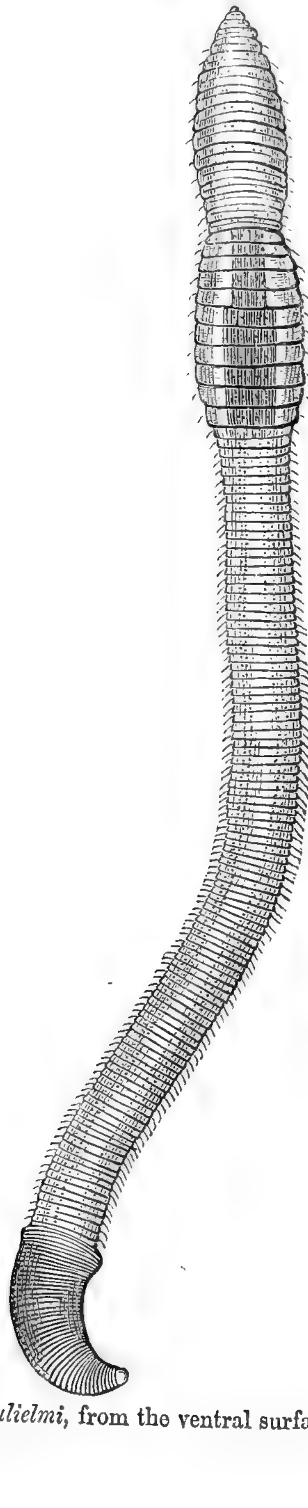
They are all rather large worms (see woodcut, fig. 1), measuring up to 6 inches in length and $\frac{3}{8}$ inch in breadth, and belong to a new genus and species of Lumbricidæ, which I propose to call THAMNODRILUS GULIELMI.

External Characters.—The *colour* is purplish on the dorsal and reddish yellow on the ventral side; the clitellum is distinguished from the rest of the body by its paler tint.

The *mouth* is situated precisely at the anterior extremity of the

[1] Named after Mr. William Lutley Sclater.

Fig. 1.



Thamnodrilus gulielmi, from the ventral surface; natural size.

body, and there is therefore no prostomium; in this character *Thamnodrilus* agrees with *Urochæta*[1] and *Diachæta*[2]. It is a little difficult to distinguish the anterior segments of the body; the buccal segment is divided externally by a very well-marked furrow, which appears to mark the line of division between two really distinct somites. A consideration of the number of the nephridia (see p. 160) leads me to infer that the divisional furrow does not imply a division into somites; furthermore (see figs. 1 and 2) each of the two anterior rings is divided on each side by a longitudinal furrow, which corresponds in position with the dorsal pair of setæ in the following segments; the presence of this furrow is perhaps an additional argument in favour of regarding them as parts of the same somite.

From the first segment to about the 8th, the breadth of the segments gradually increases; the longitudinal diameter of the segments also gradually increases up to the 8th or 9th, after which they become distinctly narrower.

The segments of the *clitellum* are perfectly distinct, and are eleven in number. The clitellum commences with the 15th segment and terminates upon the 25th; very generally a trace of glandular modification is to be found upon the 14th and 26th segments.

The clitellum of *Thamnodrilus* is therefore nearly coextensive with that of *Urobenus, Urochæta, Titanus*, and *Anteus*.

As in the former genus, the clitellum is not developed upon the ventral side of the body, but the extent of the area left free from glandular substance varies; in the anterior part of the clitellum, as far back as segment 19, the ventral pair of setæ as nearly as possible mark the boundary between the glandular and non-glandular portion of the integument; from the 20th segment to the end of the clitellum there is a space left between the glandular part of the integument and the setæ. This is illustrated in the accompanying drawing (woodcut, fig. 2).

The *setæ* are disposed in pairs; the distance separating the ventral pairs is 2·2 mm. in the clitellar region, the distance between the ventral and dorsal pair is 5·5 mm., while the dorsal pairs are separated by an interval of 12·5 mm. The setæ are not remarkable in shape except upon the clitellum; here they are modified and acquire the form illustrated in the drawing (woodcut, fig. 3); these peculiarly modified setæ are apparently found throughout the clitellum (I have also found them in segments immediately anterior), where they replace both the dorsal and ventral pairs. The accompanying figure renders any minute description of these setæ unnecessary, and will serve to show how exactly they resemble the clitellar setæ of *Urochæta*; in this genus Perrier has recorded[3] the modification of the ventral pair of setæ on the 20th segment; and Horst has stated[4] that in another species the ventral setæ of four of the

[1] Perrier, Arch. de Zool. Expér. t. iii.
[2] Benham, Quart. Journ. Micr. Sci. 1886.
[3] Arch. d. Zool. Expér. t. iii. (1874) p. 399, pl. xvii. fig. 52.
[4] Midden Sumatra, Vermes, p. 8.

clitellar segments are thus modified. This latter statement I am able to confirm from the study of an Australian species of the genus, possibly identical with Horst's species. But the modification of the setæ in the clitellar region of *Thamnodrilus* is more complete than

Fig. 2.

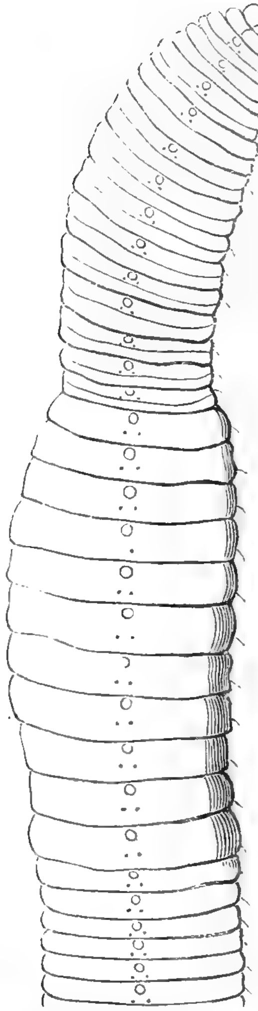


Fig. 3.

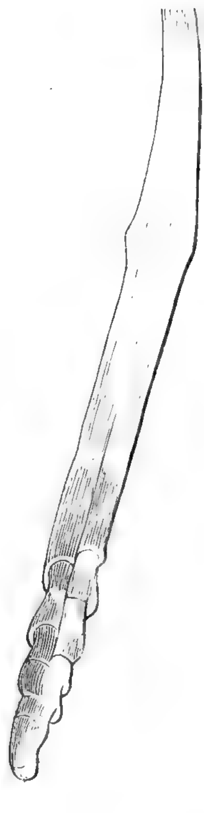


Fig. 2. *Thamnodrilus gulielmi.* Anterior segments seen laterally; apertures of the nephridia in front of the dorsal pair of setæ; segments of clitellum shaded vertically. Magnified twice natural size.
Fig. 3. Seta from one of the segments of the clitellum; highly magnified.

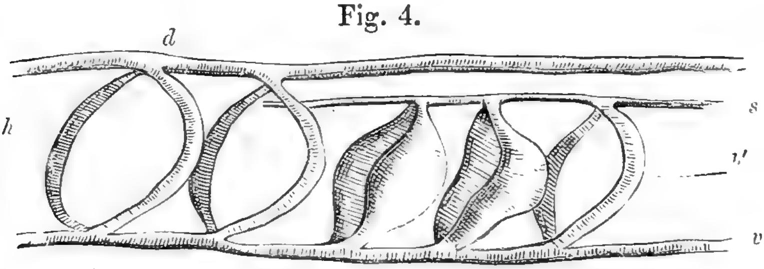
in *Urochæta*, inasmuch as it has affected the dorsal as well as the ventral pairs. The clitellar setæ are larger than the ordinary setæ, as well as differing in their ornamentation; this difference was very noticeable in an immature example, where the difference of age alone distinguished the clitellar from the ordinary setæ; moreover I have frequently found even in mature examples that the clitellar setæ of both dorsal and ventral pairs only showed slight traces of ornamentation at their free extremity; such setæ alternated in the most irregular fashion with setæ like that displayed in the drawing (fig. 3); they are, however, of equal size.

Dorsal pores appear to be entirely absent.

The only *apertures* besides the mouth and anus recognizable on the exterior of the body are those of the nephridia, which are placed in front of the dorsal pair of setæ close to the anterior margin of the segment (fig. 2); these apertures were especially plain upon the clitellum.

Vascular System.—In none of my specimens was the vascular system very well preserved. The *dorsal vessel* (fig. 4, *d*) runs close to the surface of the gizzard, and near to the hinder end of that organ gives off two pairs of slender trunks (*h*) to the ventral vessel (*v*). After this the dorsal vessel runs some way above the surface of the œsophagus, and is not directly connected with the ventral vessel; segments 10, 11, and 12 contain each a pair of lateral "hearts" (*h*),

Fig. 4.



Chief Trunks of Vascular System.

d, the dorsal vessel; *v*, ventral vessel; *s*, supraintestinal; *h*, anterior "hearts" connecting dorsal and ventral vessel; *h'*, posterior hearts connecting supraintestinal and ventral vessel.

of which the two anterior pairs are considerably stouter than the posterior pair; these are given off from the supraintestinal trunk (*s*), which is of some thickness in these segments. I could not detect any additional communication with the dorsal vessel, and am inclined to think that there is none.

Alimentary Canal.—The *mouth-aperture*, as already stated, is terminal, and in all my specimens was excessively minute; the *buccal cavity* is thick-walled and very narrow, with an almost imperceptible lumen. The *pharynx* is large, and is followed by a wide thin-walled *œsophagus*. The œsophagus is remarkable for the fact that it does not pass straight to the gizzard, but is bent upon itself, forming a loop: it might be readily imagined that this condition is simply due to the contraction produced by the preservative reagent; but I found the same condition of the œsophagus in all the specimens that I dissected, and in all of these the gizzard was apparently retracted rather than protruded, and the segments of the body in most instances were perfectly normal and not unduly contracted. The *gizzard* is like that of other Earthworms.

Œsophageal Glands.—Behind the gizzard and in front of the intestines the œsophagus is furnished with certain glands, which are evidently the homologues of similarly placed glands in other Earthworms. These glands are kidney-shaped and lie on the dorsal or lateral aspect of the œsophagus, with the concave side turned towards the œsophagus; at the middle of its concavity the gland is connected with the œsophagus by a short duct. The general appearance of these glands is strikingly similar to the "kidney-shaped glands" which I have described[1] in the intestinal region of *Megascolex cæruleus*; apparently they also resemble in outward appearance the œsophageal glands of *Notoscolex camdenensis*[2], though frequently the œsophageal glands of Earthworms have not this peculiar shape.

The œsophageal glands of *Thamnodrilus* are furnished with a very abundant blood-supply. This blood-supply is derived from the supraintestinal trunk, and not from the dorsal vessel; in the case of the two posterior pairs, at any rate, of these glands, a branch is given off on either side from the supraintestinal vessel; this at once divides into two trunks; the inner branch goes to the septum and ramifies upon its surface; the outer branch conveys blood to the œsophageal gland, which it reaches by passing along the pedicle by which that gland is attached to the œsophageal walls; the vessel then breaks up into a network of capillaries on both the anterior and posterior surfaces of the gland. It is important to notice that in these segments both the dorsal region of the mesentery and the œsophageal gland are supplied with blood from the supraintestinal trunk; the dorsal vessel gives off no branches in these segments. In *Urochæta* the calciferous glands have, according to Perrier, a similar blood-supply.

There were altogether six pairs of these glands situated in segments 9–14; the last two pairs, *i. e.* those situated in segments 13 and 14, were situated nearer to the dorsal surface of the intestine than those which preceed them. The number of those glands (six pairs) is unusual, three being the almost constant number of pairs in other Earthworms; in certain species of *Perichæta*, however, there appear to be as many as six pairs of œsophageal glands.

Body-cavity.—The dissection of this part of the body was rendered very difficult by the toughness of the septa in this region and by their firm connection with one another by numerous tendinous threads; these septa, however, in *Thamnodrilus*, are not specially thickened, as they are in many other Earthworms, but are thin and transparent, as in the posterior region of the body.

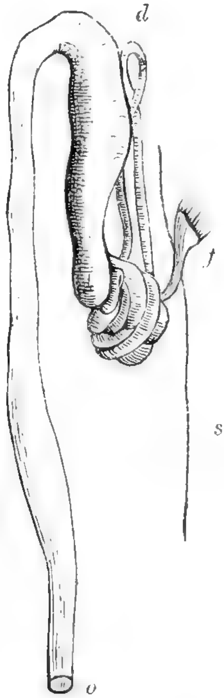
The body communicates with the exterior only by the apertures of the nephridia; there are no dorsal pores present.

[1] Trans. Roy. Soc. Edinb. vol. xxxii.
[2] Proc. Linn. Soc. N. S. W. 1886, pl. viii. fig. 1, *i.g.*

Nephridia.—The nephridia appear to be present in all the segments of the body with the exception of the first; they are differentiated into three series.

(1) The first series consists of only one pair of nephridia; these differ from those which follow in their structure and in their position. They lie beneath the œsophagus and are completely hidden by it; each gland consists of a flattened mass of glandular tubules, produced by the coil, which has the ordinary structure characteristic

Fig. 5.



One of the Anterior Nephridia.

o, external aperture; *f*, funnel opening on to the other side of the intersegmental septum *s*; *d*, glandular vesicle.

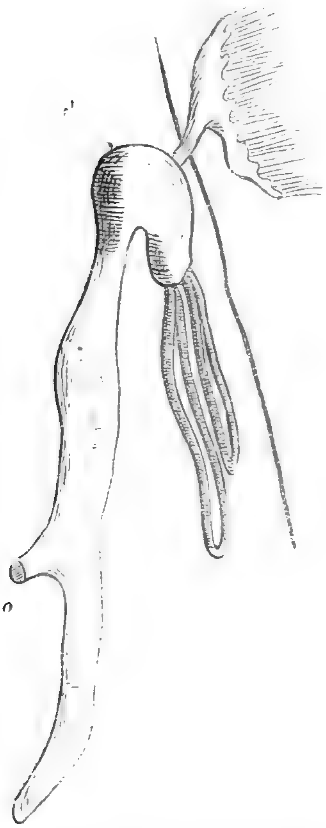
of nephridial tubules, except that the coils are more numerous. The tubule opens into a stout-walled muscular duct, distinguishable by its yellowish colour, which passes anteriorly in a somewhat sinuous course and opens on to the second segment of the body. These glands evidently correspond to the "glandes à mucosité" described by Perrier in *Urochæta*[1], and by myself in *Acanthodrilus multiporus*[2]. The funnel was very conspicuous in transverse sections. This pair of nephridia differs less from the succeeding pairs than in many other genera. The specialization of this first pair of nephridia,

[1] Arch. de Zool. Exp. t. iii. [2] P. Z. S. 1885.

which is so well marked in *Urochæta* and in *Acanthodrilus multiporus*, is, as it were, just commencing in *Thamnodrilus*.

(2) The next fourteen pairs of nephridia (see fig. 5) open on to the exterior of the body in a line with the dorsal pair of setæ; the most anterior nephridia are rather smaller than the posterior pairs in corresponding with the increasing width of the segments. The glandular part of the nephridium is very slightly developed in comparison with the extremely elongated muscular sac which communicates with the exterior; at the junction of the two regions of the nephridium, the

Fig. 6.



One of the Posterior Nephridia. Lettering as in fig. 5.

muscular duct becomes dilated and bent slightly upon itself; its walls become glandular; this portion of the gland is distinguishable by its opaque white appearance.

(3) From the 17th segment to the end of the body the nephridia are of a somewhat different character to those which precede them; the muscular sac of the gland is well developed and opens on to the exterior at the same point as in the anterior segments; it differs in being furnished with a diverticulum which is nearly as long as itself; the glandular region of the nephridium is more

complicated in the first few segments after the 17th than in the posterior segments of the body; the proximal end of the muscular duct passes into a somewhat dilated pear-shaped glandular vessel, into which opens the nephridial tubule; in the posterior nephridium (see fig. 6) the nephridial tubule is very short and bent upon itself four times, the four tubes running parallel with each other; at a point about opposite to the glandular vesicle the tubule perforates the mesentery and reaches the interior of the segment lying in front of that which contains the distal part of the organ; here it ends almost immediately in the nephridial funnel, which is very large and conspicuous; instead of being a simple funnel-shaped expansion, as in the majority of Earthworms and in the anterior nephridia of this species, this region of the nephridium forms an elongated folded membrane apparently closely agreeing with the nephridial funnel of *Anteus*[1]; this membrane is composed of the ordinary columnar ciliated cells.

Reproductive Organs.—There are two pairs of *vesiculæ seminales*, situated in segments 11 and 12; each of these bodies is somewhat kidney-shaped and flattened laterally; the membrane covering the vesiculæ is continued over the funnels of the vasa deferentia which open into the same segments. The true testes were conspicuous in a young specimen which I investigated by means of transverse sections.

I traced back the vasa deferentia, as an excessively fine tube, as far back as the 18th segment, where it appears to open close to the ventral median line. I could not, however, detect the actual orifices of the vasa deferentia. Prostate glands appear to be entirely absent, as in many (e.g. *Urochæta*, *Microchæta*) of Perrier's Intraclitellians; this group, however, cannot be distinguished by the absence of prostate glands, which are present in *Eudrilus*, *Megascolex*, and *Typhæus*. The *ovaries* are situated in the usual position in segment 13; they are small digitate glands.

The *oviducts* open by expanded funnels into the 13th segment which are placed close to the nerve-cord; their ducts perforate the mesentery and open on to the exterior in the 14th segment. I did not, however, observe the actual orifice, which must be well within the ventral pairs of setæ, if not actually unpaired and median.

Spermathecæ.—I opened one or two mature individuals and failed to find these organs; they are, however, usually present to the number of a single pair in the seventh segment. Each spermatheca is a simple, spherical, or pear-shaped pouch without any diverticulum; it opens exactly in front of the nephridium of the same segment.

It appeared to me at first that this Earthworm might possibly belong to the genus *Anteus*, E. P.[2]

Perrier's description of the genus is not very complete, as it necessarily depended upon a unique example which could be only partially dissected.

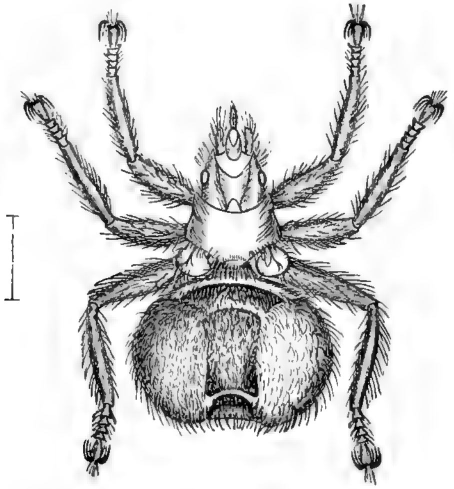
[1] Perrier, Nouv. Arch. d. Mus. t. viii. pl. i. fig. 14.
[2] "Recherches," &c. Nouv. Arch. d. Mus. t. viii. p. 49.

Anteus agrees with *Thamnodrilus* in the absence of dorsal pores, in the arrangement of the setæ, the position of the nephridiopores, the characters of their internal funnel, and in the presence of a single pair of spermathecæ in the 7th segment. Both genera have two pairs of vesiculæ seminales in segments 11 and 12. The main external points of difference appear to be in the clitellum, which is much more extensive in *Anteus* than in *Thamnodrilus,* and in the modification of the clitellar setæ in the latter genus. In *Thamnodrilus* the anterior mesenteries are not specially thickened as they are in *Anteus* and there is no modification of the nephridia in the genital segments. Whatever may be the way in which the genital products are carried off in *Anteus,* the genital ducts of *Thamnodrilus* are perfectly normal. *Anteus,* like *Thamnodrilus,* is a native of the northern part of the South-American continent.

6. Note on a new Parasitic Dipterous Insect of the Family Hippoboscidæ. By Charles O. Waterhouse.

[Received January 31, 1887.]

The insect here described was found by Dr. R. W. Shufeldt[1] at Fort Wingate, New Mexico, on a species of Swift (*Cypselus melanoleucus*), and transmitted to Mr. Sclater for examination. It is closely allied to *Anapera pallida*, a European Dipterous parasite found on



Cypselus apus. It is, however, much larger, and is at once distinguished by the almost total absence of wings—a character which

[1] See Dr. Shufeldt's paper on this Swift, 'Ibis,' 1887, p. 151.

might, by some, be considered of generic importance. Having only two examples, which appear to be females, I prefer for the present to place the species in the genus *Anapera*, and to name it

ANAPERA FIMBRIATA.

Smoky yellow, with the abdomen brown; the epistome pale yellow. The general form and structure are those of *A. pallida*, but it is considerably larger. The antennæ are beset with long black hairs. There is a thick fringe of long black erect hairs or setæ in front of the eye, continued posteriorly along the orbits of the eyes on each side of the middle opaque disk. This fringe exists, but in a much less degree, in *A. pallida*. The triangle on the vertex is longer than broad, and not transverse as in *A. pallida*. There is a series of black setæ along the posterior margin of the head. The thorax is of the same form and with the same black setæ as in *A. pallida*, but they are stronger and more conspicuous. The rudimentary wings are pale smoky yellowish, about as long as broad, with numerous black setæ on the costal area. The abdomen is somewhat round, clothed with black hair, which is very short on the disk, long at the sides and apex; the base has a transverse arcuate fold; the disk is deeply impressed, but, although this is nearly the same in both examples, it is possibly the result of contraction. The legs are as in *A. pallida*, beset with black hairs.

Length 5 lines.

7. On the Terrestrial Mollusks of the Viti Islands.—Part I. By ANDREW GARRETT, of Huahine, Society Islands. (Communicated by Mr. JOHN H. PONSONBY, F.Z.S.)

[Received December 8, 1886.]

The Viti Archipelago, which comprises nearly 200 islands and islets, is embraced in an area between 178° 20′ W. and 176° 55′ E. long., and between 15° 47′ and 19° 13′ S. lat. The islands are disposed in three groups—the eastern, intermediate, and western. The former, which is only partially explored, comprises many small islands, mostly of coralline formation, which have been more or less upheaved through volcanic agencies. All the land-shells, so far as known, comprise the same genera of small shells as obtained in the Tonga and Samoa Islands. The middle portion, which includes all the large islands, though imperfectly explored, have so far yielded many large and interesting species. Besides the same genera which occur in the eastern group, we find the genera *Placostylus, Nanina, Diplommatina, Pupina,* and *Lagocheilus*. All these genera, which are represented by peculiar species, connect the land-shell fauna with Australasia and the East Indies. The latest and most interesting discovery is the occurrence of the Asiatic genus *Lagocheilus*, which was found by Mr. Liardet in Gomea Island. The western or Assawa group, which is unexplored, will undoubtedly produce many species not found in other parts of the archipelago.

The genus *Succinea*, so widely diffused throughout the Pacific islands, has not been discovered in these islands.

The earliest known Vitian endemic land-shells are *Bulimus malleatus*, *B. fulguratus*, and *Helix nouleti*, all described in the 'Revue Zoologique' in 1842, the two former by Dr. Jay, and the latter by Le Guillou. In 1845, Philippi published *Helix pfeifferi*, and Mr. Hinds described *Pythia pollex*. In 1846 and 1847, Dr. Gould added several new species, all discovered by the U. S. Exploring Expedition. In 1855 Dr. Pfeiffer described *Helix ludersi*; and six years later Dr. Dohrn added the beautiful *Bulimus seemanni* to the list of endemic species. In 1865, Prof. Mousson published, in the 'Journal de Conchyliologie,' a complete list of the Viti land and freshwater shells, based on the collections made by Dr. Gräffe and added several new species to the 16 peculiar to the group. In 1870 Mousson's second paper appeared in the same Journal, and he described 26 new species, all collected by Dr. Gräffe. In the meantime several new species were published by H. Adams, Crosse, Angas, and Semper.

In the 'American Journal of Conchology' for 1871, and in the 'Proceedings of the Academy of Natural Sciences of Philadelphia' for 1873, the writer published descriptions and figures of 20 new species, all personally collected. The latest discovery, so far as I can ascertain, is six new minute species collected by Mr. Liardet, which were published and figured with their animals in the 'Proceedings' of the Zoological Society for 1876.

Out of 146 species now recorded 85 are peculiar to the group. The 146 species are embraced in 32 genera, 11 of which are operculated.

Genus Helicarion, Férussac.

1. Helicarion vitrinina.

Nanina? *vitrinina*, Liardet, Proc. Zool. Soc. 1876, p. 100, pl. 5. figs. 2, 2*a*.

"Shell yellow, thin, translucent, perforated, discoidal; whorls $4\frac{1}{4}$, last subangulated, the others slightly convex; beneath shining and well rounded; aperture slightly oblique, lunate; suture marginate; peristome thin; columella slightly expanded over the perforation. Animal black, with mantle covering two thirds of the shell, which it cannot enter at first."

"Found in moist situations under logs, in this respect resembling *Vitrina*." (*Liardet*.)

This species, which is unknown to me, was found at Taviuni Island.

2. Helicarion ramsayi.

Nanina? *ramsayi*, Liardet, Proc. Zool. Soc. 1876, p. 100, pl. 5. fig. 3.

"Shell similar to *N.*? *vitrinina*. When the animal is out I can detect no difference.

"Animal red; a protuberance on the back rests against the shell anteriorly. It progresses by raising its head, extending the body, and placing the posterior part of the foot down in the form of an arch, lands its body gradually from the head; and this arch thus appears to recede until the caudal extremity is reached. Like *N.* ? *vitrinina*, it cannot at first recede into its shell; and like *Vitrina strangei* of Australia, it leaves mucus in its track of a brick-red colour. *Hab.* Taviuni." (*Liardet.*)

Genus Nanina, Gray.

1. Nanina nouleti.

Helix nouleti, Le Guillou, Rev. Zool. 1842, p. 137; Pfeiffer, Mon. Hel. i. p. 69; Reeve, Conch. Icon. pl. 77. fig. 405.

Nanina nouleti, Gray, Cat. Pulm. p. 121; (*Trochomorpha*) Albers, Die Hel. p. 60, 2nd ed.; Mousson, Journ. de Conch. 1865, p. 190; (*Xesta*) 1870, p. 111; (*Hemiplecta*) Paetel, Cat. Conch. 1873, p. 85; Schmeltz, Cat. Mus. Godeffroy, v. p. 90 ("*Zonites*" in error).

Helix (*Nanina*) *rubricata*, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 178; Pfeiffer, Mon. Hel. i. p. 69.

Nanina rubricata, Gould, Expl. Exp., Shells, p. 29, fig. 66; Gray, Cat. Pulm. p. 129; (*Hemiplecta*) H. & A. Adams, Gen. Moll. ii. p. 223.

So far as known, this species is restricted to Viti Levu and Ovalau Islands, where it is not uncommon beneath decaying vegetation in forests.

It may be distinguished by its large size (25 to 30 millim. in diam.), dark chestnut-colour, globose-turbinate form, shining surface, and chiefly by the spiral impressed striæ on the body-whorl.

2. Nanina casca.

Helix calva, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 179; Pfeiffer, Mon. Hel. i. p. 41.

Nanina calva, Gray, Cat. Pulm. p. 129.

Nanina casca, Gould, Expl. Exp., Shells, p. 31, fig. 69; H. & A. Adams, Gen. Moll. ii. p. 222; (*Orobia*) Albers, Die Hel. 2nd ed. p. 59; Mousson, Journ. de Conch. 1865, p. 191; (*Xesta*) 1870, p. 112; (*Thalassia*) Paetel, Cat. Conch. 1873, p. 84; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Helix vitiensis, Pfeiffer, Proc. Zool. Soc. 1855, p. 108, pl. 32. fig. 9; Malak. Blätt. 1857, p. 35.

Nanina vitiensis (*Xesta*), Pfeiffer, Vers, p. 120.

Eurypus cascus, Semper, Phil. Landmoll. i. p. 37, pl. 1. fig. 17.

This species, like *N. nouleti*, is confined to Viti Levu and Ovalau. Like all the Viti species, lives beneath decaying leaves and under rotten wood.

A rather solid, subconoid, more or less depressed, smooth, shining species, of a pale corneous colour, sometimes with a slightly ruddy spire and perforated base.

Major diam. 15 to 21 millim. Gould's first name being preoccupied by Lowe for a Madeira *Helix*, he changed it to *casca*.

3. Nanina pfeifferi.

Helix pfeifferi (*Nanina?*), Philippi, Arch. f. Nat. 1845, p. 62; Chemnitz, 2nd ed. Helix, pl. 31. figs. 9–10; Pfeiffer, Mon. Hel. i. p. 54; Reeve, Conch. Icon. no. 1282, pl. 185.

Nanina pfeifferi, Gray, Cat. Pulm. p. 94; (*Xesta*) Albers, Die Hel. p. 59; H. & A. Adams, Gen. Moll. ii. p. 223; (*Xesta*) Pfeiffer, Vers, p. 120; (*Xesta*) Mousson, Journ. de Conch. 1870, p. 111.

Helix lurida, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 179; Pfeiffer, Mon. Hel. i. p. 47.

Nanina lurida, Gould, Expl. Exp., Shells, p. 31, fig. 68; Gray, Cat. Pulm. p. 128; (*Hemiplecta*), H. & A. Adams, Gen. Moll. ii. p. 223; (*Xesta*) Paetel, Cat. Conch. 1873, p. 85; Mousson, Journ. de Conch. 1865, p. 190; Schmeltz, Cat. Mus. Godeff. v. p. 71.

I received many examples of this species from a missionary who collected them at Kantavu. Dr. Gräffe obtained specimens in Viti Levu.

Though I have followed Pfeiffer and Mousson in referring this species to *pfeifferi*, still I have some doubts as to their being the same species. Pfeiffer and Deshayes assign it to China, and Cuming erroneously cites the Sandwich Islands as its habitat.

Though nearly as large as *nouleti*, it may be distinguished by its light colour, more depressed whorls, and smooth surface.

4. Nanina fragillima.

Nanina (*Xesta*) *fragillima*, Mousson, Journ. de Conch. 1870, p. 112, pl. 7. fig. 3; (*Microcystis*) Paetel, Cat. Conch. 1873, p. 84.

Helix fragillima, Pfeiffer, Mon. Hel. vii. p. 91.

I am indebted to Dr. Gräffe for examples of this species which he obtained in the interior of Viti Levu. It is also recorded from Kantavu.

It is a thin, transparent, shining, pale horn-coloured species with a depressed spire and strongly convex base. The last whorl is conspicuously angulated. Major diam. 14 millim.

5. Nanina similis.

Euripus similis, Semper, Phil. Landmoll. i. p. 37, pl. 1. fig. 18, pl. 2. fig. 91.

Nanina (*Euripus*) *similis*, Schmeltz, Cat. Mus. Godeff. v. p. 91.

Helix similis, Pfeiffer, Mon. Hel. vii. p. 112.

This species, which is unknown to me, was collected by Dr. Gräffe on Viti Levu.

It is described as a solid, orbicular, depressed shell of a fuscous horn-colour, with irregular fuscous lines; whorls $5\frac{1}{2}$, the last one obsoletely angulated just above the periphery. Diam. 17, height $10\frac{1}{2}$ millim.

6. Nanina hoyti.

Nanina hoyti, Garrett, Amer. Journ. Conch. 1872, p. 221, pl. 19. fig. 6; Schmeltz, Cat. Mus. Godeff. v. p. 91.

Helix hoyti, Pfeiffer, Mon. Hel. vii. p. 525.

Common in Taviuni, Gomea, and Lanthala.

It may be distinguished from *N. casca* by the pale brownish sutural band, darker spire, tawny columella, and the coarse wrinkles just beneath the suture. Major diam. 19 to 20 millim.

7. Nanina otareæ.

Nanina otareæ, Garrett, Amer. Journ. Conch., 1872, p. 222, pl. 19. fig. 8; Schmeltz, Cat. Mus. Godeff. v. p. 91.

Helix otareæ, Pfeiffer, Mon. Hel. vii. p. 524.

I discovered numerous examples of this fine species on the north-west portion of Vanua Levu.

It is about the same size as *N. nouleti,* and like that species has coarse striæ of growth and faint spiral lines, the former being larger and much more uniform in size, and the latter on our species only discernible by the aid of a lens. It may be at once distinguished by the fulvous-brown colour and the large circular pale cream-white basal patch. The last whorl is also more depressed than in *N. nouleti.* Major diam. 29 millim.

8. Nanina polita.

Nanina nouleti, var. *polita,* Mousson, Journ. de Conch. 1865, p. 190.

A few examples found beneath dead leaves on the eastern part of Viti Levu.

It is smaller, more depressed, smoother, more polished, and the whorls are flatter than in *N. nouleti.* The base is also darker, and there is not the least trace of spiral striæ. It may, I think, take specific rank.

9. Nanina tenella.

Nanina tenella, Garrett, Amer. Journ. Conch. 1872, p. 222, pl. 19. fig. 7.

Helix tenella, Pfeiffer, Mon. Hel. vii. p. 525.

Not uncommon in forests on the south-eastern part of the Vanua Levu and Kioa.

It is a fragile, smooth, polished, transparent, whitish horn-coloured species shaped like *N. hoyti,* but only 17 millim. in diameter. Its paler colour and thinner transparent texture will at once separate it from *N. casca.*

10. Nanina godeffroyana.

Nanina godeffroyana, Garrett, Amer. Journ. Conch. 1872, p. 223, pl. 19. fig. 19.

Helix godeffroyana, Pfeiffer, Mon. Hel. vii. p. 524.

This fine large species was taken in considerable numbers in the interior of the north-east portion of Vanua Levu.

It may at once be recognized by its large size (38 millim. in diameter), depressed turbinate form, yellowish or light brownish horn-colour with a wide fulvous-brown sutural band.

11. NANINA ASSAVAENSIS, n. sp.

Shell imperforate, turbinately globose, indistinctly striated with rather coarse lines of growth, smooth, shining, subpellucid, smoky horn-colour; whorls 5, slightly convex, the last one obscurely angulated just above the periphery; aperture oblique, orbicular-luniform; peristome thin, straight; columella abbreviately reflected over the axis of the shell.

Diam. 20, height 12 millim.

Abundant beneath dead leaves at Naviti Island, one of the Assawa group.

Genus MICROCYSTIS, Beck.

1. MICROCYSTIS UNISULCATA.

Nanina unisulcata, Mousson, Journ. de Conch. 1865, p. 191; (*Microcystis*) 1870, p. 113; (*Thalassina*) Paetel, Cat. Conch. 1873, p. 85; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Helix unisulcata, Pfeiffer, Mon. Hel. v. p. 80.

Helix (*Petasia*) *unisulcata*, Paetel, Cat. Conch. p. 96.

Helix laqueata, Baird, Brenchley, Cruise of the 'Curaçoa,' p. 446, pl. xl. figs. 8, 9.

This peculiar species is widely diffused throughout the group, and, like all the Viti species, is found beneath decaying vegetation.

It is the only species, so far as known, which exhibits a sculptured surface. The unisulcated whorls and more or less nodulous columella will readily distinguish it.

2. MICROCYSTIS KIOAENSIS.

Nanina kioaensis, Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 237, pl. 3. fig. 71 ("*kitaensis*" in error).

Nanina? taviuniensis, Liardet, Proc. Zool. Soc. 1876, p. 99, pl. 5. figs. 1, 1*a*, *b*.

This very distinct species only occurred to my notice in the mountain-forests of Kioa Island. Mr. Liardet's *Nanina taviuniensis*, which he obtained at Taviuni and Gomea, differs only from our species in having the base minutely perforated.

It may be distinguished by its depressed globose form, yellowish horn-colour, deep rounded body-whorl, and the prominent columellar fold.

3. MICROCYSTIS NODULATA.

Nanina (*Microcystis*) *nodulata*, Mousson, Journ. de Conch. 1870, p. 114, pl. 7. fig. 4; (*Thalassia*) Paetel, Cat. Conch. ed. 1873, p. 85.

Helix nodulata, Pfeiffer, Mon. Hel. vii. p. 67.

Discovered by Dr. Gräffe on Vanua Balavo, one of the Windward Islands.

Its chief characters are its depressed globose form, brilliant horn-colour, and nodulous columella. It is more depressed and paler than the preceding species.

4. Microcystis excrescens.

Nanina (Microcystis) excrescens, Mousson, Journ. de Conch. 1870, p. 115, pl. 7. fig. 5, 1871, p. 8; Paetel, Cat. Conch. 1873, p. 84; Schmeltz, Cat. Mus. Godeff. v. p. 91.

Helix excrescens, Pfeiffer, Mon. Hel. vii. p. 67.

Microcystis excrescens, Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 381.

This small species was found by Dr. Gräffe on the eastern portion of Viti Levu and on several islands in the Tonga group. I discovered it on one of the Cook's Islands.

It is nearly of the same size and shape as *M. nodulata*, with the columellar fold of *M. kioaensis*, but is much smaller than the latter species.

5. Microcystis upolensis.

Nanina upolensis, Mousson, Journ. de Conch. 1865, p. 166; (*Microcystis*) 1869, p. 327; 1870, var. *oneataensis*, p. 114; (*Thalassia*) Paetel, Cat. Conch. 1873, p. 85; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Helix upolensis, Pfeiffer, Mon. Hel. v. p. 108.

Helicopsis upolensis, Pease, Proc. Zool. Soc. 1871, p. 475.

Helix samoensis, Baird, in Brenchley, Cruise of the 'Curaçoa,' p. 447, pl. xl. figs. 12, 13.

This species was first described from specimens collected by Dr. Gräffe on Upolu, one of the Samoa Islands, and I subsequently discovered it on the islands of Vanua Balavo and Oneata.

A very smooth, highly polished, orbicular, depressed, pale horn-coloured species with a slight columellar nodule.

6. Microcystis sororia.

Helix sororia, Cox, Proc. Zool. Soc. 1870, p. 83; Pfeiffer, Mon. Hel. vii. p. 60.

This species, which is unknown to me, was discovered by Mr. Brazier at Ovalau.

A small imperforated, thin, smooth, shining species of the depressed-globose form, with five moderately convex whorls, of a uniform yellowish-olive colour, and with a simple columella.

7. Microcystis firmostyla.

Nanina firmostyla, Mousson, Journ. de Conch. 1865, p. 166; (*Microcystis*) 1871, p. 7; Schmeltz, Cat. Mus. Godeff. v. p. 90; (*Microcystis*) Paetel, Cat. Conch. 1873, p. 84.

Helix firmostyla, Pfeiffer, Mon. Hel. v. p. 70.

Helicopsis firmostyla, Pease, Proc. Zool. Soc. 1871, p. 475.

Obtained by Dr. Gräffe at Tikombia, one of the Windward Islands. He also found it generally distributed throughout the Tonga Islands.

A minute, depressed-convex, highly polished, horn-coloured species, shaped like *M. upolensis*, but only half as large. The columella is sometimes slightly nodulous.

8. Microcystis perpolita.

Nanina (Microcystis) perpolita, Mousson, Journ. de Conch. 1869, p. 326, pl. 14. fig. 1; 1870, p. 113; 1871, p. 8, var. *solida*; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Helicopsis perpolita, Pease, Proc. Zool. Soc. 1871, p. 475.

Helix perpolita, Pfeiffer, Mon. Hel. vii. p. 65.

This species was found by Dr. Gräffe on Viti Levu. It also inhabits Tonga and the Samoa Islands.

It is a convexly depressed, pellucid, highly polished, yellowish horn-coloured species with 4½ whorls.

9. Microcystis stearnseana, sp. nov.

Shell small, imperforated, depressedly globose, pellucid, smooth, shining, luteous horn-colour; spire convexly rounded, apex depressed; suture linear, narrowly margined; whorls 5, flatly convex, last one not descending in front, rounded, base convex; aperture nearly vertical, roundly lunate; peristome straight, acute, regularly curved, margins remote, not converging; columella with a white, prominent, nearly horizontal tooth-like fold; within the base of the aperture, a short distance from the margin, are two sublamelliform white teeth, the upper one the larger, crest-like, the smaller one close to the columellar fold.

Major diam. 3, height 2 millim.

Hab. Viti Islands.

Several examples found beneath rotten wood at Vanua Balavo, and a few were obtained under dead leaves at Uea or Wallis Island.

It is closely allied to *Nanina (Gastrodonta) ensifera*, Mousson, a Samoan species, which is smaller, more depressed, the body-whorl being subangulated and more depressedly rounded. I name this singular species after my friend R. E. C. Stearns, Esq.

Genus Trochonanina, Mousson.

1. Trochonanina samoensis.

Nanina samoensis, Mousson, Journ. de Conch. 1865, p. 165.

Helix samoensis, Pfeiffer, Mon. Hel. v. p. 70.

Zonites (Conula) samoensis, Mousson, Journ. de Conch. 1869, p. 331; 1870, p. 116; 1871, p. 10; Paetel, Cat. Conch. 1873, p. 86; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Helix clayi, Liardet, Proc. Zool. Soc. 1876, p. 101, pl. 5. fig. 7.

Microcystis samoensis, Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 384.

This minute species is generally diffused throughout the group. It is also common in the Tonga, Cook's, and Samoa Islands, and rare in the Marquesas. Under decaying vegetation.

It is a perforated, thin, depressed, turbinated, reddish or brownish horn-coloured species, with five strongly convex whorls, the last one angulated on the periphery.

2. Trochonanina microconus.

Nanina microconus, Mousson, Journ. de Conch. 1865, p. 192; (*Thalassia*) Paetel, Cat. Conch. p. 85.

Helix microconus, Pfeiffer, Mon. Hel. v. p. 94.

Zonites (*Conulus*) *microconus*, Mousson, Journ. de Conch. 1870, p. 117; Paetel, Cat. Conch. 1873, p. 86; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Helix pinnockii, Liardet, Proc. Zool. Soc. 1876, p. 100, pl. 5. figs. 5, 5*a*.

Widely diffused over the group, and, like the preceding, this species lives beneath decaying vegetation. It occurs also in the Tonga and Samoa Islands.

A minute, perforated, conical, greyish horn-coloured species with $5\frac{1}{2}$ spirally striated whorls, the last one acutely angulated and the base smooth.

3. Trochonanina barkasi.

Helix barkasi, Liardet, Proc. Zool. Soc. 1876, p. 100, pl. 5. fig. 6.

This species, which is quite unknown to me, was found at Taviuni by Mr. Liardet. He describes it as follows:—

"Shell minute, trochiform, very minutely perforated, colour golden horny; whorls $5\frac{1}{2}$, convex, roughly and irregularly striated, transversely ribbed, last whorl acutely carinated; beneath slightly convex; striæ radiating from the perforation; aperture oblique and triangular."

4. Trochonanina calculosa.

Helix calculosa, Gould, Expl. Exp., Shells, p. 48, pl. 5. fig. 63; Pfeiffer, Mon. Hel. iii. p. 41.

Zonites (*Conulus*) *calculosus*, H. & A. Adams, Gen. Moll. ii. p. 116.

Nanina calculosa, Gray, Cat. Pulm. p. 126; Schmeltz, Cat. Mus. Godeff. v. p. 91.

Trochonanina calculosa, Garrett, Journ. Acad. Nat. Sci. Philad. 1884, p. 22.

A few specimens were found on the leaves of the bushes at Malolo Island. It is also common and widely diffused throughout the Society Islands. Numerous examples occurred to my notice at Dominique, one of the Marquesas Islands.

A minute, globose-pyramidal species, with an angulated body-whorl, reflexed columella, and punctiform perforation. Colour pale corneous; whorls 5, convex.

Genus Zonites, Montfort.

1. Zonites vitiensis.

Zonites vitiensis, Mousson, Journ. de Conch. 1865 p. 193;

(*Hyalina*) 1870, p. 115 ; Paetel, Cat. Conch, 1873, p. 86 ; Schmeltz, Cat. Mus. Godeff. v. p. 90,

Helix vitiensis, Pfeiffer, Mon. Hel. v. p. 146.

Common beneath dead leaves in forests near the sea-shore, and widely distributed through the group.

A small, umbilicated, depressed, thin, pellucid, pale horn-coloured species, about the size and shape of *Hyalina arborea,* Say, a North-American species.

2. ZONITES PLICOSTRIATUS.

Zonites plicostriatus, Mousson, Journ. de Conch. 1870, p. 116.

Helix plicostriata, Pfeiffer, Mon. Hel. vii. p. 197.

Inhabits the south coast of Vitu Levu and Kantavu (*Gräffe*).

A little smaller than the preceding species, from which it differs in having the body-whorl angulated, and the sculpture consists of fine rib-like striæ and spiral impressed lines.

3. ZONITES SCHMELTZIANA, sp. nov.

Shell umbilicated, depressed, orbicular, pellucid, shining, obscurely striated, pale corneous, sparsely speckled with white; spire depressedly convex ; suture slightly impressed ; whorls 5, nearly flat, regularly increasing, last one not deflected in front, depressedly rounded, upper portion depressed and angulated ; base convexly rounded ; umbilicus small ; aperture oblique, orbicular-lunate ; peristome straight, sharp, with remote margins ; columella slightly reflected.

Major diam. 9, height 4 millim.

Hab. Malolo Island.

Common beneath decaying vegetation, in forests near the sea-shore.

Nearly twice the size of *Z. vitiensis* ; this species has the spire more depressed, the whorls flatter, and may at once be recognized by its angulated body-whorl.

Genus TROCHOMORPHA, Albers.

1. TROCHOMORPHA MERZIANOIDES.

Helix (*Trochomorpha*) *merzianoides,* Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 237, pl. 3. fig. 72.

A rare species inhabiting Vanua Levu, where I found a few examples adhering to the trunks of trees.

Its large size (22 millim.), honey-yellow base, chestnut-brown upper surface, which is mottled with radiating lines and spots of a luteous-white colour, will at once distinguish it. The upper surface is coloured nearly the same as *T. merziana,* a Solomon-Island species ; but the present species may be separated by the absence of the basal band, darker colour, the narrower last whorl, and its narrower aperture. *T. merziana* also differs in having the upper margin of the peristome inflected.

2. Trochomorpha abrochroa, Crosse.

Helix abrochroa, Crosse, Journ. de Conch. 1868, p. 176; 1870, p. 101, pl. 1. fig. 2; Pfeiffer, Mon. Hel. vii. p. 207.

Trochomorpha (Discus) abrochroa, Mousson, Journ. de Conch. 1870, p. 123, var. *pseudoplanorbis*.

This species, which appears to be somewhat scarce, was found by me under dead wood in the mountain-forests on Kioa Island. Dr. Gräffe obtained it on Viti Levu.

Easily distinguished by its thin texture, uniform luteous horn-colour, depressed form, sharp crowded striæ, and the angle on the margin of the wide umbilicus. Diam. 12 millim.

3. Trochomorpha ludersi.

Helix ludersi, Pfeiffer, Proc. Zool. Soc. 1855, p. 112; (*Videna*) Vers, p. 132; Mon. Hel. iv. p. 183.

Trochomorpha (Discus) ludersi, Mousson, Journ. de Conch. 1870, p. 122 (part.).

This fine species is abundant on the trunks of trees at Gnau (Angau) Island. I received a few specimens from a native at Ovalau, where Macgillivray obtained the type examples.

Its large size (19 millim.), light horn-colour, and, more particularly, the four narrow reddish-brown bands, two above and two in the base, will separate it from any other Vitian species.

4. Trochomorpha taviuniensis.

Helix taviuniensis, Garrett, Amer. Journ. Conch. 1872, p. 223 ("*Tavinniensis*" typ. err.); Schmeltz, Cat. Mus. Godeff. v. p. 95; Pfeiffer, Mon. Hel. vii. p. 574.

Found in numbers on the trunks of trees in damp forests on Taviuni.

A little smaller and more depressed than *T. ludersi*, with a single narrow chestnut-brown submarginal band, both above and beneath, on a tawny-yellow ground. Out of over 300 specimens one only was without the bands, and was more depressed and paler than the type. The bands are darker and wider than in the preceding species.

5. Trochomorpha tumulus.

Helix tumulus, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 175; Expl. Exp., Shells, p. 62, fig. 53; Pfeiffer, Mon. Hel. i. p. 85; Mousson, Journ. de Conch. 1865, p. 194, 1870, p. 120; Schmeltz, Cat. Mus. Godeff. v. p. 94.

Nanina tumulus, Gray, Cat. Pulm. p. 128; (*Trochomorpha*) Albers, Die Hel. 2nd ed. p. 60; (*Discus*) Paetel, Cat. Conch. p. 85.

This species, which is unknown to me, inhabits Viti Levu. Schmeltz cites Samoa as one of its habitats, which is probably a mistake, as Prof. Mousson does not mention it in his paper on the Samoan land-shells.

It is described as a small (14 millim.), solid, yellowish, pyramidal shell, with a flattened base, 6–7 whorls, the last one obtuse and angulated at the periphery.

6. Trochomorpha planoconus.

Trochomorpha planoconus, Mousson, MS., Museum Godeffroy, 1885.

Shell umbilicated, trochiform, rather solid, scarcely shining, rugosely striated; striæ rude, irregular, oblique; colour chestnut-black, varigated with fulvous, gradually passing into dark chestnut-brown; apex obtuse; base dark honey-yellow, with a darker line near the keel; spire elevated, conoid, with planulate outlines; suture linear, narrowly margined; whorls 7, slightly convex, slowly and regularly increasing, last one acutely carinated; keel compressed and rugose; umbilicus small, deep; aperture diagonal, subrhomobidal-luniform; peristome above the keel acute and gently arched, below the keel thickened and concave.

Major diam. 19, height 10 millim.

Ono Island.

Two examples received from the Museum Godeffroy. As compared with *T. merzianoides,* it is much more conical, darker coloured, smaller, and the umbilicus is not so large.

7. Trochomorpha fessonia.

Helix (*Trochomorpha*) *fessonia,* Angas, Proc. Zool. Soc. 1869, p. 626, pl. 48. fig. 7; Brazier, Proc. Zool. Soc. 1871, p. 322 (part.); Schmeltz, Cat. Mus. Godeff. v. p. 94; Pfeiffer, Mon. Hel. vii. p. 201.

Trochomorpha (*Discus*) *transarata,* var. *depresso-striata,* Mousson, Journ. de Conch. 1870, p. 121.

I received several examples of this species from Kantavu Island, where Mr. Brazier obtained the type specimens. On trees. Dr. Gräffe found it (rare) in the interior of Viti Levu.

Its most essential characters are its rather small size (12 millim.), depressed trochiform shape, crowded irregular plicate striæ, brownish colour, and pale markings. The spire is convexly-conical; whorls 6, with narrow white margins. Base rather flat, corneous, with a reddish-brown band next to the acute white keel. Umbilicus small.

8. Trochomorpha transarata.

Helix transarata, Mousson, Journ. de Conch. 1865, p. 194; Pfeiffer, Mon. Hel. v. p. 183; Schmeltz, Cat. Mus. Godeff. iv. p. 73.

Trochomorpha (*Discus*) *transarata,* Mousson, Journ. de Conch. 1870, p. 121, pl. 7. fig. 1 (excl. var.).

Helix fessonia (*Trochomorpha*), Brazier, Proc. Zool. Soc. 1871, p. 322 (part.).

When Prof. Mousson first described this species, he had only a single imperfect young example before him, which Dr. Gräffe found at Lomaloma, Vanua Balavo. Gräffe subsequently discovered some specimens of *Trochomorpha* in the interior of Viti Levu, which Mousson (in Journ. de Conch. 1870, p. 122) referred to his *T. transarata*, adding additional characters and giving a good figure of the same. On the same page he describes the var. *depresso-striata*, which latter is probably distinct and = *T. fessonia*, Angas.

Unfortunately I lost all my Kantavu specimens of the latter species when shipwrecked, and have only a single dead example of *T. transarata* from Lomaloma, which exactly coincides with Mousson's original description, and agrees with his figure of a Viti Levu shell.

Mr. Brazier (in P. Z. S. 1871, p. 322) adds *T. transarata* to the synonymy of *fessonia*. Schmeltz (in Cat. Mus. Godeff. v. p. 94, sp. 5939) quotes Mousson's var. *T. depresso-striata* as = *fessonia*, and, judging from the Museum numbers, he does not include the type, which is no. 5235 (see Cat. no. iv. p. 73), in the synonymy.

Its small size, depressed conical form, rough irregular plicate striæ, brownish horn-colour with interrupted radiating pale stripes, elevated spire, slightly convex base, and small umbilicus are its most prominent characters.

9. Trochomorpha accurata.

Trochomorpha (*Discus*) *accurata*, Mousson, Journ. de Conch. 1870, p. 120, pl. 7. fig. 2.

Nanina (*Microcystis*) *accurata*, Paetel, Cat. Conch. p. 84.

Helix accurata, Pfeiffer, Mon. Hel. vii. p. 290.

A very rare species, found by Dr. Gräffe in rocks at Veria, in the interior of Viti Levu.

It has the spire more elevated than *T. transarata*, a greenish-violet colour, the striæ strong and irregular, the umbilicus small; whorls 7, the last one acutely carinated with a compressed, white keel. Major diam. 14, height 12 millim.

10. Trochomorpha corallina.

Trochomorpha (*Discus*) *ludersi*, var. *corallina*, Mousson, Journ. de Conch. 1870, p. 123.

I found a few examples of this species on elevated coralline reefs in forests on Vanua Balavo, and took a large number in similar stations on Mango Island. Dr. Gräffe found it on coral-rocks on Malatta and Tutuna, the latter one of the northern islands of the Tonga group.

It may be described as follows:—

Shell umbilicated, sublenticular, solid, finely and obliquely striated, fulvous horn-colour, rarely whitish, with or without a marginal dorsal and basal dark fuscous band; spire convexly conoid, obtuse; suture depressedly margined above; whorls $5\frac{1}{2}$, slightly convex, slowly and regularly increasing, the last one not descending in front, acutely carinated; base convex; umbilicus small, about one seventh the greater diameter of the shell; aperture diagonal, subrhomboid-lunate; peristome simple, straight above, acute, at the base thickened with callus.

Major diam. 15, height 6–7 millim.

As compared with *T. ludersi* it is smaller, differs in the ground-colour, the umbilicus is not so large, and the bands are wider and only two in number.

11. TROCHOMORPHA SUBTROCHIFORMIS.

Helix trochiformis, Gould (not of Férussac), Expl. Exp., Shells, p. 61.

Helix eurydice, Mousson (not of Gould), Journ. de Conch. 1865, p. 170.

Trochomorpha subtrochiformis, Mousson, Journ. de Conch. 1869, p. 335, pl. 4. fig. 6; 1870, var. *albo-striata*, p. 122; Pease, Proc. Zool. Soc. 1871, p. 474.

Helix subtrochiformis, Schmeltz, Cat. Mus. Godeff. p. 95; Pfeiffer, Mon. Hel. vii. p. 289.

Mousson's var. *albo-striata* inhabits Kanathia, one of the Windward Islands, and the type is a Samoan species. The variety, which is unknown to me, is described as follows:—

"*Spira fusco-nigrescens, strigis transversis, albis, imperfectis, eleganter ornata, ad basin fulvescens, cum zona peripherica fusca.*" (Mousson.)

It is probably distinct from the Samoan type.

12. TROCHOMORPHA THEMIS, sp. nov.

Trochomorpha (*Discus*) *ludersi*, Mousson (not of Pfeiffer), Journ. de Conch. 1870, p. 122 (part.).

I obtained numerous specimens of this species at Vanua Balavo, where they were found adhering to the trunks of trees. It is also recorded from Oneata Island.

Shell with a narrow umbilicus, solid, sublenticular, not shining; striæ very fine, oblique and crowded; whitish horn-colour, with a single dorsal and basal submarginal chestnut-brown line; spire depressedly conoid, obtuse; suture with a depressed white margin; whorls $5\frac{1}{2}$, depressedly convex, slowly and regularly increasing, last one not deflected in front, acutely and compressedly carinated, keel white; base convex; umbilicus about one eighth the major diameter of the shell; aperture and peristome the same as in *T. corallina*.

Major diam. 14, height 6 millim.

As compared with *T. ludersi* it is smaller, paler, has only half so many linear bands, striæ finer and the umbilicus much smaller. *T. corallina* is of a fulvous colour (very rarely whitish), the bands are wider and paler and the suture has not got the white margin; it is also a little larger and smoother, and lives in a different station.

13. TROCHOMORPHA KANTAVUENSIS, sp. nov.

Shell widely umbilicated, thin, fragile, pellucid, depressed, lenticular, smooth, shining; incremental striæ fine, crowded, oblique;

luteous-corneous, the periphery margined above and beneath with a reddish-chestnut line, the upper one following the whorls of the spire; suture with a depressed, narrow marginal line; whorls $6\frac{1}{2}$, slightly convex, rather rapidly increasing, last one not descending in front, acute and compressedly carinated, keel whitish; base more polished than above, convex; aperture very oblique, depressed, subrhomboid-lunate; peristome thin, straight above, margins converging, basal portion slightly thickened and gently arched.

Major diam. 20, height 7 millim.

I received several hundred examples of this very distinct species from a missionary who collected them in Kantavu Island. He gave no information in regard to its station.

Specimens sent to the Godeffroy Museum in Hamburg were referred to *T. swainsonii*, a Society-Island species; and examples sent to an English correspondent were confounded with *T. metcalfei*, Pfeiffer, a Philippine species. It is probably the *Helix* (*Videna*) *planorbis*, in "Dr. James C. Cox's Exchange List," which he accredits to Kantavu. The *T. planorbis* of Lesson was collected by that naturalist in New Guinea, and differs from our shell in being smaller, mottled with olivaceous, and in having only 5 whorls. A careful comparison with the description of *T. metcalfei* has convinced me that it cannot be the same as the Kantavu shell. *T. swainsonii* is smaller, thicker, rougher, much more variable, and the positions of the lineations are different.

Its large size, depressed form, fragile texture, luteous horn-colour with the chestnut-brown marginal lines, and large umbilicus will readily separate it from any other Vitian species.

Genus Patula, Held.

1. Patula inermis.

Patula inermis, Mousson, Journ. de Conch. 1870, p. 118, pl. 7. fig. 7.

Helix inermis, Pfeiffer, Mon. Hel. vii. p. 167; (*Patula*) Paetel, Cat. Conch. p. 91.

Collected by Dr. Gräffe on Vanua Balavo. Beneath decaying vegetation.

A small, widely umbilicated, depressed orbicular, rufous horn-coloured species, with fine, oblique, costulate striæ and 4 slightly convex whorls. Diameter a trifle more than 2 millim.

2. Patula adposita.

Patula adposita, Mousson, Journ. de Conch. 1870, p. 119, pl. 7. fig. 8.

Helix adposita, Pfeiffer, Mon. Hel. vii. p. 87; (*Patula*) Paetel, Cat. Conch. p. 87.

Discovered by Dr. Gräffe on Oneata Island.

A little larger and paler than the preceding species, and the umbilicus is smaller, and the acute plicate striæ are not so crowded.

3. Patula princei.

Helix princei, Liardet, Proc. Zool. Soc. 1876, p. 100, pl. 5. figs. 4, 4*a*.

This species was found at Taviuni by Mr. Liardet.

"Shell very small, depressed, with a wide and perspective umbilicus; colour dark brown; whorls 3, prominently costulated; suture deeply impressed; aperture round." (*Liardet.*)

4. Patula irregularis, sp. nov.

Pitys irregularis, Mousson, Mus. Godeff. 1885.

Shell small, umbilicated, orbicular, depressed, thin, translucent, greyish white under a bluish horn-coloured epidermis; sculpture consisting of crowded, waved, raised striæ, with larger ones irregularly intermixed; spire convex, apex flattened; suture canaliculate; whorls 4, convex, slowly and regularly increasing, slightly turgid next the suture, last one rounded, slightly depressed above the periphery; base convex; umbilicus deep, about one fourth the major diameter of the shell; aperture slightly oblique, irregularly rounded; peristome thin.

Major diam. 3, height 2 millim.

Common at Viti Levu. I received a number of specimens of this species from the Museum Godeffroy, Hamburg.

A small uncoloured species closely allied to *P. rudis*, a Cook's Island species. The irregular striæ will separate it from the other Vitian species.

Genus Pitys, Beck.

1. Pitys subdædalea.

Patula (*Endodonta*) *subdædalea*, Mousson, Journ. de Conch. 1870, p. 117, pl. 7. fig. 6.

Helix subdædalea, Pfeiffer, Mon. Hel. vii. p. 258; (*Patula*) Paetel, Cat. Conch. p. 95.

Found by Dr. Gräffe in Mango Island. Like all the South-Sea species, it is found beneath decaying leaves and under rotten wood.

It is a little larger than *Patula adposita*, and of a pale horn-colour, with a wide umbilicus, planulate spire, the striæ costulate, and $5\frac{1}{2}$ whorls. The parietal region is garnished with three spiral laminæ, and there are four on the palate.

Genus Placostylus, Beck.

1. Placostylus malleatus.

Bulimus malleatus, Jay, Revue Zool. 1842, p. 80; Guérin, Mag. Zool. 1843, p. 61; Philippi, Abbild. ii. 9. p. 10, *Bul.* pl. 3. fig. 4; Pfeiffer, Mon. Hel. ii. p. 55; (*Charis*) id. Vers, p. 152; Reeve, Conch. Icon. pl. 29. fig. 174; Deshayes, in Fér. p. 47, pl. 144. figs. 11, 12; Gould, Expl. Exp., Shells, p. 81, fig. 78; (*Charis*) Albers, Die Hel. 1st ed. p. 152, 2nd, ed. p. 196; (*Charis*) H. & A. Adams, Gen. Moll. ii. p. 147; (*Charis*) Chenu, Mon. Conch. i. p. 436, fig. 3201;

Crosse, Journ. de Conch. 1864, p. 136, 1875, p. 20; (*Charis*) Paetel, Cat. Conch. 1873, p. 98; Garrett, Amer. Journ. Conch. 1872, p. 231.

Charis malleatus, Frauenfeld, Verh. zool.-bot. Ges. Wien, 1869, p. 874.

Placostylus (Charis) malleatus, Mousson, Journ. de Conch. 1870, p. 125; Schmeltz, Cat. Mus. Godeff. v. p. 92.

This arboreal species is restricted to Viti Levu and Ovalau Islands.

Its large size (55 millim.), white colour, olivaceous-brown maculations, malleated surface, oblong aperture, broadly expanded white lip will distinguish it. An immaculate variety is not infrequent.

2. Placostylus fulguratus.

Bulimus fulguratus, Jay, Revue Zool. 1842, p. 80; Guérin, Mag. Zool. 1843, p. 62; Philippi, Abbild. ii. 9. p. 10, *Bul.* pl. 3. fig. 2; Pfeiffer, Mon. Hel. ii. p. 55; (*Charis*) id. Vers, p. 152; Reeve, Conch. Icon. pl. 29. fig. 175; Gould, Expl. Exp., Shells, p. 80, fig. 77; (*Charis*) Albers, Die Hel. 1st ed. p. 152, 2nd ed. p. 196; (*Charis*) H. & A. Adams, Gen. Moll. ii. p. 147; Mousson, Journ. de Conch. 1865, p. 195; Crosse, Journ. de Conch. 1864, p. 137, 1875, p. 17; (*Charis*) Paetel, Cat. Conch. 1873, p. 98; Garrett, Amer. Journ. Conch. 1872, p. 231, pl. 18. fig. 1.

Placostylus (Charis) fulguratus, Mousson, Journ. de Conch. 1870, p. 125; Schmeltz, Cat. Mus. Godeff. v. p. 92

Charis fulguratus, Frauenfeld, Verh. zool.-bot. Ges. Wien, 1869, p. 874.

Otostomus fulguratus (Charis), Semper, Phil. Landmoll. iii. p. 158, pl. 17. fig. 10.

Bulimus eximius, Reeve, Conch. Syst. ii. p. 173.

Plakocheilus gracilis, Broderip, Proc. Zool. Soc. 1840, p. 182.

This, like the preceding species, is confined to the islands of Viti Levu and Ovalau, where it occurs on the trunks and foliage of trees.

A rather solid, oblong, olive-yellow species, with longitudinal, irregular, more or less interrupted, waved olive-brown stripes. Whorls 5, convex, last one with fine crowded longitudinal striæ, and obliquely transverse anastomosing sulcations. Spire decorticated, whitish or reddish. Aperture obauriform, white or light fulvous, and the lip white and widely expanded. Length 45–50 millim.

3. Placostylus elobatus.

Bulimus elobatus, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 190; Expl. Exp., Shells, p. 72, fig. 84; Pfeiffer, Mon. Hel. ii. p. 184; (*Charis*) id. Vers, p. 152; (*Charis*) Albers, Die Hel. 2nd ed. p. 196; Crosse, Journ. de Conch. 1864, p. 140 (excl. variety); (*Placostylus*) Paetel, Cat. Conch. 1873, p. 98; Garrett, Amer. Journ. Conch. 1872, p. 232, pl. 18. fig. 2; (*Euplacostylus*) Crosse, Journ. de Conch. 1875, p. 13.

Placostylus (Charis) elobatus, Mousson, Journ. de Conch. 1870, p. 124; Schmeltz, Cat. Mus. Godeff. v. p. 93.

Otostomus (*Placostylus*) *elobatus*, Semper, Phil. Landmoll. iii. p. 157, pl. 15. fig. 5.

Bulimus colubrinus, Pfeiffer, Proc. Zool. Soc. 1860, p. 138, pl. 51. fig. 4; Malak. Blätt. 1861, p. 13; Mon. Hel. vi. p. 29; Crosse, Journ. de Conch. 1864, p. 139.

This species is restricted to the island of Vanua Levu, where it occurs beneath decaying vegetation. Examples inhabiting the interior of the island are larger and much finer than those found in the forests near the sea-shore.

My largest specimens taken in the former location are 66 millim. long, and my smallest (adults) from near the sea-shore are only 46 in length. The shape varies from oblong-ovate to elongate-ovate. It is solid, white or ruddy beneath a fulvous epidermis, and ornamented with longitudinal dark green waved or zigzagged stripes, which are more or less interrupted. The apical whorls are usually reddish. The aperture and lips are usually orange-red, and the throat frequently whitish. The last two whorls are minutely corrugated. A rare variety occurs with the lips and aperture wholly white.

4. PLACOSTYLUS MOROSUS.

Bulimus morosus, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 190; Expl. Exp., Shells, p. 72, fig. 82; Pfeiffer, Mon. Hel. ii. p. 56; (*Charis*) id. Vers, p. 152; (*Charis*) Albers, Die Hel. 2nd ed. p. 196; (*Charis*) Paetel, Cat. Conch. 1873, p. 98; Garrett, Amer. Journ. Conch. 1872, p. 232; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 20, pl. 8. fig. 1; Kobelt, Jahrb. malak. Ges. 1875, p. 225, pl. 7. figs. 7–8.

Placostylus (*Charis*) *morosus*, Mousson, Journ. de Conch. 1870, p. 125; Schmeltz, Cat. Mus. Godeff. v. p. 93.

Bulimus elobatus, var. *minor*, Crosse, Journ. de Conch. 1864, p. 140.

This very distinct arboreal species has a wider range than any other species inhabiting the group. It is distributed throughout all parts of Vanua Levu, where I collected numerous examples. I found it also on Rambi, Koro, Taviuni, Gomea, Lanthala, and Prof. Mousson, on the authority of Dr. Gräffe, records it from Viti Levu.

It is a rather thin, oblong-ovate, uniform white, decorticated shell, with a large aperture and widely reflected peristome. The rough surface is not so conspicuously malleated as *P. malleatus*. There exists a rare abbreviated variety on the west end of Vanua Levu, which exhibits a few olivaceous markings similar to those on the latter species.

5. PLACOSTYLUS SEEMANNI.

Bulimus seemanni, Dohrn, Proc. Zool. Soc. 1861, p. 207, pl. 26. fig. 6; Crosse, Journ. de Conch. 1864, p. 123; Pfeiffer, Mon. Hel. vi. p. 13; Novit. Conch. iii. p. 474, pl. 102. fig. 18; Garrett, Amer. Journ. Conch. 1872, p. 232; (*Eumecostylus*) Paetel, Cat. Conch. 1873, p. 99; Crosse, Journ. de Conch. 1875, p. 10.

Placostylus (*Charis*) *seemanni*, Mousson, Journ. de Conch. 1870,

p. 126; Schmeltz, Cat. Mus. Godeff. v. p. 92; Canefri, Malac. Viagio Mag. p. 85.

Otostomus (*Placostylus*) *seemanni*, Semper, Phil. Landmoll. iii. p. 157, pl. 17. fig. 9.

This fine large ground-species is confined to Kandavu Island, where it appears to be abundant.

Though subject to considerable variation in size and shape, it may, however, be distinguished by its rather slender form, whitish horn-colour beneath a yellowish or olive-brown epidermis, which is sometimes ornamented with waved or zigzagged stripes. The surface, though coarsely striated with lines of growth, is seldom marked by transverse corrugations. The auriculate-shaped aperture is narrow, white, though sometimes tinted with fulvous, and the white lip is considerably expanded and slightly reflected and frequently contracted above. Length from 52–77 millim. Like all the ground-species, it is very frequently decorticated.

6. Placostylus kantavuensis.

Bulimus kantavuensis, Crosse, Journ. de Conch. 1870, p. 250; 1871, p. 105, pl. 5. fig. 3; 1875, p. 10; Pfeiffer, Mon. Hel. viii. p. 29.

This is also a terrestrial species, and inhabits Kandavu Island, where it was discovered by Mr. Brazier.

It is described as a rather solid, cylindrically-fusiform species, with longitudinal rugose striæ and obsolete submalleations. Colour ruddy white, with reddish apical whorls. The epidermis is olive-yellow, with longitudinal waved whitish stripes. The last whorl is subcylindrical, compressed on the middle, and the auriform aperture and the widely expanded peristome are whitish. Length 43 millim. I have never seen an example of this species.

7. Placostylus koroensis.

Bulimus koroensis, Garrett, Amer. Journ. Conch. 1872, p. 236, pl. 18. fig. 9; Pfeiffer, Mon. Hel. viii. p. 29; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 9, pl. 1. fig. 5; Schmeltz, Journ. des Mus. Godeff. Heft xii. 1876, p. 161.

Placostylus koroensis, Schmeltz, Cat. Mus. Godeff. v. p. 92.

Occurs in great profusion on the ground in the central valleys of Koro Island, where it is peculiar.

It is very closely allied to the preceding species, which it resembles in shape and sculpture. Colour corneous or tawny yellow, with a white or luteous aperture and rather widely expanded white peristome. Length 53 millim. It is very frequently distorted and very seldom exhibits traces of a fulvous epidermis, which is disposed in irregular longitudinal strips and patches. Examples sent to Mr. Crosse were, by that learned conchologist, regarded as distinct from his *B. kantavuensis*.

8. Placostylus hoyti.

Bulimus hoyti, Garrett, Amer. Journ. Conch. 1872, p. 234, pl. 18.

fig. 7; Pfeiffer, Mon. Hel. viii. p. 30; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 17, pl. 1. fig. 8.

Placostylus hoyti, Schmeltz, Cat. Mus. Godeff. vi. p. 81.

This beautiful terrestrial species is confined to that portion of Vanua Levu situated to the southward of Natawa Bay.

Though closely related to *P. elobatus* in colour, markings, and sculpture, it is, however, readily distinguished by its abbreviated form, turgid body-whorl, wider aperture, expanded and reflected lip. Length 44 to 55 millim.

9. Placostylus rugatus.

Bulimus rugatus, Garrett, Amer. Journ. Conch. 1872, p. 234, pl. 18. fig. 1; Pfeiffer, Mon. Hel. viii. p. 35; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 18.

Placostylus rugatus, Schmeltz, Cat. Mus. Godeff. vi. p. 81.

Var. crassilabris, Garrett.

Bulimus crassilabrum, Garrett, Amer. Journ. Conch. 1872, p. 233, pl. 18. fig. 5; Pfeiffer, Mon. Hel. viii. p. 35; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 18.

Placostylus crassilabrum, Schmeltz, Cat. Mus. Godeff. v. p. 93.

This arboreal species is restricted to Vanua Levu, where it is widely distributed over the island.

It is a rather thin, oblong-ovate species, of a whitish colour beneath an olive-yellow epidermis, and ornamented with small olive-green blotches, which are sometimes zigzagged. Length 43 millim. The transverse rugosities do not differ from those observed on *P. fulguratus*. As compared with that species it is more abbreviated, the outer lip more arched and more effuse, and the aperture is more oblique. The base is also not so much produced.

The variety *crassilabris* is more solid, and the peristome and parietal callus are much thicker than in the typical *P. rugatus*. This variety, of which I obtained about 200 examples, was gathered in the interior at a point about the middle of the length of the island.

10. Placostylus ochrostomus.

Bulimus ochrostoma, Garrett, Amer. Journ. Conch. 1872, p. 232, pl. 18. fig. 3; Pfeiffer, Mon. Hel. viii. p. 36; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 19.

Placostylus ochrostoma, Schmeltz, Cat. Mus. Godeff. vi. p. 81.

Bulimus rambiensis, Garrett, Amer. Journ. Conch. 1872, p. 233, pl. 18. fig. 4; Pfeiffer, Mon. Hel. viii. p. 36; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 19.

Placostylus rambiensis, Schmeltz, Cat. Mus. Godeff. vi. p. 81.

Not uncommon on foliage at Taviuni and Rambi, rare on Gomea, and I obtained two examples on that part of Vanua Levu opposite to Rambi Island.

It is the smallest species, so far as known, inhabiting the group. It is rather variable in size, ranging from 28 to 40 millim. in length, and its shape varies from ovate to oblong-ovate. The texture is rather thin, the sculpture the same as on *P. rugosus*, and the colour ruddy corneous or whitish, often with a reddish spire. Though very frequently wholly decorticated, the epidermis, when present, is very thin, light fulvous, and usually beautifully mottled with green, which is occasionally disposed in zigzag pattern. The aperture and lips are more or less intense saffron-yellow, paler in the throat. The columellar fold is not so conspicuous, and is more vertical than in the preceding species. The peristome, though usually simple, is often slightly expanded, particularly so in the Rambi shells, some of which have the lip slightly reflected.

11. PLACOSTYLUS GNAUENSIS.

Bulimus gnauensis, Garrett, Amer. Journ. Conch. 1872, p. 235, pl. 18. fig. 8 (in err. *guanensis*); Pfeiffer, Mon. Hel. viii. p. 36; (*Placostylus*) Crosse, Journ. de Conch. 1875, p. 18.

Placostylus gnauensis, Schmeltz, Cat. Mus. Godeff. vi. p. 81.

This graceful species is common and peculiar to Gnau Island, where it lives on trees and shrubs.

It may be recognized by its rather thin texture, oblong-ovate or elongate-ovate form, whitish, yellowish, or reddish horn-colour, ornamented with longitudinal undulating olive-green stripes, which are frequently shaded off with white. The surface is rugose, with small transverse corrugations. The aperture is tawny yellow or reddish, rarely white, and the lips, which are but slightly expanded, are more intensely coloured than is the throat. Length 45 millim.

12. PLACOSTYLUS GRAEFFEI.

Placostylus elobatus, Mousson (not of Gould), Journ. de Conch. 1870, p. 124.

Placostylus moussonii, "Gräffe," Schmeltz, Cat. Mus. Godeff. v. p. 93.

Bulimus, sp., Garrett, Amer. Journ. Conch. 1872, p. 232.

Bulimus moussonii, Crosse (not of Pfeiffer), Journ. de Conch. 1875, p. 11.

Bulimus gräffei, Crosse, *l. c.* p. 13; Pfeiffer, Mon. Hel. viii. p. 30.

This ground-species appears to be restricted to the central portion of Viti Levu, where it was discovered by Dr. Gräffe. I am indebted to the latter gentleman for two examples of this species, which is about the same size and shape as *P. elobatus*, but is a smoother shell, and the colour of my two specimens is olivaceous without any markings. The aperture is whitish, and the columellar fold is more horizontal than in the latter species.

13. PLACOSTYLUS VITIENSIS, sp. nov.

Bulimus vitiensis, Garrett, MS. (coll. Garrett).

Placostylus vitiensis, "Garr.," Schmeltz, Cat. Mus. Godeff. vi. p. 81.

Shell umbilicated, oblong-ovate, rather solid, slightly shining; rosy flesh-colour beneath a thin translucent epidermis, which is decorated with longitudinal olive-green zigzag stripes; surface of the last two whorls with small longitudinal striæ and small transverse corrugations; spire obtuse, decorticated, minutely punctured, two thirds the length of the shell; whorls 5, moderately convex, the last one attenuated at the base; aperture slightly oblique, oblong, auriform, light fulvous; peristome white, rather widely expanded and somewhat reflected; columellar lip dilated, and the fold oblique and prominent.

Length 41, diam. 17 millim.

I obtained 20 living examples of this species, which were collected by the natives at Na Viti Levu Bay, on the N.E. coast of Viti Levu. It is smaller and a more graceful species than *P. fulguratus*, and the base is more contracted.

Genus Stenogyra, Shuttleworth.

1. Stenogyra tuckeri.

Bulimus tuckeri, Pfeiffer, Proc. Zool. Soc. 1846, p. 30; Mon. Hel. ii. p. 158; (*Opeas*) Vers, p. 156; Reeve, Conch. Icon. pl. 68, sp. 481; (*Opeas*) Cox, Mon. Austr. Land-Shells, p. 69, pl. 13. fig. 9; Brazier, Quart. Journ. Conch. i. p. 272.

Stenogyra tuckeri, Albers, Die Hel. ed. 2, p. 265; (*Opeas*) Frauenfeld, Verh. zool.-bot. Wien, xix. p. 873; Pease, Proc. Zool. Soc. 1871, p. 473; Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 393; 1885, p. 43.

Bulimus junceus, Gould, Proc. Bost. Soc. Nat. Hist. 1846, p. 191; Expl. Exp., Shells, p. 76, fig. 87; Pfeiffer, Mon. Hel. ii. p. 220.

Stenogyra juncea, Mousson, Journ. de Conch. 1869, p. 340; Pease, Journ. de Conch. 1871, p. 93; Proc. Zool. Soc. 1871, p. 473; (*Opeas*) Paetel, Cat. Conch. p. 104; Schmeltz, Cat. Mus. Godeff. v. p. 90; Garrett, Proc. Phil. Acad. Nat. Sci. 1879, p. 19.

Bulimus walli, Cox, Cat. Austr. Land-Shells, p. 24; Pfeiffer, Mon. Hel. vi. p. 99.

Stenogyra upolensis, Mousson, Journ. de Conch. 1865, p. 175; (*Obeliscus*) Paetel, Cat. Conch. 1873, p. 104; Schmeltz, Cat. Mus. Godeff. iv. p. 29.

Bulimus upolensis, Pfeiffer, Mon. Hel. vi. p. 100.

Bulimus panayensis, Pfeiffer, Proc. Zool. Soc. 1846, p. 33; Mon. Hel. ii. p. 156; (*Opeas*) Vers, p. 156; Reeve, Conch. Icon. pl. 14. no. 76; (*Opeas*) Albers, Die Hel. p. 175.

Subulina panayensis, H. & A. Adams, Gen. Moll. ii. p. 111; Semper, Phil. Landmoll. ii. p. 137, pl. 8. fig. 15.

Stenogyra panayensis, (*Opeas*) Albers, Die Hel. ed. 2, p. 265; Martens, Ostas. Zool. ii. p. 83 (Siam), p. 376, pl. 22. fig. 8; (*Opeas*) Paetel, Cat. Conch. p. 104.

Bulimus diaphanus, Gassies (not of Pfeiffer), Journ. de Conch. 1859, p. 70.

Bulimus souverbianus, Gassies, Faune Nouv. Caléd. p. 52, pl. 2. fig. 5; Pfeiffer, Mon. Hel. vi. p. 98.

Bulimus artensis, Gassies, Journ. de Conch. 1866, p. 50; Pfeiffer, Mon. Hel. vi. p. 98.

Stenogyra novemgyrata, Mousson, Journ. de Conch. 1870, p. 126; (*Subulina*) Paetel, Cat. Conch. 1873, p. 104; Schmeltz, Cat. Mus. Godeff. v. p. 90.

Bulimus novemgyratus, Pfeiffer, Mon. Hel. viii. p. 138.

Stenogyra gyrata, Mousson, MS. in Mus. Godeffroy, 1885.

This species, which is distributed over a larger geographical area than any other species of land-shell, is diffused throughout all parts of Polynesia, the low coral-islands as well as the more elevated groups, and ranges throughout Melanesia, Micronesia, Australasia, the Moluccas, Philippines, Guam, Ceylon, Siam, Cochin China, China, and probably extends its range as far as the east coast of Africa.

Since the publication of my paper on the Society-Island land-shells I have received from Mr. E. L. Layard examples of *Bulimus souverbianus* and *B. artensis*, both of which are identical with Polynesian specimens of *S. tuckeri*.

Through the kindness of Dr. Hungerford, of Hong Kong, I have been enabled to compare Pfeiffer's *Bulimus panayensis* with *B. tuckeri*, and cannot detect a single character to separate the two species.

I am strongly inclined to believe that the West-Indian *Stenogyra subula*, Pfr., is a form of the Polynesian *S. tuckeri*, and was accidentally imported with the Tahitian bread-fruit plants nearly a hundred years ago. MM. Crosse and Fischer (Journ. de Conch. 1863, p. 361) record the West-Indian "*Bulimus subula*" from Cochin China, and give a good figure of the same, which latter is, undoubtedly the ubiquitous *S. tuckeri*. I reproduce their remarks as follows:—

"Cette espèce provient de Saigon et Fuyen-Moth, où elle a été recueillie par Monsieur Michau, dans les fossés, dans la terre et sous les herbes. Il peut sembler très-extraordinaire de retrouver en Cochinchine une espèce des Antilles, qui n'a guère été signalée jusqu'ici qu'à Cuba, à la Jamaïque et à Saint-Thomas. Pour ne conserver aucun doute à son égard, nous avons cru devoir soumettre un individu authentique à l'examin de M. Pfeiffer, qui a créé l'espèce. Il faut donc accepter le fait, qui peut-être, au reste, seulement un accident d'acclimatation: la petitesse et la légèreté de la coquille en question rendent cette supposition vraisemblable."

I have lately received from Dr. Hungerford several examples of *Stenogyra*, labelled "*Opeas subula*, Pfr., Hong Kong," which do not differ from the Polynesian *S. tuckeri*. I have several specimens of *Stenogyra* received from Dr. Gibbons, who collected them in Algoa, South Africa. They were labelled "*Stenogyra turriformis*, Krauss," but are much smaller than the latter species, and the identification is questionable. They are of the same size, and coincide very nearly with *S. tuckeri*. *Bulimus johannius*, Morelet, from the Comoro Islands, can scarcely be distinguished from some forms of the latter species.

This species, which is chiefly confined to the lowlands near the sea-shore, is found beneath decaying vegetation and under loose stones.

They vary in size, number of whorls, development of striæ, convexity of the whorls, more or less open columellar chink, and in texture vary from thin pellucid to thick opaque cretaceous without lustre. The colour is whitish, pale horn-colour, sometimes with a light greenish tint. Animal light yellow. Length 8 to 13 millim.

Genus PARTULA, Férussac.

1. PARTULA LIRATA.

Partula lirata, Mousson, Journ. de Conch, 1865, p. 136. pl. 14. fig. 4; 1870, p. 126; Heynemann, Malak. Blätt. 1867, pl. i. fig. 1 (dentition); Pfeiffer, Mon. Hel. vi. p. 158; Paetel, Cat. Conch. 1873, p. 104; Schmeltz, Cat. Mus. Godeff. v. p. 91; Hartman, Cat. *Partula,* p. 14; Obs. gen. *Partula,* Bull. Mus. Comp. Zool. ix. p. 183.

This singular *Partula* lives on foliage near the sea-shore. I obtained several hundred examples on Lanthala, and a few at Vanua, Balavo, and Taviuni. Dr. Gräffe found it on Kanathia and Oneata.

It is, so far as known, the only species of *Partula* with elevated spiral liræ. The type is pale cinereous, with the expanded lip and aperture white. There is a depressed white tubercle on the parietal wall. A tawny-brown variety is not uncommon.

Genus TORNATELLINA, Beck.

1. TORNATELLINA OBLONGA.

Tornatellina oblonga, Pease, Proc. Zool. Soc. 1864, p. 673; 1871, p. 473; Journ. de Conch. 1871, p. 93; Pfeiffer, Mon. Hel. vi. p. 264; Schmeltz, Cat. Mus. Godeff. v. p. 89; Garrett, Proc. Phil. Acad. Nat. Sci. 1879, p. 21; Journ. Phil. Acad. Nat. Sci. 1881, p. 398, 1885, p. 81.

Tornatellina bacillaris, Mousson, Journ. de Conch. 1871, p. 16, pl. 3. fig. 5; Schmeltz, Cat. Mus. Godeff. v. pp. 89, 90; Pfeiffer, Mon. Hel. viii. p. 316.

Inhabits all the groups from the Marquesas and Paumotus to the Viti Islands. On the ground in forests from near the sea-shore to 2000 feet above sea-level.

Its slender form, imperforate base, and nearly vertical simple columella will distinguish it.

2. TORNATELLINA CONICA.

Tornatellina conica, Mousson, Journ. de Conch. 1869, p. 342, pl. 14. fig. 8; (var. *impressa*), p. 16; Pease, Proc. Zool. Soc. 1871, p. 473; Pfeiffer, Mon. Hel. viii. p. 316; Garrett, Proc. Phil. Acad. Nat. Sci. 1879, p. 21; Journ. Phil. Acad. Nat. Sci. 1881, p. 399, 1885, p. 81; Schmeltz, Cat. Mus. Godeff. v. p. 89.

Cionella conica, Paetel, Cat. Conch. 1873, p. 106.

It has the same range as the preceding species, and inhabits the same station.

It is more robust and lighter-coloured than *T. oblonga,* the spire more tapering, body-whorl larger, more compressed, parietal lamina more prominent, and the columella more twisted than in that species.

3. Tornatellina columellaris.

Tornatellina columellaris, Mousson, Journ. de Conch. 1870, p. 120; Pfeiffer, Mon. Hel. viii. p. 316.

This species was collected by Dr. Gräffe on Kanathia Island.

It is an imperforated, elongate-conical species of a pale horn-colour. It differs from the two preceding species in having small denticles in the palate. I do not know the species, which should be compared with *P. perplexa*, Garr., and *P. nitida*, Pse.

4. Tornatellina perforata.

Lamellaria perforata, Liardet, Proc. Zool. Soc. 1876, p. 101, pl. 5. figs. 8, 8 *a*.

"Shell small, acute, polished, dark brown colour; epidermis thin; whorls $5\frac{1}{2}$, convex, spirally striate, with a white apertural lamina; aperture oblique, pyriform; columellar lip white, projecting from the base of the shell, expanding slightly over region of umbilicus; outer lip impressed and of a deep purple tint.

"This shell is found embedded in the bark of dead logs.

"*Note*.—The animal has the tips of the eye-pedicels bulbous.

"*Hab.* Taviuni, Fiji." (*Liardet*.)

Also unknown to me.

Genus Vertigo, Müller.

1. Vertigo pediculus.

Pupa pediculus, Shuttleworth, Bern. Mitth. 1852, p. 296; Pfeiffer, Mon. Hel. iii. p. 557; Schmeltz, Cat. Mus. Godeff. v. p. 89; Mousson (var. *samoensis*), Journ. de Conch. 1865, p. 175.

Vertigo pediculus, Pfeiffer, Vers, p. 177; (*Alæa*) H. & A. Adams, Gen. Moll. ii. p. 172; Mousson, Journ. de Conch. 1869, p. 341; Pease, Proc. Zool. Soc. 1871, pp. 463, 474; Garrett, Proc. Phil. Acad. Nat. Sci. 1879, p. 19; Journ. Phil. Acad. Nat. Sci. 1881, p. 400, 1885, p. 83.

Pupa samoensis, "MSS.," Schmeltz, Cat. Mus. Godeff. iv. p. 108; (*Sphyradium*) Paetel, Cat. Conch. p. 108.

Pupa nitens, Pease, Proc. Zool. Soc. 1860, p. 439; Pfeiffer, Mon. Hel. vi. p. 335.

Vertigo nitens, Pease, Proc. Zool. Soc. 1871, pp. 463, 474.

Pupa hyalina, "Zelebor," Pfeiffer, Mon. Hel. vi. p. 329.

Vertigo hyalina, Pease, Proc. Zool. Soc. 1871, p. 474.

Vertigo nacca, Gould, Proc. Bost. Soc. Nat. Hist. 1862, p. 280; Otia Conch. p. 237; Pease, Proc. Zool. Soc. 1871, pp. 463, 474.

Pupa nacca, Pfeiffer, Mon. Hel. vi. p. 330.

This species is common to all the Polynesian groups, and is generally diffused through the Viti Islands.

Its minute size, ovate-oblong shape, hyaline texture, obtuse spire, rounded aperture, and the thin slightly expanded lip will readily distinguish it. There are usually 5 denticles in the aperture.

2. VERTIGO TANTILLA.

Pupa (Vertigo) tantilla, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 197; Pfeiffer, Mon. Hel. iii. p. 557; (*Vertigo*) Mousson, Journ. de Conch. 1870, p. 127; (*Vertigo*) Schmeltz, Cat. Mus. Godeff. iv. p. 69; (*Pupinella*) Paetel, Cat. Conch. 1873, p. 108.

Vertigo tantilla, Gould, Expl. Exp., Shells, p. 92, fig. 103; (*Aiœa*) H. & A. Adams, Gen. Moll. ii. p. 172; Pease, Proc. Zool. Soc. 1871, pp. 460, 463, 474; Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 400, 1885, p. 84.

Pupa pleurophora, Shuttleworth, Bern. Mittheil. 1852, p. 296; Pfeiffer, Mon. Hel. iii. p. 560.

Vertigo pleurophora, Pease, Proc. Zool. Soc. 1871, p. 474.

Pupa dunkeri, "Zelebor," Pfeiffer, Mon. Hel. vi. p. 333.

Vertigo dunkeri, Pease, Proc. Zool. Soc. 1871, p. 474.

Vertigo armata, Pease, Proc. Zool. Soc. 1871, pp. 461, 474.

Pupa armata, Pfeiffer, Mon. Hel. viii. p. 407.

Vertigo dentifera, Pease, Proc. Zool. Soc. 1871, pp. 462, 474.

Pupa dentifera, Pfeiffer, Mon. Hel. viii. p. 408.

Ranges from the Society to the Viti Islands. This and the preceding species are found beneath rotten wood, under stones, and amongst decaying leaves.

In shape it varies from an abbreviate-ovate to oblong-oval, and also in a greater or less degree in the relative proportion of the whorls. Colour pale corneous under a brownish, more or less distinctly shagreened epidermis, which in perfect examples is furnished with oblique membranous riblets. The last whorl, behind the peristome, is frequently bisulcate.

March 1, 1887.

Prof. W. H. Flower, LL.D., F.R.S., President, in the Chair.

Prof. Jeffrey Bell read extracts from a communication sent him by Mr. Edgar Thurston, Superintendent of the Government Central Museum, Madras, with reference to a Batrachian of the genus *Cacopus*. Of a specimen of *C. globulosus*, Mr. Thurston wrote:—

"On laying open the visceral cavity, the globular shape was found to be due to an enormous distention of the œsophagus and stomach, the latter occupying nearly the whole of the abdominal cavity, and the remaining viscera &c. being compressed and lying posteriorly. There was no distention of the intestinal tract. The distention of the œsophagus and stomach was found, on section, to be caused by the presence in their cavities of a mass of winged White Ants (*Termites*), which, when dried, weighed 326 grains."

The colour of *C. systoma* during life was reported to be "primrose-yellow marbled with black, the yellow colouring-material rapidly dissolving in alcohol."

Mr. Salvin, on behalf of Mr. F. D. Godman, exhibited a pair of *Ornithoptera victoriæ*, the male of which had been hitherto undescribed. These specimens had been obtained at the end of May 1886, by Mr. C. M. Woodford, at North-West Bay, Maleita Island, one of the Solomon group. The female had been known many years, having been described by the late G. R. Gray from a specimen obtained by John MacGillivray, but the locality where it was captured was not recorded. The hind wings of the female were more produced than is usual in this section of *Ornithoptera*; and this had led to the suggestion that *O. victoriæ* might prove to be the female of *O. tithonus*, de Haan; but the description which follows this note shows that *O. tithonus* differs widely from *O. victoriæ*, not only in colour but also in several remarkable points of structure. The cell of the primaries was very peculiarly formed, being very wide towards its distal end, the middle and upper discocellular nervures being very long; the lower discocellular was also long, but was ranged in line with the sections of the median as in true *Papilio*; the second and third sections of the median, especially the latter, were very short, so that the short median branches and the median itself beyond the cell lay very close together. The cell of the secondaries was very long and narrow, though normal in the female.

Mr. Salvin read the following description of the male insect:—

The wings are deep black; the primaries, except the costa, have a large patch of golden green, the outer margin of which is irregular and ill-defined and reaches to within a quarter of an inch of the end of the cell; towards the apex is a large subtriangular golden patch; parallel to the inner margin and near the anal angle is an elongated stigma similar to that of *O. priamus* and its allies. The secondaries, almost from the costal margin to beyond the cell, are rich golden green, the distal part of the cell being black, though the nervures closing it are green. There are also three contiguous submarginal golden-green spots, whereof the two nearest the anal angle have a large central patch of golden yellow. Beneath, the wings are shining golden green, with the nervures, margins, a large subtriangular patch over the end of the cell of the primaries, a series of submarginal spots at the end of each secondary nervure, and two lunate spots on either side of the lower radial of the primaries black.

The antennæ and prothorax are black; the abdomen ochraceous grey, with a double row of spots on either side and a ventral median line black.

The primaries are narrow, with hardly any perceptible anal angle, the outer and inner margins meeting in a continuous regular curve. The secondaries are elongated and narrow, and the inner margin deeply incised; the elongated hairs of the inner margin are pale yellow.

Mr. Godman also sent a specimen of a male *Ornithoptera tithonus* from the island of Waigiou for comparison; and it was at once obvious how very distinct this species and *O. victoriæ* were.

Mr. Woodford, who captured these specimens, had made a large collection of Butterflies in the Solomon and New Hebrides groups, the details of which it was hoped would be laid before the Society at a future meeting.

The following papers were read :—

1. The Experimental Proof of the Protective Value of Colour and Markings in Insects in reference to their Vertebrate Enemies. By E. B. Poulton, M.A., F.Z.S., F.L.S., of Jesus and Keble Colleges, Oxford, Lecturer on Zoology and Comparative Anatomy, St. Mary's Hospital, Paddington.

[Received February 23, 1887.]

Introductory.—In the preparation of a short course of lectures which were delivered at the Royal Institution in the spring of 1886, I had occasion to work up the historical aspects of my subject :—"The Nature and Protective Use of Colour in Caterpillars." The results of this inquiry were thus expressed in the introductory part of the first lecture :—"When Darwin was investigating the bright colours of animals, and was elaborating his theory of their explanation as of use in courtship, he came across the brilliant colours of certain caterpillars and saw at once that they were a difficulty in the way of the theory. For caterpillars are undeveloped organisms ; they have been described as 'embryos leading an independent life," and there is no way of distinguishing the sexes by external colour or structure (except in a very few instances). Therefore we here meet with brilliant colours, often rendering the possessors conspicuous, which cannot be of any use in courtship. Seeing therefore that the bright colours must be of use in some other way, Darwin drew the attention of Wallace to the subject, and asked whether he could suggest any explanation. Wallace accordingly thought over the subject, and considered it as part of the wider question of the varied uses (other than sexual) of brilliant and startling colour, in other stages of insect-life and in numerous instances scattered over the whole animal kingdom, and he finally ventured to predict that birds and other enemies would be found to refuse such conspicuous caterpillars if offered to them. He believed, in fact, that such larvæ are protected by possessing a nauseous taste or smell, and that it is to their advantage to become as conspicuous as possible, so that their enemies are warned against a repeated experience of the disagreeable results which follow from tasting them, that in fact the gaudy colouring acts as an indication of something unpleasant about its possessor. It was then pointed out that, as far as experiment had gone, it had entirely confirmed Wallace's prediction. Conversely Wallace argued that larvæ which were inconspicuous, being coloured so as to resemble their surroundings, would be eaten when detected, and this prediction also seemed to receive complete confirmation."

Thinking over the whole line of argument and its apparently complete confirmation, I was led to anticipate that a somewhat different method of conducting the experiments would lead to a modification and extension of Wallace's classification of the uses of colour, in the direction of greater elasticity. At the same time it seemed better to withhold the suggestion until I had taken the opportunity of submitting it to the experimental test. I was travelling in Italy a few weeks after delivering the lectures, and took the opportunity of capturing many individuals of a few species of South-European Lizards, and of one species of Tree-Frog (*Hyla arborea*, var. *meridionalis*). I was thus able to carry out the suggested experiments, which on the whole yielded results which confirmed the conclusions I had arrived at *à priori*, and also produced other results which I had not anticipated. Some of these results were shortly communicated to the Biological Section of the British Association at Birmingham (1886), and an abstract is printed in the volume containing the papers read at that meeting. The suggested extension of Wallace's line of argument, which has now been put to the proof, is as follows:—The acquisition of an unpleasant taste or smell, together with a conspicuous appearance, is so simple a mode of protection, and yet *ex hypothesi* so absolutely complete, that it seems remarkable that more species have not availed themselves of this means of defence. What can be the principle which works in antagonism to such a mode of protection? For in Wallace's theory no suggestion of a true counterbalancing limit appeared—*i. e.* one which increased with the increasing application of this method of defence, until the latter received a check or, for the time being, was rendered of no avail, or was even turned into an absolute danger. And yet it seemed probable that such an antagonistic principle would appear as the natural outcome of the too complete success of a method of defence which depends on the acquisition of an unpleasant taste or smell together with a conspicuous appearance. If a very common insect, constituting the chief food of one or more Vertebrates, gained protection in this way, the latter animals might be forced to devour the disagreeable objects in order to avoid starvation. And the same result might be readily brought about if a scarce and hard-pressed form adopted the same line, and so became dominant, after ousting many species which were much eaten by Vertebrates. If once the Vertebrate enemies were driven to eat any such insect in spite of the unpleasant taste, they would almost certainly soon acquire a relish for what was previously disagreeable, and the insect would be in great danger of extermination, having in the meantime become conspicuous by gaining warning colours. If the reasoning be correct, it is clear that this mode of defence is not necessarily perfect, and that it depends for its apparently complete success upon the existence of relatively abundant palatable forms: in other words, its employment must be strictly limited. It has, indeed, always been recognized that an insect may be distasteful to one Vertebrate enemy, but palatable to another; and to this extent Wallace does point out a limit to the application of this principle of defence. But the counterbalancing limit which I suggested is of course entirely different, for I argued that a Vertebrate enemy may be forced by stress of hunger to eat an insect *although unpalatable to it.* Although the latter limit is thus quite distinct, it would certainly in time become identical with the former, as the distaste for the insect gradually disappeared after it had been repeatedly eaten. In fact it will be shown to be probable that many (if not all) of the instances in which an evidently distasteful insect is eaten by certain Vertebrates originally rose in this way. These suggested additions to Wallace's theory of protection by warning colours were capable of being put to the practical test. To achieve this object it was only necessary to ascertain whether an insect-eating Vertebrate could be induced by hunger to eat a gaily coloured and conspicuous larva which it was always known to refuse when other food was present, and which was evidently very much disliked on the few occasions of preliminary "tasting," which would always occur long before the time when the disgusting morsel would be reluctantly swallowed. I shall presently show that my suggestion was in every way confirmed by the test; but before giving an account of my own experience I will allude to all the previous experiments which have been made in support of Wallace's theory.

I. *Brightly Coloured or Conspicuous Larvæ.*

At a meeting of the Entomological Society of London (see Proc. Ent. Soc. ser. 3, v. p. lxxx, 1867) Wallace made his important suggestion as to the biological value of conspicuous and gaudy colours in caterpillars. It is obvious that the question of the value of such colours in the larval stage is almost the same as in other stages, and it was chiefly from the determination of the use in the latter case (due originally and principally to Bates) that Wallace suggested that a similar solution would be found to apply to the former also. Nevertheless there are reasons why such a method of defence is especially applicable to the larval stage. I have shown that there is a special reason in the anatomical construction of larvæ which explains why these organisms require to be defended from slight injuries (see Trans. Ent. Soc. Lond. 1885, pt. ii. Aug. pp. 321–323). A larva "may be described as a soft-walled cylindrical tube which owes its firmness, and indeed the maintenance of its shape, to the fact that it contains fluid under pressure. The pressure is exerted by the muscular parietes of the body. The advantage of this construction is as obvious as its danger; the larva possesses a motive force which can be applied to any movable part of the surface through the medium of the fluid." . . . "This construction is extremely dangerous; for a slight wound entails great loss of blood, while a moderate injury must prove fatal. The larvæ of *Smerinthus ocellatus* (and many others) nibble off each other's horns, and the wounded larvæ (although they do not seem to be aware of the injury) ose a great deal of blood, and although they may recover, are generally stunted; and often I am sure the loss of blood proves fatal. If the wound be at all extensive, the fat-body and viscera protrude, owing to pressure on the side distal to the wound (that on the proximal side having been relieved by escape of blood)." Therefore it is that throughout the varied means of defence possessed by larvæ "the object is always the same—to leave the larva untouched, a touch being practically fatal." Wallace also originally expressed this peculiar danger incurred by larvæ in more general terms, viz. "their soft and juicy bodies are so delicate that if seized and afterwards rejected by a bird they would almost certainly be killed" (see 'Contributions to the Theory of Natural Selection,' 1875, p. 118). Other peculiar dangers of the larval stage will be pointed out below. Although it will be seen that brilliantly coloured and distasteful larvæ are often tasted by their Vertebrate foes when impelled by hunger, all observers agree that a second trial is rendered less likely because of the unusual appearance which accompanies the unusual and unpleasant effect upon senses other than that of sight.

Furthermore, I am now able to bring forward instances of very distasteful species which have no warning colours, but, on the other hand, are well disguised by protective tints and markings; and a comparison between the behaviour of Lizards towards these and the conspicuous species respectively, affords strong confirmation of the truth of Wallace's suggestion. It now remains to summarize the whole of the evidence in favour of the prediction made in 1867; for, after all, the question is purely one of evidence, and however convincingly the *à priori* arguments may be put, they are chiefly valuable as guides to practical investigation. And this is fully recognized by Wallace, who strongly urged the practical test upon the meeting at which his suggestions were first made. Experiments have been made by Mr. J. Jenner Weir, Mr. A. G. Butler, Prof. Weismann, and by myself. Jenner Weir (see Trans. Ent. Soc. Lond. 1869, part i., April) made use of the following birds in his investigations:—*Erithaca rubecula* (Robin), *Emberiza citrinella* (Yellowhammer), *Emberiza schœniclus* (Reed-Bunting), *Pyrrhula vulgaris* (Bullfinch), *Fringilla cœlebs* (Chaffinch), *Loxia curvirostra* (Crossbill), *Turdus musicus* (Thrush), *Anthus arboreus* (Tree-Pipit). He also used to a less extent *Carduelis spinus* (Siskin) and *Linaria minor* (Redpoll).

He obtained the following results:—

"All hairy caterpillars (experimented upon) were uniformly uneaten;" viz. *Arctia caja, Eriogaster lanestris, Porthesia auriflua,* and *Orgyia antiqua*. "None of these species were even examined." The writer believes that the hairs are not themselves disliked, but that they "serve as a caution to the birds that the larvæ so clothed are uneatable." This suggestion is supported by the fact that the young and comparatively hairless larvæ of *Spilosoma menthastri* were tasted by the Siskin, Redpoll, and by a West-African Finch (*Textor erythrorhynchus*), but these three birds evidently found the larvæ disagreeable, and soon left them alone. On the other hand the more mature larva with its characteristic warning hairs was never even molested. It is probable that this explanation may be true of this and some other species, but it obviously does not apply in the case of *P. auriflua*, &c., in which the hairs themselves are a source of intense irritation and annoyance. Mr. Jenner Weir found the same results with the spiny larvæ of *Vanessa urticæ* and *V. io*, and he draws the same conclusions as to the meaning of the spines.

In this case the author states that "the metallic-looking chrysalides were also invariably rejected, thus showing that the spines were not the cause of the uneatableness of the larvæ." Experiments were also made with the following comparatively smooth-skinned, highly conspicuous caterpillars :—*Abraxas grossulariata, Diloba cæruleocephala, Anthrocera filipendulæ*, and *Cucullia verbasci*. In no case were these species molested. Thus these experiments strongly confirm Wallace's prediction. It may be doubted whether the larvæ of *Arctia caja* and of *Spilosoma menthastri* can be included among the brightly-coloured larvæ intended by Wallace, but there is no doubt that the habits of these species are such as to render them conspicuous in spite of their sober coloration. In Trans. Ent. Soc. Lond. 1870 (part iii., August), Jenner Weir has contributed another paper on the same subject. Mr. H. D'Orville, in the 'Entomologist's Monthly Magazine' (vol. vi. p. 16), had affirmed that the larvæ of *Cucullia verbasci* are eaten by birds in the wild state. In his second paper Jenner Weir conclusively showed that this species was not eaten in the wild state in certain localities, and he again proved that it was not touched in his aviary. It seems therefore certain that Jenner Weir is correct as far as his species of birds are concerned; but at the same time D'Orville seems to prove that this distasteful species may be eaten by certain birds. In this paper Jenner Weir confirms his previous experience with regard to *E. lanestris, D. cæruleocephala, A. grossulariata*, and *P. auriflua*. He also includes the following new species in the list of gaudy or conspicuous larvæ which were untouched by the above-mentioned birds:—*Odonestis potatoria, Lasiocampa quercus, Clisiocampa neustria, Hybernia defoliaria*. Of these the two first are hairy, and although with sober colour, are generally conspicuously placed on their food-plants. (I think it is also exceedingly probable that their rejection may be partially due to the possession of irritating hairs.) The two last-named larvæ are certainly brightly coloured.

Mr. A. G. Butler (Trans. Ent. Soc. Lond., March 1869, p. 27) only records experiments with three species of conspicuous larvæ. *Lacerta viridis* always refused the larva of *A. grossulariata*, but devoured that of *Phragmatobia fuliginosa*. The latter is not brightly coloured but, like the larva of *S. menthastri*, it is hairy and not inconspicuous. Frogs also refused the conspicuous larvæ of *A. grossulariata* and *Halia wavaria*, although this was often after tasting them, the rejection being accompanied by evident signs of disgust. The former larva was also rejected by Spiders, either with or without preliminary seizure. It is noteworthy that the larvæ would certainly be uninjured after being seized and then relinquished by the Frogs, and probably in the case of the Spiders also (in fact, Mr. Butler states that this was the case), but a bite from a Lizard would always be very serious and generally fatal. Mr. Butler states that the Lizards seized the distasteful larvæ before rejecting them, although this may not have been in many instances. Mr. Butler has kindly given me an account of some further experiments upon birds, the results of which are included in the Tables below.

Professor Weismann ('Studies in the Theory of Descent,' Part II., pp. 336–340, English translation by Prof. Meldola) also experimented with *Lacerta viridis*, with the results that the following brightly coloured distasteful larvæ were refused:—*Clisiocampa neustria, Euchelia jacobææ, Pygæra bucephala, Pieris brassicæ, Deilephila galii.* On the other hand, the very highly conspicuous larvæ of *Deilephila euphorbiæ* were eaten, as also were those of *E. lanestris* and *Lasiocampa pini.* The young larvæ of *Lasiocampa rubi,* at a stage when they much resembled those of the rejected *E. jacobææ,* were eaten after cautious examination. Professor Weismann also regarded the larva of *Papilio machaon* (always rejected) as conspicuous; but from my own experience I should certainly consider it well concealed upon its food-plant, and I should exclude it from the category of conspicuous larvæ which support Wallace's suggestion.

My own experiments were conducted with green Tree-Frogs (*Hyla arborea*, var. *meridionalis*), and with Lizards of the following species:—*Lacerta viridis, L. muralis* (chiefly var. *tiliguerta*), and *Tarentola mauritanica.*

My diary, printed in the form of Appendix II. to this paper, will give all the details, dates, &c. of the various experiments made during the summer of 1886, so that it is unnecessary to further allude to them here.

Finally, when a few weeks ago I told Mr. Jenner Weir of my intention to bring together all the experimental evidence upon this subject, he most kindly sent me the notes of his own observations during 1886, for incorporation in this paper. His experiments were conducted with the following species of Lizards:—*Lacerta viridis, L. agilis,* and *Zootoca vivipara,* and the diary is also printed in full as Appendix I.

It now remains to tabulate the results of all the experimental evidence upon conspicuous larvæ detailed above or described in the Appendices. Before doing so, it is necessary to recall Wallace's original suggestion, "that brilliant or conspicuous larvæ would be found to be refused by their enemies:" that is to say, they will be found to possess some unpleasant attribute. This may be a disagreeable taste or a nauseous smell in the fluids and tissues of the larva, and perceived after it has been bitten; or it may be a strongly smelling fluid, discharged by certain special glands on the approach of an enemy (e. g. *Porthesia auriflua* with dorsal glands, or the Hymenopterous *Crœsus septentrionalis* with ventral glands; in both these cases the smell given off from the everted glands can be readily perceived as sharp or unpleasant to ourselves). The larvæ of *Pieris brassicæ*, or of *Pygæra bucephala*, &c., form instances of the former class, although one cannot be sure that there is not some smell, given off from the general surface of the body. It will be shown that in some cases it is even likely that larvæ may be protected by their reputation for being indigestible. Again, the larvæ may be disliked because of the possession of irritating hairs, as in the case of *Porthesia auriflua*, in which the effects of the hairs are almost immediate and intensely irritating (to man, and evidently to lizards &c.); or as in other hairy larvæ which cause irritation after longer contact (e. g. *Odonestis potatoria*, from my own experience after long handling, and, as I hear from others, with *Lasiocampa rubi* and *L. quercus* &c.); but there is no doubt that the effects upon the delicate skin of the mouth would be much more rapid in all cases. We also see that more than one unpleasant attribute may be present in a single larva, as in the case of *P. auriflua*, &c.

Just as there may be many ways in which a larva may be unpleasant to its foes, there are many ways by which it may be rendered conspicuous, some of which have been suggested since Wallace's original hypothesis. Thus a larva may be conspicuous from its startling coloration (e. g. *P. auriflua* or *A. grossulariata*), or because it freely exposes itself, while its colours, although sober, do not harmonize with its food-plant (e. g. *O. potatoria* on grass, or *B. rubi* on heather). Again, it may become conspicuous by living in companies, in which case the individuals may be brightly coloured (e. g. *C. neustria, E. jacobææ, P. bucephala*, &c.); or may be sober-coloured, but strongly contrasted with the food-plant (*e. g.* the dark larvæ of *Vanessa io* or *V. urticæ*, freely exposed in companies on the tops of nettles). It is obviously of less importance for the gregarious species to be as conspicuously coloured as the isolated larvæ, because the numbers add greatly to the efficiency of comparatively sober colours. This explanation of the use of the gregarious habit in many species was made by Fritz Müller in 'Kosmos,' Dec. 1877, and an abstract of the paper was communicated to the Entomological Society of London by Professor Meldola (see Proc. 1878, pp. vi & vii). The descriptions of appearance in all the tables are principally taken from Newman's works, the habits being chiefly described from my own experience. Prof. Westwood has most kindly assisted me in the search for the names of many of the species employed in the experiments. (See Table I., pp. 198–203.)

A second small group of larvæ must be tabulated separately, *i. e.* those which take advantage of two methods of protection which at first sight appear to be mutually exclusive—the method of protective resemblance and that of a conspicuous appearance, warning of unpleasant attributes. Such larvæ are apt to pass unnoticed because of the harmony between their colours and markings and the artistic effect of their surroundings; but if discovered, or even if an enemy approach so that there is danger of their being discovered, the protective attitude is instantly changed for one which renders the larva conspicuous and warns the enemy of the presence of unpleasant attributes (taste or smell), or alarms it by the resemblance of the new appearance to some object of terror. These facts may even be

TABLE I.—*Undoubtedly*

Species of Larva.	Method by which rendered conspicuous.	Unpleasant attribute.	Results of	
			J. Jenner Weir, using many species of Birds and Lizards.	A. G. Butler, using Birds, *Lacerta viridis*, Frogs, and Spiders.
Pieris brassicæ.	Chief colours yellow and bluish green with black spots; also gregarious and freely exposed on upper sides of cabbage-leaves &c.	Taste or smell. "Disagreeable odour when crushed" (*Weismann*).	....	....
Vanessa io.	Intensely black, with minute white points; bristles; also gregarious and freely exposed on upper sides of nettle-leaves &c.	Ejects a green fluid from mouth when touched. ? Taste or smell. Proof lies in what follows.	Disregarded by all the birds.	....
Vanessa urticæ.	Same as *V. io* in all respects except colour, which is lighter, although much darker than leaves of nettle; yellow often present on dark ground-colour.	Ejects a green fluid from mouth when touched. ? Taste or smell. Proof lies in what follows.	Disregarded by all the birds.	....
Anthrocera filipendulæ.	Yellow and black; conspicuous position on trefoil &c.; so abundant locally as to be almost gregarious.	? Taste or smell. Proof lies in what follows.	Disregarded by all the birds.	....
Deilephila euphorbiæ.	Black, red, and yellow or white; most conspicuously coloured and freely exposed on the spurge.	"If interrupted they spit out a quantity of green liquid of an acid and disagreeable smell, similar to spurge-milk, only worse" (*Melhuish, in Stainton's 'Manual'*).	....	....
Deilephila galii.	Very variable colours, but always strongly contrasted, and "almost as conspicuous as *D. euphorbiæ*; rests fully exposed by day on the stem" [of *Galium*] (*Weismann*).	? Taste or smell. Proof lies in what follows.	....	....

Conspicuous Larvæ.

Experiments.		How far support given to Wallace's suggestion, that brilliant and conspicuous larvæ would be refused by some at least of their enemies.	How far support given to Poulton's suggestion, that a limit to the success of this method of defence would result from the hunger which the success itself tends to produce.
A. Weismann, using *Lacerta viridis.*	E. B. Poulton, using three species of Lizards and *Hyla.*		
Refused by *L. viridis.*	....	Strong support.	No evidence, for other food was not withheld.
....	....	Strong support.	No evidence, for other food was not withheld.
....	Eaten freely by *Lacerta muralis.* Not offered to others.	Support from behaviour of birds; shows that a larva may be disliked by one insect-eating Vertebrate and not by another.	No evidence, as above, from birds; of course the suggestion cannot apply to *Lacerta muralis,* which eat the larva freely.
....	....	Strong support.	No evidence.
Eaten at once by *L. viridis.*	....	A difficulty, especially as also "sea-gulls and terns devour them in numbers" (*Newman*).	The correlation of a startling appearance with some unpleasant attribute must probably have existed once if not now. Have we a case in which hunger or opportunity have caused the enemies to neglect the latter, and therefore to benefit by the former?
Neither examined nor touched by *L. viridis.*	....	Strong support.	No evidence.

TABLE I.

Species of Larva.	Method by which rendered conspicuous.	Unpleasant attribute.	Results of: J. Jenner Weir, using many species of Birds and Lizards.	A. G. Butler, using Birds, *Lacerta viridis*, Frogs, and Spiders.
Diloba cæruleocephala.	Yellow, green, and black; freely exposed on leaves of hawthorn &c.	? Taste or smell. Proof lies in what follows.	Disregarded by all the birds. Experiment repeated a second season, when the larva was "examined when moving, but not eaten."	....
Pygæra bucephala.	Yellow, orange, and black; downy; gregarious; most conspicuous on oak, elm, lime, birch, &c.	? Taste or smell. Proof lies in what follows.	Eaten by *Lacerta agilis*, but evidently disliked and generally avoided.	....
Orgyia antiqua.	Black and pink, with hairy tufts; freely exposed on upper sides of leaves of nearly all garden plants.	Eversible dorsal glands doubtless yielding odoriferous secretion. Hairs also apparently disliked, and perhaps irritating.	Disregarded by all the birds.	A young Missel-Thrush reared from the nest has frequently eaten the larvæ, but the long hairs were always rubbed off before swallowing.
Porthesia auriflua.	Black, red, and white; hairy; very conspicuous on upper sides of leaves of hawthorn &c.	Eversible dorsal glands: secretion volatile and irritant. Hairs intensely irritating.	Disregarded by all the birds. Experiment repeated a second season. Refused by all the Lizards.	Eaten, without hesitation, by a young Sky-Lark, which, however, died soon afterwards with symptoms which may have been due to irritation from the hairs.
Euchelia jacobææ.	Alternate rings of black and yellow; gregarious; very conspicuous on ragwort.	? Taste or smell. Proof lies in what follows.	....	....
Lasiocampa (Dendrolimus) pini.	"Variegated with red, brown, grey, and white, with two blue fasciæ near the head, spotted at the sides with red; it is tufted with hairs, one thicker than the rest near the tail." Apparently conspicuous on its food-plant—pine. (*Westwood and Humphreys, 'British Moths.'*)	Curtis states that Walker found the hairs intensely irritating on handling the larva.	....	....

(*continued*).

Experiments.		How far support given to Wallace's suggestion, that brilliant and conspicuous larvæ would be refused by some at least of their enemies.	How far support given to Poulton's suggestion, that a limit to the success of this method of defence would result from the hunger which the success itself tends to produce.
A. Weismann, using *Lacerta viridis.*	E. B. Poulton, using three species of Lizards and *Hyla.*		
....	....	Strong support.	No evidence.
Avoided by *L. viridis.*	Eaten by very hungry *L. muralis*, and, I believe, by *L. viridis*, and yet evidently disliked by all.	Strong support.	Strong support.
....	....	Strong support in Jenner Weir's observation; and Butler's shows that the hairs are much disliked.	No evidence, for the Missel-Thrush appeared to relish the larvæ.
....	*L. muralis*, when hungry, bit the larva, retaining it for a long time, but in the end rejected it, and much irritated by hairs.	Strong support, on the whole. It is impossible to decide whether the Sky-Lark was killed by the larvæ. If so, it strongly opposes the theory of any instinctive knowledge.	It is certainly a support to the suggestion that a Lizard when hungry enough should make such a determined attempt to eat the larva, which it evidently disliked.
Entirely disregarded by *L. viridis* until after another similar but palatable larva had been introduced; *then* tasted, but rejected.	Seized and relinquished by hungry *L. muralis*, Probably eaten later; but insufficient evidence.	Strong support.	It is certainly a support to the suggestion that a Lizard when hungry enough should make such a determined attempt to eat the larva.
Devoured by *L. viridis*, "but not exactly relished."	....	Support.	Strong support. Eaten, although unpleasant in some way.

TABLE I.

Species of Larva.	Method by which rendered conspicuous.	Unpleasant attribute.	Results of Jenner Weir, using many species of Birds and Lizards.	Results of A. G. Butler, using Birds, *Lacerta viridis*, Frogs, and Spiders.
Eriogaster lanestris.	Black, red, and white; gregarious; living on a web; rather hairy; very conspicuous on hawthorn.	? Taste or smell. Proof lies in what follows. The hairs may be irritating.	Disregarded by all the birds. Experiment repeated a second season.	....
Clisiocampa neustria.	Orange-red, black, white, and blue; rather hairy; gregarious, and living on a web when young; very conspicuous on apple &c.	? Taste or smell. Proof lies in what follows.	Disregarded by all the birds, although very hungry. Eaten by *L. viridis* and *L. agilis*, although sometimes refused, and evidently disliked.	....
Cucullia verbasci.	Green, yellow, and black; gregarious and very conspicuous on upper sides of leaves and on the stem of mullein.	The larvæ eject a green fluid from their mouths when disturbed. ? Taste or smell. Proof lies in what follows.	Disregarded by all the birds. Experiment repeated a second season.	....
Halia wavaria.	Green to lead-colour, with yellow and black. Does not assume the characteristic highly protective attitude so common in Geometræ; but most conspicuous on currant and gooseberry.	? Taste or smell. Proof lies in what follows.	....	Always refused by Frogs after tasting them; so also with Spiders. Supplied to the young of the Great Tit by the parent birds, and always eaten greedily.
Abraxas grossulariata.	Cream colour, black, and orange; as above, unlike most Geometræ, but *most* conspicuous on blackthorn, gooseberry, &c.	? Taste or smell. Proof lies in what follows.	Disregarded by all the birds. Experiment repeated a second season. Once eaten by *L. agilis*; often tasted and refused; evidently much disliked.	Always refused by Frogs and *L. viridis* after tasting them; so also with Spiders. (*Epeira diadema* and *Lycosa*?, sp., were the Spiders used in the case of this and the previous species.)
Hybernia defoliaria.	Brown and yellow; as above, unlike most Geometræ, but conspicuous and often hanging by a thread from its food-plant (oak &c.).	? Taste or smell. Proof lies in what follows.	Disregarded by all the birds.	....

(*continued*).

Experiments.		How far support given to Wallace's suggestion, that brilliant and conspicuous larvæ would be refused by some at least of their enemies.	How far support given to Poulton's suggestion, that a limit to the success of this method of defence would result from the hunger which the success itself tends to produce.
A. Weismann, using *Lacerta viridis.*	E. B. Poulton, using three species of Lizards and *Hyla.*		
Eaten by *L. viridis*, "but not exactly relished."	....	Strong support.	Support from Weismann's observation, which seems to show that the Lizard ate the larva, though not liking it.
Untouched by *L. viridis.*	Evidence insufficient, as the single larva which had disappeared may have escaped.	Strong support.	Strong support from Jenner Weir's observations with Lizards.
....	....	Strong support from Jenner Weir's observations. D'Orville states that they are eaten by birds in the wild state; Jenner Weir did not find this; and there must have been a difference in habit, perhaps due to the species of birds under observation or to extreme hunger.	No evidence from Jenner Weir. D'Orville's observations may possibly be a case in point.
....	....	Strong support, from the behaviour of the Frogs and Spiders.	The larvæ being tasted seems to point towards their being eaten in a condition of excessive hunger. The birds seemed to relish them.
....	Generally unnoticed; but tasted by Frogs, and then rejected. Once chewed for some time by a hungry *L. muralis*, and then rejected.	Strong support. The most complete evidence afforded by any larva, and the most complete unanimity in observations, in which others agree as well as those quoted.	That hungry Lizards should often make determined attempts to eat so nauseous a larva is strong evidence for the suggestion; and it is seen that one Lizard succeeded in swallowing the larva.
....	....	Strong support.	No evidence.

true of gregarious larvæ. Thus a group of phytophagous Hymenopterous larvæ may remain inconspicuous while undisturbed, but nevertheless the approach of an enemy determines united movements in the colony which render the whole strikingly conspicuous, and which may be attended later by the emission of an offensive smell from the numerous ventral glands of all the individuals simultaneously (*e. g. Crœsus septentrionalis*). In the other larvæ which suddenly assume a terrifying attitude "the effects produced approximate somewhat to an intensely exaggerated caricature of a sort of generalized vertebrate appearance, probably of the serpent type (at any rate in *Chærocampa*), such as would be most efficacious in the case of birds. It is likely that the terrifying appearance of our own larvæ in temperate latitudes first arose in the tropics, where the imitated cause of alarm to the enemies of the larva is real and obvious. And it is probable that the success of the same method in countries where the reptilian fauna cannot be said to constitute a source of alarm is due to inherited memories of a tropical life which live on, as that instinctive fear of anything snake-like which is so commonly exhibited by the higher land-vertebrates including ourselves." (Poulton, Trans. Ent. Soc. Lond. 1886, pt. ii. June, pp. 156, 157).

The success of this combination of defensive measures depends on the extraordinary sensitiveness of the larvæ, so that the transition from the one method to the other is instantaneous, and in the case of the suddenly assumed terrifying attitudes, the enemy is additionally alarmed by the way in which some dreaded object seems, as it were, to spring into existence. It is very unfortunate that so few experiments have been made upon this most interesting group of larvæ.

Just as it was suggested that insect-eating Vertebrates might, under the influence of hunger, be induced to eat and finally to relish distasteful larvæ, so we must expect that the same cause would in the end prevent this elaborate system of intimidation from being successful. In this case, however, there is no prejudice against an unpleasant taste or smell to be overcome, and it is most probable that the larvæ would be in great danger as soon as the imposition was detected. It is perhaps on this account that these methods are adopted by an exceedingly small proportion of larvæ, but also because a certain size is necessary for any chance of success. Nevertheless this size is less than might be anticipated, for the anterior part of the body with large eye-like marks is generally swollen out into a resemblance to the head of a serpent, while the larval body is partially concealed among the leaves of the food-plant, and, in many positions, what is seen merely serves to suggest a far more extended length than that which actually exists. Wallace has suggested that it is very probable that the "spectacles" of the Cobra are terrifying marks, which warn the enemy against approach, and it is most interesting to note that the *Chærocampa*-larvæ mimic the terrifying eye-like marks of a Cobra-like serpent, and not the real eyes of a serpent, which are relatively small. (Table II., pp. 206, 207).

Having thus tabulated the results of experiments upon undoubtedly conspicuous larvæ, in every way typical of the strongly coloured group to which Darwin had called the attention of Wallace, and having further tabulated those which become conspicuous on the approach of danger, it is now necessary to add a few other species which cannot be regarded as typical of the above-mentioned class, but which are not concealed or are very imperfectly concealed by protective colouring, which are more or less freely exposed upon their food-plants, or about which a difference of opinion exists. (Table III., pp. 208, 209.)

We will now consider a few of the conclusions arrived at by a study of the above tables, which give the whole of the experimental evidence (as far as I am aware) upon the precise question originally raised by Darwin. The first and obvious result of the first table is, with only one entirely antagonistic exception, the most complete demonstration of the truth of Wallace's suggestion, that a highly conspicuous appearance would be found to be accompanied by some unpleasant attribute. The exception is very remarkable, as the larva is so highly coloured, and I think the total results of all the experiments will justify us in concluding that the larva of *D. euphorbiæ* is unpleasant to some as yet unknown foes, and in all probability that it has been recently distasteful to a larger number. As to the results which bear upon my own suggestion, it must be observed that the only considerable support is to be expected from the columns of experiments under my name, because the other observers did not enter upon the investigation with this object in view, and therefore did not test whether a distasteful form would be eaten when other food was withheld. It will, however, be found that when this test was applied, in nearly all cases the unpleasant larvæ were either swallowed, or a most determined attempt was made to eat them. And there is some incidental support in the other experiments also; for in many instances the larvæ were "tasted" before being rejected, and in other cases even stronger confirmation is forthcoming, when the larvæ were eaten, although "not exactly relished" (Weismann). Since the above was written, Jenner Weir's experiments in 1886 have been included, and these strongly confirm my own observations.

It may be taken as proved that the continued spread of some distasteful form and the corresponding diminution in edible species would lead to the former becoming the prey of insect-eating Vertebrates; for a point would ultimately be reached, as it was reached in many of my experiments, when hunger would become a stronger stimulus than those lesser prejudices in which a species can very well afford to indulge while palatable food is abundant. This prejudice against peculiarities in taste having been overcome in confinement, there is nothing in the conditions of natural life which could prevent the same result from being reached, as doubtless it has been reached, again and again. A comparison of all experiments of this kind ever made with insects will show that the likes and dislikes of insect-eaters are purely relative, and are manifested to a marked extent when they are offered a variety of insects, even when obviously

TABLE II.—*Larvæ which only become*

Species of Larva.	Method by which rendered conspicuous.	Unpleasant attribute real or imaginary.	Results of	
			A. Weismann.	Lady Verney.
Chærocampa elpenor.	Larvæ brown, sometimes green. When approached, the anterior part of the body is distended, and resembles a serpent-like head (of the Cobra type), while the real head is drawn in. Two pairs of large eye-like marks are seen by an enemy approaching from above or the side, while another pair meet an enemy coming from the front, and these last are modified in the terrifying attitude out of other markings. (Poulton, Trans. Ent. Soc. Lond. 1886, pt. ii. p. 154 &c.)	Suggested danger.	A tame Jay ate the larva at once; Sparrows and Chaffinches (wild) were frightened by it, and would not come near the seed-trough in which it was placed; Fowls were evidently frightened, but in the end cautiously attacked it, when it was soon eaten.	Refused by small birds, which were evidently frightened by it, and would not come near a tray with crumbs on it, on which the larva had been placed. ('Good Words,' 1877, p. 838.)
Cerura vinula.	Green and purplish brown. When attacked, the head is drawn in and a bright red margin inflated, with two intensely black marks on it in the appropriate position for eyes; this terrifying face is turned towards any point at which the larva is touched; also pink whips are swiftly protruded from the two prongs in which the body terminates.	Terrifying aspect; the whips might be thought to be stings; the larva also ejects strong formic acid to a considerable distance. (Poulton, Trans. Ent. Soc. Lond. 1886, pt. ii. p. 157.)	Devoured by *L. viridis.*	....
The phytophagous hymenopterous *Crœsus septentrionalis.*	Green, orange, and black. Gregarious; but not conspicuous until approached; then *most* conspicuous, all individuals whipping about with the abdomen and everting the ventral glands.	Many median ventral glands everted on approach of enemy, and producing a most unpleasant smell.	....	....
A phytophagous hymenopterous larva, probably *Nematus ribesii.*	Green, with yellow and black markings. Gregarious, becoming conspicuous when approached, as in the last species, but without ventral glands.	? Taste or smell. Proof lies in what follows.	....	....

conspicuous when approached and detected.

Experiments.		How far evidence supports Wallace's suggestion.	How far evidence supports Poulton's suggestion.
J. Jenner Weir.	E. B. Poulton.		
....	....	Complete support. It would have been very interesting to have also experimented with the Lizards.	Complete support. The working of a counter principle is well seen—the uncertainty of the birds, their evidently half-detecting suspicion, and finally the trial which soon proves the imposition; all this shows the danger of reliance on such a mode of defence.
....	... .	It would be interesting to also try Birds and other smaller Lizards. This experiment alone opposes suggestion.	Support, if it be found that the appearance is really terrifying to enemies, and yet that the Lizard ate the larva through hunger.
....	Eaten at one time by nearly all Lizards freely; at another seized without suspicion, but abandoned by *L. muralis*, although a very hungry one was seen to eat the larva, which it evidently disliked.	Support; for the unpleasant qualities certainly produced effect in some cases.	Strong support from the behaviour of the Lizard, which ate the larva reluctantly, although disliking it, because it was hungry.
Refused by Lizards.	Mr. Butler tells me that these larvæ were supplied to the young of the Great Tit by the parent birds. On the other hand, Rev. G. J. Burch tells me that chickens pecked at the larvæ, but rejected them, and that the hen warned them against such food.	Support, from the behaviour of the Lizards and from Mr. Burch's observation.	It is probable that they would have been eaten, like the *Crœsus*, if the Lizards had been very hungry. Mr. Butler's birds appeared to relish the larvæ.

TABLE III.—*Not Inconspicuous Larvæ, which are*

Species of Larva.	Method by which rendered more or less conspicuous.	Unpleasant attribute.	Results of	
			J. Jenner Weir.	A. G. Butler.
Papilio machaon.	Green, black, and orange. "A striking appearance" (*Weismann*). Granting that this is so, when the larva is looked at alone I think that its colours harmonize well with its umbelliferous food-plants. However, when disturbed the pinkish-red everted glands do render it conspicuous; but this is *after* discovery.	A pair of dorsal prothoracic glands, everted when an enemy approaches, and causing a most penetrating odour like "decaying pineapple" (*Buckler*); especially noticed in fourth stage.	....	....
Arctia caja	Black, with very long grey and brown hairs. Freely exposed on dead nettle, &c., although the colour is not such as to at once attract attention.	Jenner Weir thinks that "flavour is nauseous" and that the hairs act as a warning. Nevertheless I am assured that the shorter hairs are irritating (*W. Cole*).	Disregarded by all the birds.	....
Phragmatobia fuliginosa.	Smoky brown, with brown hairs. Freely exposed on dock &c.; as above, it is not truly conspicuous.	Evidence, as far as it goes, against there being any unpleasant attribute, but only tried with Lizards.	....	Devoured by *L. viridis.*
Spilosoma menthastri.	Brown, with long brown hairs. Freely exposed on all low plants; as above.	In this case much evidence for the larvæ having unpleasant taste. Jenner Weir thinks hairs are warning.	Young and comparatively hairless; tasted and refused by many birds; disregarded by all when older and very hairy.	....
Lasiocampa rubi.	Black and brown, with long brown hairs. Freely exposed on heather &c., as above; more conspicuously coloured with black and yellow bands when younger.	I believe that there is evidence for the hairs having irritating properties.	....	....
Lasiocampa quercus.	Brown and yellow, and comparatively conspicuous when young; black with white marks and brown and grey hairs when older; exposed but not conspicuous on hawthorn.	I believe that there is evidence for the hairs having irritating properties.	Disregarded by all the birds.	....
Odenestis potatoria	Blue-grey, black, and orange; tufts of white hairs; freely exposed on grasses. Easily seen, but does not attract attention.	The hairs are certainly irritating, although it takes some time to affect the hands.	Disregarded by all the birds.	....

not Nocturnal and which do not conceal themselves.

Experiments.		How far evidence supports Wallace's suggestion.	How far evidence supports Poulton's suggestion.
A. Weismann.	E. B. Poulton.		
Two full-fed larvæ quite unnoticed by *L. viridis*; they finally pupated on side of Lizard's cage.	....	As offered to the Lizards the larvæ were no doubt conspicuous, and so the experiment supports the suggestion. It is possible that some notice may have been taken by the Lizards, but that they were repelled by the penetrating smell.	No evidence.
....	....	Favourable to the suggestion, for the larva is certainly not well-concealed.	No evidence.
....	....	We cannot say more than that it does not oppose suggestion.	No evidence.
....	... .	Conclusion as in case of *A. caja*.	No evidence.
Offered to *L. viridis* when young and resembling *E. jacobææ* (having dark and yellow bands). Nevertheless eaten after cautious tasting.	....	Thus eaten when young and more conspicuously coloured; no evidence when older. So far as it goes, the evidence is rather antagonistic.	No evidence.
....	Disregarded by the Lizards. (Adult form of larva.)	Neutral as far as the adult larva is concerned (no evidence from the younger form).	No evidence. Only one larva made use of with Lizards.
....	Disliked, but eaten by hungry *L. muralis*, and probably by *L. viridis* also.	Conclusion as in the case of *A. caja*.	Strong support from behaviour of hungry Lizards.

distasteful species are carefully excluded from the diet. Thus Butterflies and Moths are freely eaten by Lizards (see Appendices); but I am sure that they are not really enjoyed in the same way as when a Housefly or a palatable Caterpillar is offered to them. This is doubtless because the imagos of Lepidoptera are dusty, unsatisfactory things to eat, with such a small proportion of body in which the real nutriment and taste is contained, and so large an expanse due to the dry membranous wings with their scaly covering. In this respect the Butterflies contrast unfavourably (as food) with the Moths, and the latter are certainly preferred (when both are palatable in other ways). The same preference is manifested by Frogs (*Hyla arborea*) with even greater force; there is a most extraordinary difference in the behaviour of such a Frog in the presence of a Housefly or of a Butterfly respectively, and in fact the latter is often disregarded. Of course birds are in a different position as regards such insect-food, for they at any rate very generally pick off the unpalatable parts before eating a lepidopterous imago (Jenner Weir); and with them it is common to witness all the signs of an intense desire for these insects, especially Moths. Birds can similarly largely remove the unpleasantness due to larval hairs, as was seen in the case of *O. antiqua* (Table I.). We should doubtless see evidence for the existence of such nice discrimination between the relative palatabilities of various insects, in the case of all insect-eaters, if our observations were sufficiently numerous and minute; but it must be quite clear that the preferences cannot be always satisfied, when we remember the extent and keenness of competition. In this country it is hard to realize the excessive abundance of reptile life, chiefly among the Lizards, which obtains even so near to us as the south of Europe, and which almost entirely depends upon the insect fauna for food. Almost every step along an Italian road startles several Lizards on the road-side wall or bank; and it must be perfectly clear that under such circumstances it is quite impossible for all to be served with the food which is most appreciated. We see rather the very conditions which must render the acquisition of an unpleasant taste together with the correlative "warning" colours, an exceedingly hazardous mode of protection, if assumed by more than a small proportion of the species constituting the insect fauna of such a country. For in so great a press of competition among the innumerable insect-eaters, we may feel sure that some at least would be sufficiently enterprising to make the best of unpleasant food, which has at least the advantage of being easily seen and caught. And such a conclusion will, I think, be confirmed by a study of the tabulated details. It must be admitted that Wallace's suggestion, with its experimental proof, has taken a most important place among the principles which deal with the infinitely complex and ever-changing relations which obtain between the most widely separated no less than between the most allied members of the organic kingdom. But it is no less true that the principle carries with it its own compensating principle, which will come into operation precisely as the former advances to the possession of undue influence and thus throws out of adjustment the preexisting condition of comparative equilibrium.

Another conclusion which is demonstrated very completely by the tables is that a Caterpillar may be eaten by one insect-eating Vertebrate although refused by another. I believe, however, that the acquisition of an unpleasant taste and of conspicuous colours appealed, at any rate at first, to a large number, probably all, the vertebrate foes; for if this were not so, if the species became unpalatable and conspicuous to (say) half its enemies, and became conspicuous but remained palatable to the remainder, it seems only reasonable to conclude that immunity from the attacks of one set of foes would be counterbalanced, or perhaps more than counterbalanced, by the facilities afforded to the other set. On this account and for other reasons which will be given below, I think it probable that the differences observed between the enemies of insects in this respect are of recent date as compared with the acquisition of this mode of protection, and have arisen out of the great competition for food; but in most instances the change of habit has not become so far confirmed that the previously distasteful food is eaten with avidity and pleasure. The first table of highly conspicuous larvæ (including *Crœsus* and *Nematus* from the second table) can be shortly analyzed to show in it the various stages of transition from the most utter disregard to the opposite extreme of conduct, indistinguishable from that observed when the larvæ are known to be relished. The intervening stages are furnished by the details given by the different observers, and are described in the headings of the vertical columns between those numbered I. & V. (see page 212).

It must be remembered that these analyses represent a comparison between the results of experiments carried out under different systems and with the use of an incomplete number of Vertebrates in all cases. Hence many of the insects would doubtless have to be shifted into other columns after being offered to other Vertebrates, or to those actually employed, if it were certain that they were thoroughly hungry. Allowing for this, however, the analyses provide us with numerous instances of transition through all conditions of failure in the protective efficacy of the method we are discussing. At the same time one can see at a glance the relative behaviour of different insect-eaters as far as they have been tested in the case of each larva.

Jenner Weir's suggestion that the hairs of certain larvæ act as a warning of other unpleasant qualities can also be tested by the examination of the former tables. There are altogether fourteen larvæ which may be called hairy, out of a total of twenty-seven (omitting the two terrifying species). Of these, two (*L. rubi* and *P. fuliginosa*) were eaten, as far as any observations are recorded; one of the former and five others (*L. rubi, L. quercus, L. pini, P. auriflua, A. caja,* and *O. potatoria*) are either known to possess irritating hairs or are believed to possess them; as many as five are gregarious (*V. io, V. urticæ, P. bucephala, E. lanestris, C. neustria*), and this habit, together with the colour, is by far the most important factor

B.=Birds, F.=Frogs, L.=Lizards, S.=Spiders.		I. Disregarded.	II. Tasted, and then rejected.	III. Eaten when very hungry, and evidently much disliked.	IV. Eaten, but not relished.	V. Eaten with avidity.
A. Disregarded by all Vertebrates as far as experiments have been made at present.	*V. io, A. filipendulæ, D. cæruleocephala, H. defoliaria.*	B.				
	D. galii, P. brassicæ	L.				
B. Disregarded by some foes; tasted and rejected by others.						
C. Disregarded by some foes, but eaten, in some cases with relish, by others.	*C. neustria*	B., L.	L.	L.		
	E. jacobææ	L.	L.	? L.		
	A. grossulariata	B.,L.,F.	F.,S.,L.	L.		
	P. bucephala	L.	L.	L.		
	O. antiqua	B.	...	...	B.	
	E. lanestris	B.	...	...	L.	
	P. auriflua	B., L.	L.	...	...	? B.
	C. verbasci	B.	...	...	...	? B.
	V. urticæ	B.	...	...	...	L.
	N. ribesii	B., L.	B.	...	...	B.
D. Disregarded by no species of enemy.	*C. septentrionalis*	...	L.	L.	...	L.
	H. wavaria	...	F., S.	...	...	B.
E. Eaten with more or less pleasure by all the species of enemy on which experiments have been made.	*L. pini*	...	...	...	L.	
	D. euphorbiæ	...	...	...	...	B., L.

Similarly analyzing the third table, we find the following results:—

		I.	II.	III.	IV.	V.
A.	*P. machaon*	L.				
	A. caja, S. menthastri (old)	B.				
	L. quercus	B., L.				
B.	*S. menthastri* (young)	B.	B.			
C.	*O. potatoria*	B., L.	L.	L.		
E.	*P. fuliginosa*	...	...	...	...	? L.
	L. rubi	...	..	...	...	? L.

in producing a conspicuous appearance, although it may be admitted that the hairs do render subordinate assistance; of the two remaining larvæ, one is brightly coloured (*O. antiqua*), although the hairy tufts are in this case very important factors, while for *S. menthastri* no other suggestion except that of Jenner Weir has yet been made. In some of these larvæ the effective colours are chiefly on the hairy covering, and the latter practically makes up the whole appearance. Furthermore in the last species there is evidence (Jenner Weir) that the insect is disliked for some quality other than the presence of hairs. It seems probable that the hairs of larvæ possess irritating qualities to a much greater extent than is commonly supposed; but it is also likely that the hairy covering may be of direct value to the organism in other ways, some of which doubtless remain to be discovered. (Is it not likely that some tactile or other terminal organ of the nervous system may be in relation with hairs or bristles?) Of course it is well known that hairs are often exceedingly important in defending the insects by the converse method of a protective appearance (an extreme instance of this is afforded by the larva of *Acronycta leporina*, see Trans. Ent. Soc. Lond. 1886, pt. ii. June, p. 160).

Prof. Meldola has kindly looked through the proof-sheets of this paper, and has suggested to me that the probable original significance of the hairy covering was protection from injury after falling from the food-plant. The suggestion is strongly supported by the habits of the majority of hairy larvæ.

Any further considerations which arise out of the tables given above are better deferred until after an examination of similar instances in forms other than the larvæ of Lepidoptera.

II. *Brightly coloured or conspicuous Insects* (*other than Larvæ*).

Under this heading I have only included such species as have been actually subjected to experiment. There are a very large number of additional species from many groups of insects which doubtless belong to this category; but as they have never been brought to the experimental test, they are excluded from consideration on the present occasion. An extended list will be found in Wallace's 'Contributions to the Theory of Natural Selection' already referred to (The essay on "Mimicry and other Protective Resemblances among Animals"). In most of the instances given by Wallace, we may feel confident that the test would prove satisfactory, especially as the author shows that in many cases the conspicuous form is mimicked by one or more species belonging to totally different groups, which accompany the former in its range and which, nearly always, keep in a small minority. Such facts render it in the highest degree probable (in fact make it nearly certain) that the mimicked species possesses some exceptional advantage in the way of inedibility or otherwise—some unpleasant peculiarity which confers upon it a more or less complete immunity from the attacks of the Vertebrate foes of its class. But in the present paper I am rigidly limiting myself to instances which have been actually tested, and it is much to be regretted that experimental investigations have not been further extended and recorded in greater detail. The results of the tables of larvæ given above have been, in a very small proportion of cases, so directly contrary to *à priori* expectation that I do not feel confident in bringing forward any instances which have not been tested, although I feel sure that the vast majority of them would yield favourable results. I cannot, therefore, in this paper accept as satisfactory the purely negative evidence that insect-eating Vertebrates have been often seen to catch and eat insects of various kinds, but have not been seen to catch at the same time and place certain highly coloured species which were abundant and slow-flying. At the time when Bates and Wallace first made public their most important conclusions as to the meaning of conspicuous coloration and the true significance of mimicry, it was quite right that evidence of all kinds should be brought forward; but after the lapse of twenty years, we may fairly expect that conclusions which are so important in Biology shall have received the most abundant and complete experimental proof. And I know that lack of detail in the proofs which have been afforded, and the fact that a large part of the evidence brought forward is still founded on mere surmise (however probable may be the result of an actual test), have prejudiced the conclusions in the minds of many distinguished biologists, who have come to look upon the whole subject with an undeserved suspicion.

I cannot find any record of actual experiments conducted upon the well-known and conspicuous Heliconians and Danaids, and therefore I do not include them in the following list. There is, however, an observation of Meldola's which is of the nature of demonstration, and which is so interesting that I quote it in his words:—"It appears that the nauseous character of these . . . . butterflies is to a certain extent retained after death, as I found that in an old collection which had been destroyed by mites, the least mutilated specimens were species of *Danais* and *Euplœa*, genera which are known to be distasteful when living and to serve as models for mimicry, see Proc. Ent. Soc. Lond. 1877, p. xii." (Meldola's editorial notes to his translation of Weismann's Essays above referred to, p. 337). This observation (since confirmed by J. Jenner Weir, 'Entomologist,' vol. xv. 1882, p. 160) has the same kind of interest as that of Butler upon spiders, drawing attention, as it does, to the possession of a peculiar taste or smell which is recognized as nauseous by animals as widely separated as the mites and spiders are from lizards and birds. And such a consideration enforces the conclusion previously arrived at from other evidence, that when certain insect-eaters neglect the attributes which are respected by others, we see the results of an "acquired taste" produced in the first instance by hunger, and not by an obedience to the dictates of an eccentric preference for what is very universally regarded as disagreeable.

Since the above was written, my friend and pupil Mr. E. A.

Minchin has called my attention to some experiments made by M. de Nicéville upon the imagos of Acræinæ &c. (Butterflies of India, Burmah, and Ceylon, vol. i. part ii. p. 318). "M. de Nicéville has experimented with the carnivorous *Mantis* on many of the Butterflies believed to be offensive to birds, and he has found that *A. violæ* is the only Butterfly which all the species of *Mantis* he has experimented with refuse to eat."

One other consideration remains to be partially discussed before giving the list of experiments. The meaning of conspicuous coloration may be said to be clear and definite in the case of larvæ, being only capable of the explanation that it is of value for protective purposes. But in the perfect forms the other explanation of colour is always possible, *i. e.* its use in courtship, and, as a consequence, its growth from small beginnings and its gradual perfection by sexual selection. By what criterion, then, is it possible to judge of the meaning of bright and conspicuous colours in any particular instance? In the first place, the brilliant tints due to sexual selection alone rarely usurp the whole surface of an insect, and there are certain parts (exposed in the protective attitude of rest) in which we expect to find such brilliant tints replaced by the (usually) sober colours which harmonize with the environment. For instance, this is well known to be the case with the uppersides of the upper wings in most moths, and with the undersides of both wings in nearly all butterflies. If, therefore, such exposed parts are conspicuously coloured, strong presumptive evidence will be afforded for the explanation of the colour as belonging to the "warning class." Another test is found in the mode of flight, which may be expected to be such as will clearly display the colours no less than when the insect is at rest. The question is no doubt complicated by the two kinds of coloration running into each other. Thus Wallace has shown that the shapes and colours due to sexual selection may run riot in localities (certain islands) where enemies are largely excluded by barriers, and in the same way the brilliant colours of dangerous or nauseous insects may perhaps be sometimes explained by equal immunity, although due to other causes. But a conspicuous appearance gained in this way will be always liable to be used for an entirely different object as "warning coloration." But if such a change of use took place, we should expect some change of pattern or some new combination of colours, for this reason, that "warning colours" have one meaning which is not associated with sexual colours, *i. e.* the production of a conspicuous appearance and the more or less complete subordination of everything to this end. Nevertheless it is almost certain that the appearance of any species, however specialized for other ends, possesses sexual significance, and appeals as an adornment to the modified taste of the individuals concerned; and we have a rough criterion of the extent of the modification in taste, when we compare such appearances with those which possess a sexual value alone, which are concealed except during flight and which are especially displayed during courtship. Prof. Meldola has recently drawn my attention to an observation of

Darwin's which enables us to point towards the purely sexual value of one factor in the appearance of certain butterflies; and by the same kind of observation it is likely that increasing stability will be given to the whole theory of sexual selection. Darwin noticed that the magnificent surface-colours which exist on many tropical butterflies, and which change with the position from which the insect is observed (being probably due to diffraction), become most brilliant when they are seen from the front, and at an angle which corresponds with that at which they would be seen by the female as the male butterfly approaches her.

As a further test of the "warning" value of certain colours, we can use as a comparison the colours and patterns of certain larvæ which are known to be "warning" only, or which at any rate cannot be sexual. After giving the list and the experimental details, I shall attempt to show that there are certain combinations of colour, and sometimes even certain patterns, which are generally distinctive of "warning" as apart from sexual coloration. And such differences of type are to be expected; for the two systems of coloration appeal to a different class of animals and appeal to a different sense. The "warning" colours of insects appeal to a *Vertebrate's* sense of what is *conspicuous*; the sexual colours appeal to an *Invertebrate's* sense of what is *beautiful*. And it is one of the most remarkable facts in the study of comparative psychology that our own sense of what is beautiful entirely coincides with that of an insect, so that the difference in the two types of coloration depends entirely upon the *sense* alluded to above, and has probably no reference to the class of animals in which the sense exists. For, if we had no knowledge of the use and meaning of the colours of insects, we should all agree in maintaining that certain colours and patterns (which we now trace to the action of sexual selection) comprise all that is beautiful in the appearance of this class of animals, and we should draw a sharp line between these and other combinations of colour which we now recognize as possessing an entirely different significance.

In the following instances it is unnecessary to enter upon any preliminary account, as the table contains all the details which I can find recorded. Of course this list must contain any cases (if tested) in which a conspicuous appearance is believed to be due to "mimetic" resemblance to another species protected by possessing some unpleasant attribute. I much regret that hardly any of these most interesting cases have been used for experiment (see Table IV., pp. 218–223).

Looking at this fourth table, we find that the theory of warning colours is again confirmed in the most marked manner. Unfortunately the extremely interesting "mimetic" cases still lack the necessary experimental demonstration; although the intimidating larvæ of *C. elpenor* and *C. vinula* are really mimetic of vertebrate appearances, and the former has been shown to be attended by a considerable amount of success. The only "mimetic" form in this last list is *Sesia fuciformis,* and in this case the mimicry is exceedingly imperfect, while very perfect protection is gained in other ways. In fact I have suggested above that the species is not now "mimetic" at all, but retains two points of an ancestral condition in which it actually derived shelter from the reputation possessed by many Hymenoptera, these being (1) a structural point—its transparent wings, and (2) a habit—its diurnal flight. If this view be correct the species should be moved into the table given below of the results of experiments upon insects protected by evading their enemies, and *there* it would add to the instances which support Wallace's converse suggestion, that such insects will be found to be eaten just as the class we are discussing are generally refused. I have placed the species in the fourth table in deference to Wallace's opinion on the kindred species *S. bombyliformis*, which it closely resembles; but I believe that the place of both species should be below. I made several attempts to obtain the imagos of *Sphecia apiformis*, in order to offer these to my Lizards; for this species certainly does suggest a stinging Hymenopterous insect in the most remarkable way; but the attempt was unsuccessful. *S. bembeciformis* is equally well suited for experiment, but even more difficult to obtain; I hope, however, to be able to experiment with one or both species in the course of next summer.

It is noteworthy that (excluding *S. fuciformis*) there is probably no instance in this list which proves a difficulty in the way of Wallace's suggestion at all equal to that raised by the larva of *D. euphorbiæ*. For the pupa of *A. grossulariata* was not swallowed, but only well bitten by a very hungry lizard, and although the imagos of *S. lubricipeda* and *P. auriflua* were eaten (also by very hungry lizards in the former case), it cannot be asserted that they were eaten with relish; and, further, the experiment should be repeated with Birds and other species of Lizards. In all other cases the insects were refused by at least one of the animals to which they were offered. The comparison between the treatment received by Bees (described below) and Wasps, together with a comparison between their appearances, is strongly in favour of Wallace's suggestion. It now remains to analyze the list in the same manner as was adopted before, showing the transition of conduct observed (see Table, page 224).

Comparing the three analyses of all experiments ever conducted upon presumably nauseous or dangerous insects, omitting *S. fuciformis* and including *C. elpenor* and *C. vinula*, we find that out of a total of 44 cases which have been tested 13 were entirely disregarded; but this number includes *P. machaon*, which I believe ought to be placed below under forms chiefly defended by protective resemblances, and also *S. menthastri* (larvæ, which were tasted in the youngest stages). Furthermore four species (including the two just mentioned) belong to Table III., containing larvæ which can hardly be called conspicuous. Hence, omitting this table, the number is reduced to 9 cases out of a total of 37; and of the 9, not a single species has been offered to more than one out of the three groups of

TABLE IV.—*Bright-coloured or Conspicuous*

Species and Stage.	Method by which rendered more or less conspicuous.	Unpleasant attribute, real or suggested, in mimetic forms.	Results of	
			J. Jenner Weir.	A. G. Butler.
Pupa of *Abraxas grossulariata.*	Black, with yellow bands; contained "in a very slight and perfectly transparent cocoon" (*Newman*).	? Taste or smell. Proof lies in what follows.	....	....
Imago of *Anthrocera filipendulæ.*	Blackish green and red. Rests very conspicuously on flowers &c.; flight not rapid, and by day. So abundant locally as to be almost gregarious. The bright colours are well seen at rest and in flight; very sluggish and easily caught; often feigns death when captured.	? Taste or smell. Proof lies in what follows.	"Unwillingly eaten:" Jenner Weir thinks because the birds in confinement get fewer insects than when wild, and so will eat forms which they would reject if well supplied with this food.	Always refused by *L. viridis* after having been seized.
Imago of *Sesia fuciformis.*	Wings transparent, with brown margin; body various shades of brown. Flight by day *very* rapid, and insect seldom seen at rest. Its claim here depends on its somewhat Hymenopterous appearance: the closely allied *S. bombyliformis* "resembles the male of the Humble-Bee (*Bombus hortorum*)" (*Wallace*).	The suggestion of a sting, according to some authorities.	....	....
Imago of *Porthesia auriflua.*	Almost all the surface, seen at rest, is white; there are also a few small black patches on the fore wings, and the body ends posteriorly in a conspicuous yellow tuft. Flight weak in the evening, when the Moth is very conspicuous, appearing white; at rest it is also extremely conspicuous.	There may be an unpleasant taste or smell, but there is at present no experimental proof of this.	A single imago eaten by the Lizards.	....

Insects (other than Larvæ).

Experiments.		How far evidence supports the theory of "warning" and "mimetic" colours (Bates and Wallace).	Bearing of evidence on Poulton's suggestion, as before.
A. Weismann.	E. B. Poulton.		
....	One was placed in cage of very hungry *L. muralis*, and was crushed and most of the fluid contents extracted and probably eaten; however, palatable pupæ were swallowed as a whole. This pupa was untouched at first.	Strong support, for if palatable it would have been treated very differently.	Strong support.
....	....	Strong support, from the reluctance of Birds and rejection by Lizards.	Strong support in Jenner Weir's explanation of the Birds' behaviour, and some support in the Lizard's attempts.
....	One specimen eaten by *L. muralis*; no apparent hesitation or caution in capture.	At first seems to be a difficulty; but I have always thought that the suggested resemblance is very imperfect, and perhaps a remnant of a former more perfect mimicry, reliance being now placed on powerful flight and concealment during rest.	No evidence, the insect being palatable and in this instance not terrifying.
....	....	Insufficient evidence; but opposed to the theory as far as it goes.	No evidence, unless it should be proved to be a nauseous insect.

TABLE IV.

Species and Stage.	Method by which rendered more or less conspicuous.	Unpleasant attribute, real or suggested, in mimetic forms.	Results of	
			J. Jenner Weir.	A. G. Butler.
Imago of *Spilosoma menthastri.*	Wings creamy white, with black dots; body yellow, with black dots. Very conspicuous at rest or in flight (slow; evening); often feigns death when captured.	? Taste or smell. Proof lies in what follows.	Eaten reluctantly by Robin and Reed-Bunting, the latter after rejecting it at first. Tasted and rejected by Yellow-Hammer; refused by Bullfinch and Chaffinch.	....
Imago of *Spilosoma lubricipeda.*	Buff, with black spots. Very conspicuous at rest or in flight (slow; evening); often feigns death when captured.	? Taste or smell; but there is at present no experimental proof of this.	....	....
Imago of *Euchelia jacobææ.*	Fore wings very dark brown, almost black, with red spots and stripes; hind wings red with black margin; body black. Most conspicuous at rest, or especially in its weak flight by day.	? Taste or smell, or very probably from being indigestible.	Disregarded for some time, but eventually reluctantly swallowed after the removal of the wings. Same suggestion as in case of *A. filipendulæ.*	....
Imago of *Abraxas grossulariata.*	White, black, and yellow. Very conspicuous at rest or in its slow flight by day and in evening. Often feigns death when captured.	? Taste or smell. Proof lies in what follows.	Refused by Lizards, although seized on one occasion.	"Greedily devoured" by Frogs. (I think that this must be a mistake)
Imagos of Malacoderms of the genus *Telephorus*, sp.? (Coleoptera).	Black and red. Very conspicuous at rest or in flight (diurnal); easily caught. Elytra soft and no protection. Common English species called "soldiers and sailors."	? Taste or smell. Proof lies in what follows.	Disregarded by all the birds. (Quoted by Wallace.)	....

(*continued*).

Experiments. A. Weismann.	Experiments. E. B. Poulton.	How far evidence supports the theory of "warning" and "mimetic" colours (Bates and Wallace).	Bearing of evidence on Poulton's suggestion, as before.
....	....	Strong support. Also confirmed by Stainton, who offered it to Turkeys, with a large number of protectively-coloured Moths, all of which were eaten, while the *S. menthastri* was always rejected after being examined.	Strong support, especially in the reluctant way in which it was eaten by Robin &c. See Jenner Weir's explanation in case of *A. filipendulæ*.
....	Eaten at once by hungry *L. muralis*.	So far as it goes, against suggestion; but not tried with sufficient number of enemies, nor with plenty of other food.	No evidence, unless it should be proved to be nauseous; then this experiment would strongly support suggestion.
Always refused by *L. viridis*.	Two specimens eaten successively by the same Frog, and therefore it would seem not to be nauseous to this species. Next day the Moths were found in the case, having been rejected presumably because of indigestibility.	Strong support.	Strong support in Jenner Weir's explanation as above. In the case of the Frog also hunger very likely caused the insect to be taken, although not retained.
....	Refused by *L. muralis* after biting, although very hungry.	Support from the behaviour of Lizards; the other evidence must, I think, be mistaken.	Support in that the Lizards were induced to bite it severely.
....	....	Strong support.	No evidence.

TABLE IV.

Species and Stage.	Method by which rendered more or less conspicuous.	Unpleasant attribute, real or suggested, in mimetic forms.	Results of J. Jenner Weir.	A. G. Butler.
Imago of *Chrysomela populi* (Coleoptera).	Chief colour red, due to elytra: the other parts seen are a metallic lustrous blue-black.	"Strongly smelling" (*Weismann*).	....	....
Coccinella septem-punctata (Coleoptera).	Exposed surface red with black spots. Very conspicuous and easily caught; flight diurnal.	They have a very unpleasant smell. They "can emit fluids of a very disagreeable nature" (*Wallace*).	....	....
Coccinella bipunctata (Coleoptera).	Exposed surface red with two black spots. Very conspicuous and easily caught; flight diurnal.	They have a very unpleasant smell. They "can emit fluids of a very disagreeable nature" (*Wallace*).	....	....
Vespa vulgaris.	Queens and workers made use of: colours black and yellow. Very conspicuous; powerful flight, but of use for obtaining food and catching prey rather than for escaping enemies.	Sting.	....	....
Bombus terrestris, B. lapidarius, &c.	Other common species also made use of. The insects are generally conspicuous, with bands of light colour (often yellow) on a darker ground (often black). Their size also attracts attention, while their flight is clumsy and heavy, and they do not rise quickly when at rest.	Stings.	*Bombus* ? sp., killed, but not swallowed, by *L. viridis.*	*Bombus terres* is eaten by *L. viridis,* after cautious disablement, as in the case of Bees. Only eaten when hungry.
Nomada marshamella.	Very conspicuous, with black and yellow bands.	Sting.	....	....

(*continued*).

Experiments.		How far evidence supports the theory of "warning" and "mimetic" colours (Bates and Wallace).	Bearing of evidence on Poulton's suggestion, as before.
A. Weismann.	E. B. Poulton.		
Always rejected by *L. viridis*.	....	Strong support.	No evidence.
....	Refused by Frogs without tasting; also by Lizards. Miss Cundell tells me that *Hyla arborea* will eat Lady-birds in the winter when food is scarce.	Strong support.	Strong support from Miss Cundell's observation.
....	Refused by Frogs without tasting. See Miss Cundell's observation quoted above.	Strong support. Wallace also says of the Coccinellidæ, to which family this and the last species belong:—"Certainly rejected by some birds;" but no details are given.	Strong support from Miss Cundell's observation.
....	Three Frogs in succession caught one queen Wasp and then released it very quickly, and after that it was untouched. Lizards would not touch it, but watched it narrowly.	Strong support. Romanes also told me he had seen a Spider capture a Wasp, and its great caution in the process was a further support, as also is the fact that Spiders generally release Wasps from their webs.	The Frogs went as far as or farther than could have been expected.
....	*Bombus lapidarius* eaten by *L. viridis*, but I have not witnessed the method. Refused on many occasions.	Support, upon the whole; they would certainly not have been touched by the Lizards if there had been abundance of other food.	Strong support for an analogous suggestion for insects protected by stings instead of by a nauseous taste.
....	Untouched by any of the Lizards.	Strong support.	This seems to indicate that the fear of a sting is very strong; for when the insects are too active to be killed without stinging (also the case with Wasps), they are not touched by the Lizards.

		I. Disregarded.	II. Tasted and then rejected.	III. Eaten when very hungry, and evidently much disliked.	IV. Eaten, but not relished.	V. Eaten with pleasure.
A.	*Chrysomela populi*	L.				
	Malacoderms of the genus *Telephorus*	B.				
	Nomada marshamella.	L.				
B.	*Vespa vulgaris*	L., F.	F.			
C.	*A. filipendulæ*	L.	...	B.		
	A. grossulariata	L.	L.	...	...	F.? (I think a mistake).
	S. menthastri	B.	B.	B.		
	E. jacobææ	L.	...	B.	...	F. (at the time).
	Bombus terrestris, B. lapidarius, &c.	L.	L.	L.		
	Coccinella bipunctata	F.	...	F.		
	Coccinella septem-punctata	F., L.	...	F.		
D.	...	...	...	...	...	...
E.	Pupa of *A. grossulariata*	...	...	L. or II.		
	S. lubricipeda	...	...	L.? or IV. or V.		
	S. fuciformis	...	...	...	...	L.
	P. auriflua	...	...	...	...	L.? or IV. or III.

insect-eaters. Again, only one species out of the 9, viz. *Nomada marshamella*, always remained untouched by very hungry animals when other food was withheld; and we can only surmise as to what would have been the results if the other 8 had been similarly tested. It is, however, quite certain that many of them would have failed. This is, indeed, proved by the following figures:—Out of the 37 cases 15 were exposed to this rigid test, *i. e.* the species in the columns under my name in Tables I., II., and IV. (excluding *S. fuciformis* and *C. neustria*), and of the 15 only three remained untasted, and of these two have been shown by Miss Cundell to be eaten under certain circumstances.

Looking at all these figures, and especially the last, we can well understand the following objection being urged against Wallace's suggestion. It may be said, the tables, indeed, show that Wallace was right in predicting that an unpleasant attribute would be found to be associated with a conspicuous appearance. That has certainly been proved by the results of a vast majority of the experiments; but of what value is this association when insects are seized, tasted, and rejected in spite of the warning colours which, *ex hypothesi*, are assumed to prevent this very contingency? In the first place, an answer to the objection is found in the very fact that the insects were tasted and rejected to a much greater extent when the vertebrates were thoroughly hungry, for we see that when other food is present the conspicuous insects are, as a rule, untasted. We shall presently see that an inconspicuous but nauseous insect is approached by Lizards in a very different way from one which is conspicuous and nauseous. There was, in fact, strong evidence in the details of some of my experiments, that the vertebrate enemies were well aware that the insects were distasteful, and yet, when exceedingly hungry, did their best, in some cases successfully, to eat them. This was especially seen in the behaviour of the Lizards towards the larvæ of *O. potatoria*, *P. bucephala*, and *Crœsus septentrionalis* in my experiments, and towards the larvæ of *C. neustria*, *A. grossulariata*, and *P. auriflua* in Jenner Weir's experiments; for in all these cases the Lizards made repeated attempts to eat the larvæ, again and again rejecting their prey with every sign of disgust (rubbing the mouth against the cage); and yet in the end the larvæ were reluctantly eaten. I believe, however, that the suspicion with which conspicuous insects are approached results from the strongly impressed experiences of early youth and not from a habit which has become hereditary. In many cases, however, the warning experience may have been gained without tasting the insects; for we have seen that the latter are often protected by smell, which can be perceived from a distance. Excluding these instances, however, the experience of conspicuous nauseous forms must have been gained by actual trial of a large number. I hope to be able to show that it is not necessary for the young insect-eating Vertebrate to actually make trial of every species of unpleasant-tasting insect in its locality, in order to be equipped with an efficient stock of experiences with which to conduct its later life.

Such an education would be somewhat dearly bought; it would be unpleasant to the insect-eater and destructive to the insect. But if, as I shall endeavour to show, there is a superficial resemblance between the colours employed by very different insects, and frequently even a similarity of pattern, we see that a comparatively few unpleasant experiences would be sufficient to create a prejudice against any insect with colours and patterns at all resembling the nauseous forms which have already produced so indelible an impression upon the memory. And thus it is most probable that the conspicuous appearance which astonishes one sense becomes associated in the mind of the Vertebrate insect-eater with the well-remembered effect of other qualities upon other senses. Different Vertebrates vary much in their rates of education. Thus my Frogs were much more stupid in this respect than the Lizards; but then the imperfect memory or limited power of generalization in Frogs is less fatal to insects than it would be in the case of the other Vertebrates; for I do not think that the larvæ were ever injured in the least after having been tasted by these animals. It is therefore probable that the gradual development of warning colours by natural selection was due to the fatalities which followed the experimental tasting of other Vertebrate enemies (especially Birds and Lizards), which inflict incidental injuries during the process of tasting. But the warning appearance having been acquired by such means, the Frogs have certainly taken the opportunity (thus offered to them ready-made and without having themselves contributed towards its existence) to acquire a somewhat limited education. This was seen in the case of the queen wasp (see Appendix II.), which on being placed in the case was tasted by three Frogs out of twelve, but afterwards was untouched for many hours (as far as I was able to observe). A proof of the limited extent of the education is given by Butler, who speaks as if his Frogs repeatedly tried to eat the two species of nauseous larvæ (*A. grossulariata* and *H. wavaria*), seeming only to become suspicious when they had actually made a trial of the insects on each separate occasion. It also seemed to me that my Frogs generally, if not always, ate bees from want of memory or deficient discrimination; for in nearly all cases they were finally rejected. But the experience did not seem to make any difference to the readiness with which the next bee would be seized and again rejected. On the other hand I did not see a ladybird tasted on any occasion. The slight power of discrimination possessed by Frogs was also shown by the fact that they frequently jumped at and seized the dark-coloured ends of the forceps with which I used to introduce insects into their case.

For the tolerably complete demonstration of the principle which I believe has been at work, a far larger number of observations are necessary, while complete confirmation requires experimental evidence with young Vertebrates which have been reared in confinement, so that the whole of their education is under observation. As conducing towards this end, I publish the suggestion with its foundation on the resemblances indicated by the tables given below, which have this advantage, that they only include insects which have been subjected to actual experiment. Although the tables comprise so few instances, I think that the resemblances of colour and pattern are most remarkable, and hard to explain under any other theory. My suggestion does at any rate point out a very obvious use for the resemblances. The advantages which every conspicuous and nauseous or dangerous species would gain by setting as simple a lesson as possible to the foes of its class, would be so great that there is no difficulty whatever in the supposition that every stage towards convergence in colours and in patterns would have been beneficial, and, as such, would have come under the influence of natural selection. It is to be noted that advantage would accrue in the greater thoroughness of the education, no less than by shortening the process; for a few colours, with a few simple patterns scattered over a number of species, would be remembered more easily than a larger number with a separate pattern in nearly every species.

I am aware that this suggestion is but an extension to the whole group of conspicuous insects of the explanation offered by Fritz Müller to a fact which seemed for a long time an inexplicable difficulty, the undoubted fact that conspicuous butterflies presumably protected in the most complete manner by nauseous attributes, nevertheless mimic each other in the most unmistakable way. Bates, the original discoverer of "mimicry" in the animal kingdom, pointed out these apparently mysterious resemblances in the paper in which "mimicry" was itself explained and illustrated. Wallace looked upon these obscure similarities between protected forms as due to some unknown cause connected with locality.

It remained for Dr. Fritz Müller to explain the difficulties in a paper entitled "*Ituna* and *Thyridia*; a remarkable case of Mimicry in Butterflies" ('Kosmos,' May 1879, p. 100). Arguing from the instance of these two genera, which both belong to protected groups and which resemble each other, Dr. Müller suggested that under these circumstances an advantage would be gained by each of them, because the number of species which must be sacrificed to the inexperience of young birds and other enemies would be made up by both of them instead of by each independently. This paper was translated by Prof. Meldola, and appeared in the 'Proc. Ent. Soc. Lond.' (1879, p. xx). In a subsequent paper by Dr. Müller ('Kosmos,' v. Jahrgang, 1881), the same subject is considered in greater detail, and the results are accepted and expounded by Wallace in 'Nature' (vol. xxvi. p. 86). The mathematical aspect of the subject was, however, inaccurately stated in this last paper, the correct statement being supplied by Mr. Blakiston and Mr. Alexander of Tokio, Japan; the correction being published in letters by Mr. Wallace and Prof. Meldola to 'Nature' (vol. xxvii. p. 481). Subsequently a letter appeared in 'Nature' (vol. xxix. p. 405) from Mr. Blakiston and Mr. Alexander, giving the complete mathematical statement of the advantages gained by each of the protected species. The law is given in these words, "Let there be two species of insects equally distasteful to young birds, and let it be supposed that the birds would destroy the same number of individuals of each, before they were educated to avoid them. Then if these insects are thoroughly mixed, and become undistinguishable to the birds, a *proportionate advantage* accrues to each over its former state of existence. These *proportionate advantages* are inversely in the duplicate ratio of their respective original numbers, compounded with the ratio of the respective percentages that would have survived without the mimicry."

It had been previously argued that in the case of two protected species which had thus come to resemble each other, the proportionate advantage was chiefly on the side of the one which was smaller in numbers, and that when the numerical difference was great the advantage to the other could be neglected. The amended law which is quoted above shows, however, that the proportionate advantage is always the same, and this is also enforced in another part of the same letter:—"It must be remembered, however, that B does no harm to A by mimicking it; on the contrary the act of mimicry is of advantage to A over its former state of existence as well as to B; but A being more numerous the advantage is less. Still, after the assimilation, neither has an advantage *over the other*. Proportionally they suffer from the ravages of birds equally; the percentage of losses is the same; they are on equal terms. No matter how long they continue the association, neither gains or loses on the other; though through one being more numerous it loses more individuals, yet equally in proportion with the other. So that if one is twice as numerous as the other at the time of assimilation, it must always—other conditions being equal—remain twice as numerous."

Dr. Müller's interpretation was at first criticized in many quarters, the chief objection brought forward being the belief that birds do not learn the meaning of the conspicuous colours by experience, but that they avoid such insects by instinct, the ancestral experience having become hereditary. There is, however, no direct evidence for this view, and I think the account of J. Jenner Weir's observations upon Lizards, and my own upon Lizards and Frogs (given in the two Appendices to this paper), will go far to furnish an experimental refutation of such a theory, so far as these animals are concerned. In addition to this, I am assured by a very keen observer, Rev. G. J. Burch, that recently hatched chickens certainly do peck at insects which they afterwards learn to avoid without trial, and he believes that the hen assists in their education by indicating that certain insects are not fit for food. His observations were chiefly made upon a common phytophagous Hymenopterous larva which is found upon gooseberry (doubtless *Nematus ribesii*). Another observation made by Mr. Burch bears upon the same question. He offered his chickens a quantity of chickweed, knowing that this plant was often given as food to Linnets. The chickens ate the plant readily enough, but they were all extremely unwell in consequence, and vomited freely. After this Mr. Burch again offered them chickweed, but they had profited by the experience and would not touch it.

The chief attack upon Dr. Müller's suggestion was made by Mr. W.

L. Distant ('Nature,' vol. xxvi. p. 105; and 'Rhopalocera Malayana,' pt. ii. p. 33); but all his objections were very completely answered by Prof. Meldola ('Ann. & Mag. Nat. Hist.' Dec. 1882), who, in his concluding sentences, largely anticipates that further extension of Fritz Müller's theory which is here brought forward, the suggestion that all the conspicuous and dangerous or distasteful species in any country will be found to share between them a few strongly contrasted colours, arranged in few and simple patterns again and again repeated. He says:—"I am persuaded that the extension of the theory of mimicry proposed by Fritz Müller marks a great advance in our views on this subject, which is so interesting as having been the first to which the Darwinian Theory of Evolution was applied with such success by Mr. Bates. Not only are we now in possession of a consistent theory which enables us to dispense with mysterious and 'unknown local causes,' but other groups of facts hitherto incomprehensible are capable of explanation. Thus the prevalence of one type of marking and colouring throughout immense numbers of species in protected groups, such as the tawny species of *Danais,* the barred *Heliconias,* the blue-black *Euplœas,* and the fulvous *Acræas,* is perfectly intelligible in the light of the new hypothesis. While the unknown factors of species-transformation have in these cases caused divergence in certain characters, other characters, viz. superficial colouring and marking, have been approximated or prevented from diverging by the action of natural selection, every facility having been afforded for the action of this agency *by virtue of the near blood-relationship of the species concerned.* When discussing the origin of mimicry, Mr. Darwin long ago suggested that it might have commenced at a time when the species were nearly related in marking and colouring." The suggestion here brought forward and depending upon the results which are tabulated below, is a further extension of the same principles, so that certain resemblances between insects belonging to very different groups are accounted for on the supposition that natural selection has not only prevented divergence in nearly related forms which were originally similar, but has in other cases actually determined the convergence of widely separated forms which were originally unlike. This latter explanation of the resemblances was intended by Fritz Müller in his paper on "*Ituna* and *Thyridia,*" for he looked upon these genera as widely separated, and their similarity as due to convergence. There appears, however, to be some dispute as to their true affinities. It is obvious that under Prof. Meldola's suggestion we shall expect to find a far greater similarity between the species of a large group of closely allied nauseous insects in any country than between those of other large groups protected in other ways; while, on the other hand, there is no necessity for the expectation of equal uniformity among the isolated nauseous species or even among those belonging to small nauseous groups. We should rather expect the constant appearance of a few simple but very different patterns, made up of a few strongly contrasted colours; and this is precisely the arrangement which is proved to obtain by the tabulation of the appearances of all such species known to be nauseous or dangerous. There must certainly be a tendency towards a further general convergence, but the existing condition of convergence round a few well-marked types of pattern and colouring must be highly beneficial, and there was in this case no initial uniformity due to close affinity, upon which to base a general and uniform system. It was in fact *à priori* far more likely that the convergence of remote species should have been round a few successful types, while the prevention of divergence among closely related species must *ipso facto* have tended to produce concentration round a single type. It will be shown below that Fritz Müller's principle is probably attended by others, which also assist in producing convergence, at any rate in some cases.

Another result of the different origin of the two classes of resemblance alluded to above is that the uniform warning colours of a large group of closely related species are less conspicuous, and in themselves possess less of "warning" characteristics, than those of the smaller groups into which the isolated nauseous species tend to converge; for the former depend largely upon some ornamental type of colour and marking, due to sexual selection, and prevalent before the time when the nauseous attributes arose. Such a type has no doubt been modified in the direction of greater conspicuousness on the uppersides of the wings, while bright colours have appeared on their undersides, and the mode of flight has been changed into one which gives the colours their maximum effect; but still, in spite of these changes, the whole appearance of such large groups presents us with the ancestral sexually selected colours and patterns, which are of great beauty, and are no doubt still of great significance as secondary sexual characters. The success of such a stereotyped ornamental appearance for warning purposes has depended upon the modifications alluded to above, but principally upon the very fact of its prevalence and uniformity. On the other hand the smaller convergent groups of nauseous insects often present us with ideally perfect types of warning patterns and colours—simple, crude, strongly contrasted—everything subordinated to the paramount necessity of becoming conspicuous. For the nauseous attributes arising independently among the scattered species of many genera, or in all the species of small genera, instead of being chiefly concentrated among the members of some one or two dominant groups, it must have become impossible to rely upon the slightly altered ornamental appearance existing at the time when the attributes arose; but it was necessary to appeal strongly to the memory of enemies by the acquisition of some special form of pattern and colour, in which everything is subordinated to the "warning" characteristics. In the one class the pre-existing ornamental appearance was sufficiently well known to serve as a warning; in the other class it was not sufficiently well known.

It is quite clear that the two classes of resemblance which have been just considered must be carefully distinguished from true mimicry, in which the mimicking species is without any unpleasant attribute, but shelters itself under the reputation of the (nearly always) more abundant species which it resembles. In the former classes of resemblance we have groups of two or more conspicuous forms all possessing unpleasant attributes, which become convergent in external appearance, or which maintain an initial uniformity, and in either case are mutually benefited by the process. In the latter class the resemblance would be a source of danger to the mimicked species if the edibility of the mimicking species were discovered ; and the experiments detailed in the present paper show how likely it is that such qualities would be discovered if the latter species became relatively abundant. Nevertheless, *until the discovery was made*, the mimicry would be an advantage to both species, for the reasons already adduced. In the following Table the colours of conspicuous insects are tabulated, *i. e.*, those contained in Tables I. and IV., excluding *S. fuciformis* and the conspicuous larva of *L. pini*, the latter being omitted because I have never seen a specimen, and because the appearance differs greatly in the various figures I have been able to consult (see Table A, pp. 232–235).

I have described the colours of the imagos at rest to correspond with the larvæ and pupæ ; in flight the following effects are seen :—Imagos of Wasp, *Bombus*, *Nomada marshamella*, *E. jacobææ*, *A. filipendulæ*, *A. grossulariata*, the two Coccinellidæ, *Telephorus* and *Chrysomela*, would show much the same colours as at rest, although in *E. jacobææ* and *A. filipendulæ* the red would be in larger amount because of the under wings, and in the Coccinellidæ, *Telephorus* and *Chrysomela*, the black would be in far larger amount because of the body. The imagos of *S. menthastri*, *S. lubricipeda*, and *P. auriflua* would hardly show the black spots in flight, but would appear whitish, yellowish, and white respectively.

This comparison is exceedingly interesting if it is remembered that the colours which are repeated again and again are those which are known to produce the greatest effect. Thus the greatest possible contrast is afforded by black and white, and next to this by black (or some very dark colour) and yellow, orange, or red, the brightest colours in the spectrum, which possess a far higher illuminating-power than any of the others. Hence we find that the colours of all the conspicuous insects which have been tested are in all except five cases included in the short list given above. And these five only differ in the inclusion of blue in one case, and of green in the other four cases. Hence we probably see that in addition to the advantage gained by convergence which has been alluded to above, benefits have been derived from the colours which have been employed ; and as the choice of the most conspicuous colours is limited, it is seen that a certain amount of similarity must follow incidentally from the number of forms of life among which the few combinations are divided. Hence convergence has been aided and perhaps given its starting-point by the action of another principle of coloration also favoured by natural selection, and leading in the same direction as convergence itself (see Table B, pp. 236, 237).

Just as similarity in colours was favoured by the limited number of suitable combinations, so there are a few eminently conspicuous

TABLE A.—*The Colours*

Various classes of Colours. (When incompletely described in this column, the correct details are given in the columns to the right.)	Dark Ground-colour and Lighter Secondary Colours.				
	Species.	Ground-colour.	Colour next in importance.	3rd colour.	4th colour.
I. Black and white or white and black. 2 forms.	Larva of *V. io* ……	Intense black.	White points.		
II. White, black, and yellow. 3 forms.	……………	……… …..	………	………	………
III. Black and yellow or yellow and black. 10 forms.	Pupa of *A. grossulariata.*	Black.	Yellow.		
	Imago of *Nomada marshamella.*	Black.	Yellow.		
	Imago of *Vespa vulgaris.*	Black.	Yellow.		
	Imago of many species of *Bombus.*	Dark brown or black.	Yellow or orange.		
	Larva of *V. urticæ*	Black.	Yellow points and often bands.		
	Larva of *P. brassicæ*	Bluish green, with black spots, so that effect is very dark.	Yellow.		
IV. Black and red or red and black. 6 forms.	Imago of *E. jacobææ* (as seen at rest).	Very dark brown; effect black.	Red.		
	Imago of *A. filipendulæ* (as seen at rest).	Greenish black; effect black.	Red.		
	Imago of common species of *Telephorus.*	Black.	Red.		
V. Black, red, and white. 4 forms.	Larva of *D. euphorbiæ.*	Black.	Red.	Yellow or white.	
	Larva of *P. auriflua.*	Black.	Red.	White.	
	Larva of *E. lanestris.*	Black.	Reddish.	White.	
	Larva of *O. antiqua*	Dark brown; effect black.	Pink.	White or yellow.	

of Conspicuous Insects.

Light Ground-colour and Darker Secondary Colours.				
Species.	Ground-colour.	Colour next in importance.	3rd colour.	4th colour.
Imago of *S. menthastri* (as seen at rest).	Creamy white.	Black.		
Imago of *A. grossulariata* (as seen at rest).	White.	Black.	Yellow.	
Imago of *P. auriflua* (as seen at rest).	White.	Yellow.	Black.	
Larva of *A. grossulariata* ...	Cream.	Black.	Orange.	
Imago of *S. lubricipeda* (as seen at rest).	Buff.	Black.		
Larva of *E. jacobææ*	Yellow.	Black.		
Larva of *A. filipendulæ* ...	Yellow.	Black.		
Larva of *P. bucephala*	Yellow (becoming orange in parts).	Black.		
Imago of *Coccinella septem-punctata*.	Red.	Black.		
Imago of *Coccinella bipunctata*.	Red.	Black.		
Imago of *Chrysomela populi*	Red.	Blue-black.		

TABLE A

Various classes of Colours. (When incompletely described in this column, the correct details are given in the columns to the right).	Dark Ground-colour and Lighter Secondary Colours.				
	Species.	Ground-colour.	Colour next in importance.	3rd colour.	4th colour.
VI. Black, red, blue, and white. 1 form.	Larva of *C. neustria.*	Difficult to determine upon, but probably black, because it occurs so frequently between the other colours and mixed with them; also underside is dark.	Orange-red.	Blue.	White.
VII. Brown, yellow, and black. 1 form.	Larva of *H. defoliaria.*	Reddish brown.	Yellow.	Black.	
VIII. Green, yellow, and black, or green, black, and yellow. 4 forms.	....	....	....	....	....

and simple patterns which are in this case especially adapted for the respective stages of the various nauseous or dangerous insects.

Ring-patterns.—Especially suited to the cylindrical body-form, such as that of larvæ, pupæ, or of imagos with colourless wings (Hymenoptera &c.). Accordingly we find this pattern developed in such stages, and it is also often suggested on the visible part of the body of other forms.

Longitudinal Stripes.—Also especially suited to the cylindrical body-form, and accordingly it is entirely found in larvæ and in the attenuated imagos of the genus *Telephorus.*

Spots.—Especially suited to a wide coloured expanse, such as that provided by the wings of Lepidoptera or the elytra of many Coleoptera, but also fairly adapted to the cylindrical body-form, and accordingly it is characteristic of conspicuous Lepidopterous and Coleopterous imagos, only two of the four included larvæ possessing

(continued).

Light Ground-colour and Darker Secondary Colours.

Species.	Ground-colour.	Colour next in importance.	3rd colour.	4th colour.
Larva of *C. verbasci*	Pale green.	Yellow.	Black.	
Larva of *D. cæruleocephala*	Smoky green.	Yellow.	Black.	
Larva of *H. wavaria*	Green, varying to lead-colour.	Yellow.	Smoky.	
Larva of *D. galii*	Yellow, varying through light green, olive-green, various shades of brown to black (in the last case should be in opposite column).	Black.	Yellow or white.	

it in at all a marked degree (*A. grossulariata* and *A. filipendulæ*), and one of these is partially striped.

Combination of Ring and Stripe, and of Ring and Spot, and Stripe and Spot.—Also suited to the cylindrical body-form, and occurring in larvæ and in one imago only (*E. jacobææ*).

Hence the existing arrangement of many widely separated conspicuous insects possessing a similar type of pattern is due to the fact that there is a limited choice of available patterns, as well as to the factors conducing to convergence. In addition to this there is probably in some cases a certain amount of true mimicry in the acquisition of patterns and colours. Thus it is more than probable (as has been previously suggested by other observers) that the species rendered conspicuous by alternate rings of black and yellow gain great advantages from the justly respected appearance of Hornets and Wasps. It must not be forgotten, however, that the latter

TABLE B.—*The Patterns of Conspicuous Insects.*

I. RING PATTERNS.		
Pattern developed on abdominal segments	Pupa of *A. grossulariata* ... Imago of *Vespa*, *Nomada*, and *Bombus*.	Alternating rings of yellow and black.
Developed on whole length of body.	Larva of *E. jacobææ*	
II. LONGITUDINAL STRIPES.		
Stripes numerous	Larva of *P. bucephala*	Alternating stripes of black (or dark ground-colour) and yellow.
Stripes few.................	Larva of *V. urticæ* (a common var.). Larva of *P. brassicæ*	
Stripes few....................	Larva of *D. cæruleocephala*	Smoky green and yellow stripes; black dots. Perhaps should be included in VI.
Stripes few....................	Imago of *Telephorus*.........	Black, with a red stripe on each side.
Smoky stripes many; yellow, one on each side.	Larva of *H. wavaria*	Green (variable), with smoky and yellow stripes.
Striped appearance only visible from the side.	Larva of *H. defoliaria*	Brown above and yellow below; narrow black between.
The one white stripe on each side is due to white hairs; four red stripes.	Larva of *P. auriflua*	Black, with red and white stripes.
Single dorsal white; one blue, three orange-red on each side, and black alternating with these in nearly all cases.	Larva of *C. neustria*	Stripes black, orange-red, blue and white.

III. SPOTS.

		Ground.	Spots.
Yellow band and blotch on each fore wing; spots numerous; body yellow, with black spots.	Imago of *A. grossulariata* (as seen at rest).	White.	Black.
Spots numerous..............	Imago of *S. menthastri* (as seen at rest).	White.	Black.
Few black patches and a yellow tuft on end of body.	Imago of *P. auriflua*.........	White.	Black.
Orange stripe; spots few, but far the more important feature; otherwise the larva should be included in VI.	Larva of *A. grossulariata*...	Cream.	Black.
Some of the spots fuse into an irregular line on each fore wing; spots not numerous.	Imago of *S. lubricipeda* (as seen at rest).	Buff.	Black.

TABLE B (*continued*).

III. SPOTS (*continued*).			
		Ground.	Spots.
Spots few	Larva of *A. filipendulæ*	Yellow.	Black.
Seven black spots	Imago of *Coccinella septempunctata*.	Red.	Black.
Two black spots	Imago of *Coccinella bipunctata*.	Red.	Black.
Spots so minute as to produce little effect.	Larva of *V. io*	Black.	White.
Spots so minute as to produce little effect.	Larva of *V. urticæ* (normal form).	Black.	Yellow.
Six spots	Imago of *A. filipendulæ* (as seen at rest).	Black.	Red.

IV. COMBINATION OF RING AND STRIPE.		
Few small white spots also present; rings due to hair-bearing tubercles.	Larva of *E. lanestris*	Black, with incomplete reddish rings and narrow white stripe on each side.

V. COMBINATION OF RING AND SPOT.		
Spots on the yellow rings...	Larva of *C. verbasci*	Green, with incomplete yellow rings and black spots.

VI. COMBINATION OF STRIPE AND SPOT.		
Dots very minute and produce little effect.	Larva of *D. euphorbiæ*	Black, with red blotches and stripes and white or yellow dots.
Two spots and two stripes on each fore wing.	Imago of *E. jacobææ* (as seen at rest).	Black, with red stripes and spots.

VII. NOT REFERABLE TO THE ABOVE TYPES.		
One blotch on each segment. Perhaps referable to the spot-pattern III.	Larva of *D. galii*	Variable ground-colour, with a row of black blotches, each containing a pale area.
The pink colour is scattered in a kind of spot and stripe system.	Larva of *O. antiqua*	The effect chiefly made up by the dark- and light-coloured tufts of hair.
Two unequal areas with opposite colours.	Imago of *Chrysomela populi*	Large posterior part red, small anterior part blue-black.

The patterns in flight in the imagos would be different in many cases. In *E. jacobææ* and *A. filipendulæ* a conspicuous but confused mixture of red and black is seen. The slow flight of *A. grossulariata* permits its pattern to be seen almost as at rest. The others are as above described after Table A.

forms also probably gain to some extent by the greater publicity which follows from the resemblance. We therefore see that the force which tends towards the acquisition of similar forms of colour and marking in widely different organisms is itself the resultant of other forces varying in relative amounts in the different species. Of these primary forces we have been enabled to detect two in the majority of cases, and three in the minority, *i. e.* (1) The feasibility of certain colours and patterns depending upon their effect on the vertebrate eye, and thus giving the enemies as easy an education as possible; (2) The advantage of facilitating the education of enemies by giving them a small number of patterns and colours to learn; and (3) The great additional advantage conferred by trading upon the reputation of a well-known and much-feared or much-disliked insect.

These may probably be looked upon as the chief primary forces which have determined the various forms of conspicuous appearance. But such forces have had very different material to work upon in the different species, and doubtless the resultant has been largely influenced by the protective colours which existed before the "warning" colours and markings arose, and which formed the material on which the first steps (at any rate) were built. We can, in fact, point to certain conditions in the "warning" appearance of some species which are almost certainly remnants of a previous mode of defence due to protective coloration. Thus Prof. Meldola has drawn my attention to an opinion expressed by Mr. T. W. Wood ("Insects in Disguise," Student, 1868), that the larvæ of *E. jacobææ* are protected by their resemblance to the flowers of the ragwort. I believe that in the orange ground-colour of this species we have such a remnant of a former resemblance to the flowers of this plant and the groundsel, on which the species also feeds. The acquisition of the black bands and, above all, the gregarious habits are, then, later developments which have followed the acquisition of an unpleasant taste. Here it is seen that the material at the disposal of the primary forces tending towards a "warning" appearance was such as to render most probable the resultant which has actually obtained.

Again, Mr. Thomas Eedle informed Prof. Meldola that he believed the larva of *C. verbasci* resembles the flowers of its food-plant, mullein. Here, again, I entirely agree with this observation. There is a great deal in the larva which harmonizes extremely well with the yellow and dark sessile flowers, studded upon the surface of the thick green spike, and surrounded by green unopened flowers. In this case it is probable that the pattern may have been rendered a little more distinct; but the very conspicuous appearance practically depends upon the gregarious habit, and upon the fact that the larvæ do not chiefly rest upon the spike, but are commonly seen upon the uppersides of the large leaves, forming a background against which the larval colours appear with startling distinctness. But, as Mr. Eedle maintains, an isolated larva on the flowering-spike is evidently well protected by colour-harmony with its surroundings. These are but instances of the past history which must be deciphered before we can adequately appreciate the meaning of the colours and markings of any animal.

III. *Insects which evade their Enemies.*

We now come to Wallace's converse suggestion—that just as conspicuous forms which court observation will be avoided, so the insects which harmonize with their surroundings, and which evade their enemies, will be greedily eaten when detected and caught. I have adopted Meldola's suggestion that the terms "protective resemblance" should be applied to the appearances which tend to deceive enemies by their resemblance to motionless (vegetal or mineral) surroundings, the term "mimicry" denoting the resemblance to other animals. On entering upon the experimental investigation, I thought that I should have little to record except a complete agreement with everything which has been previously said upon the subject. I was surprised, however, to find some instances which are entirely antagonistic to the principles laid down by Wallace. Unfortunately the instances recorded by other observers are exceedingly few. Jenner Weir evidently experimented with a large number of species, but he gives very few details, and for the most part is content with summing-up his results as favourable, without exception, to Wallace's suggestion, in these words:—"I will now add a few words on those larvæ which are eaten greedily by birds, and my remarks on the subject will be brief; it will be unnecessary to detail all the experiments made, as the results are easily generalized.

"All caterpillars whose habits are nocturnal, dull-coloured, with fleshy bodies and smooth skins, are eaten with the greatest avidity.

"Every species of green caterpillar is also much relished.

"All Geometræ, whose larvæ resemble twigs as they stand out from the plant on their anal prolegs, are invariably eaten. . . . . They eat with great relish all smooth-skinned larvæ of a green or dull-brown colour, which are nearly always nocturnal in their habits, or mimic the colour or appearance of the plant they frequent."

Jenner Weir, however, gives details of experiments with other stages of Lepidoptera; and I am now able to add many valuable details from his experiments upon Lizards in 1886. There are also a few instances to include from Mr. Butler's paper (already quoted) and a few of which I have heard from him by letter. In my experiments I chiefly made use of the imagos of Lepidoptera, as I nearly always sought for conspicuous larvæ with which to test the suggestion previously discussed.

Other observers having given so little detail, it follows that Wallace's converse suggestion possesses extremely little precisely recorded experimental foundation. There is, however, no reason to doubt that Jenner Weir's conclusions will be very generally confirmed by extended experiments, and they doubtless express the results of many observations. But as I have come across a few startling exceptions among the most protectively coloured forms, it is safer not to assume the existence of any great body of confirmatory evidence until it has all been rigidly tested and recorded.

It will be unnecessary to separate the larvæ from the other stages, because the meaning of imitative colours is equally clear whenever they occur, while the warning colours of imagos might in some cases be mistaken for those of other significance. I will proceed at once to tabulate everything I have been able to find recorded, and will afterwards consider in detail the more remarkable cases. I have already implied that I believe the larvæ of *Papilio machaon* should be included in the Table given below. Prof. Meldola has since shown me that Mr. T. W. Wood has also taken this view of the colours of *P. machaon* (see a paper in 'The Student,' 1868, entitled "Insects in Disguise"). I believe that the bright green colouring broken up by black markings is very well adapted for concealment among the much-divided leaves of the Umbelliferæ on which the larva feeds. I also consider that the imago of *S. fuciformis* should be included (see Table V., pp. 242–259).

Looking back at this list we see that as a whole its results offer the most decided contrast to those of the previous lists, inasmuch as the vast majority of species are in this case devoured with relish. But while it thus supports the converse side of Wallace's suggestion, this is by no means so universally true as Jenner Weir's earlier experiments led him to believe. Out of a total of 44 different species, or stages, of Lepidoptera, we find 7 exceptions, viz:—Imagos of *S. ligustri, P. bucephala,* and *O. antiqua*; pupæ of *V. io, V. urticæ, P. bucephala*; and the larva of *M. typica*. Two of these appear for the first time in Table V., while the others have appeared before in other stages in the earlier tables. Deferring the consideration of the latter, we will take the two species rather more in detail.

Imago of Sphinx ligustri.—I think the evidence in this case speaks for itself, and demonstrates very completely the protective importance of mere size, unaccompanied by other alarming features or by any means of active defence. The species is admirably protected at rest and must be most carefully concealed. After twenty years, during which I have looked for insects, I have only once seen the moth at rest. Again, its flight is probably as rapid as that of any species in the world. The behaviour of *Lacerta viridis* seemed to clearly show that the moth was highly palatable, as we should expect from its very perfect means of evading its enemies. And yet the much smaller *L. muralis* would not touch the insect. If the supposition be raised that the moth possessed some smell, which was disliked by *L. muralis*, but to which *L. viridis* was indifferent, I can only say that I have met with no other instance of any difference of tastes when I experimented upon the two Lizards with the same species of insect. And if this be the correct explanation why the moth was untouched after spending many hours in the cage of *L. muralis*, I cannot but think that *L. viridis* would have shown some reluctance in devouring it, although it might have ultimately eaten it under the impulse of hunger. And, again, *L. muralis* was more ravenous than any of my Lizards; and the above tables show clearly that I have chiefly relied upon this species for the evidence that hunger will force a Vertebrate to eat an insect which is evidently distasteful to it. Further the *L. viridis* being less used for this purpose, were not pressed by hunger to the same extent as *L. muralis*. I think that the almost certain explanation is that *L. muralis* was afraid to touch an insect which was not far from its own size, while *L. viridis* was less timid, the difference in size being far greater. And such an explanation throws light on the cases already discussed, in which a large caterpillar is protected by gaining some marking which suggests the appearance of a serpent. On this point Weismann says (Meldola's translation as above, p. 330):—"It does not require much imagination to see in such a caterpillar an alarming monster with fiery eyes, *especially if we consider the size which it must appear to an enemy such as a lizard or small bird.*" The case of *S. ligustri* enforces this last remark, and shows how size *alone* may be efficient as a protection against the smaller insect-eating Vertebrates. So far as I am aware, this important use of size, unaccompanied by any accessory markings or any special attitude, is now brought forward for the first time; but it is an advantage which is probably far from uncommon, considering the number of large species in the same position as *S. ligustri*, and it has doubtless been of special importance as an initial stage in the development of the more elaborated forms of terrifying appearance already described.

Larva of Mania typica.—In this case it was perfectly clear that the larva possessed a very unpleasant taste, so that it was refused by *L. muralis* even when very hungry. And yet the description given in the table shows that the species is highly protected in the larval state by protective colouring and habits which correspond. As the exception is so important, I will add a few details to the proofs given in the table. Newman gives the following facts about the young larvæ: when hatched from the eggs laid upon the leaves of pear, plum, &c., the larvæ "devour the upper cuticle and parenchyma of the leaf, leaving the lower cuticle entire, dry and brown; they lie closely packed side by side and apparently motionless," but in reality gradually moving onwards, "leaving a larger brown space behind." We see here a most interesting adaptation of the surroundings to the brown colour of the larva. A brown larva is conspicuous on a green leaf, and a single larva could not eat away the cuticle so as to surround itself with a brown area of sufficient size until after the lapse of considerable time. Hence the subordination of gregarious habits to ends which are the exact opposite of those usually sought, viz. the intensification of warning colours. We have therefore a most elaborate and perfect mode of concealment in the younger stages of larval life. It is obvious, however, that such a method can only be successfully adopted while the larvæ are very small, so that a large number of them can rest for a long time on a single leaf. Accordingly Newman tells us that "in a few days, perhaps from ten to fifteen, they abandon this arboreal life," and descending, feed upon many kinds of low-growing plants. It hybernates in October, and again feeds greedily in the following spring; but,

TABLE V.—*Experiments with Insects which are protectively*

Species and Stage.	Protective resemblance, or habits of concealment, evasion, &c.
	1. LEPIDOPTEROUS
Larva *Saturnia carpini* ...	The green larva with its black bands and pink tubercles harmonizes remarkably well with the heather on which it feeds (*Andrew Murray*: quoted by Wallace in the essay often referred to). The larva feeds on other plants also, but the special relation of its appearance to that of heather seems to indicate that this is its ancestral food-plant. Very often, however, the larva possesses golden instead of pink tubercles.
Larva *Mamestra brassicæ*...	Commonest variety is olive-brown dorsally and dingy yellow ventrally, with abrupt line of demarcation; a triangular mark containing two white dots on the back of each segment. Other varieties are brown or dingy green or any intermediate tint. Well concealed among the leaves or in tunnels, in cabbage, broccoli, &c., but freely exposed on many plants, although always harmonizing with the surroundings.
Larva *Tryphæna orbona*...	Colour dingy umber-brown, with darker and paler markings. Feeds on low plants, and in spring on sallow and hawthorn.
Larva *Tryphæna pronuba*..	Larva concealed by day, feeding at night on almost all the plants in gardens. Colour varies from pale yellowish green to dark brown, with brown, black, and pale markings.
Larva *Tæniocampa gothica*	The whole effect of the larva is green (green ground-colour with one lateral white stripe, and a dorsal and two lateral very narrow pale yellow stripes). Hence harmonizes well with the leaves of the many plants on which it feeds. Disturbed it falls off and has some chance of escaping in the grass or other low-growing plants.
Larva *Phlogophora meticulosa*.	The whole effect green or brown (for the larva is dimorphic), as the white dorsal and lateral stripes are inconspicuous. Hence well protected on leaves of food-plant, and the brown varieties on dead leaves and earth. Same protective habit of falling off as noticed in *T. gothica*. Feeds on many low-growing plants.
Larva *Mania typica*	The larva is coloured with various shades of brown, and is most perfectly protected against brown leaves, which, as I have observed, it almost invariably selects, and upon which it sits motionless by day, feeding at night. If there are no brown leaves it retires by day into a very dark corner among the green leaves. It also has the habit of falling off. Feeds on many trees and low-growing plants.
Larva *Hyponomeuta euonymellus*.	Yellowish grey with black spots, not conspicuous in themselves; but the larvæ live in colonies, spinning a web, the latter certainly attracting attention. But the larvæ seem to be safe within it, as in a cocoon. The gregarious nature is doubtless related to the habit of spinning a common web. Feeds on spindle.

Coloured, or which evade their Enemies by other means.

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
LARVÆ.			
....	....	A. Weismann.—Devoured by *Lacerta viridis.*	Support.
....	....	A.G. Butler.—Eaten by *L. viridis.* Larvæ of this genus and of *Hadena* eaten by many birds (*e.g.*, Robins).	Support.
....	Eaten by Lizards ...	....	Support, as with last species.
....	Eaten by *Zootoca vivipara.*	....	Strong support, from the special character of the concealment.
Eaten greedily by *L. muralis.* The larvæ had been found on *Aconitum napellus*, but the Lizards were unharmed by the poisonous food in the larval digestive canal.	....	....	Support.
Eaten greedily by *Hyla*	....	....	Support.
At once attacked by *L. muralis*, the larva being immediately detected, although rolled up and motionless. Nevertheless the Lizard evidently much disliked it, and after being severely bitten, it was rejected; others tasted the larva with the same result.	....	....	At first sight a most startling difficulty. Yet it was evident, from the behaviour of the Lizards, that they fully expected the larva to be palatable; in itself a strong confirmation of the suggestion that nearly all such larvæ are palatable.
....	The "larvæ only which ventured beyond the protection of the web were eaten" by birds. The birds "appear very much to dislike the web sticking to their beaks."	....	Support. Being defended by the web there is no necessity for a specially perfect form of protective resemblance.

TABLE V.

Species and Stage.	Protective resemblance, or habits of concealment, evasion, &c.
	2. LEPIDOPTEROUS
Pupa *Vanessa io*	Dimorphic: a dark grey variety with a small amount of gold, and a yellowish-green variety with a larger amount. Some have thought that the gold is a "warning" colour, but I have shown that the green form can be produced to the exclusion of the other by placing the larva in green surroundings before pupation (see Proc. Roy. Soc. vol. xlii. p. 95). W. H. Harwood also informs me that the green form is often found on the leaves of nettles, while the other is the ordinary form, on stones, walls, &c. Hence we have in this pupa the very highest kind of protective resemblance, *i. e.* one that is adjustable to the differences between the various surroundings to which the organism is likely to be exposed.
Pupa *Vanessa urticæ*	Varying from very dark grey (almost black), with hardly any gold, to very light pinkish varieties, with much gold, and in some cases the pupæ are gilt all over. No green form. As above, the gilded appearance can be controlled by placing the larva in gilt surroundings (see Proc. Roy. Soc. vol. xlii. p. 95); while the dark forms may be produced by using black surroundings.
Pupa *Pygæra bucephala* ...	Dark reddish brown, and well protected upon or in the earth and under dead leaves &c., these being invariably the places chosen by the larva for pupation.
Pupa *Mamestra brassicæ* (almost certainly this species).	Light reddish brown: protected by being buried some slight depth in the earth. If accidentally exposed, it harmonizes fairly well with the earth.
Pupa *Tryphæna pronuba* (almost certainly this species).	Reddish brown, and protected as in the last species ....
Pupa *Plusia gamma*.........	A black chrysalis protected in a cocoon ....
	3. LEPIDOPTEROUS
Imago *Pieris brassicæ*	Protected by strong flight, and by its yellowish and black undersides harmonizing well with the yellow or white flowers of Cruciferæ, which it chiefly frequents. It is also very effectually concealed during prolonged rest (night, or during rain), for it is not commonly seen at rest, except in the intervals of flight, although such a very abundant Butterfly.

(continued).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
PUPÆ.	Refused by the birds	....	A difficulty: in view of the extremely complete form of protective resemblance. It would be interesting to experiment with other Vertebrates and with hungry birds.
Freely eaten by *L. muralis*	Refused by the birds	....	Same difficulty with birds; the same high form of protection. In this case, however, the Lizards freely ate the pupæ, and they are evidently palatable to these Vertebrates.
Bitten by *L. muralis*, but evidently much disliked and abandoned: some were eventually partially eaten when the Lizards were very hungry.	....	Edward Newman in 'British Moths.' — "They also constitute a favourite food of poultry, and are sought for with great eagerness."	Concerning the behaviour of the Lizards, it is to be noted that the pupal colour is not a very specialized form of protection, although complete, for it equally obtains in species which pupate in opaque cocoons &c.
Eaten with great relish by *L. muralis*, slightly crushed, and then swallowed whole. Great contrast to the treatment of the last species.	....	Edward Newman in 'British Moths.'—Fowls, Guinea-fowls, Peafowls, and Pheasants devour them with the greatest avidity.	Support.
Eaten at once and evidently relished by *L. muralis*.	....	....	Support.
Eaten at once (removed from the cocoon) by *L. muralis*, and probably relished.	....	....	Support.
IMAGINES. Eaten readily by all Lizards, but not much relished, I believe, because of the mechanical difficulty of the scales and wings, and not from being actually unpalatable. This applies to all Butterflies, and Moths to a less extent.	Eaten by Lizards ...	Roland Trimen.—A Swallow seen chasing this species (Trans. Linn. Soc. vol. xxvi. p. 499, footnote). A.G.Butler.—Eaten by *L. viridis*.	Support.

TABLE V.

Species and Stage.	Protective resemblance, or habits of concealment, evasion, &c.
	3. LEPIDOPTEROUS
Imago *Pieris rapæ*	Same as the last species, but not such strong flight; on the other hand, its smaller size renders its concealment more perfect.
Imago *Pieris napi*	Flight rather weaker than in the last species. Protection otherwise similar, except that the green veining of the undersides accords well with the fact that the species especially prefers shady places, where green is the predominant colour.
Imago *Anthocharis cardamines.*	Flight irregular and puzzling, although not rapid. The green and white mottled under surface of the wings harmonizes exceedingly well with the green and white flower-heads of Umbelliferæ, which are especially selected as a resting-place (T. W. Wood, quoted by Wallace). The orange patch on the male's fore wing is not conspicuous on the underside.
Imago *Vanessa io*	Flight strong: underside very dark and the insect well concealed on dark trunks, earth, or in shaded corners. Insect seldom seen at rest, except in intervals of flight, hence well concealed at night &c.
Imago *Vanessa urticæ*	As in the last species, only smaller and so more readily concealed: undersides not so dark and more variegated, but well concealed in the same places.
Imago *Smerinthus populi* ..	Flight feeble: in the evening. The irregular outline of the wings, the way they are held, their grey and brown tints (which are alone seen in repose), all render the insect highly protected by suggesting withered leaves. They are also generally well concealed in dark corners, for they are not commonly seen at rest.
Imago *Sphinx ligustri*......	Flight extremely powerful: in the evening. The various shades of brown of the fore wings and thorax are alone seen at rest, and the insect suggests bark, or even more closely the wood of a cleft tree darkened with age. It is very rarely seen at rest, although an abundant species.
Imago *Hepialus lupulinus*..	Flight very peculiar and puzzling, consisting of rapid oscillations, always taking place near the ground, and for a short time at dusk and in the early morning. At other times, when resting, very difficult to see, because of its small size and attitude, which exposes the brown tints of upper wings, with white markings, and of the body. It thus harmonizes with any of the brown surroundings (earth or dead leaves &c.), and is seldom detected, although exceedingly abundant. When disturbed it feigns death and falls to the ground, where it is very difficult to find.

(*continued*).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
IMAGINES (*continued*).			
As in the last species	Eaten by Lizards ...	T. G. B., in 'Nature' (vol. iii. p. 166), has often seen Sparrows capture the species. A. G. Butler has seen the same (information to Prof. Meldola). A.G.Butler.—Eaten by *L. viridis*.	Support.
As above. Also eaten readily by *Hyla*.	....	....	Support.
As above. Also eaten readily by *Hyla*.	....	....	Support.
Eaten readily by the Lizards, but not much relished, as above.	....	....	Support.
As above. Also eaten readily by some of the *Hylæ*, but refused by others.	Refused by all the Lizards.	....	Support. I have no doubt that the refusal of some Frogs was due to scales only. Jenner Weir's Lizards were probably not hungry.
Eaten by *L. viridis* and *L. muralis*. I think more relished than the Butterflies.	....	....	Support.
Untouched by *L. muralis*, but eaten at once by *L. viridis*. Experiment repeated later with same result.	....	....	Support from behaviour of *L. viridis*; that of *L. muralis* is exceedingly interesting, and probably introduces a new mode of protection by intimidation resulting from mere size, with no other terrifying quality.
Eaten readily by *L. muralis* ...	....	....	Support.

TABLE V.

Species and Stage.	Protective resemblance, or habits of concealment, evasion, &c.
	3. LEPIDOPTEROUS
Imago *Cerura vinula*	Flight not powerful: in the evening. At rest the fore wings and body are seen, and are grey with darker markings. The insect is large and apparently not inconspicuous; but it must be carefully concealed, for it is not commonly found, although so abundant a species.
Imago *Pygæra bucephala* ..	Flight not powerful: in the evening. At rest it is "like the broken end of a lichen-covered branch" (*Wallace*, as above). This effect is produced by the purple and pearly-grey colour of the fore wings, with brown markings, and the ochreous tip, and by the ochreous head and thorax. A very perfect form of imitative resemblance, the wings being rolled round the body so as to produce a cylindrical shape, with yellow ends, like a broken piece of decayed stick.
Imago *Dasychira pudibunda*	Flight not powerful: in the evening. At rest the colours, due to fore wings and body, are grey with darker markings. Although common, it is rarely seen, and must be carefully concealed.
Imago *Orgyia antiqua* (female).	The female Moth has rudimentary wings, and never quits its cocoon, but sits on the outside of it, being very inconspicuous, as it is covered with grey down, which harmonizes well with the colour of the surface upon which it is resting.
Imago *Acronycta psi*	Flight rapid: at night. Rests by day "on the north side of trees," and therefore protected by resembling lichens (*Wallace*, as above). Fore wings and body alone seen at rest—grey, with dark markings. I have certainly often seen it on other aspects than north; but anywhere on rough bark it is well concealed.
Imago *Mamestra brassicæ* ..	Flight rapid: at night. By day well concealed by the tints of fore wings and part of body, which are "dark smoky grey-brown, with confused markings both darker and paler" (*Newman*); thus well protected on trunks, rocks, &c.
Imago *Mamestra persicariæ*	Flight rapid: at night. By day well concealed (probably in dark corners), as it is seldom seen at rest. The fore wings and part of body alone seen, and are "rich dark bistre-brown" (*Newman*), with a white spot with a darker nucleus in the centre of the wing.

(*continued*).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
IMAGINES (*continued*). Eaten at once by *L. viridis*......	....	....	Support.
Often refused by all the Lizards, with every sign of disgust, but they were induced to eat them by hunger, and seemed to get somewhat accustomed to the diet. Large numbers employed in the experiments.	....	....	A very remarkable exception, when we consider the extremely perfect protective resemblance, which is so highly elaborated in all its details.
Eaten at once by *Hyla*, after other individuals had refused it. Offered to *L. muralis*; it was seized and eaten directly it was seen to move.	....	....	Support.
....	"The only Lepidopterous insect entirely rejected in the perfect state." Disregarded by all the birds except Robin and Reed-Bunting, and refused by these after examination.	....	Another difficulty.
At once taken and evidently much relished by *L. muralis*. Also eaten at once by some Frogs after refusal by others (experiment repeated).	....	....	Support.
Eaten by *L. muralis*..............	Eaten by Lizards ...	....	Support.
Eaten at once by *L. muralis*, and evidently much relished, as it was seized and swallowed immediately.	....	....	Support.

TABLE V.

Species and Stage.	Protective resemblance, or habits of concealment, evasion, &c.
	3. LEPIDOPTEROUS
Imago *Tryphæna fimbria* ..	Flight rapid: at night. By day very well concealed, probably near the ground and among dead brown leaves. Fore wings and part of body different shades of brown, and also olive-green in other varieties, with paler and darker markings and lines. Hind wings orange, with a broad black border, seen in flight, and with the orange and black on the undersides suggest, in the rapid motion, a yellow leaf blown by the wind. Probably the significance of the markings and the habits are the same as in the next species.
Imago *Tryphæna orbona* ...	Flight rapid: at night; not so easily disturbed by day as *T. pronuba*, but the same rapid flight and habits of concealment &c. if it is disturbed. The colours and protective resemblance are much the same as in the last species.
Imago *Tryphæna pronuba*..	Flight rapid: at night, and also easily disturbed by day, when it flies with great speed, rising very quickly and dropping down (always into good shelter of brown leaves &c.) equally quickly. The whole process is very unlike the flight of a Moth, and the colour and movement suggest a yellow leaf lifted off the ground by a gust of wind, whirled away for a certain distance, and then suddenly falling again; so exact is this resemblance, that I have rarely been certain of the Moth until it had flown a long way. If tracked down and followed the Moth rises again very readily. This resemblance is chiefly due to the brown of the fore wings, aided by the yellow and black of the hind wings and the undersides. At rest it is extremely well concealed by the varying brown shades of the fore wings and part of the body exposed. It seeks dark corners, and hides deeply among thick leaves or among dead leaves on the ground. It is also very strong and slippery, and hard to hold when caught (*Jenner Weir*). I have also noticed this feature. I should add that Jenner Weir has another theory (alluded to below) as to the meaning of yellow and black underwings.
Imago *Anthocelis pistacina*.	Flight rapid: at night; by day well concealed and seldom seen. The parts seen at rest vary much in colour, being brownish, reddish, or of different grey tints with faint darker markings.
Imago *Euplexia lucipara*...	Flight rapid: at night. Very seldom seen at rest, and evidently well concealed, probably in dark corners and among dead leaves. Fore wings and part of body alone seen are rich brown with pale markings and a white mark on the wing.
Imago *Amphipyra pyramidea*.	Flight rapid: at night; by day well concealed and very seldom seen. The parts seen at rest are brown and grey-brown, with paler and darker markings.
Imago *Hadena oleracea* ...	Flight rapid: at night. At rest well concealed and seldom seen. Fore wings and part of body seen are reddish brown, with a narrow white line and two light spots on wings. Resembling bark or dead leaves &c.

(*continued*).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
IMAGINES (*continued*).			
....	J. Jenner Weir has seen a Swallow chase this Moth by day, making "several ineffectual attempts to seize it." The Moth, however, escaped. It was evidently considered a very desirable capture.	....	Support.
....	Eaten by Lizards...	....	Strong support, as in *T. pronuba.* There is no doubt that it is also relished by birds.
I have often seen it pursued by birds with great persistence; they evidently relish it much, and make great efforts to catch it.	Evidently much appreciated by the birds, but even in the aviary its rapid movements and slipperiness made it very difficult to capture. Eaten by Lizards.	....	Strong support in the special character of the defence suited to so many emergencies; protected at rest; again, when detected or disturbed, by appearance and mode of flight; and, again, when captured, by it slipperiness and great strength; and all this coexisting with and following from the fact that it is keenly relished and much pursued.
....	Eaten greedily by Lizards, but apparently swallowed with difficulty, probably because of the scales.	....	Support.
Eaten directly by *L. muralis*, and evidently relished.	....	....	Support.
....	Eaten by Lizards ...	....	Support.
Eaten by *L. muralis*..............	....	....	Support.

TABLE V.

Species and Stage.	Protective resemblance, or habits of concealment, evasion, &c.
	3. LEPIDOPTEROUS
Imago *Cucullia verbasci* ...	Flight (probably) rapid: at night. At rest exceedingly well protected by a most perfect resemblance, both in shape and colour, to a splinter of wood; the colours of the parts seen being rich umber-brown, shading into pale wainscot-brown, and this again into the darker colour.
Imago *Gonoptera libatrix* ..	Flight rather slow: at night. At rest beautifully protected by a most special resemblance to a decayed red leaf with white spots of fungoid growth on it. The parts seen are grey with a reddish tinge, with patches of orange-red and light grey lines, and two minute but intensely white spots on each wing. Similar white marks occur on the legs, which are often partially seen at rest. The effect is greatly heightened by the irregularly toothed margin of the wings. The Moth appears in August and September, and hybernates, so that it is in the perfect state when red and brown leaves are chiefly seen, and when green leaves are mostly absent. It selects dark places in which to hybernate—tool-houses, attics, &c.
Imago *Ennomos angularia*.	Flight slow: in the evening. The angulated wings are yellow with brown lines and short brown streaks, and this colour and shape, together with the attitude and the colour of the undersides of wings (also often seen), all suggest a yellow leaf in a very perfect manner, aided by the time of appearance (August and September).
Imago *Amphidasis betularia*.	Flight slow: in the evening. Both wings and body seen at rest, and dingy white with smoky markings (the latter may suffuse the whole surface in some varieties). Although conspicuous when found at rest, it must generally be concealed with care, for it is not found very commonly at rest, although such an abundant Moth. The protective resemblance may be to variegated lichens on rocks and trees.
Imago *Halia wavaria*	Flight not rapid: in the evening; also easily disturbed by day. Both wings seen at rest (as is usual in Geometræ), and they and the body are grey; the wings with a purplish and brownish tinge, with brown spots and streaks (including the V-like mark). It is thus inconspicuous on tree-trunks &c., although without any special resemblance.
Imago *Camptogramma bilineata*.	Insect conspicuous on the wing. Flight not rapid: in the evening; also very easily disturbed by day. Well concealed in thick leaves when at rest. Wings and body yellow; former with slender white and brown waved lines. A variable amount of brown colouring.
Imago *Chloephora prasinana*	Flight rapid: in the evening. By day beautifully protected by resembling the green colour of foliage; the only parts seen (fore wings and part of body) being yellowish green with three silvery lines across the wing; these latter, on the opposite wings, come together at an angle during the attitude of rest, and convey the impression of leaf-veining. Moth flies in June.

(continued).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
IMAGINES (*continued*).	Greedily devoured by the birds.	....	Support.
Eaten at once by *L. muralis*, and evidently much relished. The Moth was detected while motionless.	....	F. W. Andrewes informs me that he has seen a Robin carry the Moth off, having flown quite near to him in pursuit of it.	Strong support, because of the special character of protection and the evident keenness with which the Moth is pursued.
Eaten at once by *L. muralis*, and evidently relished. Eaten in large numbers by the *Hyla*; although individuals would refuse them, yet they were generally taken; and sometimes one Frog would take as many as five, one after the other.	....	....	Strong support, as in the last species.
Eaten at once by *L. muralis*. Evidently relished.	....	....	Support, for it certainly evades its enemies.
....	Eaten by Lizards ...	A. G. Butler.—Greedily devoured by Frogs.	Support.
....	Eaten by Lizards ...	....	Support, for the insect clearly avoids its enemies. But the protection does not seem to be very perfect.
Eaten at once and with apparent relish by *L. muralis*. It was seized directly it was seen to move, not before.	....	....	Strong support.

TABLE V.

Species and Class or Order.	Protective resemblance, or habits of concealment, evasion, &c.
	4. IMAGINES OF OTHER INSECTS AND A FEW (The arrangement of Claus's 'Text-
CRUSTACEA.	
Armadillo vulgaris	Dark colour and habits of concealment are strongly protective.
ARACHNIDA.	
Spiders of different species.	*Epeira diadema* and *Tegenaria domestica* were chiefly employed in some of the experiments (E. B. P.), but any common Spiders which could be found were offered to the Lizards and Frogs. In appearance, and especially in their rapid retreat into concealment, the Spiders are difficult to capture, especially when it has been shown that the enemies do not like the web in their mouths.
MYRIAPODA.	
Iulus terrestris	The dark colour and habits of concealment are strongly protective, but it also possesses a very unpleasant odour.
Lithobius forficatus	The brownish orange colour, and especially habits of concealment, are strongly protective: inodorous.
ORTHOPTERA.	
Forficula auricularia	Probably this common species of Earwig was always employed. The colour and habits of concealment are strongly protective. The pincers may perhaps, in some cases, act as "terrifying" structures. The insect has a very disagreeable smell.
Periplaneta orientalis	The colour, rapid movements, and habits of concealment are strongly protective, but the insects also emit a very unpleasant odour.
Decticus verucivorus.........	A large green grasshopper, with brown spots on the fore wings. Thus well concealed, and evidently a very powerful hopper.
NEUROPTERA.	
Chrysopa perla..............	Probably this common species was employed. Its green colour protects the insect among the leaves in which it lives, but it can also emit a peculiarly unpleasant odour.

(*continued*).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
ARTHROPODA OF OTHER CLASSES. book of Zoology' is followed.) Eaten readily by *L. muralis* ...	....	....	Strong support.
Always eaten with especial relish by the Lizards and the Frogs.	Spiders eaten greedily by Lizards.	A.G. Butler.—Eaten by *Lacerta viridis.*	Strong support.
....	....	A. Weismann.—Refused by *L. viridis.*	A modification: here are unpleasant attributes coexisting with protective habits and colouring.
....	....	A. Weismann.—Greedily eaten by *L. viridis.*	Strong support.
Eaten readily by the Frogs......	Eaten by the Lizards	....	In this case the enemies made use of did not seem to object to the smell. Support.
Eaten readily in large numbers by all the species of Lizards and by the *Hyla.*	....	....	As above; unpleasant attributes coexist with protective habits &c., but the former do not protect them from these enemies.
....	....	A. Weismann.—Once eaten by *L. viridis.*	Strong support.
....	Eaten by *L. viridis.*	....	Conclusion as in the case of *Periplaneta.* The Lizards are evidently much repelled by certain smells, but do not object to others which are very unpleasant to man.

TABLE V.

Species and Class or Order.	Protective resemblance, or habits of concealment, evasion, &c.
	4. IMAGINES OF OTHER INSECTS AND A FEW ARTHROPODA
HEMIPTERA.	
Aphis hederæ and Aphides, sp.?	*Aphis hederæ* is dark and inconspicuous; aphides are generally inconspicuous, but probably also, in some cases, protected in other ways (taste or smell).
Hemipteron, sp.?	The species made use of was inconspicuous; but many possess warning-colours. The species was, however, evil-smelling, like the brilliant ones.
DIPTERA.	
Muscidæ of various species	*Musca domestica* and *M. vomitoria* chiefly employed; but also any other Muscidæ which could be found. The appearance, and especially the rapid flight and readiness with which they are disturbed, are strongly protective. Larvæ and pupæ also made use of: both concealed.
Eristalis and *Syrphus*	Probably the commonest species. Although somewhat less well-concealed than many species of *Musca*, many of the species of these genera are even stronger on the wing.
Tipula oleracea...............	Inconspicuous and easily disturbed ....
Bibio marci	The common male is black and inconspicuous: the much less common female orange-coloured and easily seen; both fly readily when disturbed.
COLEOPTERA.	
Melolontha vulgaris	The brown colouring is certainly protective; flight in the evening ....
Carabus hortensis (Fabr.)...	The dark colour and habits of concealment are certainly protective. Nocturnal habits also.
Omaseus melanarius.........	As above, the species being similar in habits and appearance, only much smaller. Nocturnal habits.
HYMENOPTERA.	
Trichiosoma lucorum	Dark colours and flight are evidently protective......................................
Cocoons of Ants, sp.?	Carefully protected, being well concealed in the galleries &c. ....

(*continued*).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
OF OTHER CLASSES (*continued*). *Aphis hederæ* freely eaten by young *Hylæ*.	Aphides? sp., eaten by *L. viridis*, *L. agilis*, and *Z. vivipara*. On another occasion hardly noticed by the Lizards.	....	Conclusion for Aphides? sp.: probably as above: the Lizards evidently dislike the taste, but will eat the insects when hungry. The treatment of *Aphis hederæ* supports conclusions.
....	Refused by the Lizards after tasting.	....	The unpleasant qualities evidently a defence in this case.
Eaten greedily and in almost any numbers by Lizards of all the species and by *Hyla*. The latter was especially keen in capturing them, but did not much care for the larvæ, which, with the pupæ, were eaten in large numbers by the Lizards.	Eaten with relish by all the species of Lizards, and in very large numbers. The larvæ and pupæ also eaten.	Eaten by *L. viridis* (*A. G. Butler*).	Strong support.
Keenly relished by the Frogs ...	Eaten voraciously by all the Lizards.	*Eristalis vulpinus* eaten in large numbers by *L. viridis* (*A. G. Butler*).	Strong support.
....	Eaten by *Lacerta viridis*.	....	Strong support.
The males eaten in large numbers by young *Hylæ*.	....	....	Support. It would be exceedingly interesting to compare the behaviour of Lizards and birds towards the male and female insects.
Eaten by *L. viridis*	....	....	Support.
Eaten by all the Lizards	....	....	Support.
Eaten by all the Lizards	....	....	Support.
Eaten by *L. muralis*...............	....	....	Support.
....	Eaten with avidity by the Lizards.	Well known to be the favourite food of Pheasants &c. In this case the species is *Formica rufa*.	Support.

TABLE V.

Species and Class or Order.	Protective resemblance, or habits of concealment, evasion, &c.
	4. IMAGINES OF OTHER INSECTS AND A FEW ARTHROPODA
HYMENOPTERA.	
Winged females of Ants, sp. ?	Colour and some of the habits appear to be protective. The gregarious habits, however, make them conspicuous, but are very important in rendering their acid secretion more formidable.
Workers of Ants, sp. ?......	As above ....
Apis mellifica	Workers made use of in all cases. The brown colouring renders the insects somewhat inconspicuous. The comparison in this respect with the more formidable Wasp is interesting.
Andrena nigro-ænea.........	The insects bear considerable superficial resemblance to the workers of the last species.

Newman states, "always I believe on herbaceous plants, never ascending trees." In this respect Newman is mistaken, for I have frequently found the full-grown larva feeding on the leaves of plum in my own garden, and it was such an individual which was given to *L. muralis*.

I can now add my own experience of the larval habits subsequent to the period at which Newman has described them. In the winter of 1884–5, I kept a number of larvæ and watched them from time to time throughout the whole period of hybernation. As the room in which they were kept was warmed, they frequently woke up at night and fed upon the Calceolaria-leaves with which they were supplied. I was most interested in observing the extreme care with which they were concealed by day. If there were any brown leaves among the food the larvæ would always get upon these, and, not content with the harmony between their colour and that of the leaf, would force their way into furrows and folds, so that they came to lie in deep shadow and were often quite concealed. I took some pains to see what the larvæ would do when all the brown leaves were carefully removed, and I found that, by seeking the darkest corners *continued*).

Experimental evidence.			Bearing upon Wallace's converse suggestion.
E. B. Poulton.	J. Jenner Weir.	Other observers.	
OF OTHER CLASSES (*continued*).			
....	Eaten by *Z. vivipara.*	....	Support; it seems clear that the Lizards do not much object to the secretion.
....	Refused by all the Lizards.	....	It may be that this secretion or the means of using it is more formidable than in the winged females.
Often seized and swallowed by Frogs; but I believe nearly always rejected in the end, and very often rapidly ejected soon after being seized, as though the animal had been stung. Often eaten by hungry Lizards; but they showed great caution in their manner of seizing and disabling the insects.	....	A. G. Butler.—Eaten by Frogs, apparently with avidity. Well known to be eaten by Lizards, and that Spiders also catch the Bees easily and frequently.	These facts show that even an insect protected by a sting may fall a victim to enemies if hungry. The comparison with Wasps supports Wallace's suggestion.
Seized and swallowed by Frogs; but I believe nearly always rejected in the end, as above.	....	....	Conclusion as above.

and deepest folds among the green leaves, they were nearly as well concealed. If a leaf became rolled up at the edge, there was certain to be a larva inside. The larvæ were kept in a glass cylinder upon a plate, and the stem of the food-plant passed through a hole in the plate and into water in a stoneware vessel placed beneath. Sometimes the stem did not fit tightly in the plate, and then all the larvæ crept through the hole and rested by day upon the stem above the water, where of course it was very nearly dark. I have had very similar experience with larvæ found upon trees. I especially remember one instance in which the leaves were completely removed from the young shoots on one part of a plum-tree trained against the wall. I could not find the larva for several days, but finally detected it most carefully concealed in the folds of the single brown and withered leaf which still remained on that part of the tree.

I have now given as much information as I possess of the habits by which this larva renders its brown imitative colouring as efficacious as possible for evading the eyes of its enemies. I have gone into details in order to show that the larva belongs to a class which is the most complete opposite of that in which the larvæ render themselves conspicuous in various ways. The experimental evidence shows, however, that the larva has a most disagreeable taste and (almost certainly) smell, so that the most ravenous of all my Lizards would not eat it. It is perfectly clear that these two methods of protection are antagonistic if present in the degree and kind possessed by this larva. One of them must be useless and merely incidental, and as it is quite certain that the highly specialized protective colouring and habits of concealment are of value to the organism, the unpleasant taste must be the useless character. And this was seen in its treatment by the Lizard, for the larva was recognized at once as something which was expected to be palatable, and was at first seized with great vigour, and it was only when the larva was injured beyond hope of recovery that its enemy recognized the unpleasant attributes and relinquished it. I witnessed the whole process; it afforded the most instructive comparison with the reluctant and hesitating way in which a very hungry Lizard would approach a highly coloured larva which it knew to be distasteful. It was quite obvious that the Lizard fully expected a palatable insect, and was greatly surprised at the unwelcome result. After the larva had bled freely, another Lizard approached, but did not taste the insect, evidently repelled by the unpleasant smell of the freshly escaped fluids. It is obvious that a larva of this kind, being unpalatable, and yet giving off no strong smell from its surface, by which to warn its enemies, belonging, moreover, to an immense group of similarly protected insects of which the vast majority are highly relished,—it is certain that such a larva can gain nothing by an unpleasant taste which can only be appreciated after fatal injury, and which is not associated with any colour, marking, or habit by which the disagreeable experience could be remembered.

We are therefore driven to the conclusion that the unpleasant quality is in this case a merely useless character, probably some incidental result of the physiological processes of digestion or metabolism. But such a condition is most important on theoretical grounds, for it at once supplies the necessary steps by which a species can change from one protective method to another. The most constant objection or difficulty which is raised against the explanation of the rise of any well-marked structure or function as due to the action of natural selection, deals especially with the initial stages. It is asked how natural selection can accumulate the earliest variations, which are (the objectors assume) of insufficient importance to act as criteria by which life and death can be settled. Darwin set the great example of giving a satisfactory answer to such objections by carefully working out one by one those cases in which especial difficulty was assumed. And here, by the instance of the larva of *M. typica*, we see at once how the difficulty of the origin of nauseous forms may be overcome; for this larva possesses a useless attribute ready-made as the incidental result of some physiological process, and at so high a stage of efficiency that there is no difficulty whatever in imagining that it might readily become an important criterion of existence, falling therefore under the influence of natural selection. Knowing that increasing efficiency in protective measures is counterbalanced by increasing keenness and cunning on the part of enemies, it is easy to see how, as a response to an advance by the latter, a species might take advantage of such an incidental quality to adopt an entirely new line of defence. The concealment of the larvæ we are considering is evidently very successful, but if it were seen through far more frequently than at present, and yet the larvæ were always rejected with disgust, there would be more and more opportunity and necessity for the enemies to remember the experience; and the further the species varied away from the beaten path of protective colouring, the greater aid would it afford to memory, which, although that of another animal, is in this respect of far less importance for the possessor than for the larva itself. I need hardly point out that in speaking of an advance in the keenness of Vertebrate insect-eaters, I mean an advance in the power of detecting all such larvæ, so that there would always remain a large proportion of palatable species; while the new line of defence would only be open to such few of them as possess the quality of distastefulness in a marked degree. I am quite aware that there is another possible explanation of the unpleasant qualities in *M. typica*; *i. e.* that they are the remnant of a former defence by such means accompanied by corresponding coloration, &c.; but while this may explain similar facts in the case of certain other species, I do not think that it is likely to hold in the instance of *M. typica*, for the protective habits and appearance are correlated in so perfect a manner that we are compelled to assume that a very long period of time must have been covered in the attainment of so unusual and specialized a result.

It now remains to consider the other exceptions which are of less theoretical importance although of extreme interest. As the same species have occurred before under other tables, it will be well to shortly tabulate the results of all the instances among Lepidoptera in which experiments have been made upon more than one stage (see Table, p. 262).

I much hope that future experiments will enable us to extend this Table, but short as it is, it appears to point to several interesting conclusions. In the first place there is no known instance of distasteful qualities in stages later than the larva when the latter is itself palatable. This statement will doubtless be true of the great majority of species however complete be the experimental investigation, and it points to the conclusion that this method of defence arose first in the larval stage. Such a relation is to be expected; for the species is exposed to more danger and is more helpless at this period than at either of the subsequent stages. The unpleasant taste appeals to non-parasitic enemies which devour insects; but the almost complete limitation of the attacks of insect-parasites to the larval stage must bear in an important way upon the other modes of protection in this stage, tending to produce that extraordinary specialization in defensive methods which are well known to occur. The imago can escape by flight, and the pupa, if exposed, may render

Species.	Larva.		Pupa.		Imago.	
	Appearance and habits.	Edibility.	Appearance and habits.	Edibility.	Appearance and habits.	Edibility.
Pieris brassicæ	Conspicuous.	Unpalatable.	Protective resemblance (highest class).	....	Protective resemblance at rest; strong flight.	Palatable.
Vanessa io	„	„ (Birds).	„ „	Unpalatable (Birds).	„ „	„
Vanessa urticæ	„	Unpalatable (Birds); palatable (Lizards).	„ „	Unpalatable (Birds); palatable (Lizards).	„ „	„
Anthrocera filipendulæ.	„	Unpalatable.	Protected in tough cocoon.	....	Conspicuous and sluggish.	Unpalatable.
Pygæra bucephala ...	„	„	Protective resemblance and concealed.	Unpalatable.	Protective resemblance.	„
Orgyia antiqua	„	„	Protected in cocoon.	....	(♀) protective resemblance, but *very* sluggish.	(♀) „
Porthesia auriflua ...	„	„	„ „	....	Conspicuous and sluggish.	Palatable (so far as evidence goes).
Euchelia jacobææ ...	„	„	Protective resemblance to the earth.	....	Conspicuous.	Unpalatable.
Cucullia verbasci ...	„	„	Protected in earthen cocoon.	....	Protective resemblance.	Palatable.
Halia wavaria	„	„	Protected in slight cocoon; inconspicuous.	....	„ „	„
Abraxas grossulariata.	„	„	Conspicuous.	Unpalatable.	Conspicuous and sluggish.	Unpalatable.
Cerura vinula.........	Protective colouring (until attacked).	Palatable.	Protected in very tough cocoon.	....	Protective resemblance, or, at any rate, well concealed.	Palatable.
Spilosoma menthastri	Exposed freely, not very conspicuous.	Unpalatable.	Protected in cocoon.	....	Conspicuous and sluggish.	Unpalatable.
Mamestra brassicæ...	Protective colouring and habits.	Palatable.	Protected in the earth.	Palatable.	Protective colouring.	Palatable.
Tryphæna orbona ...	Protective colouring and habits.	Palatable.	Protected in the earth.	....	Protective resemblance and habits.	„
Tryphæna pronuba	Protective colouring and habits.	Palatable.	Protected in the earth.	Palatable.	Protective resemblance and habits.	„

its imitative resemblance complete by entire quiescence, and it is usually effectually protected in other ways; but the larva must feed, and at the same time is sluggish in its movements, defenceless, and when palatable is more relished than any other stage, for it does not possess the hard investment of the one or the scaly covering of the other. It has also been seen that an unpleasant taste may arise incidentally at this period. Assuming, then, that the great needs of certain larvæ have been met in this way, there will be the tendency for the unpleasant quality to pass on by simple continuity into the other stages; and if these are hard pressed, there is always the possibility that such attributes may be made the starting-point of a similar method of defence for them also. Hence I believe we shall nearly always find that conspicuous unpalatable imagos develop from larvæ which are also unpalatable and conspicuous, and such a conclusion is entirely borne out by the table. But the unpleasant quality may pass on in the same way into other stages, which hold their own successfully by elaborate and perfect protective resemblances, and then there will be no tendency for the quality to be made use of, although it will always remain as a possibility should the species be worsted by its enemies in these stages. It must be remembered that the possession of an unpleasant taste by a protectively coloured species can never be injurious in any way to itself except in so far as it causes the destruction of a greater amount of insect-life, inasmuch as the part contributed by the species itself to the total destroyed does not count as food under ordinary circumstances. And the species itself remaining on the same protective lines as the great mass of palatable species, it will itself come in for a proportional share of the extra loss which follows from the fact that it is not relished as food. But so long as these unpalatable species remain in a small minority, the reaction of their own inedibility upon themselves will be inappreciable. Mr. W. Esson has kindly expressed the danger actually incurred in a mathematical form, showing that it is inappreciable when the inedible species are relatively few. If there were a practically unlimited number of protectively coloured insects consisting of two sets of species, the one set edible and the other inedible and consisting of individuals in the ratio of 100 : 1, it is reasonable to suppose that in any number n of captures there will be killed of each set a number of individuals proportional to the numbers in the sets themselves; *i. e.* of the edible $\frac{100n}{101}$ and of the inedible $\frac{n}{101}$. The insect-eaters will go on catching the insects until the edible $\frac{100n}{101}$ becomes equal to the number required for their food—a. Therefore $\frac{100n}{101} = a$ and $n = \frac{101a}{100}$; therefore there are caught of the inedible species $\frac{n}{101}$, that is $\frac{a}{100}$.

Considering the above-mentioned exceptions among the imagos rather more in detail, it would certainly be difficult to find any species with an appearance more completely the opposite of that produced by the typical warning coloration than the imagos of *P. bucephala* and *O. antiqua*. The special character of the imitative resemblance in the former has been previously alluded to. A friend has raised the objection that the moth imitates a piece of twig *cut* cleanly at both ends, an object which cannot be found in nature unassisted by art. The reply of course is that the purple and grey colour of the sides of the suggested cylinder, together with its pale ochreous ends —the one appearing to be cut transversely, the other obliquely across— present a most perfect resemblance to wood, with that particular condition of texture induced by decay, in which alone the tissue will break shortly and sharply as if cut, on the application of slight pressure or the force of an insignificant blow. *In coitu* the stick-like appearance is admirably preserved, the two insects looking like a single twig (*Newman*). It was clear from the energetic and instantaneous attacks made on these moths, that the Lizards expected them to be palatable and that the unpleasant quality is incidental and useless. It was very interesting to observe that the continuity of the unpleasant properties through the different stages in this species is accompanied by a gradual lessening in their powers. The larva was certainly disliked far more than the other stages, and the pupa seemed to be more neglected than the imago, the latter being eaten in large numbers, although often after preliminary tasting and temporary rejection. This fact also favours the explanation given above of the origin and meaning of the unpleasant qualities in the two terminal stages.

In the case of *O. antiqua*, we have a most inconspicuous insect with the same unpleasant taste. Here also the same explanation probably holds good as far as the origin of the qualities is concerned, for we have previously seen that its most brightly-coloured and freely exposed larva was disregarded by all the birds. In this case I do not yet feel certain that the property may not be of some value to the female imagos; for it would be impossible to find a more helpless insect, without even the power of attempting to escape by walking. More observations are greatly needed, and it would be especially interesting to ascertain whether the quickly-flying males are equally disliked as food.

The pupa of *P. bucephala* has been already alluded to. Confirmation is, I think, needed of Newman's statement that fowls eat this pupa freely, for the dislike of the Lizards was extremely marked, and as a rule these animals are less delicate than birds. The pupæ of *V. io* and *V. urticæ* possess the highest form of protective resemblance; and here, again, Jenner Weir's observation, I think, should be repeated, as the Lizards acted so very differently with the latter species. Is it quite certain that the birds were aware of the presence of these generally motionless pupæ in Jenner Weir's experiments?

The consideration of the fourth subdivision of the list, including species of Arthropoda other than the Lepidoptera, enforces very strongly the conclusions of the rest of this paper,—that defensive habits and structures may exist in almost any kind of combination, so that we find plenty of instances of the co-existence of unpleasant attributes with protective resemblance, as well as with a "warning" appearance.

Just as it was considered to be probable that warning-colours possess a sexual value for the species concerned, so it is probable that the most extreme cases of protective resemblance also have a similar significance. And in fact, when the most specialized instances of the latter kind are detected and are looked at in themselves, they are often seen to possess great beauty, which is absent from the objects they protectively resemble. To take an extreme case, the imago of *Melanthia albicillata* sits upon the upper-side of a leaf in the usual attitude of the Geometers, with its wings extended as if "set," and in such a position its creamy-white ground-colour and dark lines and blotches are very conspicuous, but most forcibly suggest the appearance of bird's excrement which has fallen on to a leaf from a great height, and has therefore been spread out into a large wide patch. But when the insect is detected and examined, it is seen to possess the greatest beauty. Thus Mr. Beauchamp says of it:—"The perfect insect, when bred, seems to me almost without a rival for purity and exquisite delicacy of design. I should doubt whether in the range of natural objects a more beautiful line is to be found than that exquisite cool grey streak upon the rich creamy ground of the fore wing" (Newman's 'British Moths,' p. 156). While entirely agreeing with this description, we should all maintain that it is very far from applying to the object suggested by the Moth, and which it nevertheless resembles very faithfully. And it is probable that in all cases the appearance of a sexually mature insect possesses this among its other meanings.

Thus I believe that the brightly-coloured underwings of the genus *Tryphæna* have the same significance as those of *Catocala* and of *Sphinx* and *Smerinthus*, and the same significance as the bright colours of the uppersides of both wing in most Butterflies, which are also concealed during rest. But in *Tryphæna* alone among these the bright sexually selected adornment has another meaning as well, and has also come under the independent action of natural selection. For the black and yellow colours of these wings, together with the colours of the undersides of both wings, seen during their rapid vibration in flight, greatly aid the protective resemblance to a dead leaf whirled along by the wind. And yet the very similar arrangement of *red* and black on the upper and undersides of the underwings in *Catocala* are comparatively non-protective and seem to have almost purely sexual significance. If, therefore, these brilliant colours of *Catocala* were modified by natural selection as a response to some unusual activity on the part of its foes, if they became yellow and black instead of red and black, and the habits were correspondingly modified, we should have no reason to conclude that they had in consequence lost their sexual significance, and there is no reason for forming such a conclusion in the case of the genus *Tryphæna*.

Jenner Weir has suggested that these brightly-coloured underwings have another protective meaning—that they are conspicuous, and hence form the mark of an enemy, and yet when seized they readily give way without doing harm to the insect. Again, he suggests that the enemies are startled by the sudden manner in which the bright colours are displayed; but I am not aware that a similar significance has ever been attributed to the bright colours of Butterflies suddenly seen when the wings are opened. The former suggestion probably holds, for I think the margin of the underwings is more commonly found to be notched than any other part of these insects when captured. But the primary significance of such bright colours, concealed in the protective attitude of rest, must be the same as those of Butterflies, and I should attribute the same meaning—of sexual adornment—to the brilliant colours of the underwings of the Grasshoppers of the genus *Œdipoda,* also alluded to by Jenner Weir (see Trans. Ent. Soc. Lond. 1869, pt. i. p. 23).

Conclusions.

The following are the general conclusions arrived at by the consideration of the experimental data tabulated in this paper:—

1. The extremely specialized defence of the larval stage follows from its delicate anatomical construction and the necessities which are imposed on it as the great feeding-stage.

2. Highly conspicuous insects nearly always possess some unpleasant attribute, *i. e.* a disagreeable taste or smell in the tissues and fluids of the body, or (in the case of the smell) discharged from special glands; irritating hairs; or stings.

3. The conspicuous appearance may be due to strongly-contrasted colours, the presence of hairs or tufts, and the attitude in which the body is held, and to gregarious habits, or attention may be attracted by violent movements which take place when an enemy appears.

4. In a small number of cases a highly conspicuous appearance has not yet been shown to be attended by any unpleasant attribute.

5. In the various species in which a conspicuous appearance is produced by colour and marking, the same colours and patterns appear again and again repeated. In this way the Vertebrate enemies are only compelled to learn a few types of appearance, and the types themselves are of a kind which such enemies most easily learn. Furthermore certain appearances are especially impressed on the vertebrate foes by highly aggressive insects, feared because of stings &c.; and hence there is especial advantage in any approximation to such types. Again, the selected type of conspicuous appearance also depends on the (probably protective) colours which existed at the time when the conspicuous appearance first commenced (these can be determined with a great degree of probability in some few cases).

6. In a relatively few cases aggressive forms among the Vertebrata (Serpents) are mimicked, although such an appearance is pure intimidation, for the insect is quite harmless.

7. It is not uncommon for an insect to be protectively coloured but when detected to assume a terrifying attitude, and in some cases to take up offensive measures (discharge of irritating fluid, &c.).

8. A few, probably transitional, forms may be unconcealed, and yet not very conspicuous; these may possess unpleasant qualities or may be eaten readily.

9. The likes and dislikes of insect-eaters are purely relative, and if pressed with hunger the most disagreeable and highly conspicuous insects may be eaten. Hence probably the relatively small number of species which adopt such a means of defence.

10. It seems probable that when one Vertebrate eats an unpleasant insect, and another refuses it, the former has conquered its prejudices, having originally disliked the insect.

11. In the sexually mature forms warning colours can be distinguished from sexual colours by their distribution on the surface of the body, by the way in which they are displayed in flight, by their type of pattern, and the colours employed. The sexual colours and patterns are *beautiful*, the others *conspicuous*. Nevertheless, to the modified taste of a highly conspicuous insect, the warning colours probably possess value as sexual adornments.

12. The conspicuous appearance has relation to the injury which would be inflicted by the experimental "tasting" of certain enemies, *e. g.* Birds and Lizards; but nevertheless, other enemies, which do not inflict injury in tasting, *e. g.* Frogs, have taken advantage of the warning colours to a limited extent.

13. Insects which evade their enemies by protective resemblance and attitude, rapid movements, or habits of concealment, &c., are generally palatable, but they may often possess an unpleasant taste or smell which may or may not protect them from enemies.

14. In a very small number of species the most perfect form of protective resemblance may coexist with a most unpleasant taste.

15. Mere size alone may protect a species against certain of its smaller foes.

16. Comparing the different stages in Lepidoptera, unpleasant attributes appear to arise in the larval stage, and they then often pass through the two other stages attended or unattended, in one or both, by warning colours.

17. The most highly specialized protective colours probably also possess value as sexual adornment.

Considerably over 100 species or stages of insects have been experimented upon, and the results are described in the Tables given in this paper. Looking at these results as a whole, it is seen that the various defensive measures may exist in almost any combination, and that the present condition of a species is in large part an outcome of the means of protection in past struggles. Just as in a long-contested battle the same position may be taken, lost, and retaken, but never held a second time with quite the same significance as before, because of all that has happened as a result of the previous occupation and of all that has happened since in other parts of the field, so in the ever-changing relations between a species and its enemies the structural and functional means of defence may be taken up, abandoned, and again taken up, but never in quite the same combination or with quite the same defensive meaning.

APPENDIX I.

J. Jenner Weir's Diary of Observations during 1886.

The Lizards with which the following experiments were made were:—

Lacerta viridis, two specimens, ♂ & ♀.
Lacerta agilis, two specimens, ♂ & ♀.
Zootoca vivipara, one specimen, ♀.

May 31.—*Lacerta viridis* ♂ seized the larva of *Abraxas grossulariata*, and immediately dropped it, afterwards licking its jaws as if to remove the unpleasant taste; the ♀ of the same species then examined the caterpillar and rejected it.

June 4.—*Lacerta viridis* ate the imago of a species of *Chrysopa* twice during the day; this was the more remarkable, as these insects are peculiarly malodorous.

June 9.—*Lacerta viridis* ate two larvæ of *Clisiocampa neustria*, but afterwards refused to eat more.

June 11.—*Lacerta agilis* ♀ after much hesitation swallowed a larva of *Clisiocampa neustria*.

June 12.—Larvæ of *C. neustria* and *Porthesia similis* (*auriflua*) refused by all.

Lacerta agilis ♀ ate one larva of *Abraxas grossulariata*.

June 13.—The imago of *Tipula oleracea* eaten by ♀ *Lacerta viridis*.

June 14.—Larva of *Abraxas grossulariata* tasted by *Lacerta viridis* ♂, and rejected.

June 15.—*Lacerta viridis* ♂ ate *Clisiocampa neustria*; *Lacerta agilis* ♂ bit the larva of *Abraxas grossulariata*, but refused to eat it, and afterwards rubbed his nose and mouth against the moss as if endeavouring to remove a disagreeable taste.

Cocoons of ants were eaten with avidity.

July 1.—*L. viridis, L. agilis*, and *Zootoca vivipara* all ate Aphides.

July 9.—Imagines of *A. grossulariata* refused by Lizards.

One imago of *Porthesia similis* (*auriflua*) eaten.

Aphides scarcely noticed.

July 31.—Imagines of *Halia wavaria* and *Camptogramma bilineata* eaten.

Spiders eaten greedily.

August 2.—Imago of *Abraxas grossulariata* refused after having been seized.

August 6.—*Lacerta agilis* ate unwillingly, and *L. viridis* refused the larvæ of *Pygera bucephala*.

Zootoca vivipara ate winged ♀ ant, but all the Lizards refused the neuters.

August 11.—Imagines of *Eristalis* and of *Syrphus* eaten by all the Lizards voraciously.

August 12.—One *Pygæra bucephala* larva was eaten, but this species generally allowed to crawl about the cage unnoticed.

August 27.—An evil-smelling inconspicuous Hemipteron refused after tasting.

August 30.—Lizards refused to eat the gooseberry sawfly.

August 31.—Lizards ate common earwig and imagines of *Tryphæna pronuba*, *T. orbona*, and *Amphipyra pyramidea*.

Sept. 5.—*L. viridis* ♀ killed, but refused to swallow a humble-bee (*Bombus*).

Sept. 14.—Lizards ate imagines of *Mamestra brassicæ*, *Pieris brassicæ*, and *P. rapæ*.

Sept. 27.—*Zootoca vivipara* ate larva of *Tryphæna pronuba*.

Oct. 2.—Larvæ of *Tryphæna arbona* eaten, and imagines of *Anchocelis pistacina* seized and eaten greedily, but apparently swallowed with difficulty.

Oct. 4.—All the Lizards refused the imago of *Vanessa urticæ*.

Mr. Jenner Weir also informs me that the common Muscidæ were eaten with intense relish, their larvæ and pupæ being also eaten.

APPENDIX II.

E. B. Poulton's Diary of Observations during 1886.

May 8.—About this date one larva of *L. quercus* was offered to *L. muralis* and *L. viridis*, but it was untouched, although allowed to remain many days in the cages. One imago of *Pieris rapæ* was eaten. One imago of *Dasychira pudibunda* (♀) was seized and eaten directly it was seen to move (*L. muralis*).

One larva of *Mania typica* was eagerly seized by two individuals of *L. muralis*, being detected while it was rolled up and motionless (feigning death). The larva was shaken and bitten, but it was not swallowed, and the Lizards rubbed their jaws upon the wooden floor of the cage, an evident sign of distaste. When the larva had been thus wounded another Lizard came up and inspected it closely as if it were going to bite, but soon retired without touching it. It seems probable that this last Lizard was warned by the smell of the larval fluids which had escaped after it had been wounded.

Four pupæ of *Pygæra bucephala* were introduced (*L. muralis*) and were bitten, but at once relinquished with the signs of distaste described above.

Earthworms were eaten with great avidity by all the species of Lizards.

May 9.—Five imagos of *P. rapæ* were eaten, two of them immediately. One imago of *Pieris brassicæ* was eaten at once, being pursued by two or three Lizards (*L. muralis*).

Two imagos of *Pieris napi* were immediately seized and eaten.

One imago of *Trichiosoma lucorum* was eaten at once by *L. muralis*.

May 18.—One imago of *Chloephora prasinana* was seized and eaten the instant it was seen to move but not before (*L. muralis*).

May 19.—One imago of *Gonoptera libatrix* was at once detected by two Lizards even when motionless; it was seized and eaten with great avidity (*L. muralis*).

One Noctua pupa (found when digging in the garden; almost certainly that of *Mamestra brassicæ*) was instantly seized, slightly crushed, and swallowed with great avidity (*L. muralis*). It was interesting to note the great difference between the treatment of this pupa and that of *P. bucephala*.

May 21.—One imago of *Anthocaris cardamines* (♀) was seized and eaten immediately (*L. muralis*).

May 30.—Two imagos of *C. prasinana* were eaten directly with avidity. A few larvæ of *Odonestis potatoria* were placed in the cage of *L. muralis* a day or two before, and after long delay had disappeared by this date. Two were offered to the same Lizards on this day, and one was taken at once, the other being untouched for a long time. It is quite evident that the species is disliked, but that the Lizards will eat it if they are hungry.

Several pupæ of *P. bucephala* were introduced; from one of them an imago emerged almost immediately, and was at once seized and then relinquished by two or three individuals of *L. muralis*, but it was finally eaten, although evidently unpalatable. The pupæ were not touched on this day.

One imago of *P. rapæ* was eaten at once.

One imago of *P. brassicæ* was eaten, but not at once, by *L. muralis*.

June 2.—One imago of *P. rapæ* was eaten at once by *L. muralis*.

June 4.—One pupa of *Tryphæna pronuba* was eaten directly by *L. muralis*.

One imago of *Euplexia lucipara* was eaten directly by *L. muralis*.

Two imagos of *Hepialus lupulinus* were eaten directly by *L. muralis*.

One imago of *P. bucephala* was seized at once but soon relinquished by *L. muralis*.

June 6.—The *P. bucephala* imago introduced on June 4th had now disappeared; another was offered on this day and was at once seized and eaten by *L. muralis*.

The larvæ of *O. potatoria* had now disappeared.

Three imagos of *P. rapæ* were eaten at once by *L. muralis*.

One imago of *P. brassicæ* was eaten immediately by *L. muralis*.

After this last date the various species of Lizards to which insects were offered were always accurately noted, and were indicated by the numbers I., III., IV., V., and VI. placed upon their respective cages, and which contained the following species:—

I. *Lacerta muralis* (var. *tiliguerta*), about a dozen fine specimens.

III. One ♀ *Lacerta viridis* and two ♂ of the same species: all fine individuals.

IV. *L. muralis*, var. *tiliguerta*: about half a dozen full-grown specimens.

V. A few small individuals of *L. muralis* (more than one variety).

VI. One ♀ *L. viridis*, a very fine specimen, and one full-grown Gecko (*Tarentola mauritanica*).

June 11.—I. Four imagos of *P. bucephala* were introduced, one was seized directly but relinquished; ultimately all four were eaten.

Four larvæ of *Abraxas grossulariata* were untouched.

III. Two imagos of *Cerura vinula* and four of *P. bucephala* were all taken ultimately. These Lizards (*L. viridis*) were very shy, and hardly ever seized an insect before an observer; being quite unlike *L. muralis* in this respect.

Two larvæ of *A. grossulariata* disappeared, but they may have escaped, being small larvæ.

IV. Five larvæ of *A. grossulariata* introduced; I saw one severely bitten, in fact chewed for some time, but it was ultimately relinquished. One larva of *C. neustria* was also added, and with the *A. grossulariata* could not be seen on the next day. It is possible that they may have escaped, and I do not attach importance to their absence, unless escape was impossible. One imago of *P. bucephala* was ultimately eaten.

V. Two imagos of *Amphydasis betularia*, one of *Mamestra persicariæ*, one of *M. brassicæ*, and one pupa of *Plusia gamma* were introduced and all eaten (I witnessed the capture of one *betularia* and the *persicariæ*). Four larvæ of *A. grossulariata* were untouched.

VI. Two imagos of *P. bucephala* were eaten ultimately.

June 13.—V. One imago of *Acronycta psi* was ultimately eaten.

June 15.—I. Three imagos of *P. bucephala* were all eaten by the next day.

III. Six imagos of *P. bucephala* were introduced, and five were eaten by the next day.

V. One imago of *A. cardamines* (♀) was eaten by the next day.

VI. Four imagos of *P. bucephala* were introduced and three were eaten by the next day.

In these cases the insects may have been eaten at any time between their introduction and the next day, when the next observation was taken.

June 17.—I. One imago of *Sphinx ligustri* was introduced and untouched.

V. One imago of *Hadena oleracea* and one of *A. psi* were eaten by the next day.

June 18.—I. The *S. ligustri* introduced yesterday was resting on the upper part of the cage out of reach of the Lizards; it was again placed on the floor of the case, but remained untouched.

June 19.—III. The *S. ligustri* was still untouched in I. cage, and it was therefore removed and placed in III. When the next observation was made, a few hours later, it was entirely eaten except a piece of one wing.

I. Two full-fed larvæ of *Tæniocampa gothica*, found feeding upon *Aconitum napellus*, were introduced to see if they were affected as food by the exceedingly poisonous properties and strong taste of the plant upon which they had been feeding. It seemed possible that the undigested food in the larval digestive tract might be harmful to the Lizards, even if the insects made no further use of the properties of their food for purposes of defence. However, the Lizards fought eagerly for the larvæ, and the two successful ones were separated from the rest and remained perfectly healthy.

June 21.—I. An imago of *Smerinthus populi* was eaten by the next day, having been seized at once.

III. One imago of *S. populi* and two cockchafers (*Melolontha vulgaris*) were introduced; by the next day the former and one cockchafer had been eaten.

June 25.—I. One imago of *S. lubricipeda* was eaten at once, and many imagos of *P. bucephala*.

III. One imago of *S. ligustri* was eaten in a few minutes.

July 1.—I. One imago of *S. lubricipeda* and one of *Macroglossa fuciformis* were soon eaten, the former at once. The Lizard did not seize the *M. fuciformis* with any caution, as if afraid of a sting.

July 4.—I. Three pupæ and two larvæ of *Vanessa urticæ* were eaten at once; one larva of *P. auriflua* was seized at once and chewed for some time, but it was ultimately relinquished, the Lizard seeming to be much irritated by the hairs, and continually opening its mouth. Two imagos of *Ennomos angularia* and one of *A. psi* were taken at once. One unnamed larva of a Sawfly was seized and relinquished, but apparently taken again.

IV. Two pupæ of *V. urticæ* were soon taken.

V. Three pupæ of *V. urticæ* were soon taken.

VI. One imago of *S. ligustri* taken.

August 14.—I. Six imagos of *Vanessa io* and about eight of *V. urticæ* were introduced, and many were seized at once; but the Lizards were apparently not very eager after them, although they were hungry. However, in twenty-four hours all had disappeared except one *V. io*, which had got into an inaccessible place, but when brought down it was eaten at once.

August 16.—I. A few larvæ of *V. urticæ* were eaten at once. Two larvæ of *Euchelia jacobææ* were seized at once but relinquished, the Lizards being very hungry. A few hours afterwards they had disappeared and were very probably eaten; but I do not feel able to speak with confidence, as the larvæ are small and might possibly have escaped.

September 6.—On this date *L. muralis* and *L. viridis* were taken to Birmingham and offered distasteful larvæ at a meeting of the Biological Section of the British Association. One larva of *P. bucephala* was placed in the cage of *L. muralis*, and although it was often very severely bitten and for some considerable time by many of the Lizards, it was not eaten. For a day or two before this date the same species of larva had been placed in the cages of *L. muralis* and *L. viridis*, and some of them had disappeared, so that I believed that they must have been eaten. Subsequently I was able to confirm this suspicion, for when I was removing the individuals of *L. muralis* from the travelling cage (Sept. 7), I found the fæces of one of them upon the floor, the excreta *consisting entirely of a partially digested larva of P. bucephala.*

I also offered (Sept. 6) the same species of Lizard a number of larvæ of the Sawfly (*Crœsus septentrionalis*), and although the Lizards seized them eagerly at first, they soon rejected them with every sign of disgust, the jaws being rubbed against the floor of the cage to remove as far as possible every trace of the unpleasant taste. However, on the railway journey from Birmingham to Oxford (Sept. 6) I actually saw a hungry Lizard seize one of these larvæ, and with much hesitation reluctantly swallow it. I was surprised at this behaviour, for earlier in the summer I had certainly seen these same larvæ devoured with apparent avidity by nearly all the Lizards. On one occasion also I placed the conspicuous pupa of *Abraxas grossulariata* in the cage of *L. muralis*. I subsequently found that it had been bitten, and as all its contents were gone it seems certain that it had been at any rate partially eaten. I have also offered the imago of this species to the Lizards, but it has always been refused after tasting in some instances. Furthermore, immense numbers of pupæ and imagos of *Vanessa urticæ* were eaten by all the Lizards at various dates towards the end of August and beginning of September, while early in the summer humble-bees (*Bombus lapidarius* &c.) were sometimes eaten by *Lacerta viridis*, and the common hive-bee (worker) was sometimes eaten with considerable caution by most of the Lizards. Common wasps (queens and workers), on the other hand, were invariably undisturbed; and this was also the case with *Nomada marshamella*. Cockroaches were always eaten with avidity by all the Lizards, as well as the common species of Muscidæ, with their larvæ and pupæ. *Coccinella septem-punctata* was invariably refused without tasting. The Carabidæ—*Carabus hortensis* and *Omaseus melanarius*—were eaten readily. The Isopod (*Armadillo vulgaris*) was also relished.

Experiments with the Frogs (*Hyla arborea*, var. *meridionalis*) were less numerous and systematic; but they yielded some very interesting results:—

May 7, 1886.—A queen wasp was put in the aquarium, and immediately a Frog sprang at it and drew it into its mouth, but instantly recognizing (apparently by the tactile sense) the danger, released the insect. It is possible that the Frog was stung, but the whole process, capture and release, was so rapid that it is very likely that the animal escaped. As soon as the wasp was free a second Frog behaved in precisely the same manner, and after this a third. After this I did not see the wasp again attacked, and it was left in the aquarium for twenty-four hours.

May 9.—One imago of *Pieris napi* taken instantly.

May 13.—One imago of *A. cardamines* (♀) taken instantly by one Frog after being refused by others.

May 29.—One imago of *A. cardamines* (♀) eaten at once by one Frog after having been refused by others.

One imago of *Orgyia pudibunda* (♂) eaten at once by one Frog after having been refused by others.

June 6.—Two imagos of *E. jacobææ* were eaten at once, one directly after the other, *by the same Frog*, so that the taste could not have been unpleasant. However, they were evidently indigestible, for next day both were found floating in the aquarium.

One larva of *A. grossulariata* was refused after being just tasted by one Frog.

These are all the regular notes made upon the insects eaten by the Frogs, but in addition to the above various other larvæ and imagos were given to them. The following imagos were eaten:—*E. angularia*, *V. urticæ* (both these in great numbers, although they were often refused by individual frogs), *Acronycta psi*.

The following larvæ were also eaten:—*Phlogophora meticulosa*, and the hymenopterous *Crœsus septentrionalis*.

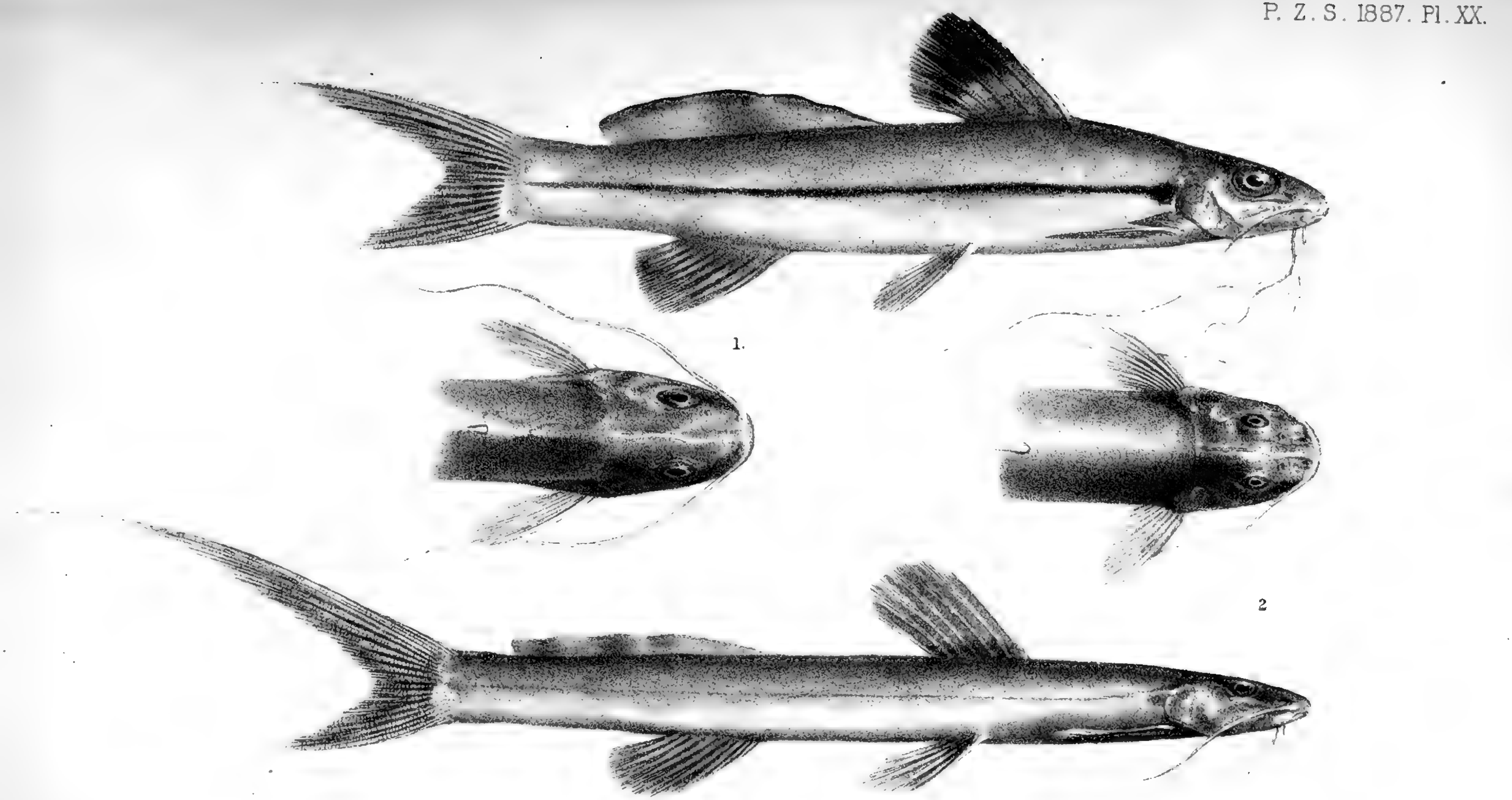
Although wasps were refused, the common hive-bee was eaten, together with other species of bees (*e. g. Andrena nigro-ænea*) and many species of Diptera (*e. g.* common species of *Musca*, *Eristalis*, and *Syrphus*, *Bibio marci*, &c.) and of spiders (*e. g. Epeira diadema*, *Tegenaria domestica*, &c.). All of these were relished and eagerly sought after except the bees, which were generally swallowed, but in most cases rejected afterwards and were found floating in the aquarium. Very often I saw the bees (*Apis* and *Andrena*) liberated after being held in a Frog's mouth for some seconds, and as soon as the animal began to reject it most violent and active efforts were made, especially with the tongue, in order to get rid of the insect as rapidly as possibly. From the sudden and spontaneous way in which the insect was often rejected after being held in the mouth for some seconds, I was led to believe that the Frog was stung. Earthworms were eaten by some of the Frogs, but apparently without relish, and the majority refused them altogether, and the same was true of the larvæ of the commonest Muscidæ. *Coccinella septem-punctata* and *C. bipunctata* were invariably refused. Cockroaches, Earwigs, and *Aphis hederæ* were eaten, the latter by very young Frogs.

2. An Account of the Fishes collected by Mr. C. Buckley in Eastern Ecuador. By G. A. Boulenger, F.Z.S.

[Received February 7, 1887.]

(Plates XX.–XXIV.)

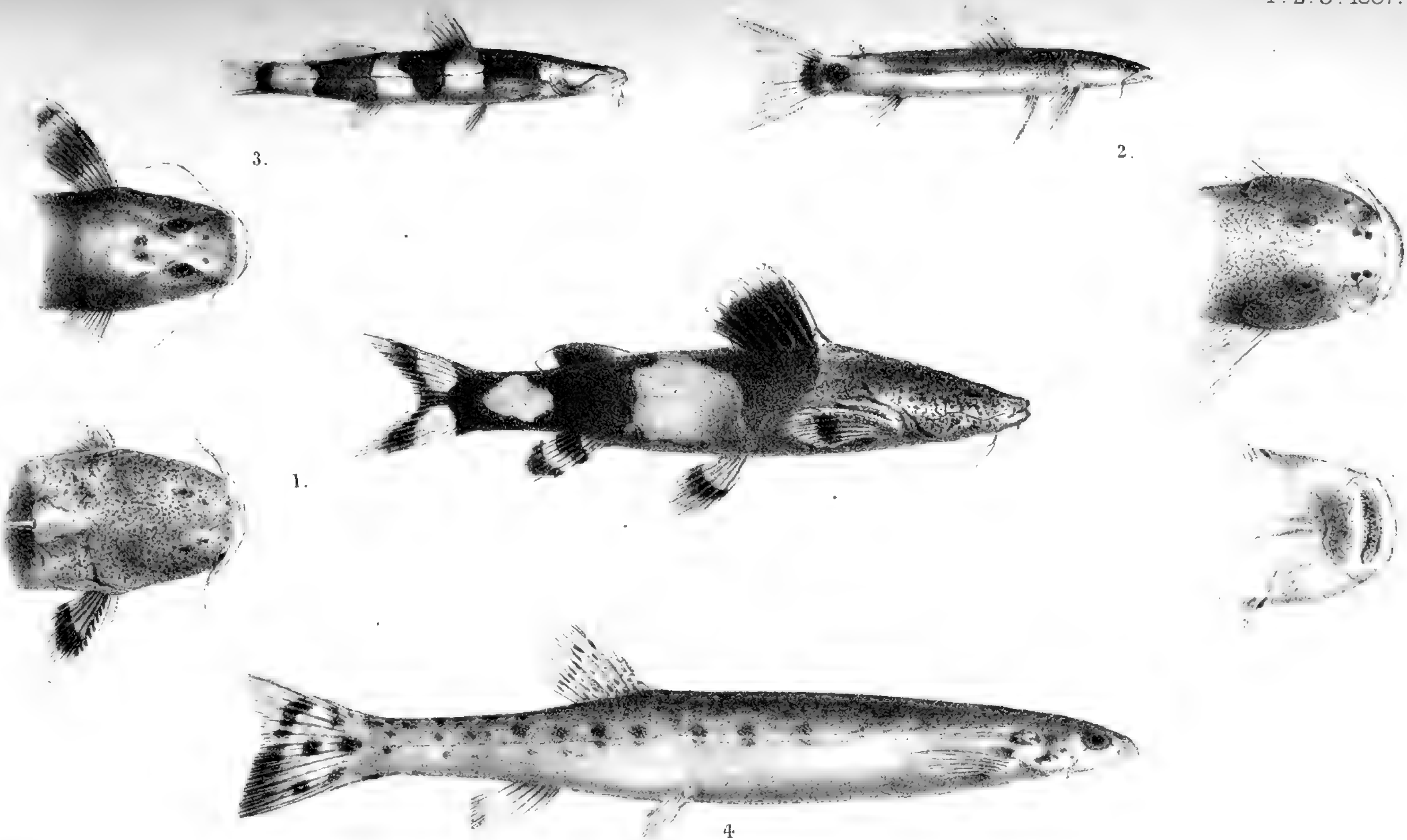
The rich collections brought over from Ecuador by the late Mr. Clarence Buckley in 1880 contained a large number of highly interesting and well-preserved Fishes obtained at three localities, viz. Canelos, Sarayacu, and Pallatanga. On the arrival of the collection a set of all the species was selected and retained for the National Museum. The duplicates having been sold by the well-known dealer Mr. Gerrard to other institutions, principally to the Vienna Museum, some of the novelties have already been described by Dr. Steindachner.



Peter Smit del. et lith.

1. PIMELODUS BUCKLEYI. 2. PIMELODUS LONGICAUDA.

Mintern Bros. imp.



Peter Smit del. et lith.

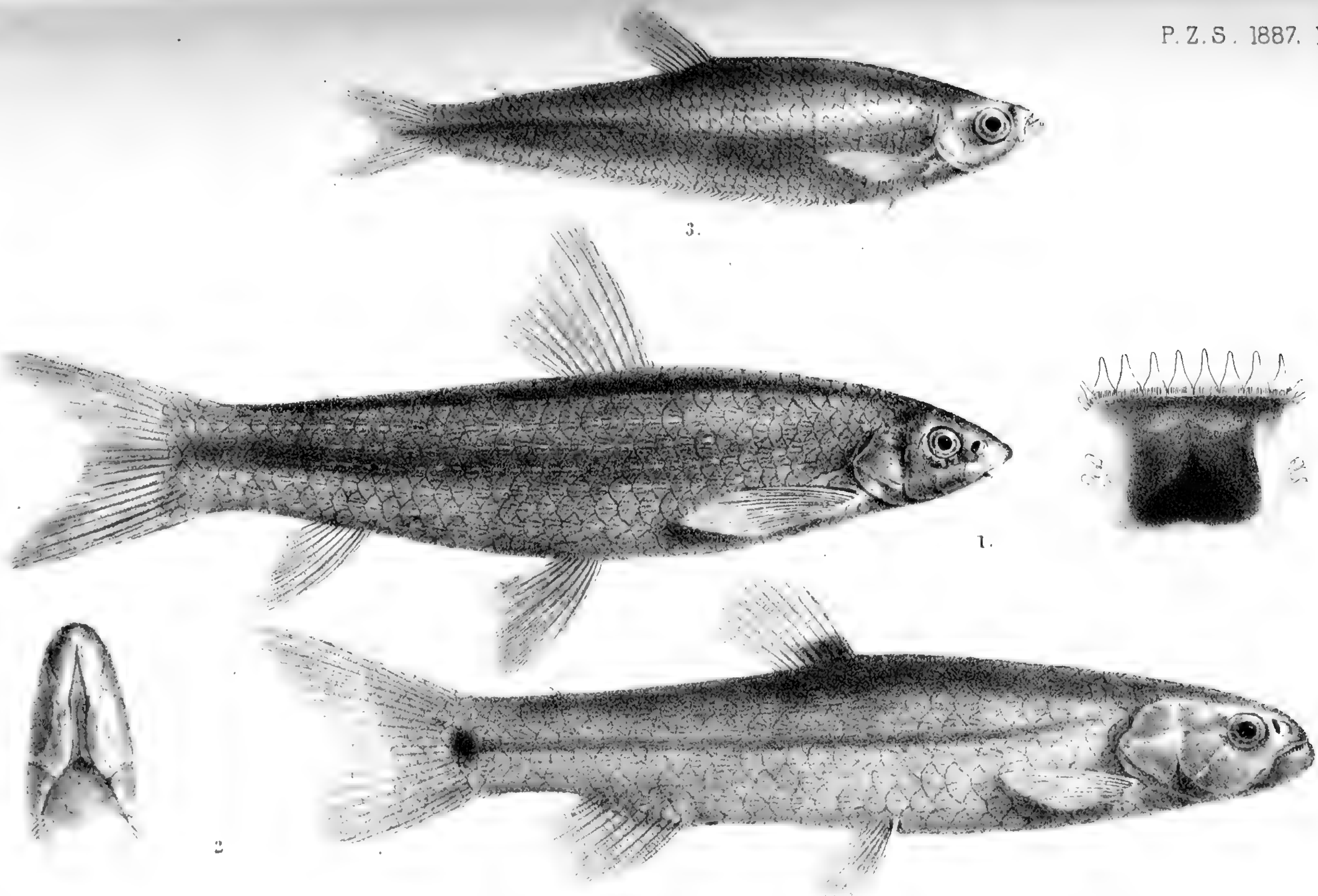
Mintern Bros. imp.

1. PIMELODUS PULCHER. 2. STYGOGENES HUMBOLDTII.
3. NANNOGLANIS FASCIATUS. 4. STEGOPHILUS PUNCTATUS.

Peter Smit del. et lith.

CHÆTOSTOMUS DERMORHYNCHUS.

Mintern Bros. imp.



Peter Smit del. et lith.

Mintern Bros. imp.

1. PARODON BUCKLEYI. 2. PIABUCINA ELONGATA.
3. LEPTAGONIATES STEINDACHNERI.

Peter Smit del. et lith.

Mintern Bros imp.

STERNARCHUS CURVIROSTRIS.

CHROMIDES.

1. ACARA SYSPILUS, Cope.

Acara syspilus, Cope, Proc. Acad. Philad. 1872, p. 255.
Canelos.

2. CRENICICHLA SAXATILIS, L.

Canelos.

SILURIDÆ.

3. PIMELODUS BUCKLEYI, sp. n. (Plate XX. fig. 1.)

Pimelodus lateristriga (non Müll. & Trosch.), Cope, *l. c.* p. 270.

D. 1/6. A. 12. P. 1/9.

Near *P. lateristriga*. Head naked above; occipital process narrow, thrice as long as broad, extending to the basal bone of the dorsal spine. Adipose fin much developed, a little more than one third of the total length (without caudal); its distance from the dorsal fin is less than the length of the latter. The maxillary barbels extend to the origin of the anal, the outer mandibulars to the extremity of the pectorals. The length of the head is one fifth of the total length (without caudal); eyes of moderate size, occupying the middle of the head. Dorsal fin much higher than long; the spine much shorter than the anterior branched rays, two thirds or three fifths the length of the head. Pectoral spine rather longer than dorsal spine, smooth on its inner edge, feebly serrated at the extremity of its outer edge. Caudal fin deeply cleft, with the lobes pointed, the upper being the longer. A dark brown spot on the shoulder, at the origin of the lateral line; a blackish streak along the latter; upper half of dorsal blackish; adipose fin with a fine dark brown edge.

Total length 150 millim.

Two specimens from Canelos.

4. PIMELODUS (RHAMDIA) LONGICAUDA, sp. n. (Plate XX. fig. 2.)

D. 1/6. A. 10. P. 1/9.

Head naked above; occipital process short, widely separated from the dorsal spine. Adipose fin long, its length being contained once and one third to once and three fourths in the total (without caudal); its distance from the dorsal fin is one half or three fifths of its own length. The maxillary barbels extend to the base of the ventrals, the outer mandibulars to the axilla. The length of the head is one sixth of the total length (without caudal); the depth of the body below the dorsal equals the depth of the tail above the anal, and is contained nine or ten times in the total length (without caudal). The lower jaw is the shorter; the band of præmaxillary teeth is about four times as broad as long. Eye equally distant from the end of the snout and the gill-opening; its diameter a little less than the width of the interorbital space. Dorsal fin higher than long, with the spine very feeble. Pectoral spine very feeble, not striated. The posterior anal rays do not extend to the vertical from the end of the adipose fin if laid backwards. The free portion of the tail is as deep as long. Caudal fin deeply forked, the upper lobe much produced, much longer than the lower, measuring more than one fourth of the total length. Upper parts brownish, lower whitish.

Total length 175 millim.

Four specimens from Canelos.

5. Pimelodus (Pseudopimelodus) pulcher, sp. n. (Plate XXI. fig. 1.)

D. 1/6. A. 9. P. 1/5–6.

Head naked above; occipital process short, about as long as and in contact with the basal bone of the dorsal spine. The length of the adipose fin equals about three fourths of its distance from the dorsal, or the depth of the tail below its origin. The maxillary barbels extend to the base of the pectoral spine; the outer mandibulars a little shorter than the maxillaries. The length of the head is about two sevenths of the total (without caudal); the depth of the body below the dorsal one fifth or one ninth of the total length (without caudal). Head slightly longer than broad. The band of teeth in the upper jaw is of moderate breadth, without prolonged lateral portion. Eyes very small, directed upwards, and covered with skin. Dorsal fin a little higher than long, with strong serrated spine. Pectoral spine very stout, depressed, very strongly serrated along its inner, less so along its outer edge. Caudal forked. Pale brownish on the head and body, with a dark brown band encircling the body and covering the dorsal fin, save its upper border, which is white; head dotted with brown; tail and caudal dark brown, with a large round light spot on each side of the free portion of the tail (sometimes confluent); two large whitish spots, one above the other, on the caudal, the extremity of which is whitish; adipose fin dark brown, whitish in front and behind; pectoral and ventral with one, anal with two dark brown cross bands.

Total length 87 millim.

Three specimens from Canelos.

6. Cetopsis plumbeus, Stdr.

Cetopsis plumbeus, Steind. Denkschr. Ak. Wien, xlvi. 1883, p. 31, pl. vi. fig. 3.

Sarayacu.

7. Stygogenes humboldti, Gthr. (Plate XXI. fig. 2.)

One specimen, 56 millim. long, from Pallatanga. Specimens from Canelos are mentioned by Steindachner. They are of great interest as settling the point of the exact habitat of the species, those upon which it was established being without locality. Whether *S. humboldti* is identical with Humboldt's *Pimelodus cyclopum* must remain an open question. The opinion of Putnam (Amer. Nat. 1871, p. 694) loses all value from the fact that he also proposes to unite *Arges brachycephalus*, Gthr.! On comparison of young specimens of the latter species with others obtained by Mr. Edward Whymper at Milligalli, Ecuador, and which are undoubtedly the *Brontes prenadilla*, C. & V., I am convinced that Steindachner's recent suggestion that *A. brachycephalus* is identical with *A. prenadilla* is correct.

8. Plecostomus bicirrhosus, Gron.

Two young specimens from Canelos.

9. Chætostomus cirrhosus, Val.

Canelos.

10. Chætostomus microps, Gthr.

Canelos.

11. Chætostomus dermorhynchus, sp. n. (Plate XXII.)

D. 1/8. A. 1/5. P. 1/6. V. 1/5. L. lat. 25.

Allied to *C. microps*, Gthr., and *C. nudirostris*, Ltk. Head and body much depressed, without any prominence; the width of the head equals its length, and is one third of the total (without caudal); the entire margin of the snout naked, soft, swollen, without tentacles; fold of the upper lip short, not prolonged in the middle; barbel very short. Diameter of the eye about one sixth of the length of the head, and three fifths of the width of the interorbital space. Interoperculum with four or five strong, hooked, erectile spines, none of which are as long as the diameter of the eye. Thorax and abdomen entirely naked. Dorsal fin slightly higher than long; the length of the anterior rays nearly equals the length of the head; the basal length of the fin is less than its distance from the caudal; six scutes between the two dorsal fins. Caudal fin feebly emarginate, lower lobe longest; anal moderate; ten scutes between anal and caudal. Pectoral spine of moderate strength, extending beyond the root of the ventral. Scutes of body not keeled, with short spines along the margin; posthumeral ridge indistinct. Olive-brown above, each dorsal scute with a rather indistinct light central dot; an indistinct dark lateral band; dorsal fin with light dots; lower surfaces whitish.

Total length 148 millim.

Three specimens from Canelos.

12. Loricaria filamentosa, Stdr.

Loricaria filamentosa, Steind. Denkschr. Ak. Wien, xxxix. 1879, p. 45, pl. ix.

Canelos.

13. Loricaria lanceolata, Gthr.

Loricaria lanceolata, Günth. Proc. Zool. Soc. 1868, p. 235, fig. 3.

Two specimens from Canelos, one of which agrees in every respect with the type. The other, an adult male with long hair-like bristles on the sides of the snout, the nape, and the pectoral fin, differs in the much smaller size of the pectorals, which do not reach the base of the ventrals. I must add that the ventral and dorsal scutes of the three specimens before me agree perfectly with the accurate figure of *L. magdalenæ*, Stdr. (Denkschr. Ak. Wien, xxxix. p. 74, and xli. p. 26, pl. vii. fig. 2).

14. ACESTRA KNERI, Stdr.

Acestra knerii, Steind. Denkschr. Ak. Wien, xlvi. 1883, p. 26, pl. vii. fig. 1.

Canelos and Sarayacu.

15. BUNOCEPHALUS KNERI, Stdr.

Bunocephalus knerii, Steind. *l. c.* p. 9, pl. ii. fig. 2.

Canelos.

16. TRICHOMYCTERUS KNERI, Stdr.

Trichomycterus knerii, Steind. Sitzungsb. Ak. Wien, lxxxvi. i. 1882, p. 81, pl. v. fig. 1.

Canelos.

NANNOGLANIS, g. n. (Trichomycterina).

Adipose fin present, large. Dorsal fin short, without pungent spine, placed nearly in the middle of the body and behind the ventrals fins; anal short; caudal truncated. Teeth villiform, in broad bands in the jaws; palate toothless; cleft of the mouth moderate. No nasal barbel; one maxillary and two lateral mentals. Eyes directed upwards. Head covered with soft skin. No opercular or interopercular armature. Gill-openings wide, continuous across the throat. Ventrals six-rayed.

17. NANNOGLANIS FASCIATUS, sp. n. (Plate XXI. fig. 3.)

D. 7. A. 8. P. 9. V. 6.

The length of the head is one fifth of the total, the height of the body one ninth. The diameter of the eye is one third of the length of the snout and three fourths of the width of the interorbital space. The maxillary barbel extends to the middle of the pectoral, the outer mandibular not quite so far. The origin of the dorsal is in the middle between the end of the snout and the extremity of the adipose fin, which is as long as the head. Pectorals not quite reaching the base of the ventrals. Vent situated below the origin of the dorsal fin. Yellowish, with four broad brown, black-edged cross bands above; the first is the broadest, and occupies the space between pectorals and ventrals; the third is below the adipose fin; and the fourth, narrowest, at the base of the caudal; a dark brown line from the eye to the maxillary barbel.

Total length 52 millim.

Two specimens, without particular locality.

18. Stegophilus punctatus, sp. n. (Plate XXI. fig. 4.)

D. 8. A. 7. P. 6. V. 5.

Closely allied to *S. macrops*, Stdr. Head as long as broad; its length is contained six and a half times in the total, the depth of the body nearly nine times. Eye large, covered with skin; its diameter equals the length of the snout and is contained four times in the length of the head. Barbel shorter than the eye. Anal behind the dorsal, the origin of which is nearly midway between the occiput and the extremity of the caudal. Latter fin emarginate. Pale brown above, with numerous small brown spots; a lateral series of large rounded purplish-brown spots; dorsal and caudal brown-spotted.

Total length 114 millim.

Canelos. A single specimen.

Characinidæ.

19. Curimatus dobula, Gthr.

Curimatus dobula, Günth. Proc. Zool. Soc. 1868, p. 243.

Curimatus nasus, Steind. Sitzungsb. Ak. Wien, lxxxvi. i. 1882, p. 80, pl. v. fig. 2.

Canelos.

20. Parodon buckleyi, sp. n. (Plate XXIII. fig. 1.)

D. 12. A. 9. P. 17. V. 8. L. lat. 37. L. transv. 9.

Dental formula $\frac{2-8-2}{3-3}$; præmaxillary teeth fringed rather than denticulated, each with about twenty fringes. The height of the body is not quite one fourth of the total length (without caudal), the length of the head one fifth. The height of the dorsal a little exceeds the length of the head; its origin is nearer the adipose fin than the end of the snout, and falls above the thirteenth scale of the lateral line. A length of six scales separates the extremity of the pectoral from the base of the ventral, which falls below the middle of the dorsal; ventrals extending slightly beyond the vent. Upper half pale brownish, lower yellowish, separated by a greyish band; a brown band along each side of the back; fins unspotted.

Total length 135 millim.

A single specimen from Canelos.

This being the first specimen of the genus *Parodon* received by the British Museum, the characters enumerated in the following tabular synopsis of the species hitherto described are merely the result of compilation. The shape of the præmaxillary teeth of *P. buckleyi* is clearly quite distinct from that of the species established by Kner and by Reinhardt, who describe and figure each tooth with about ten or twelve denticles. Whether the new species differs in this respect from the type of the genus I am not able to say, Valenciennes's figure not being executed with sufficient accuracy, and the description merely stating "le bord (des dents) est denticulé et comme finement frangé."

	D.	A.	P.	L. lat.	Mand. teeth.	Height of body contained in total length.
1. *P. suborbitalis*, C. & V.	11	9	16	37	3—3	More than six times.
2. *P. buckleyi*, Blgr.	12	9	16	37	3—3	Less than six times.
3. *P. nasus*, Kner	11	9	15	36–38	3—3	,,
4. *P. hilarii*, Rhdt.	11	9	15	38	2—2	,,
5. *P. affinis*, Stdr.	12	8	12	44–45	2—2	,,

21. Characidium fasciatum, Rhdt.

Characidium fasciatum, Reinh. Overs. Vidensk. Forh. 1866, p. 56, pl. ii. figs. 1, 2.

D. 11. A. 8. V. 9. L. lat. 36–37. L. transv. $\frac{4}{4}$.

The height of the body equals the length of the head, and is contained four times and one third to four times and three fifths in the total length (without caudal). Nasal openings widely separated from each other, as in the types (one of which, presented by Prof. Reinhardt, is in the British Museum)[1]. Suboperculum rather strongly produced and angular posteriorly. Snout and eye equal in length, measuring about one fourth the length of the head. Origin of the dorsal a little nearer the adipose fin than the end of the snout. Pectorals extending to the base of the ventrals, which do not reach the anal. Brownish (probably hyaline in life), with a broad silvery band along the lateral line, and more or less distinct traces of ten or eleven dark transverse bands on the body and tail; a purplish band across the base of the six posterior dorsal rays, a small round blackish spot on the base of the caudal, at the termination of the silvery lateral band.

Total length 87 millim.

Four specimens from Sarayacu.

Dr. Steindachner (Sitzungsb. Ak. Wien, lxxxvi. 1882, p. 78) mentions *C. fasciatum* from Canelos, and describes, from the same locality, a new species, *C. purpuratum* (*C. etheostoma*, Cope?), of which I am sorry to find no specimens.

22. Leporinus striatus, Kner.

Canelos.

23. Piabucina elongata, sp. n. (Plate XXIII. fig. 2.)

Piabucina unitæniata (non Günth.), Steind. Denkschr. Ak. Wien, xlvi. 1883, p. 41.

D. 10. A. 12. V. 8. L. lat. 30. L. transv. 8.

[1] Steindachner's statement in his description of *C. fasciatum* (Sitzungsb. Ak. Wien, lxxiv. 1877, p. 559), "Entfernung der Narinen von einander gering," is somewhat surprising.

The height of the body is considerably less than the length of the head, and is one fifth of the total (without caudal); the length of the head is contained about four times and one fourth in the total (without caudal). Lower jaw obtuse, projecting beyond the upper; the inner borders of the mandibles closely approximate anteriorly, diverging posteriorly, the part of the chin exposed between them being Λ-shaped, as in *P. unitæniata*[1]. The maxillary extends beyond the anterior margin of the orbit. The diameter of the eye is nearly half the width of the interorbital space, a little less than the extent of the snout, and one fifth of the length of the head. The origin of the dorsal fin is nearer to the root of the caudal than to the end of the snout, and behind the vertical from the base of the ventral. Adipose fin very small; caudal forked, with its basal half scaly. The length of the pectoral is two thirds of that of the head, and exactly one half of its distance from the ventral. Ventral shorter than pectoral. Pale brown above, yellowish inferiorly; a black lateral band becoming greyish and rather indistinct in the adult; a black spot on the base of the anterior dorsal rays, another on the root of the caudal fin.

Total length 145 millim.

Two adult specimens from Canelos, and three young from Sarayacu.

24. Tetragonopterus rutilus, Jen.

Tetragonopterus fasciatus, Gthr.

Canelos.

25. Creagrutus muelleri, Gthr.

Canelos.

26. Paragoniates alburnus, Stdr.

Paragoniates alburnus, Steind. Sitzungsb. Ak. Wien, lxxiv. i. 1876, p. 117, pl. viii. fig. 3.

Canelos.

Leptagoniates, g. n.

Body elongate, very strongly compressed. Dorsal fin short, placed behind the middle of the length of the body, far behind the ventrals; anal very long, nearly two thirds the length of the body. Cleft of the mouth narrow; præmaxillary, maxillary, and mandible with a single series of tricuspid teeth. Gill-openings wide. Scales moderate. Lateral line complete.

The nearest ally of this new genus is *Paragoniates*, Steind., which differs in the following points:—Cleft of the mouth wide; anal originating very slightly in advance of the dorsal; lateral line interrupted.

[1] In *P. erythrinoides*, C. & V., the inner borders of the mandibles are widely separated in front and nearly parallel.

27. LEPTAGONIATES STEINDACHNERI, sp. n. (Plate XXIII. fig. 3.)

D. 10. A. 70. V. 8. P. 12. L. lat. 47. L. transv. $\frac{7}{7}$.

The depth of the body is one fourth of the total length (without caudal), the length of the head one sixth. Mandible strongly projecting beyond the mouth; maxillary not reaching below the anterior border of the eye; præmaxillary teeth 15, maxillary (on each side) 11, mandibular 14; mandibular teeth largest, maxillary smallest. The diameter of the eye equals nearly two fifths the length of the head, and exceeds the width of the interorbital space. The pectoral fins reach nearly the extremity of the ventrals, which are small; the dorsal originates above the 23rd anal ray. Colourless; sides of head and a lateral band above the lateral line silvery.

Total length 95 millim.

A single specimen from Sarayacu.

28. ANACYRTUS PAUCIRADIATUS, Gthr.

Canelos.

29. ANACYRTUS KNERII, Stdr.

Anacyrtus knerii, Steind. Denkschr. Ak. Wien, xxxix. 1879, p. 65.

Cynopotamus humeralis, Kner, nec Val.

Canelos.

GYMNOTIDÆ.

30. STERNARCHUS ALBIFRONS, L.

Canelos.

31. STERNARCHUS (RHAMPHOSTERNARCHUS) CURVIROSTRIS, sp. n. (Plate XXIV.)

Snout produced into a long narrow tube, which is bent downwards; the diameter of this tube, halfway between its extremity and the eye, is one eighth of the length of the snout. The distance between the eye and the base of the pectoral equals two thirds the length of the snout. Mouth very narrow, its cleft not twice as long as the diameter of the eye. Vent below the eye. Anal commencing nearer the eye than the gill-opening; 185–188 rays. The greatest depth of the body is contained once and three fifths in the length of the head, and five times in the total. Scales on the upper and lower parts very small, those in the middle of the side of moderate size. Uniform brown.

Total length 125 millim.

Two specimens from Canelos.

32. STERNOPYGUS CARAPUS, L.

Canelos.

33. CARAPUS FASCIATUS, Pall.

No particular locality.

EXPLANATION OF THE PLATES.

PLATE XX.

Fig. 1. *Pimelodus buckleyi*, p. 275.
2. *Pimelodus* (*Rhamdia*) *longicauda*, p. 275.

PLATE XXI.

Fig. 1. *Pimelodus* (*Pseudopimelodus*) *pulcher*, p. 276.
2. *Stygogenes humboldti*, p. 276.
3. *Nannoglanis fasciatus*, p. 278.
4. *Stegophilus punctatus*, p. 279.

PLATE XXII.

Chætostomus dermorhynchus, p. 277.

PLATE XXIII.

Fig. 1. *Parodon buckleyi*, p. 279.
2. *Piabucina elongata*, p. 280.
3. *Leptagoniates steindachneri*, p. 282.

PLATE XXIV.

Sternarchus (*Rhamphosternarchus*) *curvirostris*, p. 282.

3. Note on a Vestigial Structure in the Adult Ostrich representing the Distal Phalanges of Digit III. By RICHARD S. WRAY, B.Sc. (Communicated by Professor FLOWER.)

[Received February 2, 1887.]

While examining an Ostrich's wing in the fresh state in order to make out the relation of the quill-feathers to the bones, I was struck by observing that the phalanx of the third digit had a large amount of cartilage at its tip. Having another wing available with that part uninjured, I removed the skin covering it, and carefully dissected out the phalanx of digit III. From the tip of this there extends a round band or rod of cartilage about half the length of the first phalanx; at its base it is as broad as the tip of the phalanx, at the other end about one sixteenth of an inch in breadth. Its distal end fades into the connective tissue in that region. When first dissected out, the cartilaginous rod showed no signs of ossification; but when placed in glycerine, the rod became quite transparent, showing a free second phalanx embedded in it, and occupying its proximal third (see fig. 1, p. 284).

The shape of the phalanx of digit III. is often as shown in fig 2, the pointed end being the fused second phalanx, which in adult specimens may be free and embedded in cartilage. The adult Ostrich, therefore, presents the nearest approach to the pentadactyle manus among Birds.

Through the kindness of Mr. G. B. Howes, I have had the opportunity of examining some fore limbs of Ostrich embryos. These (see fig. 3) show a most interesting appearance, the outline of the digits is clearly seen where they are encased in the skin. The tips of all the digits are free, including digit III., which has its tip free and projecting beyond the wing-fold. On removing the skin and examining the skeleton, phalanx 1 is distinct, then a rod of cartilage extends to the tip of the projecting fold of skin (*a*, fig. 4). This rod of carti-

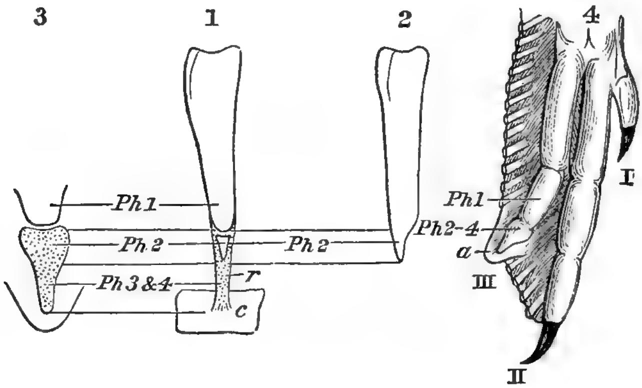


Fig. 1. Phalanx 1 and the vestigial cartilage of digit III., adult Ostrich. *Ph.* 1, 1st phalanx; *Ph.* 2, 2nd phalanx; *r*, vestigial cartilaginous rod; *c*, connective tissue.
Fig. 2. Phalanx of digit III. of another adult Ostrich, showing Ph. 2 ankylosed.
Fig. 3. The distal part of digit III. in the manus of the embryo (fig. 4).
Fig. 4. Ventral view of left manus of embryo. *a*, free tip of digit III.

lage probably represents the remaining phalanges of the digit, which are never definitely differentiated except phalanx 2: this is ossified in the broader basal third of the rod; in the embryo, before ossification commences, the basal part is much the broadest. All this points to the conclusion that this cartilaginous rod is a vestigial structure, representing in addition to the second (ossified in the adult), the third probably, and possibly also the fourth, phalanx of digit III. (see figures 1 and 3).

4. On the Terrestrial Mollusks of the Viti Islands.—Part II.[1] By ANDREW GARRETT, of Huahine, Society Islands. (Communicated by Mr. JOHN H. PONSONBY, F.Z.S.)

[Received December 8, 1886.]

Genus MELAMPUS, Montfort.

1. MELAMPUS LUTEUS, Quoy & Gaimard.

Auricula lutea, Quoy & Gaimard, Voy. Astrol. ii. p. 163, pl. 6. figs. 25–27; Deshayes, Lam. Hist. viii. p. 388; Küster, Auric. p. 39, pl. 6. figs. 1–3; Mousson, Jav. Moll. p. 47, pl. 5. fig. 6.

[1] See Part I., *suprà*, p. 164.

Conovulus luteus, Anton, Verz. p. 48.

Melampus luteus, Beck, Ind. p. 106; M. E. Gray, Figs. Moll. Anim. pl. 306. fig. 5; H. & A. Adams, Proc. Zool. Soc. 1854, p. 10; Gen. Moll. ii. p. 243; Pfeiffer, Syn. Auric. no. 30; Mon. Auric. i. p. 36; Mörch, Cat. Yoldi, p. 38; Mousson, Journ. de Conch. 1869, p. 346; Martens & Langk. Don. Bism. p. 55; Gassies, Faun. Nouv. Cal. p. 62; Pease, Journ. de Conch. 1871, p. 93; Proc. Zool. Soc. 1871, p. 477; Paetel, Cat. Conch. p. 114; Schmeltz, Cat. Mus. Godeff. v. p. 88; Garrett, Proc. Phil. Acad. Nat. Sci. 1879, p. 28; Journ. Phil. Acad. Nat. Sci. 1881, p. 402, 1885, p. 89.

Easily distinguished by its large size (18 millim.) and uniform luteous colour. Abundant just above high-water mark; it ranges from the Gambier Islands to the East Indies.

2. Melampus fasciatus (Deshayes).

Auricula fasciata, Deshayes, Encycl. Méth. ii. p. 90; Lam. Hist. viii. p. 337; Küster, Auric. pl. A. figs. 2, 3; Mousson, Java Moll. p. 46, pl. 5. figs. 28, 29.

Melampus fasciatus, Beck, Ind. Moll. p. 107; (*Tralia*) H. & A. Adams, Proc. Zool. Soc. 1854, p. 11; Pfeiffer, Syn. Auric. no. 33; Mon. Auric. i. p. 38; Mousson, Journ. de Conch. 1869, p. 348; Pease, Proc. Zool. Soc. 1871, p. 477; Martens & Langk. Don. Bism. p. 55; Paetel, Cat. Conch. p. 114; Schmeltz, Cat. Mus. Godeff. v. p. 88; Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 402, 1885, p. 90.

Conovulus fasciatus, Griffith, Cuv. Anim. Kingd. pl. 27. fig. 13; Anton, Verz. p. 48; Guérin, Icon. Moll. p. 17, pl. 7. fig. 8.

Tralia (*Pira*) *fasciata*, H. & A. Adams, Gen. Moll. ii. p. 240.

This, like the preceding species, lives just above high-water mark, and has the same extensive geographical range.

It is subject to considerable variation in shape and colour. The type varies from bluish white to luteous, and is girdled with from four to six narrow chestnut bands on the body-whorl. Varieties of a uniform bluish-white, corneous, brownish, or orange-brown are not infrequent, as well as one of an orange-brown with three chestnut bands. The spire is marked with minute radiating grooves.

3. Melampus parvulus, Nuttall.

Melampus parvulus, Nuttall, MS., Pfeiffer, Syn. Auric. no. 11; Mon. Auric. p. 24; H. & A. Adams, Gen. Moll. ii. p. 243; Pease, Proc. Zool. Soc. 1871, p. 477; Martens & Langk. Don. Bism. p. 56, pl. 3. fig. 10; Paetel, Cat. Conch. p. 114; Brazier, Quart. Journ. Conch. i. p. 274.

Common on the margins of mangrove-swamps. Mr. Brazier records it from Torres Straits. I took a few examples at Samoa and Wallis Islands. Mr. Nuttall obtained the type specimens at the Sandwich Islands. I have also received examples from New Caledonia.

The Viti shells, which are a little smaller than Sandwich-Island specimens, do not differ from the latter except in having in some examples one or two more denticles or plicæ on the parietal wall, and the base more distinctly impressedly striated. It may be recognized by its ovate shape, smooth shining surface, dark chestnut or olive-brown colour, short, convexly conoid spire, and mucronated apex. On the lower portion of the parietal region may be observed two approximating folds, the lower one the smaller and occasionally wanting. There are usually one or two small denticles above, and the palate has five to seven laminæ. The columella-fold is continuous with the basal portion of the peristome.

M. granum, Gassies, is either the same as *M. parvulus* or very closely related.

4. Melampus tongaensis, Mousson.

Melampus tongaensis, Mousson, Journ. de Conch. 1871, p. 22, pl. 3. fig. 8; Schmeltz, Cat. Mus. Godeff. v. p. 88; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 316.

A number of examples were taken in the same station as the preceding species. Dr. Gräffe found the type specimens at Tongatabu, one of the Tonga Islands. Prof. Mousson has described a variety *pallidula* (*l. c.*) from Vavao in the same group.

It is very closely allied to, and perhaps only a form of, *M. parvulus*. It is about the same size and colour, but is a little more oblong in shape and the spire more produced. The dentation and plicæ are the same in the two species.

5. Melampus semisulcatus, Mousson.

Melampus semisulcatus, Mousson, Journ. de Conch. 1869, p. 347, pl. 15. fig. 2; Paetel, Cat. Conch. p. 114; Schmeltz, Cat. Mus. Godeff. v. p. 88; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 318; Pease, Proc. Zool. Soc. 1871, p. 477.

Occurs on the margins of mangrove-swamps, where I gathered thousands of specimens. I also obtained it in similar stations at Upolu, one of the Samoa Islands.

This species is of an oblong pear-shape and a uniform cinnamon colour; it has a short, usually eroded, spire, and is spirally grooved, the grooves being more or less evanescent on the middle of the body-whorl. There are three folds in the parietal region and usually two lamina in the palate. Length 11 millim.

6. Melampus sculptus, Pfeiffer.

Melampus sculptus, Pfeiffer, Proc. Zool. Soc. 1859, p. 29; Mon. Pneum. (Auric.) iv. p. 316.

Melampus fricki, Pfeiffer, Proc. Zool. Soc. 1859, p. 29; Mon. Pneum. (Auric.) iv. p. 304; Pease, Proc. Zool. Soc. 1871, p. 477.

Melampus semiplicatus, Pease, Proc. Zool. Soc. 1860, p. 146, 1869, p. 60 (animal), 1871, p. 477; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 304; Schmeltz, Cat. Mus. Godeff. v. p. 88; Layard, Cat. Land and Freshw. Moll. N. Caled. p. 4.

Melampus strictus, Gassies, Journ. de Conch. 1874, p. 213; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 324.

Melampus pseudocommodus, "Mousson," Schmeltz, Cat. Mus. Godeff. iv. p. 69; Paetel, Cat. Conch. p. 114.

A few examples found just above high-water mark on a small islet on the north coast of Vanua Levu.

Pfeiffer's type specimens in Cuming's Museum were labelled Admiralty Islands. His *M. fricki*, together with Pease's *semiplicatus* and Mousson's *pseudocommodus*, were obtained at the Sandwich Islands, where I first discovered Pease's type specimens. Shells received from New Caledonia labelled *M. strictus* do not differ from Viti examples.

The longitudinal plications on the upper third of the shell, pale or dark brownish colour, numerous whorls, rather long acute spire, and single parietal fold will readily distinguish this species. The basal portion is also more or less distinctly plicated. The palate has from one to three laminæ. Length 10 millim.

7. MELAMPUS CONSANGUINEUS, sp. nov.

Shell imperforate, solid, obovate, smooth, shining, faintly striated with lines of growth, light chestnut-brown; spire convexly conoid, apex mucronate; sutural line distinct, linear; whorls 7, flattened, the last one subangulate on the shoulder, and obliquely impressedly striated at the base; the lower portion of the parietal region with two spiral plications, the upper one the larger, and occasionally there exists one or two posterior denticles; palate with from 11–14 white plicæ; columellar fold continuous with the basal portion of the peristome.

Length 9, diam. 5 millim.

Not uncommon at high-water mark at Vanua Levu.

The uniform pale chestnut colour and numerous plications in the throat will determine it.

8. MELAMPUS STRIATUS, Pease.

Melampus striatus (*Tralia*), Pease, Proc. Zool. Soc. 1861, p. 244, 1871, p. 477; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 311; Garrett, Journ. Acad. Nat. Sci. Phil. 1885, p. 89.

Melampus montrouzieri, Souverbie, Journ. de Conch. 1866, p. 148, pl. 6. figs. 1, 1*a*; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 312.

Melampus ornatus, Mousson, Journ. de Conch. 1871, p. 21, pl. 3. fig. 7; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 312.

Not infrequent on the margins of mangrove-swamps in the Viti, Tonga, and Samoa Islands. It also inhabits the Society Islands and New Caledonia.

It may be distinguished by its oblong-ovate form, the brownish-corneous, chestnut-brown, or greenish-brown colour, its mucronated spire, and the 8 whorls marked by closely-set transverse impressed lines, the upper half with small longitudinal plications, which give that part of the shell a granulated appearance. The transverse lines are frequently evanescent on the middle of the body-whorl. There are from two to three folds on the parietal region, the upper one small and granuliform. There may be observed one to three lamelliform plications in the palate, and sometimes several raised white parallel striæ. Length 9–10 millim.

M. granifer, Mousson, an East-Indian species, is very closely allied to, if not identical with, *M. striatus*.

9. Melampus adamsianus, Pfeiffer.

Melampus adamsianus, Pfeiffer, Proc. Zool. Soc. 1854, p. 121; Syn. Auric. no. 12; Novit. Conch. i. p. 18, pl. 5. figs. 17–19; Mon. Auric. i. p. 24; Gassies, Faun. Nouv. Caléd. p. 57, pl. 7. fig. 2; Hutton, Cat. Moll. New Zeal. p. 576 ("ex Pfeiffer")

Tralia adamsiana (*Pira*), H. & A. Adams, Gen. Moll. ii. p. 244.

Melampus variabilis, Gassies, Faun. Nouv. Caléd. p. 65, pl. 6. fig. 8; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 315.

Melampus cinereus, Gassies, Journ. de Conch. 1867, p. 62; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 314.

Melampus avenaceus, Mousson, Journ. de Conch. 1870, p. 134; 1871, var. *vavaoensis*, p. 21.

Melampus angustus, "Mousson," Schmeltz, Cat. Mus. Godeff. iv. p. 68; Paetel, Cat. Conch. p. 114 (juvenile).

A small and very variable species, 7 to 10 millim. long, and of various colours—light or dark chestnut, luteous, fulvous, cinereous, frequently ornamented with bands and lines of a chestnut colour on a pale ground or pale bands on a dark ground. The shape varies from oblong-ovate to subcylindrical; surface smooth, shining; base with oblique incised striæ. Spire short or elongate, acute, obscurely radiately plaited or grooved. Parietal region with from one to four plications, the posterior two when present granuliform. Columellar fold more or less continuous with the peristome. The variety *vavaoensis* is common in the Viti group, associated with the type, into which it gradually intergrades.

Specimens occur in great profusion just above high-water mark in sheltered places. Dr. Gräffe found it in the Tonga group and it is abundant in New Caledonia, whence I have received numerous examples labelled *M. adamsianus*, *M. cinereus*, and *M. variabilis*. The New-Caledonian shells exhibit the same variation as the Viti shells, some of which have the spire so much elongated that they might easily be mistaken for a distinct species; but having carefully studied several thousand specimens collected in the latter group, I find the character individual only. The number of plications in the aperture cannot, except in certain species, be relied on as a specific character. It was first described from specimens in the Cumingian Museum, and the habitat "New Zealand" is probably erroneous. Mr. Hutton, in his Catalogue of New-Zealand Mollusca, merely repeats Pfeiffer's description. Von Martens does not include it in his list of New-Zealand shells.

10. MELAMPUS CREBRISTRIATUS, sp. nov.

Shell imperforate, solid, obovate, slightly shining, striated with lines of growth and marked by rather crowded transverse incised lines; colour dark chestnut-brown or fulvous, with or without two light chestnut bands; spire mucronate, convexly conoid; suture distinct, linear; whorls 7–8, subplanulate, the last one subangulate on the shoulder; the lower portion of the parietal region with two subcontiguous folds, the lower one small, and occasionally there exists small posterior denticles; palate with from 10–18 whitish laminæ on a layer of whitish callus; peristome and columella fulvous.

Length 10–13, diam. 6–7 millim.

A few examples found near high-water mark on the north coast of Vanua Levu.

11. MELAMPUS RUSTICUS, sp. nov.

Shell small, imperforate, obovate, finely striated, brown, with irregular longitudinal fulvous stripes and small spots; spire short, conoid, apex eroded, truncate; whorls 4 remaining, last one subangulated, obliquely striated at the base; aperture elongate, narrow, slightly oblique, violaceous or brown, base rounded; parietal region with an acute horizontal lamina just below the middle; columellar fold sharp, oblique, and continuous with the acute peristome; palate with 4–6 faint laminæ.

Length 7, diam. 5 millim.

Rather common on the margins of mangrove-swamps. I also found it in the Tonga and Samoa Islands.

It is the same shape as, but smaller than, *M. semisulcatus*, with which it is found associated. It is also darker coloured, and differs from the latter in the absence of spiral sulcations and in having only one parietal fold.

12. MELAMPUS INCISUS, sp. nov.

Shell imperforate, obconic, solid, marked by fine incremental striæ and spiral incised lines, which are sometimes evanescent on the middle of the body-whorl; colour brown or luteous, with or without four transverse chestnut bands, and frequently with irregular longitudinal more or less interrupted fulvous lines and dots; spire short, conoid, apex eroded, truncate; whorls 5 remaining, last one subangulated above; suture linearly impressed and slightly lacerated; aperture somewhat oblique, elongate, violaceous brown; parietal region with two contiguous folds just above the columellar plait, the upper one the larger, above which are from two to six more or less distinct denticles; palate with five to fourteen white irregular laminæ; columellar fold oblique, continuous with the peristome.

Length 8–10 millim.

Not infrequent on the margins of mangrove-swamps in Vanua Levu.

Genus Tralia, Gray.

1. Tralia melanostoma (Garrett).

Persa melanostoma, Garrett, Amer. Journ. Conch. 1872, p. 224, pl. 19. fig. 11; Schmeltz, Cat. Mus. Godeff. v. p. 87.

Melampus melanostoma, Pfeiffer, Mon. Pneum. (Auric.) iv. p. 325.

Abundant and gregarious under stones, near and a little below high-water mark, on the east end of Taviuni Island.

A small oblong-ovate or elliptically ovate tawny-brown species, with a blackish aperture, short, acute, spirally striated spire, and generally with a transverse brown band beneath the suture. Aperture rounded at the base, narrow above. Parietal region with one or two superior denticles, and a large fold just above the columellar plait. Peristome thick, labiated within and sinuous above. Length $4\frac{1}{2}$ millim.

2. Tralia costata (Quoy & Gaimard).

Auricula costata, Quoy & Gaimard, Voy. Astrol. ii. p. 173, pl. 13. figs. 43–46; Deshayes, Lam. Hist. viii. p. 337; Küster, Auric. p. 46, pl. 7. figs. 5–7.

Melampus costatus, Beck, Ind. Moll. p. 107; (*Tralia*) H. & A. Adams, Proc. Zool. Soc. 1854, p. 12; Pfeiffer, Syn. Auric. no. 56; Mon. Auric. i. p. 55; Mousson, Journ. de Conch. 1870, p. 135; Paetel, Cat. Conch. p. 114.

Tralia costata (*Persa*), H. & A. Adams, Gen. Moll. ii. p. 245; Chenu, Man. Conch. i. p. 477. fig. 3527.

Common, associated with the preceding species.

A solid, ovate, longitudinally ribbed, fulvous or reddish-brown species, with three plaits on the parietal wall and columella. The peristome is thick and sinuous above. Length 8–10 millim.

3. Tralia alba (Gassies).

Melampus albus, Gassies, Journ. de Conch. 1865, p. 211; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 326.

Melampus lucidus, Pease, Amer. Journ. Conch. 1869, p. 75; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 327.

Melampus pellucidus, Pease, Journ. de Conch. 1871, p. 93.

Two specimens occurred to my notice under a clump of coral on the east coast of Taviuni Island.

A smooth white or horn-coloured species, $3\frac{1}{2}$ to 5 millim. long, of an oblong-ovate form, with a rather produced spire, and the plications the same as in the preceding species.

Genus Laimodonta, Nuttall.

1. Laimodonta layardi, H. & A. Adams.

Ophicardelus layardi (*Laimodonta*), H. & A. Adams, Proc. Zool. Soc. 1854, p. 35.

Laimodonta layardi, H. & A. Adams, Gen. Moll. ii. p. 246.
Melampus layardi, Pfeiffer, Syn. Auric. no. 48; Mon. Auric. i. p. 51; Gassies, Faune Nouv. Caléd. p. 61, pl. 7. fig. 7; Tennent's Ceylon, i. p. 239; Cox, "Exchange List," p. 33; H. Nevill, Enum. Hel. etc. Ceylon, 1871, p. 4.
Laimodonta conica, Pease, Proc. Zool. Soc. 1862, p. 242; Amer. Journ. Conch. 1868, p. 101, pl. 12. fig. 15; Journ. de Conch. 1871, pp. 93, 94; Proc. Zool. Soc. 1871, pp. 470, 477; Schmeltz, Cat. Mus. Godeff. v. p. 81; Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 403, 1885, p. 91.
Laemodonta conica, Martens & Langk. Don. Bism. p. 57, pl. 3. fig. 13.
Laimodonta anaaensis, Mousson, Journ. de Conch. 1869, p. 63, pl. 5. fig. 1.
Plecotrema anaaensis, Paetel, Cat. Conch. p. 114.
Melampus conicus, Pfeiffer, Mon. Pneum. (Auric.) iv. p. 319.
"?" *Melampus anaaensis*, Pfeiffer, *l. c.* p. 320.

A few dead examples found in beach-sand.

Since the publication of my paper on the Land-shells of Cook's Islands Mr. E. L. Layard has sent me for determination a Ceylon species of *Laimodonta*, which proves to be *L. layardi*, and is identical with Pease's *L. conica*. Dr. Cox and Gassies record *L. layardi* from New Caledonia, and Pease quotes it (*conica*) from "Central Pacific." I have obtained it in all the groups from the Paumotus to the Viti Isles.

The species now under consideration is closely allied to the Sandwich-Island *L. bronni*, but is smaller, more slender, and the spiral engraved lines are more conspicuous. My examples average from 6 to 8½ millim. in length. Colour chestnut-brown, with one or two whitish bands. The outer lip is slightly sinuous posteriorly and has one or two internal riblets. All the three descriptions alluded to mention a single plait in the palate. In the eight specimens before me six have two riblets in the palate.

Station under stones above high-water mark.

Genus Pedipes, Adanson.

1. Pedipes jouani, Montrouzier.

Pedipes jouani, "Montrouzier," Souverbie, Journ. de Conch. 1862, p. 244, pl. 9. fig. 11; Gassies, Faun. Nouv. Caléd. p. 65, pl. 6. fig. 22; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 332.
Pedipes subglobosus, Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 236, pl. 3. fig. 70.

Eight examples found lurking under stones a little below high-water mark at Lauthala Island.

Our specimens do not differ from the New-Caledonian shells except in being paler. Its subglobose form, small, crowded granulated spiral ridges, fulvous-brown colour, slightly shouldered body-whorl, and short mucronated spire will readily distinguish it. The flattened callose columella is armed with two compressed transverse folds, above which may be observed a sharp deflected parietal plait, and a tubercle on the inner margin of the acute peristome, which latter is thickened within. Length $4\frac{1}{2}$ millim.

Genus Pythia, Bolten.

1. Pythia pollex (Hinds).

Scarabus pollex, Hinds, Ann. Nat. Hist. x. p. 82; Voy. Sulph., Zool. p. 60, pl. 16. figs. 9 & 10; A. Adams, Proc. Zool. Soc. 1850, p. 150; Ann. Nat. Hist. 2nd ser. viii. p. 69; Reeve, Conch. Icon. sp. 7, fig. 7.

Pythia pollex, Pfeiffer, Syn. Auric. no. 82; Mon. Auric. i. p. 86; Brit. Mus. Cat. Auric. p. 65; H. & A. Adams, Gen. Moll. ii. p. 240; Mousson, Journ. de Conch. 1870, p. 133; Paetel, Cat. Conch. p. 114; Schmeltz, Cat. Mus. Godeff. v. p. 87; Cox, Proc. Linn. Soc. New South Wales, vi. p. 611.

Scarabus zonatus, Hombron & Jacquinot, Voy. Pôle Sud, Zool. v. p. 41, pl. 10. figs. 18–20.

Very abundant and generally distributed throughout the group. Occurs beneath decaying vegetation in forests near the sea-shore.

This species is subject to considerable variation in size, shape, and colour. Though usually umbilicated, it is nevertheless very frequently imperforate. The shape varies from broad ovate to oblong ovate; spire subacute, more or less produced, and laterally subangulated. The sculpture consists of longitudinal, closely set, elevated striæ, often evanescent on the body-whorl, and very conspicuous and slightly arched on spire and upper part of the last whorl. The superior parietal tooth is subtriangular, the lower one compressed, fold-like, and subduplicated. The columellar plait is slightly oblique, compressed, and in imperforated specimens is continuous with the broadly expanded and slightly reflected peristome. The palate is armed with two stout and from four to six small teeth.

The colour varies from light chestnut to blackish chestnut, more or less conspicuously mottled with luteous, and generally with one or two pale transverse bands above. The varices, which are not very conspicuous, are usually spotted with white or luteous. Uniform horn-coloured or luteous specimens with or without chestnut mottlings are not uncommon. Aperture white or buff-yellow, with or without chestnut maculations. Sometimes the very dark examples show three or four pale transverse bands. The following measurements will show the variation in shape and size:—

Length 36, diam. 21 millim.
,, 34, ,, 23 ,,
,, 23, ,, 15 ,,

2. Pythia albovaricosa, Pfeiffer.

Pythia albovaricosa, Pfeiffer, Zeit. Malak. 1853, p. 190; Syn. Auric. no. 84; Mon. Auric. i. p. 87; Brit. Mus. Cat. Auric. p. 66;

Novit. Conch. i. p. 6, pl. 3. figs. 1 & 2; H. & A. Adams, Gen. Moll. ii. p. 240; Cox, Proc. Linn. Soc. New South Wales, vi. p. 592.

Scarabus albovaricosus, Reeve, Conch. Icon. sp. 4, pl. 1. figs. 2, 6.

In looking over a lot of about 200 specimens of *P. pollex*, I found amongst them an example of Pfeiffer's *P. albovaricosa*, which does not differ in a single feature from five Solomon-Island specimens received from Dr. Cox. I cannot indicate the island whence the shell was obtained, but am inclined to believe it was Kantavu.

Dr. Pfeiffer and Reeve, on the authority of Cuming, cite Celebes as habitat of this species; and Dr. Cox, in his valuable paper on the "Nomenclature and the Distribution of the genus *Pythia*," says it is a common Solomon-Island species. As it is now well ascertained that many of Cuming's localities are erroneous, the former habitat needs confirmation.

This species may be characterized by its large size (31 to 44 millim.), rather light texture, oblong-ovate form, smooth body-whorl, the upper part of which, together with the spire, is marked by short, longitudinal, slightly arcuated grooves. Colour light or dark chestnut, sometimes light fulvous with very small darker irrorations. The varices are white with wide black or dark chestnut margins, and the six specimens now before me all have a large lateral diffused blackish patch on the front and back of the body-whorl. Aperture luteous or whitish. Palatal teeth 4 or 5.

3. PYTHIA SAVAIENSIS, Mousson.

Pythia pantherina, A. Adams, var. *uveana*, Mousson, Journ. de Conch. 1865, p. 177; Schmeltz, Cat. Mus. Godeff. iii. p. 28; Pease, Proc. Zool. Soc. 1871, p. 477; Paetel, Cat. Conch. p. 114; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 348; Cox, Proc. Linn. Soc. New South Wales, vi. p. 617.

Pythia savaiensis, Mousson, Journ. de Conch. 1869, p. 345, 1870, p. 133; Pease, Proc. Zool. Soc. 1871, p. 477; Schmeltz, Cat. Mus. Godeff. v. p. 87; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 341; Cox, Proc. Linn. Soc. New South Wales, vi. p. 613; G. Nevill, Hand-list Moll. Mus. Calcutta, p. 223.

Not uncommon in forests near the sea-shore at Kioa Island. Dr. Gräffe obtained it at Ovalau, Samoa, and Tonga group. I gathered several hundred examples at Wallis Island (=Uvea or Uea), one of the latter group.

A solid, ovate, umbilicated (rarely imperforate) species, 21 to 28 millim. long, with the striation of *P. pollex*, and the lower parietal fold simple; the upper one is small and trilobed. Colour corneous or yellowish-horn colour mottled with chestnut, rarely uniform light or dark chestnut. Varices spotted with white, and the aperture is luteous. The palate is furnished with 4 or 5 teeth.

The small size, absence of bands, uniform shape, and the simple lower parietal fold will readily separate it from *P. pollex*.

Mousson's name *savaiensis* is derived from Savaii, one of the Samoa

Islands. He very correctly drops one *i*; and Pease, who retains both, spells it "*savaiiensis.*" Both Schmeltz and Paetel erroneously quote it as "*savayensis.*" All, however, refer to one and the same species.

4. Pythia lentiginosa, Garrett.

Pythia lentiginosa, Garrett, Amer. Journ. Conch. 1872, p. 220, pl. 19. fig. 4; Schmeltz, Cat. Mus. Godeff. v. p. 87; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 337; G. Nevill, Hand-list Mus. Calcutta, p. 222; Cox, Proc. Linn. Soc. New South Wales, vi. p. 604.

This species occurred to me in only *one* location, a small islet close to the east end of Taviuni, where it was found in abundance associated with *P. pollex.*

It is remarkably uniform in colour, and differs but little in shape and size. It is a solid, ovate or oblong-ovate shell, 21 to 29 millim. long, yellowish white, profusely spotted with small fulvous-brown maculations, and with a honey-yellow aperture. The varices, which are not very conspicuous, are spotted with white and chestnut, which on the sides of the body-whorl are elongated into stripes. The basal perforation varies from rimate to umbilicate. The lower parietal fold shows a very slight indication of an external groove.

5. Pythia perovata, Garrett.

Pythia perovata, Garrett, Amer. Journ. Conch. 1872, p. 221, pl. 19. fig. 5; Schmeltz, Cat. Mus. Godeff. v. p. 87; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 34; Cox, Proc. Linn. Soc. New South Wales, vi. p. 608.

I collected about 2000 specimens of this species on the margins of mangrove-swamps at Vuna Dawa on the north side of Natawa Bay, Vanua Levu, and at Na Viti Levu Bay in the N.E. part of Viti Levu. Examples taken at the latter location were larger than the Vuna Dawa shells.

This very distinct species is of an ovate or abbreviate-ovate shape, solid; spire short, base imperforate, sometimes rimate, more rarely perforated; longitudinally striated, the striæ straight and most conspicuous above. The dentation is white or tawny; the upper tooth on the parietal wall is vertical, elongate, crest-like, simple or very rarely with a slight inferior lobe projecting to the left. The lower fold is compressed and furnished with a small, short, tooth-like duplication. The columellar plait is obliquely twisted and continuous with the widely expanded peristome, which latter is simple above and slightly reflected below. Palate with four, rarely five teeth, two of which are the larger. Colour light to dark chestnut or reddish chestnut, rarely light yellowish-horn colour, frequently indistinctly mottled with a tint darker than the ground-colour, and very often with a blackish sutural band. Varices rarely spotted with whitish. Length 15 to 24 millim. The adults are very frequently eroded over the whole surface.

Genus Plecotrema, H. & A. Adams.

1. Plecotrema souverbiei, Montrouzier.

Plecotrema souverbiei, "Montrouzier," Souverbie, Journ. de Conch. 1862, p. 246, pl. 9. fig. 12; Gassies, Faune Nouv. Caléd. p. 67, pl. 6. fig. 23; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 343.

Plecotrema turrita, Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 235, pl. 3. fig. 68.

Not uncommon under stones a little below high-water mark on the east end of Taviuni. It also inhabits New Caledonia.

This remarkable species is easily recognized by its ovate-conical form, scalariform spire, corneous or dull fulvous colour, subperforated and angulated base. The sculpture consists of numerous, small, crowded, granulated spiral ridges, with the intermediate grooves crossed by sublaminated striæ. There is a prominent crest-like varix just behind the peristome, which latter is acute, continuous, and slightly porrected. Parietal region with a superior nodiform tooth beneath, of which there is a simple acute plait. Columellar fold small and nearly transverse. Outer lip labiate within and bidentate. Length $4\frac{1}{2}$ millim.

Very closely allied to, if not identical with, *P. bella*, a Philippine species.

2. Plecotrema hirsuta, Garrett.

Plecotrema hirsuta, Garrett, Amer. Journ. Conch. 1872, p. 219, pl. 19. fig. 2; Schmeltz, Cat. Mus. Godeff. v. p. 87; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 348.

Abundant in the same station and locality as the preceding species.

An imperforated, solid, acutely-ovate, corneous species, with spiral rugose liræ, 16 to 18 on the body-whorl, garnished with short, deciduous, curved hair-like setæ. The intervening sulcations deep, narrower than the lirations, and crossed by sublaminated striæ. There is a stout obtuse varix just behind the peristome, and the dentation, excepting the lower parietal fold, which is bifid, does not differ from the preceding species. Length 5 to 7 millim.

3. Plecotrema octanfracta (Jonas).

Pedipes octanfracta, Jonas, Zeit. Malak. 1845, p. 160.

Plecotrema octanfracta, Jeckeli, Nachr. Malak. Ges. 1872, p. 65; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 346.

Plecotrema clausa, H. & A. Adams, Proc. Zool. Soc. 1853, p. 121; Gen. Moll. ii. p. 241; Pfeiffer, Syn. Auric. no. 101; Novit. Conch. i. p. 15, pl. 5. figs. 9–11; Mon. Auric. i. p. 103; Pease, Proc. Zool. Soc. 1871, pp. 459, 477; Paetel, Cat. Conch. p. 144; Schmeltz, Cat. Mus. Godeff. v. p. 87.

Plecotrema consobrina, Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 236, pl. 3. fig. 69.

Not uncommon under stones a little below high-water mark at Kioa and Taviuni. It also inhabits the Sandwich and Paumotu Islands, and I found it very abundant and gregarious at the Gambier Islands.

A small, solid, ovate species with the spiral liræ of *P. hirsuta*, but more numerous, smoother, more crowded, and the aperture is not so much contracted. The external varix is smaller, and the base of the shell is more rounded than in the latter species. Colour light brownish, sometimes corneous, usually with a faint pale zone beneath the suture, and the aperture is more or less tinged with brownish. The dentation is the same in both species. Length 3 to 5 millim.

Genus Cassidula, Férussac.

1. Cassidula intuscarinata, Mousson.

Auricula (Cassidula) intuscarinata, Mousson, Journ. de Conch. 1870, p. 132, pl. 7. fig. 9.

Cassidula intuscarinata, Schmeltz, Cat. Mus. Godeff. v. p. 88; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 353.

Occurs in profusion on the mud in mangrove-swamps at Viti Levu and Vanua Levu. I have received the same species from New Caledonia labelled *C. mustellina.*

This species, like nearly all the shells inhabiting swamps, is very frequently stained and more or less eroded. When in good condition it is of a brown or brownish-liver colour, sometimes olive-brown, with an obscure pale band on the subangulated shoulder. Rarely light fulvous-brown, with an indistinct light chestnut band between the shoulder and the sutural line. The base, aperture, and the peristome tawny flesh-colour, the latter with a stout external varix. The shape of the shell is subovate, with spiral incised lines, and the aperture is obauriform. The strongly labiated lip is deeply emarginated above. Upper parietal tooth small, nodiform, and the plait beneath is nearly transverse. Columellar fold slightly oblique. Length 14 to 20 millim.

2. Cassidula crassiuscula, Mousson.

Cassidula crassiuscula, Mousson, Journ. de Conch. 1869, p. 343, pl. 15. fig. 1; Paetel, Cat. Conch. p. 114; Pease, Proc. Zool. Soc. 1871, p. 477; Schmeltz, Cat. Mus. Godeff. v. p. 88; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 352.

Auricula (Cassidula) crassiuscula, Mousson, Journ. de Conch. 1871, p. 191.

Cassidula nucleus, Gassies (Martyn ?), Faune Nouv. Caléd. p. 71, pl. 3. fig. 9.

Like the preceding species, it occurs in profusion on the mud in mangrove-swamps, but is more generally diffused throughout the group. It also inhabits Tonga and the Samoa Islands. Mr. Layard, of New Caledonia, sent me specimens collected in that island, labelled "*Melampus nucleus*, Martyn."

It has the same shape and dentation as *C. intuscarinatus*, but is much more variable in colour, and in size ranges from 10 to 16 millim. long. It is of different shades of chestnut-brown, white, corneous, fulvous, frequently with from one to four pale transverse bands on the body-whorl, and more rarely with a sutural livid band. Aperture pale fulvous, brownish or white, and the lip light fulvous or white.

I am inclined to believe this species is diffused throughout the New Hebrides, Solomon Islands, and, perhaps, extends its range into the East Indies. I am sure Samoa is the eastern limit of the genus *Cassidula*; Martyn's *C. nucleus*, which is erroneously quoted as a Tahitian species, does not inhabit that group.

I am also strongly inclined to believe Mousson's *C. crassiuscula* is identical with his *C. sulculosa*, an East-Indian species.

3. CASSIDULA PALUDOSA, Garrett.

Ophicardulus paludosus, Garrett, Amer. Journ. Conch. 1872, p. 220, pl. 19. fig. 3.

Cassidula paludosa, Paetel, Cat. Conch. p. 114.

Plecotrema paludosa, Schmeltz, Cat. Mus. Godeff. v. p. 87.

Melampus paludosus, Pfeiffer, Mon. Pneum. (Auric.) iv. p. 327.

Common in the mud in mangrove-swamps, and probably generally distributed in the group. I took a few examples at Upolu, one of the Samoa Islands.

A small, solid, ovate, whitish, yellow-corneous, or chestnut-brown species, with fine, spiral, incised, punctured lines and a carinated base. Spire convexly-conical, and more produced than in the preceding species. Aperture white, tawny, or fulvous, with the dentation of *C. crassiuscula*, with the addition, in old specimens, of a small denticle in the labial sinus. Length 8 to 10 millim.

Genus AURICULA, Lamarck.

1. AURICULA SUBULA, Quoy & Gaimard.

Auricula subula, Quoy & Gaimard, Voy. Astrol. ii. p. 171, pl. 13. figs. 39 & 40; Deshayes, Lam. Hist. viii. p. 334; Küster, Auric. p. 53, pl. 8. figs. 9 & 10; Jay, Cat. Shells, 1850, p. 265; A. Adams & Reeve, Voy. Samarang, p. 55, pl. 14. fig. 15, with animal; Pfeiffer, Auric. no. 147; Mon. Auric. i. p. 141; Gassies, Faune Nouv. Caléd. p. 69; Paetel, Cat. Conch. p. 115.

Pythia subula, Beck, Ind. Moll. p. 104.

Ellobium subula, H. & A. Adams, Proc. Zool. Soc. 1853, p. 8; Gen. Moll. ii. p. 238, pl. 82. fig. 1.

Auricula elongata, "Parreyss," Küster, Auric. p. 53, pl. 8. figs. 6–8; Jay, Cat. Shells, 1850, p. 264; Pfeiffer, Auric. no. 146; Mon. Auric. i. p. 140; Morelet, Sér. Conch. p. 93; Mousson, Journ. de Conch. 1871, p. 18; Paetel, Cat. Conch. p. 115; Schmeltz, Cat. Mus. Godeff. v. p. 88.

Auricula buddii, Parreyss, MS.

Ellobium elongatum, H. & A. Adams, Proc. Zool. Soc. 1854, p. 8; Gen. Moll. ii. p. 237.

Ellobium oparicum, H. & A. Adams, Proc. Zool. Soc. 1854, p. 9; Gen. Moll. ii. p. 237.

Auricula oparica, Pfeiffer, Syn. Auric. no. 46; Novit. Conch. i. p. 28, pl. 7. figs. 14–16; Mon. Auric. i. p. 139.

Auriculus subula, Pfeiffer, Mon. Pneum. (Auric.) iv. p. 360.

Auriculus elongatus, Pfeiffer, *l. c.*

Auriculus oparicus, Pfeiffer, *l. c.*

A very abundant species, inhabiting the margins of mangrove-swamps, and widely diffused throughout the group. Likewise common to the Tonga and Samoa Islands, and generally distributed over Melanesia. It has also been found at different points in the East Indies; and Morelet records it from Mauritius.

A small species, 9 to 16 millim. long, of a slender fusiform shape; smooth, shining, longitudinally striated, acute, with a convexly-conical spire, very frequently truncated by erosion, and more or less lacerated at the suture. Body-whorl narrow, usually longer than the spire, attenuated or rounded at the base, rarely rimate. Aperture elongate, white, or light fulvous, sometimes livid, with a compressed subtransverse plait on the lower part of the parietal wall, and two small, oblique, approximating folds on the columella, the upper one sometimes evanescent. Peristome obtuse, in old specimens slightly sinuous above, and adnate next the suture. Colour white, beneath an epidermis which varies from pale olivaceous horn-colour to chestnut-black.

A careful comparison of the descriptions of *A. elongata* and *A. oparica* has convinced me that they do not differ from *A. subula*, which Quoy obtained at the New Hebrides. Pfeiffer, in his description of *A. elongata*, mentions only a single columellar fold, and quotes the Sandwich Islands, "Feejee," and one of the Philippines as habitat. It certainly does not live on the former group. Schmeltz cites one of the Caroline Islands and "Tahiti," the latter erroneous. *A. oparica*, which was described from specimens in Cuming's Museum, is assigned to "insula Opara (ins. Societatis)." There is no island of that name in the Society group; but there is a very small island, about 600 miles south of Tahiti, called Rapa-Oparee, which from its small size and rugged surface is not likely to be the home of the marsh-loving *Auriculæ*.

2. Auricula semisculpta, H. & A. Adams.

Ellobium semisculptum, H. & A. Adams, Proc. Zool. Soc. 1854, p. 9; Gen. Moll. ii. p. 237.

Auricula semisculpta, Pfeiffer, Syn. Auric. no. 139; Mon. Auric. i. p. 136; Novit. Conch. i. p. 39, pl. 10. figs. 7–9; Gassies, Faune Nouv. Caléd. p. 70, pl. 3. fig. 11; Schmeltz, Cat. Mus. Godeff. v. p. 88.

Auriculus semisculptus, Pfeiffer, Mon. Pneum. (Auric.) iv. p. 359.

I found several hundred examples of this species in different parts of the group. They were *all* found buried in rotten bogs on the margins of mangrove-swamps. I also took many in similar stations at Wallis Island and Samoa. I have received it from New Caledonia, and, undoubtedly, it ranges throughout Melanesia. The locality "Gambier Islands," usually assigned to this species, is decidedly erroneous. There are no swampy lands and not a single perennial stream in the group. Schmeltz is also wrong in citing Huahine, Society Islands, as habitat.

This species varies considerably in shape, thickness, and in size ranges from 12 to 30 millim. long. The surface is shining, longitudinally striated, and the upper portions of the whorls are sculptured by crowded spiral rows of minute granules, which, in large adults, sometimes cover the whole surface of the body-whorl. The lower part of the parietal region is armed with a prominent, compressed, oblique fold, and just beneath is a smaller and more vertical one on the columella. The peristome is rather strongly labiated and sinuous above. The shape of the shell varies from oblong-ovate to oblong-turreted, the spire is more or less produced, and the base imperforated. Colour white, beneath a fulvous-yellow or yellowish horn-coloured epidermis.

Genus Truncatella, Risso.

1. Truncatella valida, Pfeiffer.

Truncatella valida, Pfeiffer, Zeit. Malak. 1846, p. 182; Mon. Auric. (Appendix) i. p. 184; Jay, Cat. Shells, 1854, p. 253; Küster, Mon. p. 11, pl. 2. figs. 7, 8, 19–21, 23; H. & A. Adams, Gen. Moll. ii. p. 311; Martens, Ostas. Zool. ii. p. 262; Paetel, Cat. Conch. p. 118; Pease, Proc. Zool. Soc. 1871, p. 477.

Truncatella vitiana, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 208; Expl. Exp., Shells, p. 109, fig. 126; Otia Conch. p. 40; H. & A. Adams, Gen. Moll. ii. p. 311; Pfeiffer, Mon. Pneum. ii. p. 6; Mousson, Journ. de Conch. 1869, p. 356, 1870, p. 195; Paetel, Cat. Conch. p. 118; Schmeltz, Cat. Mus. Godeff. v. p. 104.

Truncatella vitiacea, Mousson, Journ. de Conch. 1865, p. 185.

Taheitia vitiana, Pease, Proc. Zool. Soc. 1871, p. 477.

Truncatella conspicua, "Bronn," Pfeiffer, Mon. Auric. (Appendix) i. p. 184; Paetel, Cat. Conch. p. 118; Layard, Cat. Land & Freshwater Shells N. Caled. p. 1.

This species occurs in abundance in all parts of the group, and lives just above high-water mark in sheltered places. It occurs also in the Samoa, Tonga, and Ellis group, and is diffused throughout Australasia and the East-India Islands.

It may be characterized by its solid texture, slightly tapering cylindrical form, white, luteous, corneous, or ruddy corneous colour, and $4\frac{1}{2}$ slightly convex persistent whorls. The sculpture consists of nearly erect, obtuse ribs (25 to 35) on the body-whorl, and the base is more or less distinctly carinated. The peristome is thick, slightly expanded and auriculated at the suture. The operculum is thin, convex, smooth, with an elastic lamina-like margin.

Length 6 to 8 millim.

I am inclined to believe that *T. pacifica*, Pease, from the Caroline Islands, is identical with *T. valida*.

2. Truncatella rustica, Mousson.

Truncatella rustica, Mousson, Journ. de Conch. 1865, pl. 14. fig. 8; Paetel, Cat. Conch. p. 118; Schmeltz, Cat. Mus. Godeff. v. p. 104; Pfeiffer, Mon. Pneum. iv. p. 14.

Truncatella costellifera, Pease, Proc. Zool. Soc. 1871, pp. 468, 477; Pfeiffer, Mon. Pneum. (Auric.) iv. p. 16.

I found a few examples of this species at Taviuni, associated with *T. vitiana*. It was also obtained at Wallis Island (="Uvea"), where Dr. Gräffe found the type specimens. Mr. Pease's *T. costellifera*, which Mr. Brazier obtained at Vavau, Tonga Islands, is undoubtedly the same as *T. rustica*.

It is smaller (6 to 7 millim. long), more slender, the aperture not so large, and the ribs less numerous (20 to 25), and the basal keel is more conspicuous than in *T. valida*, and is continuous with the large rib just behind the peristome, which gives the latter a duplicated appearance. The colour corneous or ruddy corneous.

3. Truncatella ceylanica, Pfeiffer.

Truncatella ceylanica, Pfeiffer, Proc. Zool. Soc. 1856; Mon. Auric. (Appendix) i. p. 186; H. Nevill, Enum. Pneum. Ceyl. 1871, p. 6; Tennent's Ceylon, i. p. 239.

Truncatella teres, Pfeiffer, Proc. Zool. Soc. 1856, p. 336; Mon. Auric. (Appendix) i. p. 188; Cox, Mon. Austr. Land-Shells, p. 92, pl. 15. figs. 9, 9*a*, 9*b*; Paetel, Cat. Conch. p. 118.

Truncatella semicostata, Montrouzier, Journ. de Conch. 1862, p. 243, pl. 9. fig. 10; Pfeiffer, Mon. Pneum. iii. p. 6; Gassies, Faune Nouv. Caléd. p. 73, pl. 8. fig. 2; Paetel, Cat. Conch. p. 118; Schmeltz, Cat. Mus. Godeff. v. p. 104.

Truncatella cerea, Gassies.

Truncatella nitida, Gassies.

We obtained many thousand specimens, in all stages of growth, near high-water mark at Ovalau Island.

This species may be distinguished by its rather thin shining texture and more or less evanescent riblets, which are either well developed on all the whorls, or entirely absent except at the sutures, where they are reduced to plicate crenulations. Sometimes the crenulations disappear, so that the shell is perfectly smooth and polished. Some examples have the upper whorls ribbed, and the lower one smooth or crenulated at the suture and base.

Having lately received from my esteemed correspondent, Mr. E. L. Layard, of New Caledonia, a lot of *Truncatella ceylanica* from Ceylon, together with *T. teres* from the Comoro Islands, and many examples of *T. semicostata* from New Caledonia, and after a critical comparison of the three species, I have failed to discover a single specific character to separate one from the other. Dr. Cox records *T. teres* from N.E. Australia.

Through the courtesy of the Rev. Montrouzier of New Caledonia, I have been enabled to examine typical specimens of *T. cerea* and *T. nitida* labelled in Gassies's *own* handwriting, and do not hesitate to refer the former to the smooth crenulated and the latter to the smooth non-crenulated varieties of *T. ceylanica*.

4. Truncatella granum, Garrett.

Truncatella granum, Garrett, Amer. Journ. Conch. 1872, p. 225; Schmeltz, Cat. Mus. Godeff. v. p. 105; Pfeiffer, Mon. Pneum. iv. p. 16.

This small species occurred to my notice in one locality only, the N.E. end of Taviuni, where it was found abundant beneath loose stones a little below high-water mark.

Its small size ($4\frac{1}{2}$ to 5 millim. long), uniform cinereous colour, $4\frac{1}{2}$ persistent whorls, 20 to 25 riblets on the body-whorl, small ovate aperture, and conspicuous duplicated peristome will distinguish it from the preceding species.

5. Truncatella avenacea, sp. nov.

Shell small, rimate, cylindrical, corneous; ribs rather small, erect, rounded, about the same width as their interspaces, 35 to 40 on the last whorl; suture impressed; whorls persistent, $4\frac{1}{2}$, convex; base distinctly carinated; aperture small, vertical, oval, a little less than a fourth the length of the shell; peristome continuous, obtuse, slightly expanded, and duplicated by the continuation of the basal keel. Length 6, diam. $2\frac{1}{2}$ millim.

A few examples found associated with *T. vitiana* at Vanua Levu.

It more nearly resembles the strongly ribbed *T. semicostata* than any other species inhabiting the group; but may be distinguished from that species by its more numerous ribs, more convex whorls, smaller aperture, and more conspicuous basal keel and duplicated peristome.

Genus Taheitia, H. & A. Adams.

1. Taheitia funiculus (Mousson).

Truncatella funiculus, Mousson, Journ. de Conch. 1870, p. 171; Paetel, Cat. Conch. p. 117; Pfeiffer, Mon. Pneum. iv. p. 21.

This species was discovered by Dr. Gräffe in the interior of Viti Levu.

It is a slender, cylindrical, whitish horn-coloured species, with 6 persistent convex whorls and a deep suture; the ribs are sharp, rather remote, 12 to 16 in the body-whorl, all converging at the base. The aperture is small, vertical, semicircular. Peristome obtuse, expanded, continuous, and slightly porrected. Length 8, diam. 2 millim.

2. Taheitia turricula (Mousson).

Truncatella turricula, Mousson, Journ. de Conch. 1870, p. 196; Paetel, Cat. Conch. p. 117; Schmeltz, Cat. Mus. Godeff. v. p. 104; Pfeiffer, Mon. Pneum. iv. p. 20.

Inhabits Mango Island, where it was discovered by Dr. Gräffe. I do not know this species.

It is a long, slender, greyish-white species, with 5 persistent subconvex whorls and a deep suture; the riblets, of which there are 18 to 20 on the last whorl, are thin, sharp, and separated by rather wide interspaces. The vertical aperture is obtusely biangulately ovate, and the porrected peristome is continuous, expanded, and slightly reflected. Length 9 millim.

3. TAHEITIA ARCASIANA (Crosse).

Truncatella arcasiana, Crosse, Journ. de Conch. 1868, p. 177, 1870, p. 107, pl. 7. fig. 13; Mousson, Journ. de Conch. 1870, p. 196; Schmeltz, Cat. Mus. Godeff. v. p. 104; Pfeiffer, Mon. Pneum. iv. p. 20.

Truncatella alternans, Mousson, in Cat. Mus. Godeff. iv. p. 76.

This species (which is unknown to me) was found by Dr. Gräffe in the interior of Viti Levu.

Mr. Crosse says it is an elongated, cylindrically-turreted, chalky, dull whitish species, 9 millim. long, with remote riblets, which are sometimes evanescent on the middle of the whorls. The persistent 6 whorls are rather convex, the suture is impressed, and the aperture suboval. The peristome is continuous, porrected, and slightly expanded.

4. TAHEITIA SCALARIFORMIS (Reeve).

Truncatella scalariformis, Reeve, Proc. Zool. Soc. 1842, p. 197; Conch. Syst. ii. pl. 182. fig. 6; Pfeiffer, Zeit. Malak. 1846, p. 186; Mon. Auric. i. (Appendix) p. 191; Jay, Cat. Shells, 1850, p. 252; Küster, Mon. p. 15; H. & A. Adams, Gen. Moll. ii. p. 31; Schmeltz, Cat. Mus. Godeff. v. p. 104.

Truncatella truncatula, var., Anton, Verz. Conch. p. 62.

Truncatella arctecostata, Mousson, Journ. de Conch. 1869, p. 68, pl. 5. fig. 4, 1870, p. 195; Paetel, Cat. Conch. p. 117; Schmeltz, Cat. Mus. Godeff. iv. p. 76; Pfeiffer, Mon. Pneum. iv. p. 19.

Taheitia scalariformis, Pease, Proc. Zool. Soc. 1871, pp. 468, 477; Journ. de Conch. 1871, p. 92; Martens & Langk. Don. Bismark. p. 60, pl. 4. fig. 1.

Prof. Mousson's original description of *T. arctecostata* was drawn up from specimens of *T. scalariformis* collected by me at Anaa, Paumotu Islands. The same, or a very closely allied, species was subsequently discovered by Dr. Gräffe on Viti Levu, and referred by Mousson to *T. arctecostata.* I have not seen any Viti specimens.

It is a thin, subpellucid, cylindrically-turreted, yellowish-white or corneous species, with 4 or 5 persistent convex whorls. The riblets are numerous (38 to 40 in the last whorl), very slightly arched, and converging at the base. The aperture is vertical, small, broadly ovate, and the peristome is thin, continuous, and expanded. Operculum typical. Length 6 millim.

Genus DIPLOMMATINA, Benson.

1. DIPLOMMATINA MARTENSI, H. Adams.

Diplommatina (Diancta) martensi, H. Adams, Proc. Zool. Soc.

1866, p. 446, pl. 38. fig. 11; Mousson, Journ. de Conch. 1870, p. 186; Brazier, Journ. de Conch. 1870, p. 84; Schmeltz, Cat. Mus. Godeff. v. p. 102; Pfeiffer, Mon. Pneum. iv. p. 85.

Diplommatina paradoxa, Crosse, Journ. de Conch. 1857, p 449.

Diplommatina australiæ, Schmeltz (not of Benson), Cat. Mus. Godeff. iii. p. 30; Paetel, Cat. Conch. p. 118.

Diplommatina macrostoma, "MSS.," Schmeltz, Cat. Mus. Godeff. iv. p. 75; Paetel, Cat. Conch. p. 118.

Diplommatina distorta, "MSS.," Schmeltz, *l. c.* p. 75; Paetel, *l. c.* p. 118.

This species inhabits Viti Levu and Ovalau.

It may be distinguished by its sinistral, distorted, ovate-conical form, cinereous or luteous horn-colour, 5½ swollen whorls, the last one smaller than the preceding and ascending. The sculpture consists of fine, crowded, oblique, lamelliform striæ, which become larger and more remote on the body-whorl. Aperture large, subvertical, and nearly circular. The peristome is continuous, expanded, and in adults the parietal wall is subplicate. Length 3 millim.

2. Diplommatina pomatiæformis, Mousson.

Diplommatina (*Diancta*) *pomatiæformis*, Mousson, Journ. de Conch. 1870, p. 180, pl. 8. fig. 2; Pfeiffer, Mon. Pneum. iv. p. 81.

Discovered by Dr. Gräffe in the central portion of Viti Levu.

A sinistral, inflated, costate-striated, cinereous species, with 6½ rounded whorls, the last one smaller than the penultimate, scarcely ascending, and the striæ coarser and more distant than on the preceding whorls. The vertical aperture is circular, pale luteous, and the peristome is slightly reflected and duplicated. Length 5 millim.

3. Diplommatina subregularis, Mousson.

Diplommatina (*Diancta*) *subregularis*, Mousson, Journ. de Conch. 1870, p. 181, pl. 8. fig. 3; Pfeiffer, Mon. Pneum. iv. p. 81.

This species inhabits "Nagara," on the south coast of Viti Levu, where it was found by Dr. Gräffe.

A sinistral, yellowish horn-coloured species, shaped like the preceding, but not so much inflated and with the spire more regular. The sculpture consists of distant acute striæ. Whorls 7, convex, the penultimate somewhat inflated, the last one small and ascending. The vertical aperture is quadrately circular, and the slightly expanded peristome is subduplicated. Length 3 millim.

4. Diplommatina ascendens, Mousson.

Diplommatina (*Diancta*) *ascendens*, Mousson, Journ. de Conch. 1870, p. 184, pl. 8. fig. 5; Pfeiffer, Mon. Pneum. iv. p. 82.

Dr. Gräffe discovered this species on the island of Viti Levu.

It is a sinistral species about 3½ millim. long, of a flesh-white colour, acutely ovate form, with distant lamelliform riblets and rather deep suture. Whorls 5½, convex, rapidly increasing, the last one smaller than the penultimate and ascending. The rather large aperture is somewhat quadrate in shape and the peristome is expanded, duplicated, slightly sinuated, and the columella is obtusely nodulous.

5. Diplommatina godeffroyana, Mousson.

Diplommatina (*Diancta*) *godeffroyana*, Mousson, Journ. de Conch. 1870, p. 182, pl. 8. fig. 4; Paetel, Cat. Conch. p. 118; Schmeltz, Cat. Mus. Godeff. v. p. 102; Pfeiffer, Mon. Pneum. iv. p. 82.

Also discovered by Dr. Gräffe on the southern portion of Viti Levu.

It is described as a sinistral, ovate, inflated, whitish horn-coloured species, with distant lamina-like striæ, 6 whorls, the antepenultimate larger than the penultimate, and the latter larger than the body-whorl, which slightly ascends the preceding one. The subvertical aperture is circular; the peristome is acute, shortly expanded, and slightly duplicated. Length $3\frac{1}{2}$ millim.

6. Diplommatina tuberosa, Mousson.

Diplommatina (*Diancta*) *tuberosa*, Mousson, Journ. de Conch. 1870, p. 185; Paetel, Cat. Conch. p. 118; Schmeltz, Cat. Mus. Godeff. v. p. 102; Pfeiffer, Mon. Pneum. iv. p. 83.

This is another of Dr. Gräffe's newly discovered species, which he found at Vaini Loba, on the south part of Viti Levu.

It is described as a sinistral, rather thin, elongate-ovate, pale horn-coloured species, with distant lamelliform riblets, 6 rounded whorls, the penultimate retracted and compressed in front, and the sides inflated. The last whorl is small, attenuated, and slightly ascending. The aperture is subcircular, and the peristome is slightly reflexed. Length 3–4 millim.

7. Diplommatina quadrata, Mousson.

Diplommatina (*Diancta*) *quadrata*, Mousson, Journ. de Conch. 1870, p. 187, pl. 8. fig. 1; Pfeiffer, Mon. Pneum. iv. p. 83.

Also found by Dr. Gräffe at Viti Levu.

A sinistral, ovate, pale-yellowish species, with crowded costulate striæ and convexly conical spire. Whorls 5, rapidly increasing, convex, the fourth one subinflated, the penultimate swollen on the back and retracted on the front, the last one attenuated, compressed at the base, and rapidly ascending. The subquadrate aperture is subpatulous, and the peristome is expanded. Length $4\frac{1}{2}$ millim.

8. Diplommatina taviensis, Liardet.

Diplommatina taviensis, Liardet, Proc. Zool. Soc. 1876, p. 101, pl. 5. figs. 9, 9*a*.

"Shell with the penultimate whorl contracted in front, leaving the previous one and lip of the aperture joining regularly costated; lip double; aperture circular and entire."

"Animal with two tentacles, short and cylindrical, with an active arched motion, as in *Helicina*. Eyes situated at the base of the tentacles inside."

"*Hab.* Taviuni, Fiji." (*Liardet.*)

Genus Moussonia, Semper.

1. Moussonia fuscula, Mousson.

Diplommatina (Moussonia) fuscula, Mousson, Journ. de Conch. 1870, p. 188, pl. 8. fig. 9; Pfeiffer, Mon. Pneum. iv. p. 93.

Moussonia fuscula, Paetel, Cat. Conch. p. 102.

The type was found by Dr. Gräffe on Oneata, one of the Windward Islands. Prof. Mousson mentions a var. *vitiana* from Viti Levu.

It is a minute, dextral, abbreviately turreted species of a brownish horn-colour, with fine striæ and 7 rounded whorls, of which the penultimate is the larger. The body-whorl is rather slender, rounded, and ascending. The aperture is circular, and the columella bears an obtuse plait or tooth. Peristome expanded. Length ·2 millim.

Genus Ostodes, Gould.

1. Ostodes diatretus (Gould).

Cyclostoma diatretum, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 205; Expl. Exp., Shells, p. 105, fig. 124.

Cyclotus diatretus, Pfeiffer, Consp. Cyclos. no 22; Mon. Pneum. i. p. 33; Gray, Cat. Phan. p. 18.

Cyclophorus (Ostodes) diatretus, var. *intercostata,* Mousson, Journ. de Conch. 1870, p. 179.

Dr. Gould's type specimens of this rare species were found on the west end of Vanua Levu. I obtained two dead specimens at Vanua Balavo, one of the Windward Islands, where Dr. Gräffe also found a single dead example, and one on Oneata, which Prof. Mousson characterized as var. *intercostata.*

This species is readily distinguished by its depressed form, wide open umbilicus, rude spiral, unequal, elevated lines, whitish horn-colour, rounded aperture, and simple peristome. Diam. 12 millim.

It is very closely related to the New-Caledonian *O. bocageanus,* but is smaller and more depressed.

Whilst searching in the mountains on the west end of Vanua Levu I found a very much weathered *Ostodes* twice the size of Gould's species, and subsequently found a similar specimen on the beach at Kioa Island. The specimens are in the Museum Godeffroy in Hamburg. It is undoubtedly an undescribed species.

2. Ostodes liberatus, Mousson.

Ostodes liberatus, Mousson, MS., Mus. Godeffroy, 1885.

Shell widely umbilicated, depressed, whitish horn-colour; spire slightly elevated; apex prominent; suture deeply impressed; whorls 4, convex, transversely rudely striated, undulated, and sculptured with numerous elevated spiral lines, larger, more prominent, and crenulated on and above the rounded periphery; umbilicus very wide, showing all the volutions to the apex; aperture circular, nearly vertical; peristome thin, continuous, straight.

Major diam. 10, height 4 millim.

Viti Levu.

I received four examples of this singular species from the Museum Godeffroy. One specimen has the last whorl separated from the penultimate a distance of 4 millim. It may be distinguished by its depressed form, undulated whorls, and crenulated spiral lines.

3. Ostodes strictus, Mousson.

Ostodes strictus, Mousson, MS., Museum Godeffroy, 1885.

Shell umbilicated, depressed, turbinate, solid, rugose, decorticated, cinereous, sometimes with a ruddy tinge on the last whorl; spire depressedly conoid, apex exserted; suture impressed; whorls 5, convex, transversely rugosely wrinkled, closely lineated with spiral elevated lines, becoming evanescent on the rounded body-whorl; umbilicus wide, freely exhibiting all the whorls, spirally lineated with raised lines, and the margins slightly angulated; aperture oblique, subcircular; peristome straight, simple, nearly continuous, briefly joined to the body-whorl.

Major diam. 13, height 7 millim.

Vatu Lale.

Three examples received from the Godeffroy Museum. It is very closely related to Gould's *O. strigatus*, a Samoa species, and, excepting in size, can scarcely be distinguished from the New-Caledonian *O. bocageanus*.

Genus Pupina, Vignard.

1. Pupina vitiensis, Garrett.

Pupina vitiensis, Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 233, pl. 3. fig. 62; Schmeltz, Cat. Mus. Godeff. vi. pp. 83, 104.

A somewhat rare species, found beneath damp decaying leaves at Gomea Island. Mr. Liardet records a species of *Pupina* as occurring on Taviuni, which is probably the same as the Gomea shell. Schmeltz erroneously assigns it to Kandavu.

A brilliant, highly polished, oblong, whitish corneous species, with slightly swollen spire, the left side more convex than the right, and the columella with a tongue-like projection forming a deep notch. An obtuse plait on the upper part of the parietal wall. Length 7 millim.

Genus Omphalotropis, Pfeiffer.

1. Omphalotropis moussoni, Pease.

Omphalotropis ovata, Mousson (not of Pease), Journ. de Conch. 1865, p. 198, pl. 14. fig. 10; Paetel, Cat. Conch. p. 124; Schmeltz, Cat. Mus. Godeff. iv. p. 75.

Omphalotropis moussoni, Pease, Journ. de Conch. 1869, p. 147; Schmeltz, Cat. Mus. Godeff. v. p. 101.

Realia (*Omphalotropis*) *moussoni*, Mousson, Journ. de Conch. 1870, p. 194, 1871, p. 27; Pfeiffer, Mon. Pneum. iv. p. 224.

I found a few examples of this species at Vanua Balavo, where Dr. Gräffe discovered the type specimens. The Doctor subsequently found it on Viti Levu, Ticombia, and at Tongatabu, one of the Tonga group. All the species of this genus live beneath decaying vegetation.

A smooth, ovate-ventricose, yellowish horn-coloured species, with two faint transverse zones, and six subinflated whorls, the last one perforated and slightly keeled close to the perforation. Length $3\frac{1}{2}$ millim.

2. Omphalotropis parva, Mousson.

Omphalotropis parva, Mousson, Journ. de Conch. 1865, p. 199; Pease, Journ. de Conch. 1869, p. 147; Paetel, Cat. Conch. p. 124; Schmeltz, Cat. Mus. Godeff. v. p. 101.

Realia (*Omphalotropis*) *parva*, Mousson, Journ. de Conch. 1871, p. 28; Pfeiffer, Mon. Pneum. iv. p. 224.

Realia lævis, Baird, in Brenchley's Cruise of Curaçoa (ex Schmeltz, in C. M. G. v. p. 101).

Omphalotropis vitiensis, Liardet, Proc. Zool. Soc. 1876, p. 101, pl. 5. figs. 11, 11 *a*.

This small species is not only generally diffused throughout the group, but occurs also in the Tonga and Ellis group of islands. Dr. Baird gives "Samoa" as habitat; neither Gräffe nor myself detected it in that group.

A small, smooth, ovate-conical species, $4\frac{1}{2}$ millim. long, of a pale corneous, yellowish, or violaceous horn-colour, with 6 convex whorls, and a strong basal keel contiguous to the perforation.

3. Omphalotropis ingens, Mousson.

Realia (*Omphalotropis*) *ingens*, Mousson, Journ. de Conch. 1870, p. 189; Pfeiffer, Mon. Pneum. iv. p. 227.

This species was found by Dr. Gräffe in Oneata, where it occurred in a semi-fossil condition.

An acutely-ovate species, with longitudinal riblets and 7 flattened whorls, the last with a basal filiform keel. Length 7 millim.

4. Omphalotropis longula, Mousson.

Realia (*Omphalotropis*) *longula*, Mousson, Journ. de Conch. 1870, p. 193; Pfeiffer, Mon. Pneum. iv. p. 233.

Omphalotropis longula, Paetel, Cat. Conch. p. 124.

Inhabits Ticombia, one of the Windward Islands.

This species may be characterized by its smooth, rather thin, subpellucid, conically-turreted form, 7 slightly convex whorls, the last one rounded and filocarinate at the base. The aperture is oval, and the peristome slightly expanded. Length 6 millim.

5. Omphalotropis circumlineata, Mousson.

Realia (*Omphalotropis*) *circumlineata*, Mousson, Journ. de Conch. 1870, p. 191, pl. 7. fig. 11; Pfeiffer, Mon. Pneum. iv. p. 230.

Omphalotropis circumlineata, Paetel, Cat. Conch. p. 124.

Garrettia ? *circumlineata*, Schmeltz, Cat. Mus. Godeff. v. p. 100.

This interesting species was discovered by Dr. Gräffe on Vanua Balavo and Viti Levu.

A thin, turbinate, conical, reddish horn-coloured species, with 6 angulate whorls which are spirally lineated with elevated lines, two on the body and one on the whorls of the spire so much larger than the others as to give the former a biangular, and the latter an angular outline. The basal keel is small. Length $5\frac{1}{2}$ millim.

Mousson's figure is not very characteristic. The whorls are too much rounded, and do not exhibit the large spiral lines which modify the outlines of the shell.

Mr. Schmeltz refers it with a doubt to the genus *Garrettia* (=*Diadema*, Pease). An examination of the operculum would decide the question of its generic rank.

6. Omphalotropis costulata, Mousson.

Realia (*Omphalotropis*) *costulata*, Mousson, Journ. de Conch. 1870, p. 190, pl. 7. fig. 10; Pfeiffer, Mon. Pneum. iv. p. 233.

Omphalotropis costulata, Paetel, Cat. Conch. p. 124.

A few examples found beneath dead leaves at Vanua Balavo, where Dr. Gräffe obtained the type specimens.

A small, ovate, whitish horn-coloured species, $5\frac{1}{2}$ millim. long, with 6 convex whorls, and furnished with small, longitudinal, crowded riblets. The perforated base has a well-defined keel, and there is sometimes faint indication of a peripheral keel.

7. Omphalotropis subsoluta, Mousson.

Realia (*Omphalotropis*) *subsoluta*, Mousson, Journ. de Conch. 1870, p. 192, pl. 7. fig. 12; Pfeiffer, Mon. Pneum. iv. p. 219.

Omphalotropis subsoluta, Paetel, Cat. Conch. p. 124; Schmeltz, Cat. Mus. Godeff. v. p. 100.

Discovered by Dr. Gräffe at Oneata, one of the Windward Islands.

A smooth, pale horn-coloured, turreted species, with $7\frac{1}{2}$ convex whorls; the last one, which is slightly separated from the penultimate, is usually furnished with a filiform carina a little below the periphery. A similar remote keel circumscribes the basal perforation. The vertical aperture is about one fifth the length of the shell. Peristome porrected, continuous, and slightly patulous at the base. Length 10 millim.

8. Omphalotropis zebriolata, Mousson.

Omphalotropis zebriolata, Mousson, Journ. de Conch. 1865, p. 181, pl. 14. fig. 11, 1870, p. 193, 1873, p. 108; Pease, Journ. de Conch. 1869, p. 145; Proc. Zool. Soc. 1871, p. 476; Paetel, Cat. Conch. p. 124; Schmeltz, Cat. Mus. Godeff. v. p. 101.

Realia (*Omphalotropis*) *zebriolata*, Mousson, Journ. de Conch. 1870, p. 193, 1871, p. 27; Pfeiffer, Mon. Pneum. iv. p. 225.

Omphalotropis perforata, Mousson, Journ. de Conch. 1865, p. 182, pl. 14. fig. 12; Pease, Journ. de Conch. 1869, p. 145; Proc. Zool. Soc. 1871, p. 476; Paetel, Cat. Conch. p. 124; Schmeltz, Cat. Mus. Godeff. v. p. 101.

Realia (Omphalotropis) perforata, Mousson, Journ. de Conch. 1871, p. 27; Pfeiffer, Mon. Pneum. iv. p. 222.

The type specimens of *O. zebriolata* and *O. perforata* were found by Dr. Gräffe at "Uvea" or Wallis Island, one of the northern islands of the Tonga group. Having personally collected hundreds of examples of both forms in the same locality, and as they gradually intergrade, I have united the two species. Dr. Gräffe also detected it on the neighbouring island of Futuna and on the low coral-islands of Ellis group. He likewise obtained the form *O. zebriolata* at Kanathia, Viti Islands. Mr. Pease wrongly assigns it to Samoa.

It may be distinguished by its ovate-conical form, smooth surface, fissured base, and variable colour—rose-red, pale luteous, violaceous brown, often pale banded at the periphery; sometimes with pale dots or longitudinal flexuous or zigzag lines. The basal keel is contiguous to the umbilical fissure. The pyriform aperture is usually concolor and the glazed parietal wall is frequently reddish brown. Length 5 to 7 millim.

It is shaped like the well-known *O. huahinensis*.

9. Omphalotropis rosea (Gould).

Cyclostoma roseum, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 205; Expl. Exp., Shells, p. 105, fig. 121; Petit, Journ. de Conch. 1850, p. 47.

Omphalotropis rosea, Pfeiffer, Proc. Zool. Soc. 1854, p. 307; Consp. Cyclos. no. 47; Mon. Pneum. i. p. 308, iii. p. 176; H. & A. Adams, Gen. Moll. ii. p. 300.

Hydrocena rosea, Pfeiffer, Mon. Pneum. ii. p. 162.

Assiminea rosea, Martens, Ann. & Mag. Nat. Hist. 1866, xvii. p. 206.

Through the kindness of Mr. E. L. Layard, I have received an adolescent example of Gould's *O. rosea*; but, unfortunately, the kind donor cannot give me any information in regard to the exact locality except the comprehensive one "Fiji." I am inclined to believe it inhabits the small Windward Islands.

It may be distinguished by its large size, elongate-conical shape, rather solid texture, 6–7 whorls, and rose or luteous horn-colour. The conspicuous basal keel is close to the slightly perforated umbilicus. Length 8–9, diam. 4½–5 millim.

10. Omphalotropis bifilaris, Mousson.

Omphalotropis bifilaris, Mousson, Journ. de Conch. 1865, p. 183; Pease, Journ. de Conch. 1869, p. 146; Proc. Zool. Soc. 1871, p. 476; Paetel, Cat. Conch. p. 124; Schmeltz, Cat. Mus. Godeff. v. p. 101.

Realia (Omphalotropis) bifilaris, Mousson, Journ. de Conch. 1869, p. 353, 1870, p. 194 (var. *angusta*), 1871, p. 29; Pfeiffer, Mon. Pneum. iv. p. 232.

Obtained by Dr. Gräffe at Kanathia, and the var. *angusta* in the interior of Viti Levu. The latter has a smaller basal fissure, and the two carinations are evanescent. It is probably a distinct species. The type is also distributed throughout the group, and occurs at Wallis Island.

This species may be recognized by its conical form, pale horn-colour beneath a light brownish epidermis, 6 convex whorls, incised suture, and filocarinate periphery. The basal perforation is margined by a rather distant keel. Length 6 millim.

11. Omphalotropis layardiana, sp. nov.

Realea (Omphalotropis) rosea, Mousson (not of Gould), Journ. de Conch. 1870, p. 192.

Omphalotropis bythinæformis, "MSS.," Paetel, Cat. Conch. p. 124 (ex Schmeltz in Cat. Mus. Godeff. iv. p. 74).

I obtained several specimens of this species at Vanua Balavo, one of the Windward Islands. It may be described as follows:—

Shell umbilicated, rather solid, ovate-conic, smooth, scarcely shining, uniform corneous; spire rather short, convexly-conical, apex obtuse; suture slightly incised; whorls 6–7, convex, narrowly tabulated, last one rounded; umbilicus large; basal keel large, and distant from the umbilical opening; aperture abbreviately ovate, angular posteriorly and rounded in front; peristome obtuse, margins nearly or quite continuous.

Length 6, diam. 4 millim.

It differs from *O. rosea* in its smaller size, more abbreviate form, more swollen whorls, large umbilicus, and remote keel.

Genus Lagocheilus, Blanford.

1. Lagocheilus hispidus, Liardet.

Lagocheilus hispidus, Liardet, Proc. Zool. Soc. 1876, p. 101, pl. 5. figs. 10, 10*a*.

"Shell small, bulimoid, hispid, of a brown colour; whorls 5½, spirally costate: aperture circular.

"*Hab.* Gomia, Fiji." (*Liardet.*)

The existence of this East-Indian genus in the Viti group is remarkable. So far as known, it has not been detected in any other part of the Pacific.

Genus Helicina, Lamarck.

1. Helicina tectiformis, Mousson.

Helicina tectiformis, Mousson, Journ. de Conch. 1870, p. 199, pl. 8. fig. 7; Paetel, Cat. Conch. p. 126; (*Trochatella*) Brazier, Proc. Zool. Soc. 1871, p. 322; Schmeltz, Cat. Mus. Godeff. v. p. 98; Pfeiffer, Mon. Pneum. iv. p. 250.

Helicina mangoensis, Sowerby, Proc. Zool. Soc. 1870, p. 250.

This fine species appears to be peculiar to the small island of Mango, where it is very abundant on coralline rocks.

A depressedly-conical, acutely carinated species of a uniform white colour, with a sulphur-yellow spire; frequently greyish, more or less tinged with red. The sculpture consists of rather coarse, elevated, oblique striæ of growth, and closely-set spiral raised lines. The very oblique aperture is subtriangular, and the obtuse peristome is more or less expanded. There are 5 flat whorls, the last one with a prominent compressed acute keel. Diam. 12 millim.

2. HELICINA SEMPERI, Mousson.

Helicina semperi, Mousson, Journ. de Conch. 1870, p. 201, pl. 8. fig. 8; Paetel, Cat. Conch. p. 126; Schmeltz, Cat. Mus. Godeff. v. p. 98 (as of Gräffe); Pfeiffer, Mon. Pneum. iv. p. 278.

Obtained by Dr. Gräffe at Oneata.

A solid, smooth, somewhat lenticular, shining species with five flattened whorls, the last one rounded at the periphery, and the colour variable—white, yellow, reddish, frequently with reddish zigzag strigations. Peristome obtusely thickened, and the basal callus white. Diam. 10 millim.

3. HELICINA INTERNA, Mousson.

Helicina interna, Mousson, Journ. de Conch. 1870, p. 201, pl. 8. fig. 6; 1871, p. 24; Paetel, Cat. Conch. p. 125; Schmeltz, Cat. Mus. Godeff. v. p. 99; Pfeiffer, Mon. Pneum. iv. p. 248.

Found by Dr. Gräffe in the interior of Viti Levu and at Mango Island. It is also recorded from the Tonga group.

A turbinately-conical species of a uniform white or yellowish colour, with or without a spiral reddish-brown zone, and regular conical spire. Whorls 5, slightly convex, the last one rounded or obtusely angulated. Peristome acute. Diam. 9 millim.

4. HELICINA GOMEAENSIS, Garrett.

Helicina gomeaensis, Garrett, Proc. Phil. Acad. Nat. Sci. 1873, p. 233, pl. 3. fig. 13.

On the foliage of bushes at Gomea Island.

A depressedly trochiform, somewhat shining species, with spiral impressed striæ. Colour light straw-yellow, rarely with two brownish-red zones. Whorls 5, somewhat convex, last one slightly angular on the periphery. The white peristome is broadly expanded. Diam. 10 millim.

5. HELICINA PALLIDA, Gould.

Helicina pallida, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 202; Expl. Exp., Shells, p. 96, fig. 113; Pfeiffer, Mon. Pneum. i. p. 396; Gray, Cat. Phan. p. 290; (*Pachystoma*) H. & A. Adams, Gen. Moll. ii. p. 303; Mousson, Journ. de Conch. 1865, p. 197, 1870, p. 200; Paetel, Cat. Conch. p. 125; Schmeltz, Cat. Mus. Godeff. v. p. 74.

I found a few examples of this species at Vanua Levu, Kioa, and Vanua Balavo. On foliage.

A cinereous or pale yellowish-white species, more depressed than the preceding one, the whorls flatter, the last one angular, the spiral lines more indistinct, and the periphery with a compressed keel. The peristome is thinner and not so much expanded. Diam. 9 millim.

6. Helicina beryllina, Gould.

Helicina beryllina, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 202; Expl. Exp., Shells, p. 95, fig. 111; Pfeiffer, Mon. Pneum. i. p. 354; Gray, Cat. Phan. p. 256; (*Idesa*) H. & A. Adams, Gen. Moll. ii. p. 304; Mousson, Journ. de Conch. 1865, p. 197, 1869, p. 357 (var. *flavida*), 1870, p. 200; Paetel, Cat. Conch. p. 125; Pease, Proc. Zool. Soc. 1871, p. 476; Schmeltz, Cat. Mus. Godeff. v. p. 98.

I obtained numerous examples of this species at Vanua Balavo, where it occurs on the trunks of trees. Dr. Gräffe found it at Kanathia and Oneata. Prof. Mousson has described the var. *flavida* from Samoa.

About the same size but thinner than *H. semperi*, and the spire is more conical, and the last whorl more depressed, so much so as to give the periphery an obtusely angular appearance. The peristome is thin. Colour white or pale greenish yellow, frequently with a dorsal spiral red zone; basal callus greenish yellow.

7. Helicina fulgora, Gould.

Helicina fulgora, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 201; Expl. Exp., Shells, p. 97, fig. 106; Pfeiffer, Mon. Pneum. i. p. 401; Gray, Cat. Phan. p. 293; H. & A. Adams, Gen. Moll. ii. p. 302; Mousson, Journ. de Conch. 1865, p. 178, 1869, p. 356, 1870, p. 198 (var. *expansa*), 1871, p. 25 (var. *diminuta*); Pease, Proc. Zool. Soc. 1871, p. 476; Paetel, Cat. Conch. p. 125; Schmeltz, Cat. Mus. Godeff. v. p. 98.

Dr. Gould's type specimens were obtained at Manna and Upolu, Samoa Islands. Mousson's variety *expansa* was found by Dr. Gräffe at Kanathia and Viti Levu. He also described the small var. *diminuta* from the Tonga Islands. Pfeiffer erroneously cites the Sandwich group as one of its localities.

This species, which lives on the ground in forests, may be distinguished by its thin, smooth, shining shell, convexly conoid spire, angular and conspicuously carinated body-whorl. The peristome is thin and expanded, forming an angle at the point of union with the columella. Colour pale corneous, white, or light sulphur-yellow, with longitudinal flexuous reddish or white narrow stripes. Diam. 4 to 9 millim.

8. Helicina musiva, Gould.

Helicina musiva, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 201; Expl. Exp., Shells, p. 98, fig. 107; Pfeiffer, Mon. Pneum. i. p. 368; Gray, Cat. Phan. p. 259; H. & A. Adams, Gen. Moll. ii. p. 302; Mousson, Journ. de Conch. 1865, p. 178 (var. *uveana*), 1869, p. 357, 1870, p. 202 (var. *vitiana* et *subcarinata*), 1871,

p. 25, 1873, p. 107 (var. *rotundata*); Pease, Proc. Zool. Soc. 1871, p. 476; Paetel, Cat. Conch. p. 125 (*musica* in err.).

This variable species is abundant beneath decaying vegetation in the lowlands near the sea-shore, and is generally diffused throughout the group. It is also common in similar stations in the Tonga and Samoa Islands. Prof. Mousson's var. *rotundata* was obtained at the low coral-islands of the Ellis group.

The shape varies from depressed globose to sublenticular, and in size it varies from 3 to 5 millim. in diameter. The usual colour is white, corneous, or pale yellowish horn-colour, with radiating reddish-chestnut, more or less zigzagged or undulating stripes; it is rarely unicolor, and sometimes light chestnut. The periphery is rounded or subangulated, and the peristome slightly expanded.

H. oceanica, Pease, inhabiting the Kingsmill group, is probably a variety of *H. musiva*.

9. Helicina articulata, Pfeiffer.

Helicina articulata, Pfeiffer, Proc. Zool. Soc. 1854, p. 53; Mon. Pneum. ii. p. 191; Malak. Blat. 1854, p. 103.

A few examples found beneath decaying leaves near the sea-shore, on the west end of Vanua Levu.

Pfeiffer mentions "Tanna, New Hebrides," as the habitat of *H. articulata*.

Very closely related to the depressed subangulated forms of *H. musiva*, and the colour and markings are nearly or quite similar in the two species. The two articulated white and chestnut bands at the suture and periphery are not constant. The filocarinated body-whorl is its most prominent character. Diam. 5–6 millim.

10. Helicina pohliana, sp. nov.

Helicina miniata, "Lesson" (not of Lesson in Voy. Coquille), Museum Godeffroy, 1885.

Shell solid, depressedly-conoid, smooth, shining, fulvous or luteous, with very faint oblique striæ and distant irregular microscopical impressed spiral lines; spire convexly conoid; whorls 5, flatly convex, last one obtusely carinate; keel white, compressed beneath; aperture small, diagonal, semioval; peristome very thick, labiate within; basal callus white or pale yellowish.

Viti Levu.

I received this species from the Museum Godeffroy, labelled "*H. miniata*, Lesson." Lesson's species is peculiar to the island of Bolabola, one of the Society group.

Its solid texture, yellow colour, obtuse white keel, and thick obtuse peristome will readily distinguish it from any other Viti species.

11. Helicina incisa, Mousson.

Helicina incisa, Mousson, MS., Museum Godeffroy, 1885.

Shell minute, depressed-conoid, very faintly striated by lines of growth, and spirally lineated with fine impressed lines; colour yellowish, corneous, with or without radiating reddish spots and bands; spire conoid; suture linearly impressed; whorls $4\frac{1}{2}$–5, flatly convex, slowly and regularly increasing, the last one depressed, subangulated on the periphery; base convex; aperture oblique, lunately oval; peristome expanded, slightly obtuse.

Diam. 4 millim.

Ono Island.

Several examples received from the Museum Godeffroy. Possibly only a variety of *H. musiva* with fine spiral impressed lines.

Genus Georissa, Blanford.

1. Georissa juvenilis (Mousson).

Diancta juvenilis, Mousson, MS., Mus. Godeffroy, 1885.

"Viti Levu."

Shell imperforate, ovate-conical, rather solid, corneous; spire conical, apex obtuse; suture deeply impressed; whorls 5, strongly convex, longitudinally obliquely plicately ribbed; ribs rude, irregular, becoming more crowded and smaller near the peristome; aperture suborbicular; peristome simple, straight; columellar region thickened with callus. Length $2\frac{1}{2}$ millim. Several examples were received from the Museum Godeffroy. The oblique longitudinal riblets will at once determine this from any other Polynesian species.

2. Georissa parva (Pease).

Cyclostoma parvum, Pease, Proc. Zool. Soc. 1864, p. 674.

Chondrella parva, Pease, Proc. Zool. Soc. 1871, pp. 465, 476; Pfeiffer, Mon. Pneum. iv. p. 294; Garrett, Journ. Acad. Nat. Sci. Philad. 1884, p. 106, pl. 3. fig. 41.

Hydrocena insularis, "Crosse," Mousson, in Museum Godeffroy, 1885.

Examples of this species received from the Museum Godeffroy, labelled "*Hydrocena insularis*, Crosse, Viti Levu," do not differ from Pease's *Chondrella parva* inhabiting the Society Isles. It is shaped like *G. juvenilis*, but is a little larger, and the whole surface is smooth and somewhat shining.

Genus Assiminea, Leach.

1. Assiminea nitida, Pease.

Hydrocena nitida, Pease, Proc. Zool. Soc. 1864, p. 674.

Assiminea nitida, Pease, Journ. de Conch. 1869, p. 165, pl. 7. fig. 11; Proc. Zool. Soc. 1871, p. 476; Schmeltz, Cat. Mus. Godeff. v. p. 103; Garrett, Proc. Phil. Acad. Nat. Sci. 1879, p. 29; Journ. Phil. Acad. Nat. Sci. 1881, p. 408, 1884, p. 107.

? *Realia nitida*, Pfeiffer, Mon. Pneum. iii. p. 202.

Hydrocena parvula, Mousson, Journ. de Conch. 1865, p. 184, 1873, p. 108.

Omphalotropis parvula, Pease, Journ. de Conch. 1869, p. 155 Proc. Zool. Soc. 1871, p. 476; Paetel, Cat. Conch. p. 124.

Assiminea parvula, Pease, Proc. Zool. Soc. 1871, p. 476; Schmeltz, Cat. Mus. Godeff. v. p. 103.

Realia parvula, Pfeiffer, Mon. Pneum. iii. p. 213.

Assiminea lucida, Pease, Journ. de Conch. 1869, p. 166, pl. 7. fig. 10; Proc. Zool. Soc. 1871, p. 476.

Assiminea ovata, "Pease," Schmeltz, Cat. Mus. Godeff. v. p. 103.

Hydrocena pygmæa, Gassies, Journ. de Conch. 1867, p. 63.

Assiminea pygmæa, Pease, Journ. de Conch. 1869, p. 165.

? *Realia pygmæa*, Pfeiffer, Mon. Pneum. iv. p. 214.

Hydrocena similis, Baird, in Cruise of the 'Curaçoa.'

This small species is generally distributed throughout all the groups from the Paumotus to the Viti Islands and New Caledonia, and ranges from near the sea-shore to about 2000 feet above the sea-level. They are found beneath decaying leaves, under stones and dead wood.

It may be recognized by its small size, $2\frac{1}{2}$–4 millim. long, smooth, shining surface, ovate-conical form, light or dark corneous colour, rarely with a faint transverse band on the last whorl.

2. ASSIMINEA BREVISSIMA (Mousson).

Hydrocena brevissima, Mousson, Journ. de Conch. 1870, p. 194.

Found by Dr. Gräffe at Vanua Balavo.

A minute, broadly conical, thin, pellucid, shining, pale reddish horn-coloured species with $3\frac{1}{2}$ whorls. Length $1\frac{1}{2}$ millim.

3. ASSIMINEA FISCHERIANA (Gassies).

Hydrocena fischeriana, Gassies, Faune Nouv. Caléd. 1863, p. 115, pl. 7. fig. 18.

Realia fischeriana, Pfeiffer, Mon. Pneum. iv. p. 421.

Assiminea vitiensis, Garrett, Amer. Journ. Conch. 1872, p. 225, pl. 19. fig. 14.

Abundant on the margins of mangrove-swamps. It also occurs at New Caledonia.

Shaped like *A. nitida*, but larger, darker coloured, with or without one or two pale bands on the body-whorl.

The following species, though quoted as Viti shells, have been found neither by Dr. Gräffe nor by myself. Their existence in the group certainly needs confirmation.

PARMELLA PLANATA, H. Adams, Proc. Zool. Soc. 1867, p. 308, pl. 19. fig. 20.

"Habitat Fiji Islands." (*H. Adams.*)

NANINA SCORPIO, Gould, Expl. Exp., Shells, p. 33, fig. 67.

"Feejee Islands." (*Gould.*)

Not identified by any subsequent author. It has been referred to the genus *Helicarion*.

Pupina adamsiana, Crosse, Journ. de Conch. 1871, p. 330; 1872, p. 60, pl. 2. fig. 6.

"Vanua Levu." (*Crosse.*)

Mr. Crosse cites the locality on the authority of a London dealer. The species is closely allied to if not identical with *Hargravesia polita*, a Solomon-Island species.

Helicina lens, Lea, Observ. i. p. 161, pl. 19. fig. 56.

"Feejee Islands." (*Lea.*)

Perhaps a unicoloured variety of *H. fulgora*, Gld.

Helix leucolena, Crosse, Journ. de Conch. 1867, p. 447; 1868, p. 171, pl. 6. fig. 6.

"Vanua Levu, Viti." (*Crosse.*)

Mr. Crosse, who obtained the type specimen from a London dealer, was informed it came from Vanua Levu. The type is foreign to the group.

Helix semirufa, Albers, Die Hel. p. 106.

"Habitat in insulis Fidschi." (*Albers.*)

Most certainly foreign to the group.

Partula tæniata, Mörch, is wrongly assigned to the Viti Islands. It is peculiar to Moorea, one of the Society Islands.

Partula alabastrina, Pfeiffer, Proc. Zool. Soc. 1856, p. 39. Solomon Isles (*Pfeiffer*); Fiji Islands (*Hartmann*).

Partula compressa, Pfeiffer (*Bulimus*), Zeitschr. f. Malak. 1850, p. 75. Fiji Islands (*Hartmann*).

5. Notes on a small Collection of Shells from the Loo Choo Islands. By Edgar A. Smith.

[Received February 10, 1887.]

Among the valuable collections made at the Loo Choo Islands by Mr. H. Pryer were a few shells, which he has liberally presented to the British Museum. As five out of the nine species are represented by fairly large series of specimens, I have been enabled to make a few observations on the variations they present. These may be of some use if they tend to prevent the multiplication of species which eventually have to be regarded merely as varieties. The specimens were obtained, I believe, from the largest island of the group, the name of which is variously written Loo Choo, Lu-Tschu, Lu Chu, Liew Kiew, and Riu Kiu.

1. Helix despecta, Gray.

This species, also *H. ravida*, Benson, *H. redfieldi*, *H. sieboldiana*, both of Pfeiffer, and *H. assimilis*, H. Adams, are all very much alike, and might well be considered varieties of one and the same species. In the series of eighteen specimens from Loo Choo I find considerable differences in form, some being much higher and more globose than others. One example is of a peculiar purplish-brown colour, and another is remarkable in having a thickening or limbus within the lip.

2. Helix mercatoria, Gray.

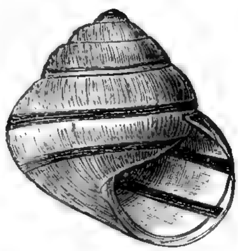
This species varies considerably in intensity of colour, from a very deep black-brown to pale yellowish olive, and the lines of growth in some examples are very much coarser than in others. One specimen with a comparatively smooth surface has the peripherial dark band unbordered by a pale zone on each side as usual. The colour of the peristome is also variable, being in the dark or most common forms purplish brown, and of a pale flesh-tint in shells of a lighter colour.

3. Helix luhuana, Sowerby.

The two specimens which I assign to this species are rather young and consequently thinner than adult shells. They differ also from the typical form in colouring, having only faint indications of transverse bands and much more distinct spiral striæ, in which respect they exactly resemble *H. peliomphala* from Japan.

4. Helix largillierti, Philippi, var.

Testa perforata, globoso-conica, mediocriter tenuis, incrementi lineis oblique arcuatis tenuiter striata, sordide albida, zonis duabus nigro-fuscis cincta, epidermide tenuissima flavescente induta; anfractus 6, *convexiusculi, superne ad suturam angustissime submarginati, ultimus subglobosus, ad peripheriam supra aperturam obsolete angulatus; apertura late lunata, longit. totius* ½ *subæquans; peristoma expansum, albidum vel dilutissime roseo tinctum, margine columellari reflexo, umbilicum semiobtegente. Diam. max.* 27 *millim., min.* 23, *alt.* 25.



Helix largillierti, var.

In form this variety very closely approximates to *H. callizona*, Crosse, but may be slightly higher in the spire. That species, however, according to Martens[1] and some specimens from Kiga, Japan, which I have assigned to it, is very distinctly spirally striated, as is the case in *H. peliomphala* and other allied species from

[1] Pfeiffer's Novitates Conch. vol. v. p. 31.

Japan. On the contrary, the shells here described have a smoother aspect and exhibit only the faintest trace of spiral striæ. The typical form of *H. largillierti,* also from the Loo Choo Islands, is considerably smaller, but of about the same proportions ; it has the same number of whorls, a similar umbilicus and angulation at the periphery, and the same very faint spiral striation. A variety is described by Pfeiffer with a single band just above the slight angle of the body-whorl, and falling above the sutural line upon the spire. The two specimens collected by Mr. Pryer have a similar band, and a second situated three or four millimetres below the periphery. Although so large, these specimens are evidently young, being very thin, and having only partially developed the lip of the aperture ; the internal thickening described as present in the type is only feebly discernible.

5. Helix connivens, Pfeiffer.

Of the forty-six specimens of this species obtained by Mr. Pryer, twelve only belong to the unbanded form, the remainder having the single red line at the periphery as figured by Reeve and Pfeiffer. The lip in both varieties may be either white or pinkish.

6. Clausilia valida, Pfeiffer.

Not one of the twenty-four examples of this species at hand belongs to the brown-banded variety, all being of a uniform greyish-yellow tint. The largest specimen, consisting of seven whorls, is 33 millimetres in length, or seven longer than the six-whorled shell described by Pfeiffer. All have the spire decollated.

7. Cyclophorus turgidus, Pfeiffer.

None of the specimens obtained by Mr. Pryer are as large as the types, also from Loo Choo, described by Pfeiffer ; but they agree in every respect with the small form he mentions from the Ibyat, an island of the Bashee group, situated some three hundred miles to the south-west of Loo Choo. They appear to be pretty constant in form, style of colouring, and in the decided peripherial carination ; but the peristome varies from white to a reddish tint, and in some specimens it is of a much more duplex character than in others. The operculum is semitransparent, a little concave externally, and consists of seven slowly enlarging whorls which are finely keeled at the suture.

C. ibyatensis, Pfeiffer, from the same island as the small variety of *C. turgidus,* differs only in having the last whorl rounded instead of more or less carinate at the periphery. It should be regarded as a variety of this species rather than as a distinct form. The British Museum possesses quite a typical specimen of *C. turgidus,* from the island of Formosa, presented by M. Dickson, Esq.

8. Cyclophorus exaltatus, Pfeiffer, var.

A single specimen only was obtained. It differs from Hong-Kong and Formosan examples in having a slightly larger aperture, and an orange-red instead of a white peristome. The convexity of the whorls, the sculpture, and the style of colouring are quite of the same character. A similar variation in the colour of the peristome occurs in the preceding species.

9. Leptopoma vitreum, Lesson.

The distribution of this species is very wide, it being recorded from the Nicobar Islands, Java, the Moluccas, Philippines, New Ireland, Frankland and Fitzroy Islands, and New Caledonia. It has not previously been met with at Loo Choo, the most northern point of its range yet known. The two specimens are of medium size, and of transparent white colour without any markings.

March 15, 1887.

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 February 1887:—

The total number of registered additions to the Society's Menagerie during the month of February was 46, of which 7 were by birth, 21 by presentation, 7 by purchase, 4 were received on deposit, and 7 by exchange. The total number of departures during the same period, by death and removals, was 112.

The most noticeable additions during the month of February were as follows:—

1. A Burmeister's Cariama (*Chunga burmeisteri*), received in exchange February 24, being the fifth specimen of this rare species of the Northern Provinces of the Argentine Republic that the Society has acquired.

2. A White-fronted Heron (*Ardea novæ-hollandiæ*), from Australia, presented by F. B. Dyas, Esq., February 25th. This species is new to the Society's Collection.

3. A young specimen of a Black-winged Kite (*Elanus cæruleus*), taken from the nest by Mr. R. Southey of Southfield, Plumstead, Cape of Good Hope, and received February 28th. This species is likewise new to the Society's Collection.

Mr. Howard Saunders, F.Z.S., exhibited a young male Harlequin Duck (*Cosmonetta histrionica*), shot on the 2nd December, 1886, near the Farne Islands, off Northumberland, where it was in company with two others, one of which was also obtained (Zool. 1887, p. 70). Mr. Saunders stated that records of the occurrence of this species were not unfrequent; but that inasmuch as, with one exception, every reputed British specimen which had been submitted to competent examination had proved to belong to some other species, the possessor, Mr. R. W. Chase, of Edgbaston, had kindly complied with a request to send his bird up, that its identification might be placed beyond a doubt—an example to be commended to other owners of rarities. The only British-killed specimen previously known to exist was in the collection of Mr. J. Whitaker, of Rainworth Lodge, Notts., and had been obtained at Filey, Yorkshire, in 1862. So-called specimens had generally proved to be females or young of the Long-tailed Duck or of the American Wood Duck.

The following papers were read :—

1. On the Bats collected by Mr. C. M. Woodford in the Solomon Islands. By Oldfield Thomas.

[Received February 11, 1887.]

(Plates XXV. & XXVI.)

The Mammalian collection made by Mr. C. M. Woodford in the Solomon Islands, and recently acquired by the Natural History Museum, consists almost wholly of Bats; and as nothing has been hitherto recorded about the Chiropterous fauna of these islands, his collection is naturally of great interest and importance.

The localities at which Mr. Woodford collected were Alu, in the comparatively large Shortland Island, and Fauro Island, close to Shortland, all the specimens therefore coming from the extreme western part of the archipelago.

The collection consists of 23 specimens belonging to 10 species, of which two are new, one of these representing also a new genus. As might have been expected, the greater proportion of the species, and all of those presenting any special interest, belong to the fruit-eating section of the order. One Solomon-Island Bat only was not obtained by Mr. Woodford, namely *Pteropus rayneri*, Gray, which comes from the other extremity of the archipelago. This I have included in the following list in order to make it a complete catalogue of the known species of the group.

1. Pteropus grandis, sp. n.[1] (Plate XXV.)

a, b. Ad. sk. ♂ and a separate skull. Alu, Shortland Island, 4/86.

Size large, about equal to *Pt. gouldi*. Ears decidedly longer than the muzzle, acutely pointed. Origins of wings about an inch apart on the back. Interfemoral membrane very narrow in the centre, concealed by the fur. Fur rather coarse, hispid over the shoulder-glands, rather woolly on the legs. Fore limbs and membranes nearly naked above, a few scattered black hairs on the proximal half of the forearm. Fur on back adpressed, rather more than an inch in breadth at its narrowest part. Rump and hind limbs nearly to the ankles thickly clothed with woolly hairs. Below, the humerus, proximal half of forearm, and the membranes between the humerus and femora are covered with hair, and a thin band of fur

[1] Preliminary diagnosis published, Ann. & Mag. N. H. (5) xix. p. 147, Feb. 1887.

$\frac{2}{5}$

J. Smit lith. Hanhart imp.

PTEROPUS GRANDIS

1/1

J. Smit lith.

Hanhart imp.

NESONYCTERIS WOODFORDI.

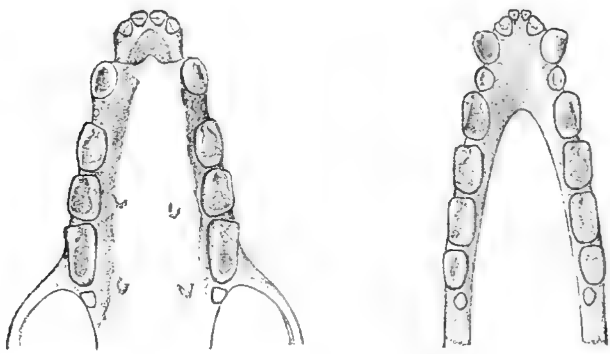
passes along outside the forearm nearly to the wrist. Femora and proximal third of tibiæ thickly clothed with softer woollier fur.

Face, middle of back, chin, and centre line of belly black. Neck all round, shoulders, sides of body, and hind limbs below dark maroon-red, the tufts over the shoulder-glands rather paler. Rump and upperside of thighs bright orange-yellow, contrasting markedly with the sombre hue of the back.

Skull agreeing closely with that of *Pt. gouldi* in size and proportions.

Teeth (fig. 1) large and heavy as compared to those of *Pt. gouldi*, *Pt. chrysoproctus*, and others, but far smaller and lighter than those of *Pt. melanopogon*. Upper incisors broad, touching each other, the combined breadth of the four 8 mm. Canines rather short, thick and stout, with a broad and prominent internal basal ledge. Anterior premolars minute, deciduous. Second premolar large and broad, with a prominent internal secondary cusp. All the cheek-teeth

Fig. 1.



Teeth of *Pteropus grandis*, natural size.

broad and strong; combined length of the three largest 18 mm., and the breadth of the centre one 4 mm. Last molar slightly larger than one of the outer incisors, its antero-posterior diameter 2·2 mm. Lower teeth presenting very much the same characters as the upper. Outer incisors very large, 2 mm. in transverse diameter. Canine with large internal basal ledge or cingulum as in the upper jaw. Second premolar unusually near the canine, the comparatively large first premolar larger than the diastemata in front of and behind it, 2·6 mm. in diameter. Last molar about equal to one of the middle upper incisors, smaller than the outer and larger than the inner lower incisors.

Dimensions of an adult male in skin:—Head and body (c.) 325 mm., head 74, muzzle 32, ear (above crown) 30, forearm 170 (=6·7 in.), thumb 73, index finger 118, tibia 122, calcaneum 24.

Skull (specimen *b*). Basal length 67, greatest breadth 39, supraorbital foramen to tip of nasals 30, interorbital breadth 10, intertemporal breadth 7·5, breadth from tip to tip of postorbital processes 30, palate length 40.

It is with considerable reluctance that I find myself compelled to add another species of *Pteropus* to the long list of those already known; but the characters of *Pt. grandis* so entirely fail to fit in with those of any of the hitherto described species, that I have no alternative but to do so.

Pt. grandis differs from every known species at all approaching its size by its dark maroon-coloured neck, throat, and sides, and by its bright yellow rump. Apart from coloration, again, it differs from *Pt. edulis* by its much smaller size and broadly edged canines, from *Pt. gouldi*, *aneiteanus*, and *poliocephalus* by its very much heavier teeth, and from *Pt. melanopogon* by its smaller teeth and longer pointed ears. On the whole it may be looked upon as most nearly allied to *Pt. chrysoproctus*, a native of the Moluccas, which resembles it in many of its characters, but differs by having its neck both above and below rich yellow, by its yellowish crown and dark-coloured rump. The teeth also of *Pt. chrysoproctus* are smaller and lighter than in *Pt. grandis*; the canines are thinner and have narrow postero-internal ledges, and, finally, there is a much greater space between the canines and second premolar below, the anterior premolar having a diameter less than the length of either of the diastemata in front of or behind it.

To another species also *Pt. grandis* bears a certain amount of resemblance, namely to *Pt. rayneri*, Gray, also from the Solomon Islands; but that species has much shorter ears, and is very far smaller, having a forearm only 135 mm. long, a skull only 55 mm. long, and teeth which, although they have very much the same shape and relative proportions as in *Pt. grandis*, yet differ so markedly in their actual size as to preclude all possibility of the two species being the same.

2. Pteropus hypomelanus, Temm.

a. Alu, Shortland Island, 4/86.

Previously known range, from Borneo to New Guinea.

This is the first published notice of the occurrence of this species in the Solomon Isles; but its discovery there was made in 1883, when Surgeon H. B. Guppy, of H.M.S. 'Lark,' obtained and sent to the Museum a specimen, also collected on Shortland Island.

3. Pteropus rayneri, Gray[1].

Discovered in the islands of San Christoval and Guadalcanar in

[1] I may take this opportunity of stating that an examination of the typical specimen of *Pteropus molossinus*, Temm., preserved in the Leyden Museum, proves that the Caroline-Island *Pteropus* described by me in 1882 (P. Z. S. 1882, p. 756) under the name of *Pt. breviceps* is not really distinguishable from that species, of which, up to that date, the locality was unknown. I must, however, for my own justification, point out that the shoulder-tufts of *Pt. molossinus*, instead of being "bright yellow" as has been described, are really of a dark orange-brown, but little in the type, and in my specimens not at all, lighter than the general colour of the body. Nor can I at all fully appreciate the alleged resemblance in dentition between the very small-toothed *Pt. molossinus* (see figures *t. c.* pl. lv.) and the large-toothed *Pt. aneiteanus* and *Pt. jubatus*, the latter of which has the largest teeth of any member of the genus.

1854 by Dr. F. M. Rayner, during the voyage of H.M.S. 'Herald;' not obtained by Mr. Woodford.

4. Cynonycteris brachyotis, Dobs.

a, b. Fauro Island, 5/86.

Previously known habitat, New-Ireland group; also recorded from Celebes[1].

The two specimens obtained by Mr. Woodford are both slightly immature, and both retain their first upper premolars. They agree in every respect with the typical specimens.

5. Harpyia major, Dobs.

a, b. Alu, Shortland Island, 4/86. (New Georgia, Coll. Brit. Mus.)

Hab. E. New Guinea; New-Ireland group; Solomon Islands.

6. Cephalotes peronii, Geoffr.

a. Alu, Shortland Island, 4/86. (Ugi, Dr. H. B. Guppy, H.M.S. 'Lark'; San Christoval, F. M. Rayner, H.M.S. 'Herald.')

Hab. Austro-Malayan subregion, from Celebes to Solomon Islands.

Nesonycteris[2], g. n.

Muzzle long, narrow, cylindrical; nostrils projecting considerably; upper lip with a vertical groove bounded laterally by raised naked edges; posterior palate-ridges divided in the centre; index finger without a claw, longer than the metacarpal bone of the middle finger; wing-membranes as in *Melonycteris*[3]; tail none.

Dentition:—I. $\frac{2}{1}$, C. $\frac{1}{1}$, Pm. $\frac{3}{3}$, M. $\frac{2}{3}\times 2=32$.

Shape, size, and position of teeth much as in *Melonycteris*[4], but lower inner incisors entirely obsolete.

Skull as in *Melonycteris*; premaxillæ distinctly separated anteriorly[5]. Lower jaw with a very long gutter-like *symphysis,* and with a long diastema between the first premolar and that next behind it.

This most interesting new genus presents a combination of the characters of several of the hitherto known Macroglossine Bats. Thus, in the clawless state of the index finger it resembles *Eonycteris* and *Notopteris*; by the attachment of its wing-membranes and the form of its palate-ridges, *Melonycteris* and, fairly closely, *Megaloglossus.* And, again, while the number of the incisors is as in *Notopteris,* the other teeth closely resemble those of *Melonycteris,* to which, on the whole, it is certainly most nearly allied.

[1] Jentink, Notes Leyd. Mus. v. p. 173 (1883).

[2] νῆσος, an island, νυκτερίς, a bat.

[3] See Dobson, P. Z. S. 1877, p. 119.

[4] Figured, *id. l. c.* figs. 5 and 6.

[5] As they are in *Melonycteris,* although by some accident that genus has been placed under the heading of "premaxillary bones united in front," in the Cat. Chiropt. Brit. Mus. p. 4, nothing being said on the subject in the description of the genus pp. 97–8.

This discovery and that of the highly interesting West-African *Megaloglossus woermanni*, Pagenst.[1], of which I have seen a beautiful spirit specimen from Liberia in the Leyden Museum, render the synopsis of genera in Dr. Dobson's Catalogue of Chiroptera somewhat obsolete, since, according to Dr. Dobson's synopsis, *Nesonycteris* would come next to *Notopteris* and *Eonycteris* instead of to *Melonycteris*, its nearest ally. I have therefore thought it convenient to draw up the following synopses of the Macroglossine genera, the first based solely on the soft-part and external characters, and the second on those of the skull and teeth.

I. *External or Soft-part Characters.*

A. Tail very short; wings from the sides of the back.
- a. Wing-membrane from the base of the first toe; no claw on index .... 1. EONYCTERIS.
- b. Wing-membrane from the third, or second and third toes.
  - a′. A claw on index.
    - a″. Posterior palate-ridges undivided .... 2. MACROGLOSSUS.
    - b″. Posterior palate-ridges divided in centre.
      - a‴. Lower part of rhinarium broad, convex laterally .... 3. MEGALOGLOSSUS.
      - b‴. Lower part of rhinarium narrow, concave laterally .... 4. MELONYCTERIS.
  - b′. No claw on index. Palate-ridges and rhinarium as *Melonycteris* .... 5. NESONYCTERIS.

B. Tail long; wings from centre of back; no claw on index .... 6. NOTOPTERIS.

II. *Cranial and Dental Characters.*

A. Pm.^{1} above and below small, single-rooted.
- a. Penultimate molar many times as large as last .... 1. EONYCTERIS.
- b. Penultimate molar but little larger than last.
  - a′. Pm.^{1} nearly as large as that next behind it; premaxillæ united .... 2. MACROGLOSSUS.
  - b′. Pm.^{1} minute.
    - a″. Middle premolar three fourths as long as the canine .... 3. MEGALOGLOSSUS[2].
    - b″. Middle premolar barely one third as long as the canine; premaxillæ separate.
      - a‴. Incisors $\frac{2}{2}$ .... 4. MELONYCTERIS.
      - b‴. Incisors $\frac{2}{1}$ .... 5. NESONYCTERIS.

B. Pm.^{1} above and below long, double-rooted .... 6. NOTOPTERIS.

7. NESONYCTERIS WOODFORDI, sp. n.[3] (Plate XXVI.)

a. Ad. sk. ♀. Fauro Island, 5/86.

b, c. Ad. sk. ♂ and yg. al. Alu, Shortland Island, 4/86.

Strikingly like *Melonycteris melanops*[4], Dobs., in size, proportions, shape and length of ears, and in the colour and texture of the fur of

[1] JB. Hamb. ii. p. 125, pl. i. (1885).

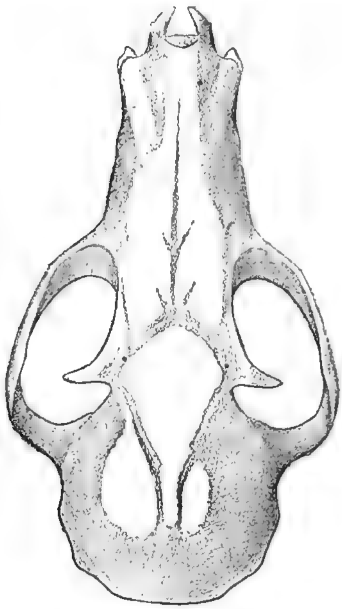
[2] For several details connected with the dentition of this interesting genus, I am indebted to Dr. F. A. Jentink, of the Leyden Museum.

[3] Preliminary diagnosis published, Ann. & Mag. N. H. (5) xix. p. 147, Feb. 1887.

[4] Figured, P. Z. S. 1877, pl. xvii.

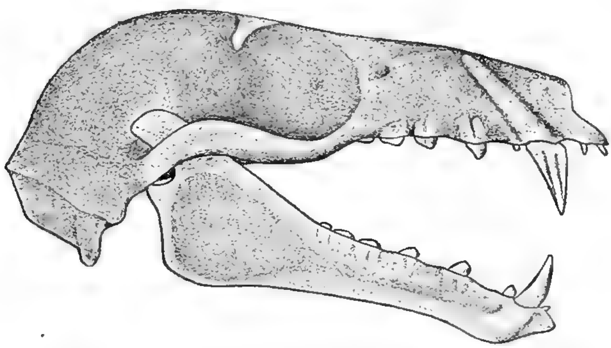
the back, this being of precisely the same soft cottony nature, and of the same fulvous-yellow tinge; but the face, instead of being varigated with black and white, and quite different from the back, is quite like the latter, except that it is rather darker. The under-

Fig. 2.



Skull of *Nesonycteris woodfordi*, upper view; twice natural size.

Fig. 3.



Skull of *Nesonycteris woodfordi*, side view; twice natural size.

side also is very similar to the back, although rather paler and duller, while in *M. melanops* it is nearly black. Point of insertion of the antebrachial membrane without any trace of a white spot.

Ears small, obtusely pointed. Nostrils very prominent. Palate-ridges 7 in number, the 6th and 7th divided in the centre as in *M. melanops*[1].

Humerus, proximal half of forearm, and upperside of hind legs to ankles thickly clothed with soft woolly fulvous fur. Wing-membranes behind humerus and whole of interfemoral membrane also covered with fur. On the lower side the same parts are hairy as on the upper, but the hair is much thinner and sparser.

Skull (figs. 2 and 3) long and slender, with a long narrow muzzle; postorbital processes well developed; premaxillæ widely separated in front.

Upper incisors 4, forming an even semicircular row; canines very long and powerful, with deep vertical grooves on their anterior, external, and posterior surfaces; pm.[1] minute, quite close to the canine; molars very small, smaller even than in *Melonycteris*, posterior one about two thirds the size of the anterior.

Lower incisors one on each side, near the canines, widely separate in the middle; canines slightly grooved posteriorly; pm.[1] close to the canines, and succeeded by a broad diastema; posterior molar in section of about the size of pm.[1].

Dimensions of specimen *b*, an adult male (skin):—

Head and body (c.) 100 mm., head 35, muzzle 15, ear (from notch at base) 11, above crown 8, forearm 55 (=2·18 in.).

8. PHYLLORHINA DIADEMA, Geoffr.

a. Fauro Island, 5/86.

Previously known range: Oriental Region as far east as the Key Islands and Western New Guinea.

9. PHYLLORHINA CERVINA, Gould.

a–d. 3 ♂ & 1 ♀. Fauro Island, 5/86.

Previously known range: N. Australia, New Guinea and neighbouring islands, including Duke of York Island.

One of the male specimens has no transverse frontal sac, while the other two have it well developed. In all other respects, however, the specimens are quite identical.

10. VESPERUGO ABRAMUS, Temm.

a. Fauro Island, 5/86.

Previously known range: Palæarctic, Oriental, and Austro-Malayan part of Australian Region, as far east as New Guinea.

11. EMBALLONURA NIGRESCENS, Gray.

a–f. All ♀. Fauro, Shortland, and Savo Islands. (Ugi; Guppy.)

Previously known range: Austro-Malayan subregion, as far east as New Ireland.

This species seems to be very common in the group, as both

[1] See figure by Pagenstecher, Naturh. Mus. Hamb. 1884, tab. fig. 2.

Surgeon Guppy and Mr. Woodford obtained it in considerable numbers.

For a comparison of the Chiropterous fauna of the Solomons with that of the neighbouring islands, it fortunately happens that the Bats of the nearest group, viz. that of New Britain, New Ireland, and Duke of York, have been fully worked out by Dr. G. E. Dobson[1], who based his papers on the specimens obtained in those islands by the Rev. George Brown. These specimens are all in the Natural History Museum, so that I have had the advantage of being able to compare Mr. Woodford's Bats directly with those named by the chief living authority upon Chiroptera.

The following parallel lists show the species as yet known from the two groups, those marked with an asterisk being peculiar to their respective groups.

Megachiroptera.

New-Ireland group.	*Solomon group.*
Pteropus melanopogon.	*Pteropus grandis.
—— capistratus.	—— hypomelanus.
	*—— rayneri.
Cynonycteris brachyotis.	Cynonycteris brachyotis.
Harpyia major.	Harpyia major.
Cephalotes peronii.	Cephalotes peronii.
Macroglossus minimus.	
*Melonycteris melanops.	*Nesonycteris woodfordi.

Microchiroptera.

Phyllorhina tricuspidata.	Phyllorhina diadema.
—— cervina.	—— cervina.
—— calcarata.	
*Vesperugo angulatus[2].	Vesperugo abramus.
Kerivoula hardwickii.	
Emballonura nigrescens.	Emballonura nigrescens.

The New-Ireland group has therefore two, and the Solomon group three peculiar species, while there are five species common to both groups, a number that is certain to be largely increased as the islands are more fully explored. The proportion of fruit-eating to insectivorous Bats is larger by a slight fraction in the Solomons than in the other group, a difference only to be expected from the more oceanic position of the former. This position has also resulted, so far as is yet known, in the nearly entire absence of terrestrial Mammalia in the Solomons, the only other mammals besides Bats known from there being the arboreal and widely-spread *Cuscus orientalis*, Pall., and a Rat from Florida Island, described by Mr. E. P. Ramsay[3]. On the other hand, Mr. Brown collected in the New-Ireland group, as recorded by Mr. Alston[4], no less than six indigenous

[1] P. Z. S. 1877, p. 114, and 1878, p. 314.

[2] Peters, SB. nat. Freund. 1880, p. 122. Only known to me by the original description.

[3] Proc. Linn. Soc. N. S. W. vii. p. 43, 1882. This Rat appears to be a member of the arboreal genus *Uromys*.

[4] P. Z. S. 1877, p. 123.

species of Rodents and Marsupials, many of them of such a distinctly non-arboreal nature as to preclude the possibility of their having been originally introduced on drifting logs or trees, a means of distribution to which no doubt the Solomons owe the presence of their two non-flying mammals and Rat, the *Cuscus*.

2. A List of the Birds collected by Mr. Charles Morris Woodford in the Solomon Archipelago. By W. R. Ogilvie-Grant.

[Received February 14, 1887.]

(Plate XXVII.)

The Natural History Museum has recently received a collection of Birds made by Mr. C. M. Woodford at Fauro, Alu, Shortland Island, and other localities; and, although comparatively few specimens were obtained, some of the species are very interesting, and one at least is new to science. This is a Crow belonging to the genus *Macrocorax*.

The following is an extract from a letter received from Mr. C. M. Woodford:—"I find that Hornbills and Cockatoos do not extend beyond Malayta, being entirely unknown on the island of San Christoval and the smaller islands adjacent; and as they are not found in the groups to the south-east, this will be the limit to which these two genera extend."

The following is a list of the species, with remarks on some of the rarer ones, and notes on their soft parts made by the collector.

1. Astur pulchellus.

Urospizias pulchellus, Ramsay; Salvad. Orn. Papuasia, iii. App. p. 508.

a. ♂ ad. Alu. Iris brown; bill black at tip; nostrils and base of mandibles yellow; legs yellow.

b. ♂ juv. Fauro. Iris brown; legs and base of bill yellow; the tip black.

This species, at first described by Ramsay as *A. soloensis*, Lath., as already observed by Finsch, is a very distinct bird. It is nearly allied to *A. dampieri*, Gurney, but may be easily distinguished by the colour of the breast and abdomen, which is a uniform deep vinous red (chestnut-hazel, Ridgway) instead of vinous with faint, narrow, pale cross bars on the flanks, belly, and under tail-coverts.

Char. *Male adult.* Head, back, upper coverts, quills and tail-feathers slaty grey (Ridgway), the latter without any trace of cross bars. Throat and fore neck light slaty grey. Breast, abdomen, flanks, and under tail-coverts deep vinous red (chestnut-hazel, Ridgw.). Axillaries and under wing-coverts pale vinous red the latter with greyish cross bars. Quills below slaty grey, the inner web lighter, with whitish wavy bars towards the distal extremity.

Total length 13·5 inches, culmen ·6, wing 7·7, tail 6·25, tarsus 2·1.

W. Hart del et lith.

Mintern Bros. imp.

MACROCORAX WOODFORDI.

Young male. General colour above warm brown, with rufous edges to the feathers. Upper wing- and tail-coverts brown, with rufous edges. Quills above brown, with narrow light-red edges, indistinctly barred with dark brown, except on the outer web of the primaries, the distal half of the inner web pale buffy red, showing the dark bars very strongly. Tail-feathers brown, with 9 or more narrow dark brown cross bars, the outer pair on each side inclining to reddish. Crown of head, occiput, and sides of neck dull brown. Nape and hind neck reddish brown, the former showing traces of grey. Lores, eyebrows, ear-coverts, and cheeks grey. Throat whitish grey. Neck, breast, and under tail-coverts buffy white, with broad reddish-brown bars on some of the feathers. Abdomen whitish buff and almost immaculate. Sides of body, flanks, and thighs reddish buff with faint bars of darker. Under wing-coverts and axillaries the same. Under surface of quills ashy white, shading into pale buffy red, with marked brown cross bars, indistinct on the outer web of the primaries.

Measurements the same as above.

This young male is evidently just entering its first moult, and has already got one of the adult grey feathers in the secondaries.

2. Haliastur girrenera.

Haliastur girrenera (V.); Salvad. *t. c.* i. p. 15.

a, b. ♀ ad. Alu. Iris brown; bill and legs yellow.

c. ♂ juv. Fauro. Bill black; iris brown; legs yellow.

3. Pandion leucocephalus.

Pandion leucocephalus, Gould; Salvad. *t. c.* i. p. 11.

a, b. ♂ Alu. Iris pale or dull yellow; bill black; legs dirty grey.

c. ♂ juv. Alu. Iris reddish yellow.

4. Cacatua ducorpsi.

Cacatua ducorpsii, Jacq. & Pucher.; Salvad. *t. c.* i. p. 104.

a. ♂ ad. Alu. Iris brown; skin round eye blue; bill and feet grey.

5. Geoffroyius heteroclitus.

Geoffroyius heteroclitus (Hombr. & Jacq.); Salvad. *t. c.* i. p. 194.

a. ♂ ad. Alu.

b, c. ♀ ad. Alu. Iris pale yellow; bill black; feet and legs grey.

6. Eclectus polychlorus.

Eclectus pectoralis (P. L. S. Müll.); Salvad. *t. c.* i. p. 197.

a. ♂ ad. Alu. Upper mandible yellow; legs black; iris yellow.

b, c. ♂ ad. Alu. Upper mandible orange, lower black; legs dirty grey; iris yellow. Nom. vernac. "Karo."

d. ♀ ad. Alu. Bill and feet black; iris yellow.
e. ♀ ad. Shortland Island. Legs and bill black; iris yellow.
f. ♂ ad. Fauro. Iris yellow; upper and lower mandibles yellow; feet black.

7. Eos cardinalis.

Eos cardinalis (Gray); Salvad. *t. c.* i. p. 249.

a, b. ♂ and ♀ ad. Iris red; feet black; bill yellow and black.
c. ♀ ad. Alu. Iris red; legs black; bill black with yellow tip.

8. Trichoglossus massena.

Trichoglossus massena, Bp.; Salvad. *t. c.* i. p. 288.

a, b. ♂ ad.; *c.* ♀ ad. Alu. Iris red; bill orange; legs grey.

9. Rhytidoceros plicatus.

Rhytidoceros plicatus (Penn.); Salvad. *t. c.* i. p. 392.

a. ♂ ad. Shortland Island. Iris yellow; legs black; bill dirty white, reddish at base; skin white at eyes and throat.
b. ♀ juv. Guadalcanar.

10. Halcyon saurophaga.

Sauropatis saurophaga (Gould); Salvad. *t. c.* i. p. 469.

a, b. ♂, ♀ ad. Fauro. Iris brown; legs and bill black.

The female is very distinctly greener on the back than the male, which is much brighter blue.

11. Halcyon tristrami.

Sauropatis tristrami (Layard); Salvad. *t. c.* iii. App. p. 524.

a, b. ♂, ♀ ad. Fauro. Iris brown; bill and feet black; the lower mandible whitish at base.

12. Halcyon sancta.

Sauropatis sancta (Bodd.); Salvad. *t. c.* i. p. 470.

a. ♀. Alu. Iris dark brown; feet and bill black above, the latter white below.
b, c. ♂. Fauro. Iris brown; bill black, whitish below; legs black.

13. Eurystomus crassirostris.

Eurystomus crassirostris, Sclater; Salvad. *t. c.* i. p. 510.

a, b. ♂ ad.; *c, d.* ♀ ad. Alu. Iris brown; bill and feet red.

14. Macropteryx mystacea.

Macropteryx mystacea (Less.); Salvad. *t. c.* i. p. 537.

a. ♀ ad. Alu. Eyes black; bill and feet black.

15. Hirundo tahitica.

Hirundo tahitica, Gm.; Salvad. *t. c.* ii. p. 5.

a. ♀ ad. Alu. Bill, legs, and iris black.

16. MONARCHA CASTANEIVENTRIS.

Pomarea castaneiventris (Verr.); Salvad. *t. c.* ii. p. 11.

a. ♀ ad. Alu. Iris brown; bill and legs bluish grey.

b. ♀ ad. Fauro. Iris brown; bill grey; legs black.

This specimen is referred with doubt to the above-named species, being a somewhat smaller bird, and having the chestnut of the breast and belly much darker than the type.

17. RHIPIDURA TRICOLOR.

Sauloprocta melaleuca (Q. & G.); Salvad. *t. c.* ii. p. 48.

a. ♀ ad. Uru Bay, Malayta. Legs, beak, and iris black.

With nest, taken from the upper part of a dead limb of a tree, which it assimilated in colour, and two eggs, partially incubated, one of which was broken.

18. RHIPIDURA RUSSATA.

Rhipidura russata, Tristr.; Salvad. *t. c.* ii. p. 67.

a. Shortland Island. Iris black.

19. GRAUCALUS PUSILLUS.

Graucalus pusillus, Ramsay; Salvad. *t. c.* ii. p. 140.

a. ♂ juv. Alu. Legs and bill black; iris pale yellow. Nom. vernac. "Binbin."

b, c. ♂ and ♀. Fauro. Bill and feet black, iris yellow.

20. GRAUCALUS ELEGANS.

Graucalus elegans, Ramsay, Proc. Linn. Soc. N. S. W. vi. p. 176.

a. ♂ ad. Fauro. Iris brown; legs and bill black.

Agrees well with Mr. Ramsay's description.

21. CALORNIS METALLICA.

Calornis metallica (Temm.); Salvad. *t. c.* ii. p. 447.

a. ♀ ad. Alu. Bill and legs black; iris bright red. Nom. vernac. "Ouririri."

b, c. ♂, ♂ juv. Fauro. Iris red; bill and legs black.

22. CALORNIS CANTOROIDES.

Calornis cantoroides, G. R. Gr.; Salvad. *t. c.* ii. p. 456.

a. ♀ ad. Alu. Bill and feet black; iris red.

I have compared the above specimen, which is evidently *C. solomonensis* of Ramsay, with Gray's types of *cantoroides* in the British Museum, and find them in every respect similar.

23. LAMPROCORAX GRANDIS.

Lamprocorax grandis, Salvad.; Salvad. *t. c.* ii. p. 460.

a. Alu. Iris red; bill and legs black.

b, c. ♂, ♀ ad. Fauro. Iris dark red; bill and feet black.

24. Mino kreffti.

Mino kreffti (Sclat.); Salvad. *t. c.* ii. p. 469.

a. ♀ ad. Alu. Legs, beak, and patch round the eye bright yellow; iris yellow, pupil black. Nom. vernac. "Tigeno."

b. ♂ ad. Fauro. Iris, legs, and bill bright yellow.

c. ♀ ad. Fauro. Iris, eye-patches, legs, and bill bright orange.

25. Macrocorax woodfordi, sp. nov. (Plate XXVII.)

a. ♀ ad. Aola, Guadalcanar. Iris dark grey; bill grey (yellowish in the skin, with black tip); legs black.

The general colour above is black glossed with greenish on the head and neck and purplish blue over the rest of the upper surface. Head, neck all round, underparts, flanks, thighs, and under tail-coverts black, glossed with green. The rest of the feathers black, glossed with purplish blue, except some of the feathers of the wing-coverts, back, secondaries, and primaries, which are dull brownish black and evidently worn, as the bird is in full moult.

Total length $15\frac{1}{2}$ inches, culmen 2·3, wing 10·3, tail 5, tarsus 2.

This species is very strongly marked, being one third smaller than the only other known species *M. fuscicapillus*, Gray, from the Aru Islands, from which it also differs in general colour and in having the upper mandible less strongly arched.

26. Ptilopus lewisi.

Ptilopus lewisii, Ramsay; Sharpe in Gould's 'Birds of New Guinea,' pt. xvii.

a, b. ♂ ad. Alu. Bill yellow; feet red; iris yellow.

27. Globicera rufigula.

Carpophaga rufigula, Salvad. *t. c.* iii. p. 79.

a. ♂ ad. Malayta. Bill, wattle, legs, and iris red.

This specimen agrees well in every respect with the type specimen in the British Museum, and is easily distinguished from the nearly allied *G. rubricera* of G. R. Gray, from New Ireland, by the burnished green-gold back, pale vinous throat, and dove-grey chest, while in the latter the back is burnished red-gold and the throat uniform pale vinous with the chest.

28. Macropygia rufo-castanea.

Macropygia rufo-castanea, Ramsay; Salvad. *t. c.* iii. p. 149.

a. ♂ ad. Alu. Eye brown; bill and legs brown.

29. Calœnas nicobarica.

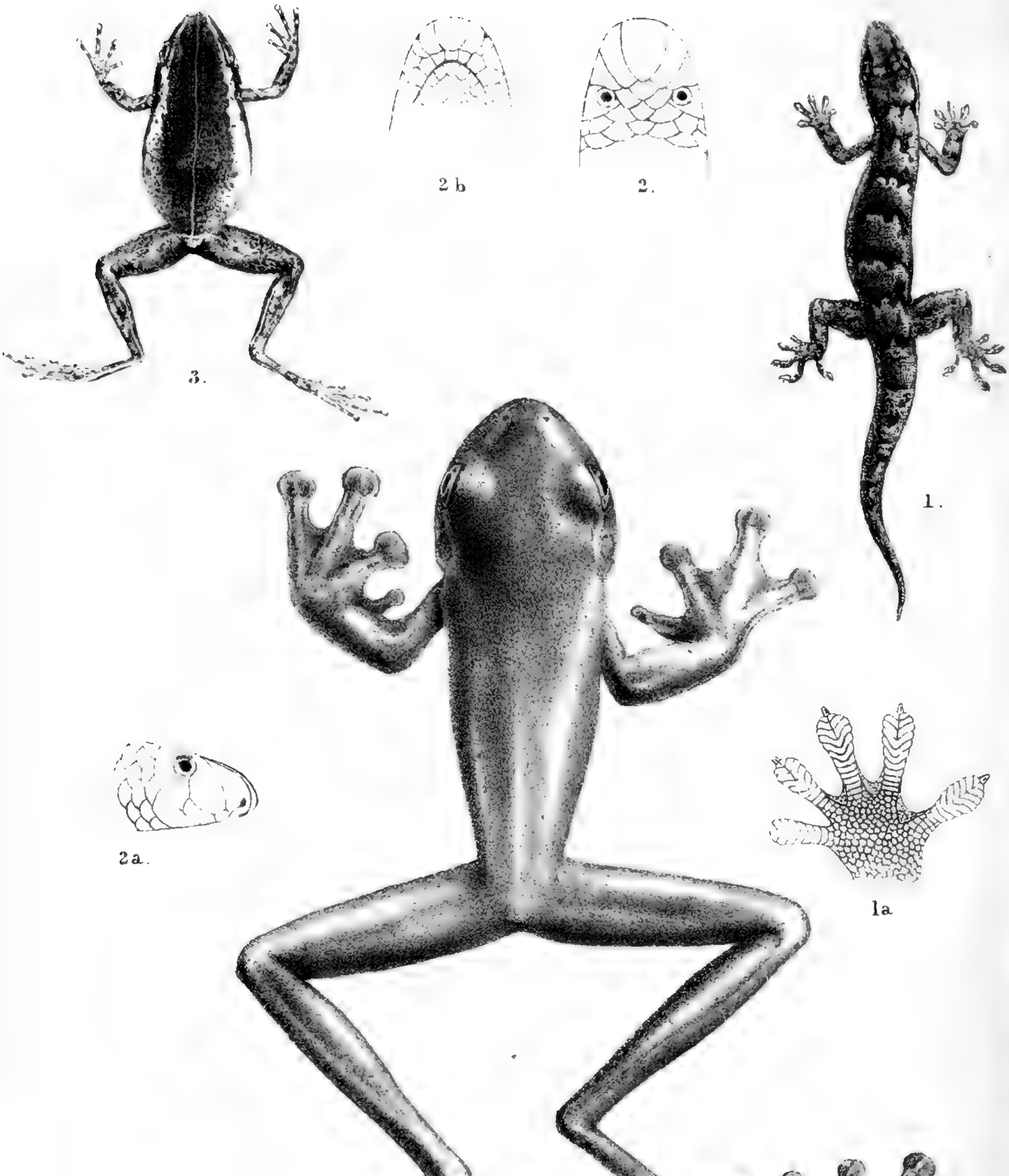
Calœnas nicobarica (Linn.); Salvad. *t. c.* iii. p. 209.

a. ♂ ad. Alu. Iris pale yellow; bill and feet black.

30. Megapodius brenchleyi.

Megapodius brenchleyi, G. R. Gr.; Salvad. *t. c.* iii. p. 240.

a. ♀ ad. Alu. Bill dull yellow; legs black; iris brown.



Peter Smit del. et lith

Mintern Bros. imp.

1. LEPIDODACTYLUS WOODFORDII. 2. TYPHLOPS ALUENSIS.
3. BATRACHYLODES VERTEBRALIS. 4. HYLA LUTEA.

31. PORPHYRIO MELANOPTERUS.

Porphyrio melanopterus, Temm.; Salvad. *t. c.* iii. p. 280.

a. ♂ ad. Fauro. Iris reddish brown; bill and shield red; legs dirty pink; joints of legs and toes grey.

32. DEMIEGRETTA SACRA.

Demiegretta sacra (Gmel.); Salvad. *t. c.* iii. p. 345.

a. ♂ ad. Fauro. Iris yellow; legs yellow; bill yellowish black.

33. BUTORIDES JAVANICA.

Butorides javanica (Horsf.); Salvad. *t. c.* iii. p. 359.

a. ♂ ad. Fauro. Upper mandible black, lower one pale yellow; iris yellow; feet yellow; legs grey.

34. NYCTICORAX CALEDONICUS.

Nycticorax caledonicus (Gmel.); Salvad. *t. c.* iii. p. 372.

a. ♂ juv. Fauro. Iris yellow; legs yellow; bill black, yellow below.

35. ANOUS LEUCOCAPILLUS.

Anous leucocapillus, Gould; Salvad. *t. c.* iii. p. 457.

a. Shot at sea. Bill, eyes, and legs black.

3. Second Contribution to the Herpetology of the Solomon Islands[1]. By G. A. BOULENGER, F.Z.S.

(Plate XXVIII.)

[Received February 15, 1887.]

Rich as has been the herpetological booty of Mr. H. B. Guppy's exploration of the islands of Bougainville Straits, the knowledge of that fauna is so far from being exhausted that a recent visit to the same islands by a second collector, Mr. C. M. Woodford, has yielded examples of as many as nine more species of Reptiles and Batrachians, seven of which are altogether new to science. The collection now reported upon was made at two localities, viz., Faro Island, and Alu, Shortland Islands. It contains specimens of the following species already known from the Solomon Group:—

Faro:—*Gymnodactylus pelagicus*, Gir., *Gehyra oceanica*, Less., *Lepidodactylus guppyi*, Blgr.[2], *Gecko vittatus*, Houtt., *Varanus indicus*, Daud., *Lygosoma smaragdinum*, Less., *L. cyanurum*, Less., *L. cyanogaster*, Less. (*carteretii*, D. & B.), *L. nigrum*, Hombr. & Jacq., *Dipsas irregularis*, Merr., *Hoplocephalus par*, Blgr., *Rana*

[1] *Cf.* Tr. Zool. Soc. xii. pp. 35-62, pls. vii.-xiii. (1886).

[2] Male with a long, uninterrupted series of femoral and præanal pores, angular mesially; 44 pores altogether.

bufoniformis, Blgr., *R. guppyi*, Blgr.[1], *Cornufer guppyi*, Blgr., *C. solomonis*, Blgr., *Ceratobatrachus guentheri*, Blgr.

Alu:—*Corucia zebrata*, Gray, *Dendrophis solomonis*, Gthr., *Dipsas irregularis*, Merr.

In addition to these species, the following, new to the Solomons, were obtained:—

REPTILIA.

LEPIDODACTYLUS WOODFORDI, sp. n. (Plate XXVIII. fig. 1.)

Closely allied to *L. guppyi*. Digits without distinct web. Tail a little depressed, rounded. Femoral and præanal pores 25 altogether. Grey above, with zigzag black cross bands, six between the nape and the base of the tail; a black streak from the nostril to the neck, passing through the eye and above the ear; lower surfaces whitish.

	millim.
Total length	78
Head	11
Width of head	7
Body	29
Fore limb	14
Hind limb	18
Tail	38

Faro Island. A single male specimen.

LYGOSOMA SOLOMONIS, sp. n.

Body elongate, limbs short; the distance between the end of the snout and the fore limb is contained once and three fifths to once and two thirds in the distance between axilla and groin. Snout short, obtuse. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal; a single anterior loreal; frontonasal broader than long, forming a narrow suture with the rostral and with the frontal; latter shield about as long as frontoparietals and interparietal together, in contact with the first and second supraoculars; four supraoculars; seven supraciliaries; frontoparietals and interparietal distinct, latter a little smaller than former; parietals forming a suture behind the interparietal; four to six pairs of nuchals; fourth or fifth labial below the eye and entering the orbit. Ear-opening oval, a little smaller than the eye-opening; no auricular lobules. 24 or 26 smooth scales round the middle of the body, the two vertebral series largest. A pair of large præanals. Limbs widely separated when adpressed; the length of the hind limb equals the distance between the anterior border of the orbit and the fore limb. Digits short; subdigital lamellæ smooth, undivided, 15 to 17 under the fourth toe. Tail thick, once and one third the length of head and body. Brown above, dotted with blackish; pale brownish inferiorly, dotted with brown.

[1] One of the specimens exceeds the type (*l. c.* pl. ix.) in size, measuring 185 millim. from snout to vent.

	millim.
Total length	135
Head	11·5
Width of head	7·5
Body	45·5
Fore limb	9
Hind limb	16
Tail	78

Three specimens from Faro Island.

Lygosoma woodfordi, sp. n.

Body elongate, limbs rather short; the distance between the end of the snout and the fore limb is contained once and three fifths in the distance between axilla and groin. Snout moderately elongate, truncate. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal; a single anterior loreal; rostral forming a broad straight suture with the frontonasal, which is broader than long; præfrontals forming a short median suture; frontal as long as frontoparietals and interparietal together, in contact with the first supraciliary and the two anterior supraoculars; four supraoculars, followed by a very small fifth, first longest; ten supraciliaries, first largest; frontoparietals and interparietal distinct, former much larger than latter; parietals forming a suture behind the interparietal; no nuchals; nine upper labials, seventh below the centre of the eye; a series of rather large suborbitals separates the orbit from the labials. Ear-opening oval, a little smaller than the eye-opening; no auricular lobules. 34 smooth scales round the middle of the body; dorsals largest, laterals very small. A pair of enlarged præanals. The adpressed limbs just meet. Digits rather short, slightly compressed; 18 smooth lamellæ under the fourth toe. Dark brown above, with strong metallic gloss; sides with curved or oblique black bars; lower surfaces yellowish.

	millim.
Total length	166
Head	19
Width of head	12
Body	87
Fore limb	24
Hind limb	37
Tail (reproduced)	60

A single specimen from Faro Island.

Lygosoma concinnatum, sp. n.

Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and one fifth to once and two fifths in the distance between axilla and groin. Snout short, obtuse; supraocular regions swollen. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal; a single anterior loreal (except in one of the specimens, which has a very small shield above it); rostral forming a broad, straight suture with the frontonasal, which is much broader than long; præfrontals forming a median suture; frontal much narrowed posteriorly, as long as or shorter than fronto-parietals and interparietal together, in contact with the first and second supraoculars; four supraoculars, first longest; eight or nine supraciliaries, first largest; frontoparietals and interparietal distinct, former longer than latter; parietals forming a suture behind the interparietal; no enlarged nuchals; fifth upper labial largest and below the centre of the eye. Ear-opening oval, nearly as large as the eye-opening; no auricular lobules. Scales smooth, or dorsals and laterals indistinctly pluricarinate, laterals smallest; 40 scales round the middle of the body. A pair of enlarged præanals. The hind limb reaches the elbow of the adpressed fore limb or the axilla. Digits rather elongate, slightly compressed; subdigital lamellæ smooth, 22 to 25 under the fourth toe. Tail once and a half the length of head and body. Dark brown above, with strong metallic gloss; back black-spotted; sides with black and whitish spots elegantly arranged; a black band on each side of the head, passing through the eye; sometimes a large, black, white-edged spot on each side of the neck; lower surfaces brownish white, clouded or longitudinally streaked with darker.

	millim.
Total length	130
Head	13
Width of head	9
Body	49
Fore limb	17
Hind limb	27
Tail (reproduced)	68

Four specimens from Faro Island.

LYGOSOMA ALBOFASCIOLATUM, Gthr.

Faro Island.

TYPHLOPS ALUENSIS, sp. n. (Plate XXVIII. fig. 2.)

Body much elongate, of subequal diameter throughout. Snout depressed, rounded. Nasal completely divided; a præocular separates the nasal from the ocular, which rests on the third and fourth upper labials; eye very distinct; the so-called rostral rounded posteriorly, its width about three fifths the distance between the eyes; a small azygos shield separates the rostral from the mouth. 22 scales round the middle of the body. Tail comparatively long, twice and one third as long as broad at the base, tapering, ending in a spine. Brown above, yellowish inferiorly; upper head-shields edged with yellowish.

Total length 245 millim.; diameter of body 4; length of tail 10.

A single specimen, from Alu, Shortland Islands.

BATRACHIA.

CORNUFER DORSALIS, A. Dum.

Faro Island.

BATRACHYLODES, g. n. Ranidarum.

Pupil horizontal. Tongue oval, free and feebly nicked behind. No vomerine teeth. Tympanum distinct. Fingers and toes free, the tips dilated into large disks. Distal phalanges T-shaped. Omosternum and sternum with a bony style.

BATRACHYLODES VERTEBRALIS, sp. n. (Plate XXVIII. fig. 3.)

Snout short, obtuse; loreal region nearly vertical; nostril nearer the tip of the snout than the eye; interorbital space broader than the upper eyelid; tympanum three fifths the diameter of the eye. First finger shorter than second; disk of third finger as large as the tympanum; disk of toes smaller than of fingers; subarticular tubercles feeble; a rather indistinct, oval, inner metatarsal tubercle. When the hind limb is pressed against the body, the tibio-tarsal articulation marks the posterior border of the eye. Skin smooth above and below. Grey-brown above; a fine whitish vertebral line, continued along the upper face of the thigh and the outer side of the tibia and tarsus; a whitish line on the canthus rostralis, extending from eye to eye; it is continued behind the eye, as a gradually widening band, to the groin; side of head and of anterior half of body dark brown; indistinct brown bands across the limbs; lower parts dirty white.

From snout to vent 30 millim.

A single adult female, from Faro Island.

HYLA LUTEA, sp. n. (Plate XXVIII. fig. 4.)

Tongue oval, slightly free and very slightly nicked behind. Vomerine teeth in two strong transverse groups close together between the choanæ. Head much depressed, as long as broad or slightly broader than long; snout rounded; canthus rostralis very indistinct; loreal region concave; nostril nearer the tip of the snout than the eye, its distance from the latter equal to its diameter; interorbital space broader than the upper eyelid; tympanum very distinct, about two thirds the diameter of the eye. Fingers half-webbed, the web nearly reaching the disks of the second and third fingers; disks larger than the tympanum; no projecting rudiment of pollex. Toes three-fourths webbed, the disks as large as the tympanum; subarticular tubercles small and flat; a small, flat, inner metatarsal tubercle; no cutaneous tarsal fold. When the hind limb is pressed against the body, the tibio-tarsal articulation reaches the tip of the snout or a little beyond. Skin smooth; belly and lower surface of thighs with large flat granules. Uniform lemon-yellow above, white inferiorly; a white line along the outer side of the forearm and fourth finger and of the tarsus and fifth toe.

Male with an internal subgular vocal sac, and black nuptial excrescences on the inner finger.

From snout to vent 67 millim.

Three specimens from Faro Island.

EXPLANATION OF PLATE XXVIII.

Fig. 1. *Lepidodactylus woodfordi*, p. 334.
1 *a*. —— ——. Lower view of foot; multiplied 3 times.
2. *Typhlops aluensis*, p. 336. Upper view of head; multiplied 4 times.
2 *a*. —— ——. Side view of head; multiplied 4 times.
2 *b*. —— ——. Lower view of head; multiplied 4 times.
2 *c*. —— ——. Lower view of tail.
3. *Batrachylodes vertebralis*, p. 337.
4. *Hyla lutea*, p. 337.

4. On the Milk-dentition of the Koala. By Oldfield Thomas.

[Received February 15, 1887.]

Among the few remaining Marsupials in which no trace of a milk-dentition has yet been found, the Koala (*Phascolarctos cinereus*) occupies a prominent place, especially as in this animal the last premolar, or pm.^{4}, which among Marsupials is the only tooth that ever has a milk predecessor, is unusually large and powerful, and might have been therefore expected, as in the allied Phalangers, to have a proportionally well-developed predecessor.

At last, however, I have been able to find traces in the Koala of

Head of young Koala, showing milk-dentition; natural size.

just such a rudimentary milk-dentition as has been described in the Thylacine by Prof. Flower[1], and showing, just as in that animal, that the ancestors of the Koala have had, and that it has now lost, the ordinary amount of tooth-change found in the great majority of Marsupials.

In two very young and hairless Koalas, four and five inches long respectively, I find, on cutting open the side of the jaw, clear and

[1] Phil. Trans. 1867, p. 63.

distinct calcified milk-teeth, as shown in the accompanying drawing (fig. p. 338). Both above and below they lie in the groove on the outer side between the uncut pm.[4] and m.[1], their summits being slightly above the level of these teeth, but yet not projecting above the gum. They are each about 4 millim. in length, the upper one with a conical root and thickened crown about 2 millim. in diameter, while the lower one is slenderer and has a proportionally longer root and smaller crown.

It is quite evident that these teeth never become functional, but are absorbed long before the animal is old enough to be able to use them, and in all probability they never cut the gum.

The discovery of milk-teeth in the Koala is of considerable interest when viewed in relation to their comparatively long persistence in the Phalangers on the one hand, and their entire absence, so far as is yet known, in the Wombats on the other, the Koala presenting in this, as in so many other characters, an intermediate condition between the two.

In this connection, however, it may be noted that throughout the Mammalia rootless-toothed animals do not have the same need of a functional milk-dentition as do rooted-toothed ones, owing to the manner in which the ever growing teeth are able to increase in size *pari passu* with the growth of the animal. No better example of this can be quoted than the case of the allied Rodent genera *Cavia* and *Dasyprocta*, the first having rootless premolars, whose milk-teeth are absorbed before birth, and the second having rooted premolars preceded by well-developed and long-persistent milk-teeth.

The bearing of this rule on our present subject is evident; for while the entire absence of milk-teeth was quite to be expected in the case of the rootless-toothed Wombats, their extreme state of reduction in the Koala is a most surprising fact, especially as there are in the latter animal no anterior premolars to make up during youth for the absence of milk-teeth, as there are in the Thylacine, in which a similar reduction of the milk-dentition has taken place.

5. On a new Gecko, of the Genus *Chondrodactylus*, from the Kalahari Desert. By G. A. Boulenger, F.Z.S.

[Received March 3, 1887.]

Mr. J. J. Weir, F.Z.S., has handed over to me two small Lizards from the Kalahari, to be presented to the Natural History Museum in case they should prove of interest. Although unfortunately in a dry state, having been pinned in an insect-box, they are in comparatively good condition. One belongs to the well-known *Eremias lugubris*, Smith, the other represents a new Gecko of the genus *Chondrodactylus*, Peters, of which a single species was known, *C. angulifer*, Peters, also from South Africa. The discovery f a second species is therefore of great interest, and I have much pleasure in connecting with it the name of Mr. Weir.

CHONDRODACTYLUS WEIRI, sp. nov.

Distinguished from its ally in the following points:—Tubercles on the supraorbital edge scarcely enlarged, separated from those on the other side by three series of tubercles in the middle; the width of the interorbital space equals quite one half of the vertical diameter of the orbit. Enlarged dorsal tubercles larger, more strongly keeled, subtrihedral. Ventral scales much larger; 6 or 7, on the middle of the belly, correspond to the horizontal diameter of the eye (instead of 11 or 12 in *C. angulifer*). Coloration very similar to that of the adult *C. angulifer*, *i. e.* with a blackish crescentic band, concavity forwards, extending from shoulder to shoulder, and pairs of round whitish spots on the back. The unique specimen measures 95 millim., in which the tail enters for 40.

April 5, 1887.

Prof. W. H. Flower, LL.D., F.R.S., President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March 1887:—

The total number of registered additions to the Society's Menagerie during the month of March was 76. Of these 22 were by birth, 43 by presentation, 6 by purchase, 1 by exchange, and 4 were received on deposit. The total number of departures during the same period, by death and removals, was 94.

The most noticeable additions during the month were:—

1. Two Long-tailed Grass-Finches (*Poëphila acuticauda*), from Derby, King Sound, N.W. Australia, presented to the Collection by Mr. Walter Burton, F.Z.S., March 18. These are the first examples of this elegant little Grass-Finch which have been received by the Society.

2. A Fisk's Snake (*Lamprophis fiskii*) and a Narrow-headed Toad (*Bufo angusticeps*), from South Africa, presented to the Society by the Rev. G. H. R. Fisk, and received 24th March. Both of these are new to the Society's Collection, and Fisk's Snake, being new to science, has been named by Mr. Boulenger after its donor.

I also wish to call attention to the fact that Sir Walter Buller has presented to the Society the female Huia-bird (*Heteralocha gouldi*) which he deposited in the Society's Gardens on the 22nd April last year, and that he hopes to be able to obtain for us a companion of the male sex. The female bird in the Gardens is now in good health and condition.

The following extracts were read from a letter addressed to the Secretary by the Rev. Geo. H. R. Fisk, C.M.Z.S., dated Capetown, March 9, 1887:—

"The annexed anecdote of a Mouse[1] and a Ringhals Snake (*Sepedon*

[1] [In a subsequent letter Mr. Fisk states that the Mouse was believed to be a specimen of *Dendromys melanotis*.—P. L. S.]

hæmachates) was written for me at my request by my friend Mr. Sydney Cowper, who, you may remember, was the Cape representative at the late Colonial and Indian Exhibition. His name is guarantee of strict accuracy.

"I send you a copy of his writing, thinking it may be interesting, showing as it does a way in which perhaps many young snakes are destroyed. Were not an immense number of the eggs and of the young of snakes destroyed by their natural enemies, their number would soon in some parts become so great as to be very inconvenient indeed to other animals and to man also.

"I have long known that cats kill snakes. I have seen a lizard kill a snake. You will remember a snake which I sent to your Society which had devoured the eggs laid by another snake, and now we have an instance of a Mouse killing and eating a young venomous snake.

"Probably there are many other ways in which great numbers are destroyed before they reach an age and size when they become very dangerous.

"'On Saturday the 19th February my friend Mr. W. Holms and I managed to secure on Wynberg flats, without injury to the specimens, two young 'Ringhals,' probably from 7 to 14 days old, measuring the one some 10 inches and the other 9 inches in length. We brought them home in our handkerchiefs, placed them in a bandbox, and proceeded to find food for them. A tour round the garden (Rokeby, Wynberg) produced one tortoise, one toad, one field-mouse, one cricket, two spiders, and some gentles. These, excepting the toad, were all placed in the bandbox with the two snakes, and we expected to find the snakes in good condition the following morning.

"'On looking into the box next morning I found but three survivors of the previous night, namely the *tortoise*, the *mouse*, and one '*Ringhals*.' The mouse had evidently had the best of it, for he was devouring the remains of one of the snakes, and, judging by the distention of his little abdomen, I think he must also have consumed the cricket, spiders, and gentles. I watched the survivors attentively during Sunday, and saw the mouse make an onslaught on the remaining Ringhals. He fastened on the snake's back with his tiny sharp claws and pecked away with his teeth, the snake trying its utmost to wriggle away and to secrete itself under the tortoise, which it eventually managed to do. The snake seemed much frightened, and, although he struck at the mouse frequently, and sometimes with apparent success, the mouse generally avoided the stroke with the utmost agility, and before letting go had ridden three or four times round the bandbox on the snake's back. I imagine that the fang of a young 'Ringhals' is not sufficiently developed to penetrate the thick hair on a mouse. I have written this account to you, as the fact of the mouse having eaten the snake is antagonistic to the generally conceived idea of reptilian customs.

"'The Ringhals left for England by the R.M.S. Hawarden Castle on the 2nd inst., and the mouse I returned to his habitat under the stump of a tree in the garden, and although I have several times tried to catch him again, I have (unfortunately for me) been unsuccessful.—S. COWPER.' "

Mr. J. H. Leech, F.Z.S., exhibited specimens of some new Butterflies from Japan and Corea, which he was intending to describe at a future meeting of the Society, and gave some account of his expedition to those countries in quest of Lepidoptera.

A communication was read from Prof. J. H. Scott and Prof. T. J. Parker, containing a description of a Whale of the genus *Ziphius*, of which a specimen had been recently obtained near Dunedin, New Zealand.

This paper will be printed entire in the Society's 'Transactions.'

The following papers were read:—

1. On the Occurrence of *Scorpæna scrofa* off the South Coast of England. By FRANCIS DAY, C.I.E., F.Z.S.

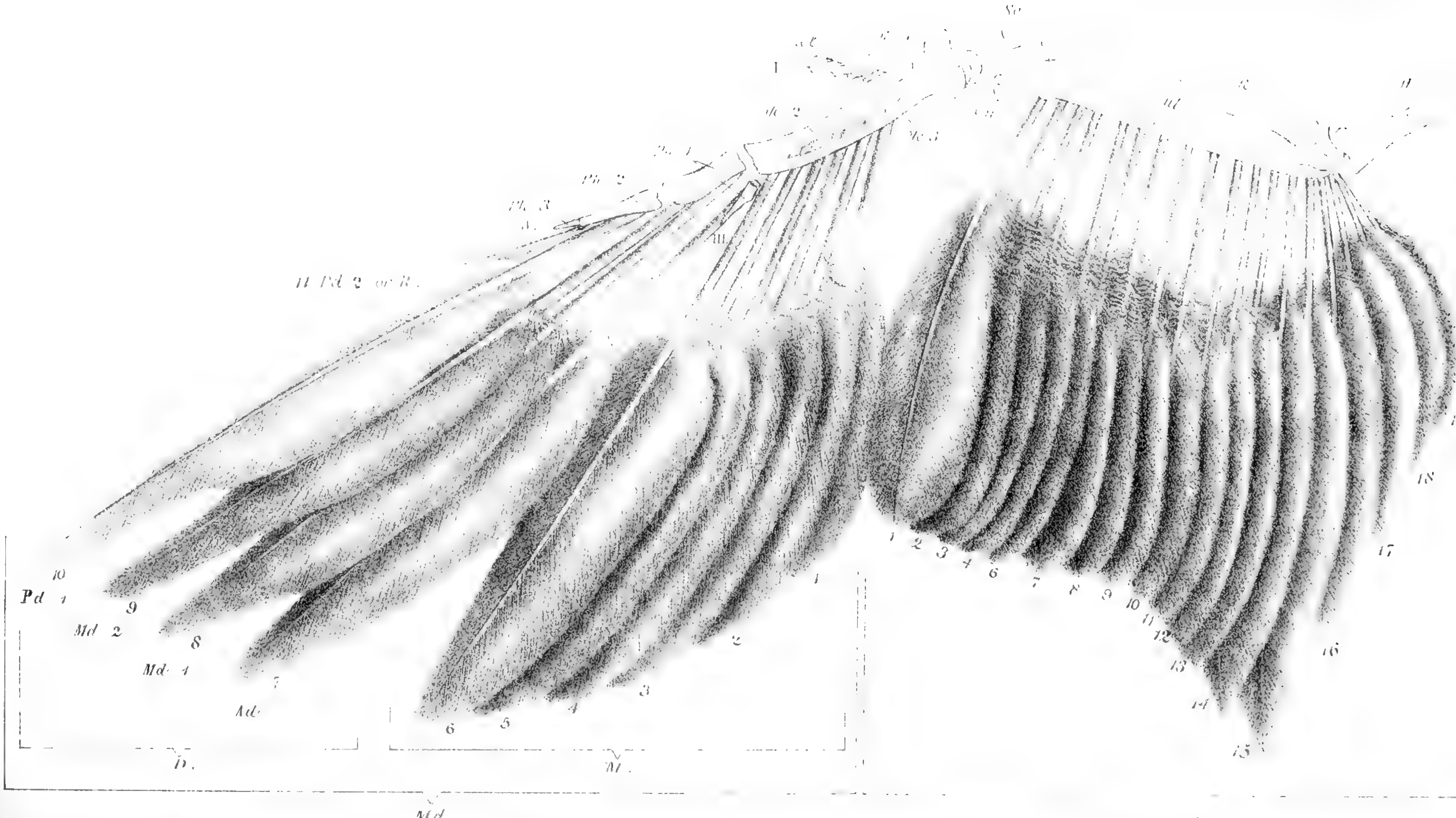
[Received March 26, 1887.]

On March 21st I was fortunatae enough to secure in Cheltenham a recently stuffed specimen of *Scorpæna scrofa*, 11·2 inches in length, which had been obtained under the following circumstances. It had been captured by a trawler at Brixham at the beginning of the month, and forwarded next day to Mr. Woore, fishmonger in this town, as being a fish quite new to the local fishermen. Owing to my being away and to obviate its being spoiled, Mr. Woore had it stuffed, and in this condition I first saw it. So far as I know, this fish has not previously been obtained along our shores, and I think its occurrence ought to be recorded.

B. vii. D. $11/\frac{1}{10}$. P. 19. V. $\frac{1}{5}$. A. $\frac{3}{5}$. C. 13. L. r. 46.

The specimen agrees so thoroughly with the description in Cuvier and Valenciennes's 'Histoire Naturelle des Poissons,' vol. iv. p. 288, that further remarks upon this subject appear to be unnecessary. Although in the 'Catalogue of the Fishes of the British Museum' this species is described as having "the head entirely scaleless and smooth," and no mention of spines exists in the description, still in the definition of the genus it is remarked that "the head is armed with spines." Valenciennes refers to "les nombreuses épines de sa tête," and Moreau, in his 'Poissons de la France,' very accurately describes the fish.

Hab. The Mediterranean and along the Atlantic shores of France as high as the Gironde and Rochelle. Moreau observed that he had never seen it from the coast of La Vendée. Common also at Madeira. It does not appear remarkable that a straggler should occur along our southern shores, but its occurrence during a very cold March would hardly have been anticipated.



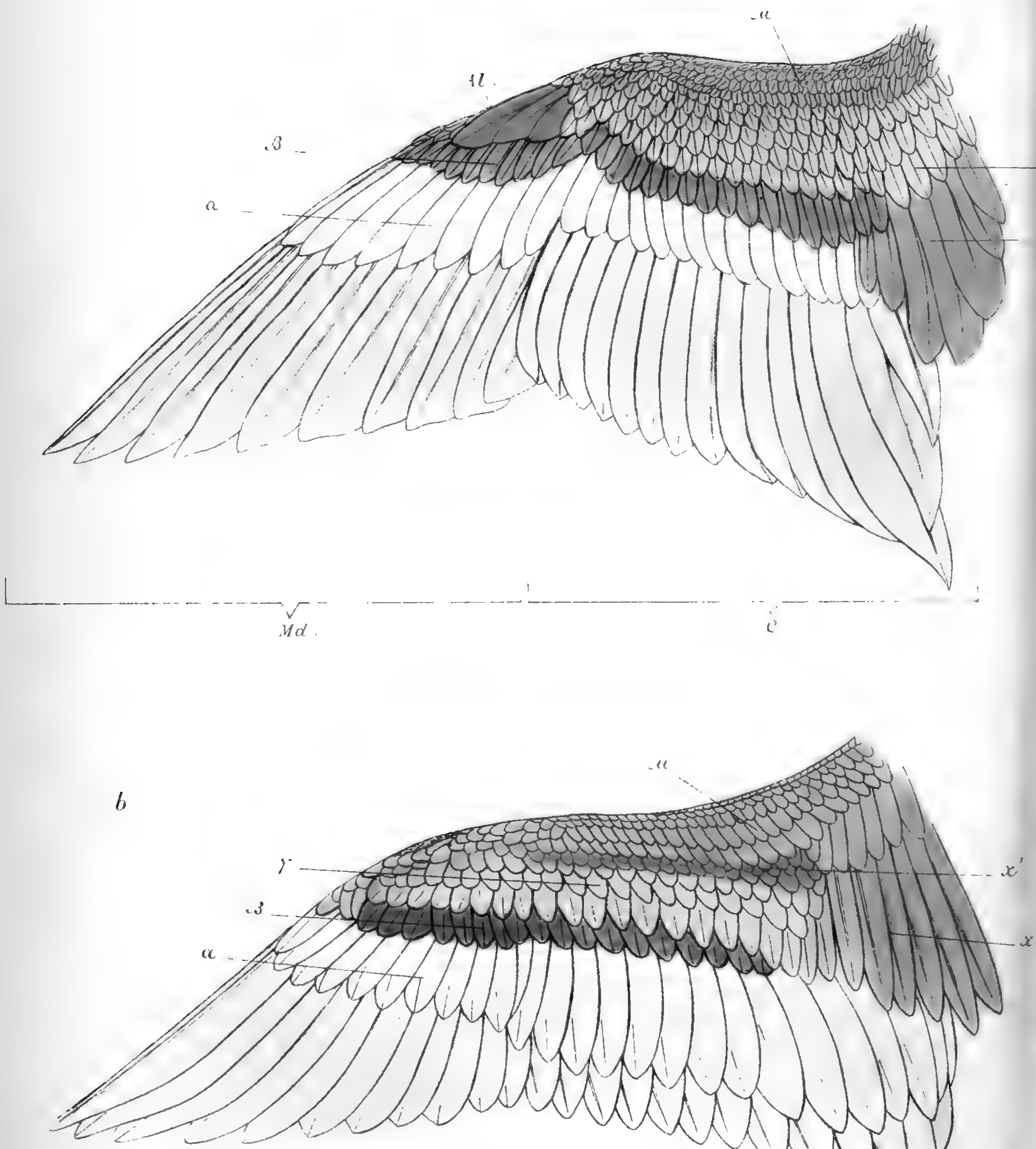
R.S.Wray del. J.Smit lith.

MORPHOLOGY OF BIRDS-WINGS

Hanhart imp.

a

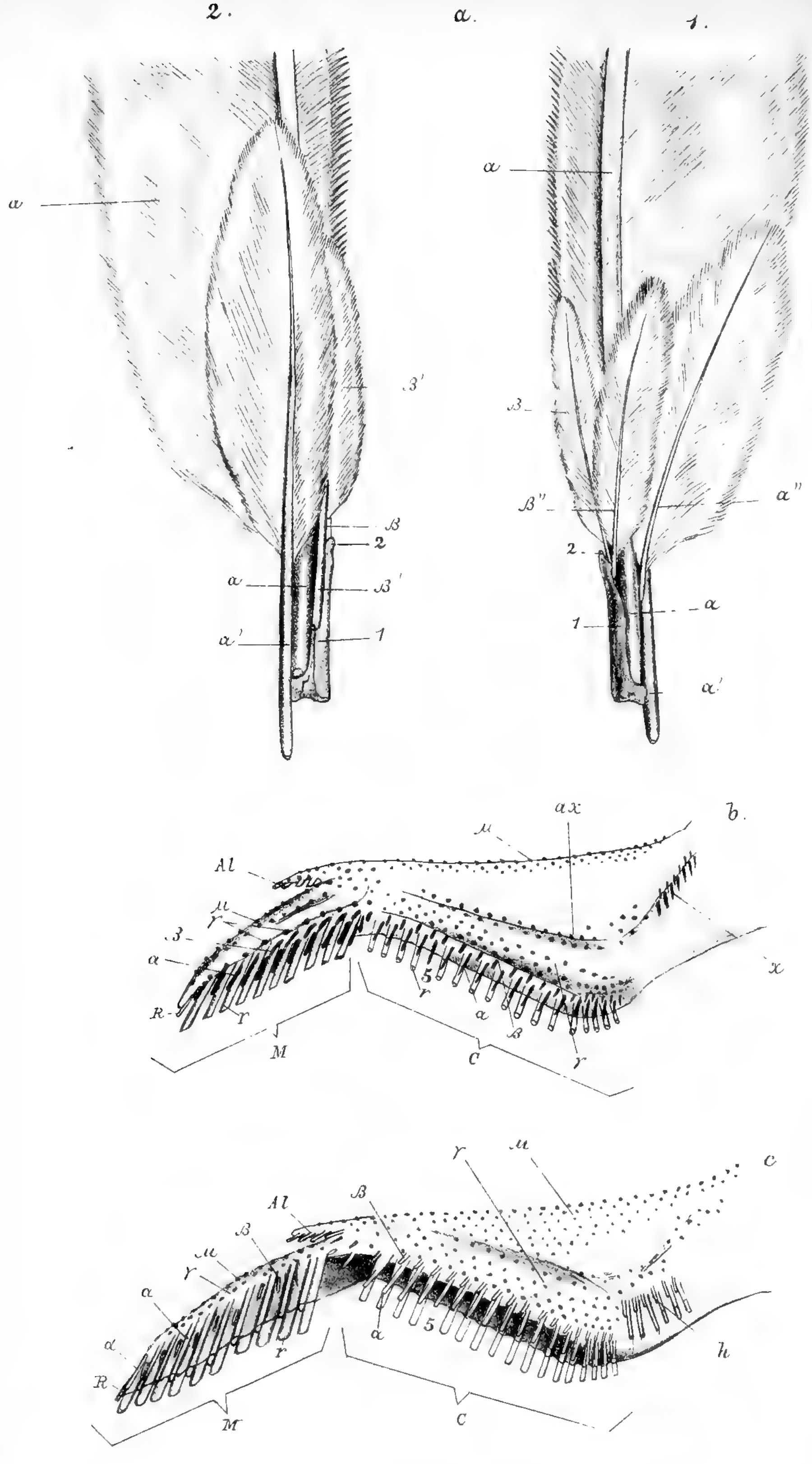
b



R. S. Wray. del. J. Smit lith.

Hanhart imp.

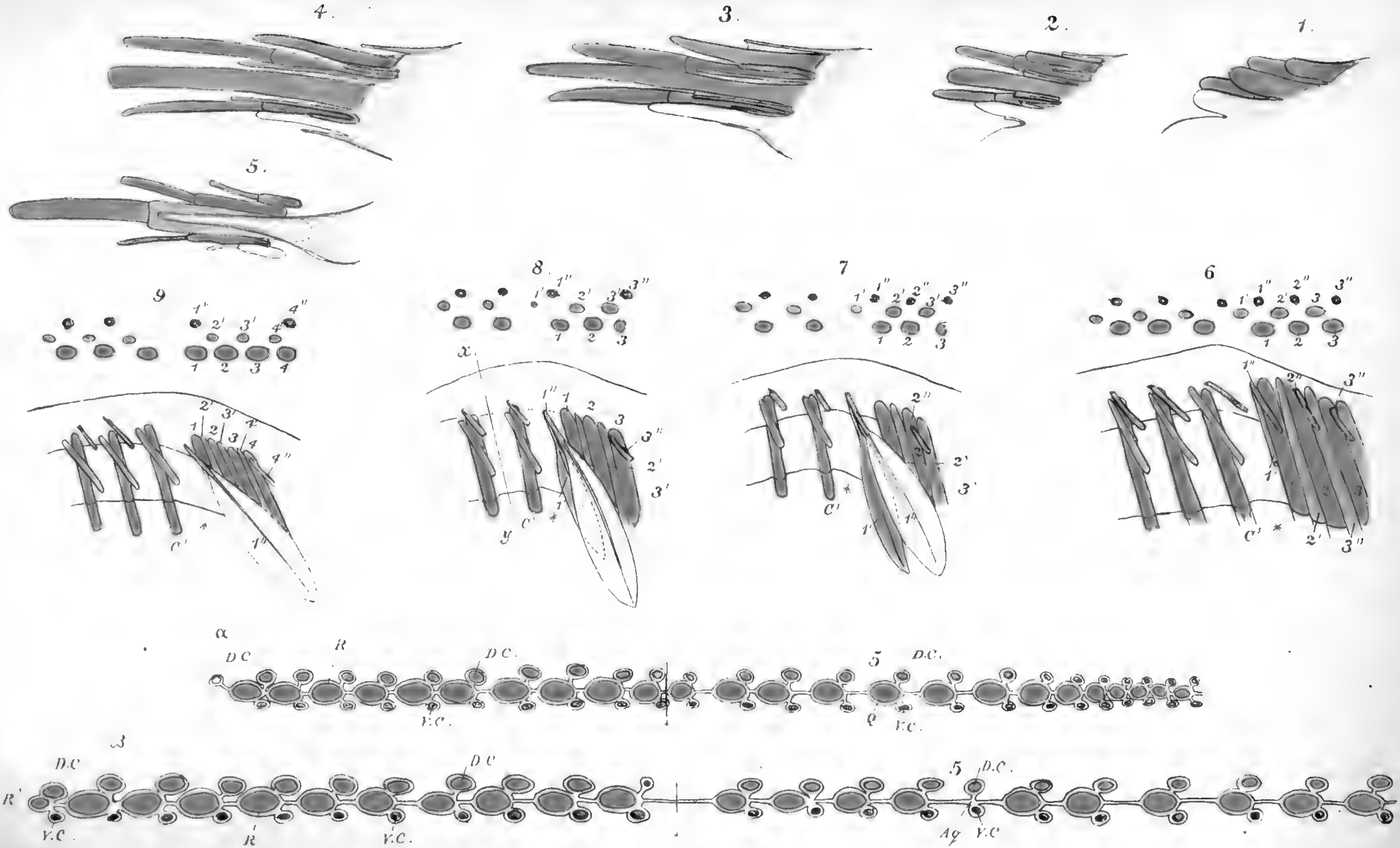
MORPHOLOGY OF BIRDS-WINGS.



R.S. Wray, del. J. Smit lith.

Hanhart imp.

MORPHOLOGY OF BIRDS-WINGS.



R.S. Wray del. J. Smit lith.

Hanhart imp.

MORPHOLOGY OF BIRDS-WINGS.

2. On some Points in the Morphology of the Wings of Birds. By Richard S. Wray, B.Sc. Lond. (Communicated by Professor Flower, P.Z.S.)

[Received March 7, 1887.]

(Plates XXIX.–XXXII.)

Since the publication of Sundevall's paper "On the Wings of Birds" in 1843 but little advance seems to have been made in our knowledge of the disposition and modification of the feathers of the bird's wing, although his original Swedish paper was twice translated into German. In fact the paper, though forty years old, contains much information not to be found in modern descriptions, a great deal of it having apparently been overlooked. I have had occasion to go into the subject somewhat fully in preparing specimens to illustrate the structure of the bird's wing in the Index Museum of the British Museum (Natural History). While doing this I found the ordinary descriptions unsatisfactory, and at times could not reconcile what I saw with them. This occasioned me to examine a great many birds' wings of different groups, and led to the results described in the following paper. The wings were all examined with a view to make out the mode of insertion of the feathers, their relations one to another and to the bones, and dried skins were used only when fresh specimens were unavailable. Through the kindness of Professor Flower I had great facilities afforded me in the way of obtaining specimens, and I take this opportunity of expressing my great thanks to him for his encouragement and assistance throughout the work.

While Sundevall's paper gives the correct relations of the parts, especially of the coverts, yet many points with regard to the remiges and greater coverts he seems to have overlooked, and of others his interpretation is erroneous. The relation of the remiges to the bones of the manus is not fully described nor accurately figured. That the primaries form two groups, metacarpals and digitals, is recognized, but the absolute constancy of the most proximal digital resting upon the phalanx of digit III. has never been insisted upon; Sundevall's figure shows it as having no connection with the phalanx. The presence of one or two more dorsal greater coverts than remiges on examination turns out to be erroneous, since every one may be accounted for. The presence of a small accessory remex (remicle) which I have made out renders the interpretation of the relations of the coverts to the remiges more intelligible. These and some other important points are discussed in the present paper. References to Sundevall's paper are to the English translation which appeared in 'The Ibis'[1] for October 1886, and are indicated thus (S. p. 396).

The nomenclature adopted is founded upon that most in use

[1] "On the Wings of Birds," by C. J. Sundevall. Translated from the original Swedish of the 'Kongl. Vetensk.-Akad. Handlingar,' 1843, by W. S. Dallas, F.L.S. (Ibis, 1886, p. 389.)

at present, and has this advantage that it is applicable to both sides of the wing, and reduces the terms used to a minimum. Professor Flower and Dr. Sclater have done me the kindness of revising the nomenclature[1] for the remiges. The term "tertials" or "tertiaries" has been abandoned, "cubitals" always including them when present, because there is no way of absolutely distinguishing any definite number of remiges as belonging to this special category. There is certainly a distinction to be founded upon the arrangement of the little muscular slips and tendons attached to the cubital remiges; but it would not be of much use in practice, owing to the difficulties in the way of determining it with regard to many birds.

The main points of interest brought to light by the examination of a considerable number of birds, some of almost every large group, will be treated of, the wing of the Wild Duck, which is an extremely good type, being first described in detail. The preparations in the Natural-History Museum fully illustrate this paper, and most of the accompanying drawings are taken from these preparations or from essentially similar ones.

The Wild-Duck's Wing.

When the wing is extended for flight, the surfaces and borders correspond to those of the primitive vertebrate limb, the preaxial border being directed forwards, the postaxial backwards, and the dorsal and ventral surfaces upwards and downwards respectively. It is in this position the wing is best studied; and when plucked of feathers posteriorly it presents a fold of skin from the elbow to the tip in which the flight-feathers and their principal coverts are embedded; these and their position are first described.

When the wing is prepared as shown in the drawing (Plate XXIX.) two main groups of quill-feathers are seen:—the SECONDARIES or CUBITALS attached to the ulna, and the PRIMARIES or METACARPO-DIGITALS attached to the manus. Of the latter, six, the *Metacarpals* (1–6), are attached to the metacarpus, and five, the *Digitals* (7–11), attached one (*addigital*, 7) to phalanx 1 of digit III., two (*middigitals*, 8, 9) to phalanx 1 of digit II., and two (*predigitals*, 10, 11) to phalanx 2 of digit II. The distal predigital (11) is always small, and is designated the *remicle*; its relations, described in detail later, show that it is as much a primary as the so-called "spurious tenth" of many Passerines. The quill-feathers on the cubitus stand out more or less at a right angle to the bone; those on the manus form a gradually increasing obtuse angle, till the last feather lies parallel with the phalanx to which it is attached.

The remiges are best numbered from the wrist-joint, proximally for the cubitals and distally for the metacarpo-digitals; because with scarcely any exception reduction in number takes place at the distal end of the manus and the proximal end of the cubitus.

[1] A somewhat similar nomenclature was proposed by Dr. Alix, 'Journal de la Société philomatique,' 1874, p. 10. "Sur les plumes ou rémiges des ailes des oiseaux."

The remaining feathers of the wing are the coverts; they are best understood if described from the posterior margin of the wing.

On the dorsal side the row of feathers (Plate XXX. fig. *a*, *α*) lying next the remiges are the *tectrices majores*, being quite definitely related to the remigeal quills, and lying close pressed upon their bases. Each remex is serial with the covert proximal to it, the cubital coverts crossing over the bases of the remiges, the metacarpal coverts lying parallel and pressed upon two contiguous remiges (*cf.* Plate XXXI. figs. *b* and *c*). There is a well-developed covert to every metacarpal except the first, which possesses only a very small and vestigial one, 1′, which is completely hidden by a median covert, 1″ (Plate XXXII. fig. 8), which in many birds functionally replaces it, the *t. major* disappearing.

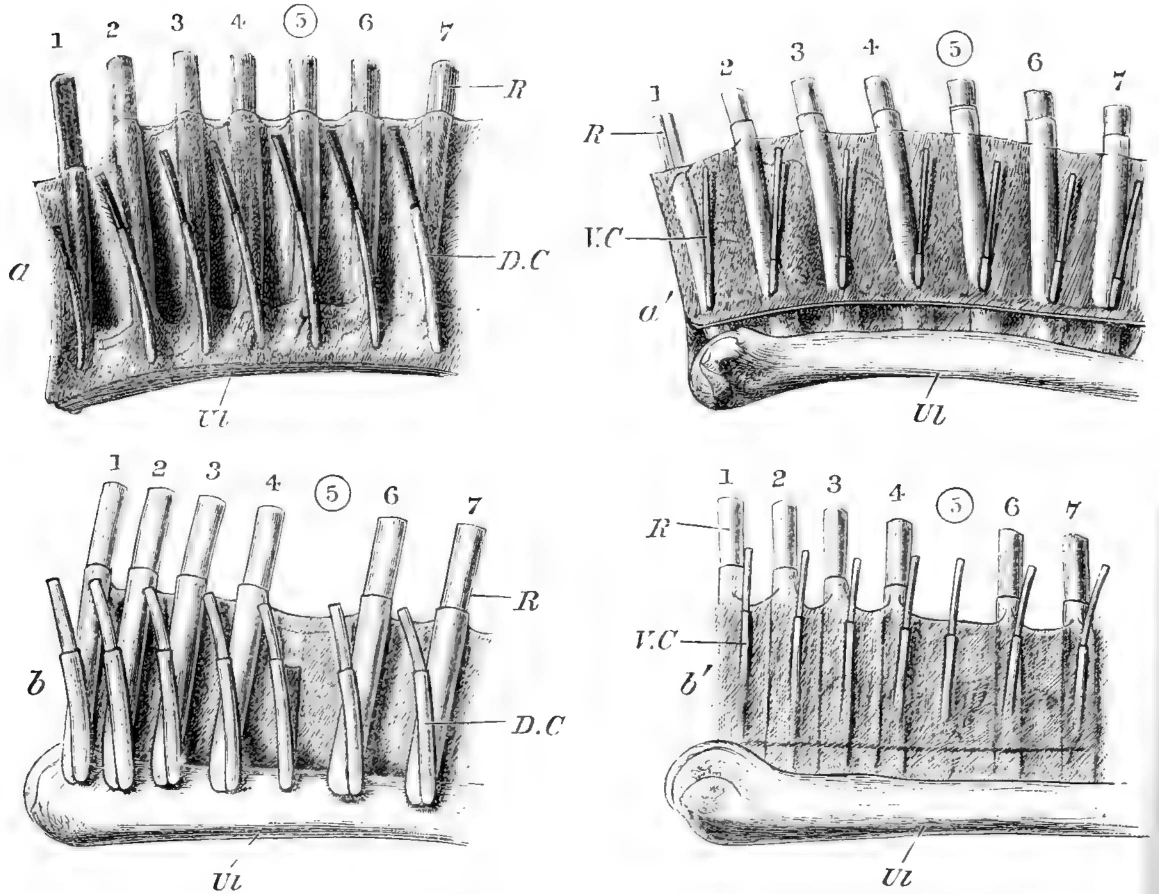
On the ventral surface of the wing is a row of feathers (Plate XXX. fig. *b*, *α*), bearing the same relations to the remiges as those just described; these are the *tectrices majores* of the lower surface (*cf.* Plate XXX. fig. *b*, and Plate XXXI. fig. *b*). If fig. *b*, Plate XXXII., be examined, which shows the relations of the above feathers in section, starting at the tip of the wing the remicle, or predigital 2 (R′), is seen to have proximal to it a dorsal and ventral covert, forming a group of three. The next remex is similar, and so to the 1st metacarpal, whose dorsal covert is very small and rudimentary. These relations show that the remicle is a small metacarpo-digital which has probably not been differentiated into a flight-feather. The cubitals show the same arrangement except the fifth group, where there are a pair of coverts, but no remex; this condition is termed *aquincubital*, and is later described more fully.

On the dorsal surface the next row of feathers to the *t. majores* are the median coverts (Plate XXX. fig. *a*, *β*), or *tectrices mediæ*, arranged serially with the other groups. On the cubitus they lie with a reversed overlap to the remiges and t. majores; those, however, which lie most proximal are unreversed (S. p. 415, footnote, and Goodchild, P. Z. S. 1886, p. 191). Those on the manus lie unreversed, and generally the median covert of the 2nd metacarpal is wanting (*cf.* Plate XXXII. fig. 8). On the ventral surface of the wing, the next row of feathers (Plate XXX. fig. *b*, *β*) bears similar relations; they are the *tectrices mediæ* of the lower surface, and always lie with reversed overlap to the remiges and t. majores (S. p. 491). The distal four or five are generally deficient on the manus in the Duck (Plate XXXI. fig. *b*). In many birds they are nearly all suppressed on the manus.

The tectrices majores and mediæ on the ventral surface have at first sight an anomalous position. Being on the ventral side of the adult wing, one would expect the backs of the feathers to look ventralwards, whereas they look dorsalwards just as do the remiges. This is pointed out by Sundevall (S. p. 419), who, however, gives an erroneous explanation, saying they are aftershafts developed at the expense of the true feather-shaft; a more probable explanation is discussed later.

The feathers so far described are seated in the wing-membrane, the next rows being in the skin covering the muscular portion of the wing and in the patagium. On the dorsal surface five rows of feathers (Plate XXX. fig. *a*, γ) follow the t. mediæ, lying with the same overlap, and on the manus being scantily represented; they

Fig. 1.



a, a′. Drawings of preparations of the distal cubital remiges, with their attached tectrices majores, of the Pheasant.

a, Dorsal view; *a′*, ventral view. (This shows the "quincubital" condition.)

b, b′. Drawings of preparations of the distal cubital remiges, with their attached tectrices majores, of the Golden Eagle. "Aquincubital."

b, Dorsal view; *b′*, ventral view; 1, 2, 3, &c. the remiges (*R*), numbered from the wrist-joint; *D.C*, dorsal tectrix major; *V.C*, ventral tectrix major; *Ul*, ulna.

are the *tectrices minores*. They extend on to the arm, and on the dorsal surface of the humerus a row of 6 feathers becomes elongated, forming an apparent continuation of the remiges of the forearm, the feathers of the next row taking the form of coverts; they form the humerals (*pennæ humerales*), the "parapteron" of Nitzsch (Plate XXX. fig. *a, h*). On the ventral surface next the median coverts are three row of feathers (Plate XXX. fig. *b*, γ), the *tectrices minores* of the lower surface, which are but scantily represented on the manus.

A fairly well-marked space[1] running the whole length of the cubitus separates these from two to three rows of feathers which run from the wrist to the elbow; and then are continued on the arm, where they become largely developed, 6 to 8 feathers (Plate XXXI. fig. *b, ax*) forming the axillaries (hypopteron of Nitzsch). This row may be termed, when distinct as here, an axillary row, though really forming part of the minores; in some birds there is no space separating them, and then they are confluent. The t. minores of the upper and lower surface generally correspond, both producing special developments, the "humerals" and "axillars."

The next group of feathers (Plates XXX. & XXXI., μ) grow along the posterior border of the wing, extending from the proximal end of the patagium to the end of the manus. On the dorsal surface they soon approach the minores and become confluent with them, though distinguishable in fresh undisturbed plumages by difference of overlap. On the ventral surface the patagial space is large, and separates them well from the minores. The feathers growing from the edge of the patagium are sufficiently elongated to cover this deficiency. At the wrist they become confluent with the other series and are continued on the hand. This group of feathers is common to both surfaces of the wing, insomuch as they form on the anterior border a shelving series, giving a clean finishing edge to the anterior margin of the wing. They are best termed marginals (*tectrices marginales*). The feathers of the pollex, *plumæ pollicis* ("alula," "ala spuria"), are partly of this series and of the minores; and by specialization produce four small quill-feathers with coverts, which lie closely embracing the dorsal part of the anterior border of the manus, and hiding many of its lesser coverts.

The table at the end of this paper (p. 355) shows the relation of the nomenclature adopted above with that of Sundevall, and the ordinary nomenclature such as that found in Coues's Key to N. A. Birds. All birds' wings (except the Penguins) are directly referable to the type just described. It contains all the elements which occur in the wing, and it is by the specialization and suppression of these parts that the different wing-forms have been derived, at any rate among Carinates, the Ratite wing being more primitive in structure.

Some Modifications of the Wing.

The remiges of the manus show a remarkable constancy both in number and position, for (with the sole exception of the Penguins) the first *digital* always lies upon the phalanx of digit III., its end resting upon the metacarpo-phalangeal articulation; the *middigitals* are always constant in position, so are the *predigitals*. On the metacarpus are six feathers always except in Flamingoes, Grebes, and

[1] This is especially well seen in the Grebes.

Storks, where seven occur. The *predigitals* are the only other remiges of the manus which show modifications of any interest. In the typical condition (*cf.* Plate XXXI. fig. *a*) we have the large predigital 2 (α) and the small remicle (β), with their dorsal and ventral coverts all intimately attached to the phalanx. This arrangement is probably generally present in the Pygopodes, Gaviæ, Tubinares, many Limicolæ, *Pterocles*, Odontoglossæ, Herodiones, Anseres, Pelicans, Striges, and Accipitres. Among other birds it is probably not generally present, but it may be found in many of the lower forms of Passeres, and in some Picariæ, probably never in Gallinæ.

The remicle disappears in these forms, but its dorsal covert remains well developed, especially well seen in the Gallinæ, and its ventral covert may also remain, but often disappears. All trace of the group may disappear, as in the nine-primaried Passerines, where predigital 2 is reduced to a mere rudiment, but can generally be detected; its covert is always well marked. The so-called pencil-feather of the Woodcock is the dorsal covert of the remicle group.

The chief, most interesting, and most puzzling modification of the cubital feathers is that in a great many birds the fifth remex is always undeveloped, its coverts being normally developed and present. This occurs probably in all birds except *Phœnicopterus*, Gallinæ, Passeres, and a few Picariæ. Up to the present I have never met with a trace of this feather in a vestigial condition. If the figures of the preparation of the distal part of the cubitus of the Golden Eagle be compared with those of the Pheasant (see p. 346), the exact nature of this modification is at once apparent. In the Pheasant (a, a') the fifth remex is present with its coverts, showing all normal relations; in the Golden Eagle (b, b') the coverts are present but no remex. The former condition may be termed *quincubital*, the latter *aquincubital*. Such is the constancy of one or the other condition in each natural group, that I have as yet met with no exceptions anywhere, except among the so-called Picariæ, many of which are, and most of which probably will turn out to be, *quincubital*. The Goatsuckers are *aquincubital*, while the Swifts are *quincubital*. *Pterocles* is *aquincubital*; *Goura* is *aquincubital*. Of course exceptions may turn up, seeing that of the whole number of birds but a comparatively few have as yet been tested for this point.

In the Gallinæ the first cubital feather is shortened; this is possibly due to mechanical requirements in the folding of the wing, as the metacarpal remiges are inserted so near the actual joint as to leave but little room. Nitzsch states that sometimes the last feather on the manus undergoes shortening. I have not met with this condition.

In the description of the Duck's wing it was pointed out that the upper major covert to the first metacarpal remex is very small and rudimentary. When the feathers are all plucked off except the remiges, major and median coverts, the appearance at the wrist-joint is that represented in the figs. 6–9 (Plate XXXII.), where the remiges are red, the major coverts yellow, and the median blue. The diagram above each of the figures shows the real homologies of these feathers, in their undisturbed primitive conditions. Sundevall mentions that there are generally one or two extra major coverts connected with the cubital series, of which the feather *l* in his figures (the median covert here under consideration) is one. The other he does not mention (S. p. 414, par. 2). Really there are no extra coverts at all, unless the fifth cubital coverts in the aquincubital condition of the wing are so considered. In the Duck (Plate XXXII. fig. 8) it is seen that the larger feather (1″), which at first sight appears to represent the major covert, is really the median covert in front of the remex in the undisturbed quincunx series; the little feather (1′) underneath being the real major covert. In this wing the two feathers have not become so closely attached to the first metacarpal as is the case in some other birds, example the Golden Eagle, Barn-Owl, &c. (Plate XXXII. fig. 6). Here the relations are more apparent; the major covert is small and rudimentary, but bears the same relation the other major coverts do. The median covert is a fairly large feather, which crosses the metacarpals at a considerable angle. In the Duck the median covert of metacarpal 2 is suppressed, in the Eagle it is present (2″, fig. 6). The Grebe, with seven metacarpals, shows similar modifications at the wrist-joint (Plate XXXII. fig. 7). In many birds (*e.g.* Passerines) the major covert altogether disappears, the median covert is large, and takes its place, lying across the metacarpals at a considerable angle, and causing the suppression of the next one or two mediæ (Plate XXXII. fig. 9).

The remaining feather-tracts undergo modifications in different groups, which are generally of more or less minor importance. The axillars and humerals vary in their development in different groups, in the Passerines disappearing almost absolutely, in all probability in connection with the relative shortness of the humerus. The marginals in many birds of this group are much elongated on the ventral side and cover the patagium.

When the wing is folded these feathers (often with the last two or three major cubital coverts) present much the appearance of the axillars in some birds. They have often been erroneously so described, whereas they have nothing whatever to do with them, the true axillars being represented by but a few semiplumes at most.

The modifications of the overlap of the dorsal cubital median and minor coverts have recently been very fully worked out by Goodchild (P. Z. S. 1886, pp. 184–203). These feathers are termed by Goodchild the "median cubital coverts;" but it is much better to confine the term "median coverts" to the row following the majores, and call the others "minor coverts." Goodchild's terms "supplementary row of median coverts" or "upper wing-coverts" and "posterior row of median coverts" are unnatural, because part of his supplementary row in the majority of cases belongs to the t. mediæ, and the greater and proximal part of his posterior row to the same, whereas the distal part belongs to the first row of minores (*cf.* his fig. 1, p. 186, P. Z. S. *loc. cit.*). His supplementary row generally means the distal t. mediæ proper, and sometimes includes some of the feathers of the next two or three rows on the wrist, which appear, as a consequence of folding superficially, to form a series with them; it is simply accommodation, and is only very striking when the wing is examined in the folded condition, as most of his were. Grouping the feathers according to their insertion, and remembering the conditions of folding which must occur at the wrist, the observations of Goodchild give the most complete view of this subject we have. The Passerine birds possess only the single row, *t. mediæ*, the minores being completely absent (S. p. 415, *cf.*); this is characteristic of them, and goes along with a very scantily feathered ventral surface.

The median and minor coverts of the lower surface[1] show a great variety of modification, which if systematically worked out would I believe furnish valuable characters. But practically ornithologists take no account of the lower surface of the wing, and but little can be made out from ordinary skins. For skins to be of much value for studying wing-characters, some of them ought to be prepared with one wing in the extended position. Fresh wings are much the most valuable, but they are not always available. According to Sundevall the median coverts often show a tendency to disappear, which I have noticed, often they are very small. In the Passeres the row of *t. majores* disappears; this is recognizable by difference of overlap.

The Duckling's Wing.

If the wing of a Duckling be examined when it is a mere downy appendage, of no use for flight, it will be found to be an exact foreshadowing of the flying wing. The fifth cubital remex is absent, not even a vestige of it can be found; so we may conclude that this modification is a very ancient and deep-seated one. The plumules (down) clothing the wing are more feather-like than the adult down. In fact a Duckling's wing forms an interesting comparison with an Ostrich's or Rhea's, these wings probably never having got beyond a stage parallel to this. The way the plumules of the Duckling are shed is very interesting; at the base of the plumule the new pennaceous feather forms, grows, and begins to force its way out from the skin. The plumule remaining attached by its base to the tip of the new feather is carried out away from the skin about $\frac{1}{2}$ to $\frac{3}{4}$ inch, then the connection becomes very slight, and soon the plumule is lost. This forms an analogous parallel to the shedding of milk-teeth, the plumule being retained till the new feather can functionally take its place.

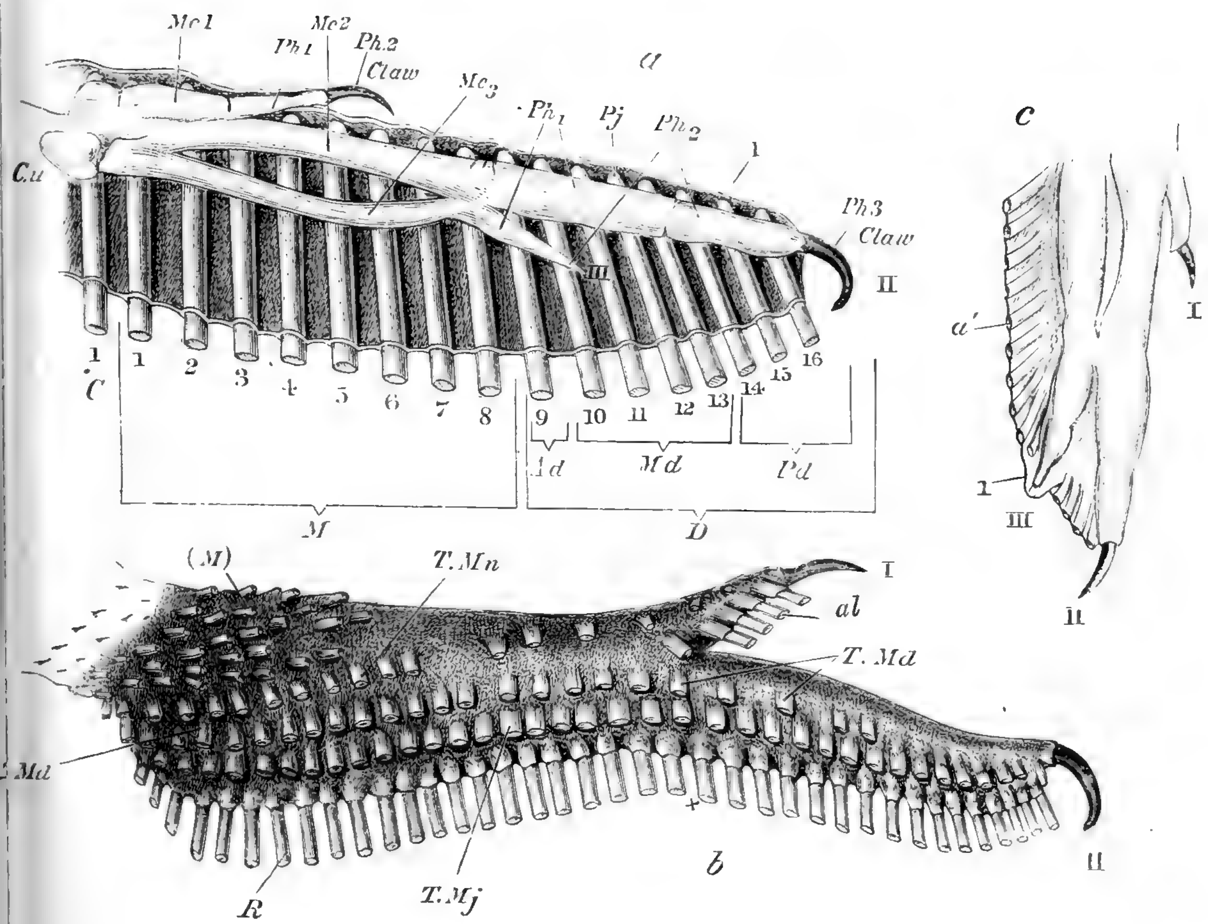
The Wings of the Ratitæ.

The wings of the Ratitæ conform to the same general plan as those of the Carinatæ, presenting a modification of a more generalized type, which correlates with their bony structure.

In the unplucked Ostrich wing, little beyond a confused mass of feathers can be made out. The ventral surface is totally devoid of

[1] There are some very good figures of the lower surface of the wing of certain Hawks in the 'Zoologist,' 1880, p. 273, pls. 2 and 3.

Fig. 2.



a. Preparation of the manus of the Ostrich, showing the primaries and the manner of their attachment to the bones.
b. Dorsal view of the antebrachium and manus of the wing of the Ostrich.'
c. Ventral view of the manus of an embryo Ostrich.

M, metacarpals; *D*, digitals; *Ad*, addigitals; *Md*, middigitals; *Pd*, predigitals; *Cu*, cuneiforme; *Mc* 1, 2, 3, metacarpals 1, 2, 3; *Ph* 1, 2, 3, phalanges 1, 2, 3; I, II, III, digits I, II, III; *T.Mj*, tectrices majores; *T.Md*, tectrices mediæ; *T.Mn*, tectrices minores; *M*, marginals; *Al*, pennæ pollicis (alula); 1, beneath this fold are the two ventral t. majores mentioned in the text; *a'*, tectrices majores inferior.

feathers except for one row, the t. majores of the lower surface. If the feathers be cut short, so that only the base of the quill is left in the skin, their arrangement can then be satisfactorily studied (*cf.* fig. 2). On looking at the figure (2, *a*), the remiges, *R*, are seen in their natural position, next a row of t. majores, *T.Mj*, then the

t. mediæ, *T.Md*, but scantily represented on the manus. There is part of a row, *T.Mn*, representing the minores, and a few rows of marginals, *M*. The dorsal surface of the humerus is uniformly covered by rows of feathers. The pollex bears four remiges and a few coverts, *Al*.

The disposition with regard to the bones gives 16 primaries or metacarpo-digitals, and about 20 (20–22 or 23) cubitals. The quills have not the same firm attachment as those of the Carinates, there being no grooves in the phalanges to receive them, and their bases project beyond the anterior edge of the bone (*cf.* fig. 2, p. 351). In the Carinatæ the quills attached to the phalanges lie almost parallel to them, whereas here the angle is little larger than a right angle. This is a much more primitive condition.

The primaries are disposed as follows:—Eight metacarpals, one addigital, four middigitals, and three predigitals. This probably represents a more primitive wing-form than the Carinate, where seven metacarpals and five digitals is the highest number of primaries. Probably the ancestral wing-form became modified into the forms we know by reduction and specialization of these feathers, seen more numerous in the Ostrich than elsewhere.

The Rhea's wing presents the same general characters as the Ostrich; the ventral surface is bare, and the dorsal surface, with the feathers cut, shows the same arrangement; but when the relations of the remiges to the bones are considered, it is seen to approach more nearly to the Carinate type in some respects. The primaries are twelve in number, there being seven metacarpals, one addigital, two middigitals, and two predigitals. This reduction is correlated with shortening and reduction of the manus. The angle of insertion of the digitals is more obtuse than in the Ostrich.

The wing of the Emu I have not had the opportunity of dissecting, but it is probably similar in arrangement to the Ostrich and Rhea, judging from a stuffed specimen.

The wing of the Cassoway[1] shows a great exaggeration of the feature, noticed in the Ostrich, of the quills projecting beyond the bones, its quill-spines being the sole remains of the cubital remiges.

The Apteryx shows, as was first pointed out by Prof. Flower (Roy. Instit. Lect. 1886), a few true cubital remiges, indicated by their long quills.

The Penguin's Wing.

This departs the most of all wings from the general plan. The paddle form of the wing and its scale-like feathers are familiar, and there is little or no differentiation apparent beyond the passage from mere scales anteriorly to feathers posteriorly. On the ventral side

[1] In the wing of a Cassowary dissected since writing the above there are to be seen structures representing, in all probability, the "primaries," which appear at first sight to be entirely wanting in these forms. I hope to describe this specimen, together with some other interesting Ratite wings, in a future paper.

this is all. On the dorsal the first four rows of feathers show a certain amount of differentiation, being somewhat elongated, and showing what might be looked upon as a tendency to form remiges and coverts, which was early lost, the wing taking a different function to those which developed into organs of flight. The embryo of the Penguin shows in its wings no signs of being a degeneration or modification of the specialized flight-wing of other Carinates. There appears to be no trace of remigial structure at all in this wing.

Origin of Wing and General Conclusions.

The study of the wings of living birds leads to the conclusion that the power of flight was gradually acquired, and also tends to throw some light upon the way wings were originally evolved from a reptilian manus. Recent researches[1] seem to show that the ancestral form of the avian manus was probably a webbed form, and inferentially belonged to an aquatic type of animal. From this "webbed paw" was developed the starting-point of the wing, by special modification of the scales or feather foretypes on the dorsal surface. The Penguin's paddle represents, perhaps, a highly modified survival of this starting-point; the Ratite wings are modified conditions of the intermediate stage in the wing-formation. At some future time I hope to bring forward the evidence in favour (or otherwise) of this view more fully worked out; however, the following are some of the points which tend to support that view.

In the adult flight-wing of the Carinates there are two rows of feathers situate on the ventral side of the wing, reversed in position, the t. majores and mediæ. Sundevall explains this by saying it is an aftershaft developed at the expense of the feather-shaft, and states (S. p. 419) that the aftershaft is entirely deficient; but in a Pheasant I have found it normally developed, though small in these feathers. His explanation is erroneous. The true explanation probably is that these feathers or their antetypes were originally on the dorsal surface and have been carried down to the ventral in the formation of the "ala membrana" by the excessive development of the remiges and tectrices majores. That is, that originally on the dorsal surface of the arm and manus there took place a special modification of the scales or feather foretypes by which rows of these were directed backwards in the "primitive embryonic" position of the limb. Next two or three rows began to be specialized and to become larger and more prominent than the others; then these, by their unequal growth, carried over a fold of skin and formed the wing-membrane, carrying some of the structures to the ventral side, which are now seen as the reversed feathers (*cf.* diagrams, Plate XXXII. figs. 1–5). In the embryo bird the feather-rudiments first appear on the dorsal surface, pointing to the fact that the modification here is very ancient and deep-seated; the remiges and greater coverts (superior) being the earliest to appear; quickly they begin to assume

[1] Prof. W. K. Parker's recent paper "On the Morphology of Birds," read at the Royal Society, Jan. 27, 1887.

larger proportions, and at the very earliest stages the remiges are distinguishable. At this stage the wing is quite rounded in section, there being no trace of the "ala membrana;" the next feathers to appear are the t. majores (inferior), closely followed by the other ventral coverts, the other dorsal coverts meanwhile having appeared. At this stage (*cf.* Plate XXXII. fig. 1) the inferior major and median coverts are distinctly more on the dorsal half of the rounded edge of the wing than its ventral, but very quickly they become quite ventral, owing to the rapid growth of the remiges. This stage is quickly passed over, but sufficient is visible to show that these feathers are carried distinctly to the lower surface by inequality of growth (*cf.* Plate XXXII. figs. 2–4). The feathers resulting from these are the plumules seen in the wing of the Duckling, and of no use for flight. The wing of a Duckling reproduces in a great measure, allowing for specialized differences, the adult Ostrich's wing or the Rhea's; and these wings are survivals of the transition state of the wing, probably never having been used for flight, but having undergone special modifications of their own from that point. It is pretty clear the remiges of the Ostrich and Duck's wing correspond, more so the Ostrich and Duckling's; in the Ostrich we have but one row of ventral coverts, and in the embryo we get them most distinctly on the dorsal side. The Ostrich embryo figured (fig. 2 *c*, p. 351) shows the manus from the ventral surface; digits I., II., and III. being well developed; digit III. at its tip projecting beyond the general fold of the wing; in fact there is a very complete webbed manus. The feathers seen (a', fig. 2 *c*, p. 351) are the row of ventral coverts, and lying over digit III. on its dorsal surface are two of this row hidden from sight by it. In the adult, one of these feathers grows over the distal part of phalanx 1 of digit III., owing to elongation of its quills; here we have the dorsal position actually preserved in the adult. The wing of the Ostrich presents also a primitive condition especially in the cubital region, in that the "ala membrana" is not specialized as in the Carinatæ, being in the intermediate condition of the Carinate embryo. Probably the feathers now representing the remiges and the principal coverts were more numerous in the primitive wing type, and have become restricted in number on the manus; thus the Ostrich has 16, the Grebes 12, while most birds have only 11 primaries.

Wing-Formula.

The main facts with regard to the feathers of a bird's wing may be expressed as a formula. Denoting the metacarpo-digitals by *Md*, the metacarpals by *m*, the digitals by *d*, and expressing the number of feathers in each group by a number placed after (thus, six metacarpals, m 6), the cubitals by *C*, "quincubital," "aquincubital" by C^5, we formulate the remiges

$$Md\,11\ \ m\,6\ \ d\,5\ \ C^5 x\,*.$$

The coverts are indicated by α, β, γ, for the t. majores, mediæ, and minores respectively; by placing a figure below the line, thus α_2,

* x = number of cubitals, which varies considerably in different groups.

Table of Nomenclature.

	This Paper.	Sundevall.	General.
Dorsal Coverts. Tectrices superiores.	Tectrices marginales.	Tectrices minimæ s. antecubitales.	Tectrices minores. (Parapteron (from Nitzsch) and humerals.)
	Tectrices minores. (Pennæ humerales.)	Tectrices minores cubiti vel manus. (Pennæ humerales.)	
	Tectrices mediæ.	Tectrices secundæ seriei.	Tectrices mediæ. { Median primary coverts. Median secondary coverts.
	Tectrices majores.	Tectrices majores.	Tectrices majores. { Upper primary coverts. Greater upper secondary coverts.
Remiges.	Primaries, or Metacarpo-digitales.	Remiges primores.	Primaries.
	Secondaries, or Cubitales.	Remiges cubitales.	Secondaries—Tertiaries.
Ventral Coverts. Tectrices inferiores.	Tectrices majores.	Tectrices aversæ s. inferiores primæ.	Tectrices inferiores. (Under wing-coverts.)
	Tectrices mediæ.		
	Tectrices minores. (Axillaries.)	Tectrices infrabrachiales s. plumæ infra-cubitales. (Plumæ infrahumerales.)	.... (Axillars.)
	Tectrices marginales.	Tectrices antecubitales inferiores or infra-marginales.	
	Alula or Plumæ pollicis.	Plumæ pollicis.	Alula or Ala spuria.

it indicates the number of rows, and placing these symbols above or below a line, thus $\frac{\alpha_1\,\beta_1}{\alpha_1\,\beta_1}$, their dorsal or ventral position; the marginals are expressed by μ, the humerals by h, the axillars by x, a number after the h or x denoting the number of specialized feathers forming the "parapteron" and "hypopteron." When any two rows are confluent it may be indicated thus, $\widetilde{\gamma\,x}$, where the axillars and minores are indistinguishable as separate groups; *Al* expresses the quill-feathers of the pollex.

Formula for the Duck:—

$$Md\,11\ \ m\,6\ \ d\,5\ \frac{\alpha_1\,\beta_1\,\gamma\,\mu}{\alpha_1\,\beta_1\,\gamma\,\mu}\ \ C\,19\,\frac{\alpha_1\,\beta_1\,\gamma_5\,h\,6\,\mu}{\alpha_1\,\beta_1\,\gamma_3\,x\,7_{(2\text{-}3)}\,\mu}\ Al\,4.$$

Typical Passerine formula:—

$$Md\,10\ \ m\,6\ \ d\,4\ \frac{\alpha_1\,\beta_1\,\gamma\mu}{\alpha_1\,\beta_0\,\gamma\mu}\ C\,9\frac{\alpha_1\,\beta_1\,\gamma_0\,\mu}{\alpha_0\,\beta_1\,\gamma_2\,\mu}\ Al\,3.$$

Formula for Ostrich wing:—

$$Md\,16\ \ m\,8\ \ d\,8\ \frac{\alpha_1\,\beta_1}{\alpha_1}\ C\,20\frac{\alpha_1\,\beta_1\,\gamma_1\,\mu}{\alpha_1}\ Al\,4.$$

These formulæ might prove of value to ornithologists by enabling them to briefly express the main characters of the wings of different groups of birds. The three given above at once express very great differences in the wings of these birds: thus it is seen at once how, in the Passerine, the upper minores, the axillars, and humerals are absent; and the whole of the lower coverts, except one row, in the Ostrich. These are here introduced to show the possibility of using a wing-formula expressing most of the characters.

DESCRIPTION OF THE PLATES.

Plate XXIX.

Drawing of a preparation of the right wing of the Wild Duck, seen from below, showing the relation of the quill-feathers to the bones.

al. Plumæ pollicis (alula). *C.* Cubitals or secondary remiges. *Md.* Metacarpo-digitals or primary remiges. *M.* Metacarpals. *D.* Digitals. *Ad.* Addigital. *Md* 1 & 2. Middigitals 1 and 2. *Pd* 1. Predigital 1. *Pd* 2 or *R.* Predigital 2 or remicle. *H.* Humerus. R. Radius. *Ul.* Ulna. *Sc.* Scaphoid. *Cu.* Cuneiform. *Mc* 1, 2, 3. Metacarpals 1, 2, 3. *Ph* 1, 2, 3. Phalanges 1, 2, 3. I., II., III. Digits 1, 2, and 3.

Plate XXX.

a. Plan of the arrangement of the feathers on the dorsal surface of the extended left wing of *Anas boschas.*

b. Plan of the arrangement of the feathers on the ventral surface of the extended right wing of *Anas boschas.*

C. Cubitals (grey). *Md.* Metacarpo-digitals (grey). *α.* Tectrices majores (pink). *β.* Tectrices mediæ (green). *γ.* Tectrices minores (brown). *μ.* Tectrices marginales (yellow). *Al.* Plumæ pollicis (red). *h.* Humerals. *x.* Axillars. *x'.* Axillary row of minores.

PLATE XXXI.

a. The distal phalanx of digit II. of the wing of the Barn-Owl, with the attached predigitals and their coverts, showing the remicle and its relations.

1. Ventral view. 2. Dorsal view.

α. Predigital 1. β. Predigital 2 (remicle).
α'. Dorsal tectrix major to α.
α''. Ventral tectrix major to α.
β'. Dorsal tectrix major to remicle.
β''. Ventral tectrix major to remicle.
1. Phalanx 2 of digit II.
2. Fused phalanx 3 of digit II.

b and *c.* Diagrams of the ventral and dorsal surfaces of the wing of the Wild Duck, showing the points of insertion of the feathers of the different groups.

C. Cubitals. *M.* Metacarpo-digitals. *R.* Remicle. *r.* Remex.

α. Tectrices majores.
β. Tectrices mediæ.
γ. Tectrices minores.
μ. Tectrices marginales.
x. Axillars.
h. Humerals.
Ax. Axillary row.
(5). Absent fifth cubital remex.
Al. Alula.

PLATE XXXII.

Figs. 1–5. Diagrams showing how the ventral tectrices majores and mediæ have been carried over from the dorsal side, and the "ala membrana" formed.

1. The earliest condition of the feather-rudiments.
2–4. Intermediate conditions.
5. The condition in the adult wing.

Remiges—red.
Tectrices majores (superior)—yellow.
Tectrices majores (inferior)—green.
Tectrices mediæ (superior)—dark blue.
Tectrices mediæ (inferior)—light blue.

These diagrams represent sections across the wing in the direction *x–y* (fig. 8).

Figs. 6–9. The remiges and upper principal coverts in the region of the wrist-joint in Barn-Owl (6), Grebe (7), Duck (8), and Lark (9).

1, 2, 3, 4. Metacarpal remiges (red).
1′, 2′, 3′, 4′. The corresponding major covert (yellow).
1″, 2″, 3″, 4″. The corresponding median covert (blue).
* Wrist-joint.

The plan of these feathers in section is shown above each, and represents the primitive unmodified relations.

α. Drawing of section through the large feathers of the wing just below the edge of the "ala membrana" of the Pheasant.

β. The same of the Duck. The proximal cubitals are not shown.

R. Remex (red).
DC. Dorsal covert, tectrix major (yellow).
VC. Ventral covert, tectrix major (green).
R′. Remicle.
* The wrist-joint.
Q. Fifth cubital remex present.
Aq. Fifth cubital remex absent.

3. On the Classification of the Coleoptera of the Subfamily *Languriides*. By the Rev. H. S. Gorham, F.Z.S. &c.

[Received March 26, 1887.]

Family Erotylidæ.

Subfamily Languriides.

While working out the Languriidæ of Messrs. Godman and Salvin's collection for the 'Biologia Centrali-Americana,' I have had to examine a great portion of the species and proposed genera in my own and other collections from all parts of the world, with a view to ascertain whether any characters existed by which their classification could be placed on a natural basis. The genera, and in most cases the subfamilies, which exist in the New World are distinct from those of the Old. It was to be supposed *à priori* that the *Languriæ* would not be an exception, yet, as is well known, the species from both regions often bear a very close resemblance, and at first sight might naturally be presumed to belong to the same genera. Mr. Crotch proposed a few genera in his descriptive Catalogue; but that work was so much hurried that his diagnoses are too short; they hardly amount to more than the indication of what, with his true entomological instinct, he saw would prove the types of new genera. Nevertheless, a close examination of the species enables me to state that these genera are, in most cases at least, well founded, but that other and greater combination of characters are needed for their proper definition. At the same time I find that many more genera must be made if we are to treat this group as the progress of biological science requires, and to express the affinities and differences of the minor groups into which it can be subdivided by a binomial nomenclature.

In order to make certain of the position of the group, I have dissected a considerable number, and considered the structure of the various parts of the body in comparison with those of the Erotylidæ, Phytophaga, and various Clavicorn Coleoptera; and I come to the conclusion that they can nowhere be better placed than as a subfamily of the Erotylidæ. Dr. Sharp, at my request, made a careful dissection of one of the largest species, and he has pointed out to me that the statement of M. Chapuis in the 'Genera des Coléoptères' (although I do not know if he is responsible for it), that the metathoracic episterna and epimera are without apparent distinction, is incorrect; these structural plates of the pleuræ are quite apparent, though not to be easily seen, and only as small points, until the elytra are removed and the side exposed. The epimera will then be found in close proximity with, and lying above, the episterna, but rather more dorsal in position, and nearly or quite covered by the elytral epipleuræ. Lacordaire did not include the *Languriæ* in the Monograph of the Erotylides; but any one who will read his general remarks will see that he was not of MacLeay's opinion, that these insects had any close affinity with *Cerylon*, but simply was doubtful whether, with Latreille, their proper place was with the Erytolidæ, or whether it should be with *Eumorphus*. The opinion which has been put forward that they might be very much modified Phytophaga is negatived by the fact that the tarsi are five-jointed, the small fourth joint, which is like a nodule at the base of the claw-joint, being closely analogous to the similar joint in both the Erotylidæ and Endomychidæ, though the alliance is greater with the former than the latter family, in which there are but four joints inclusive, while in both Erotylidæ and Languriæ there are five.

I shall now give a summary of the characters to which I have paid especial attention, and upon which this attempt at classification of these Beetles is founded.

1. *The Head.*—The antennæ are eleven-jointed without exception; the two basal joints are short and stout, not very different in length, the third rather longer than these or succeeding joints; the four apical joints are pubescent, those preceding them either glabrous (the more evoluted form as in *Pachylanguria*) or clothed with hairs.

The ocular striola is a groove above the canthus or rim of the eye and is of great use; it is absent in certain genera, very distinct in others, and modified in degree of fineness or in length; in others, from it in front starts a sharp ridge, forming the upper edge of the socket of the antennæ and bordering the epistome. This latter is the part of the head immediately before the labrum, and both afford some useful characters. On the occiput are frequently found very minute raised ridges, or carinæ, and these are the organ of stridulation. Sometimes they are so obsolete that the greatest pains is necessary to trace their rudiments, or more correctly their nascent origins. I do not consider them of importance for classification, nor even as truly generic characters. The eyes themselves are either coarsely or quite finely granulated (*i. e.* the facets are like a cluster of ocelli, or are much modified so as to approach the more highly evoluted eyes with even surfaces). These give generic characters, but, as in the Cleridæ, do not serve for higher aggregates.

The palpi, maxillæ, labium, or mentum are not variable to any great extent. The labrum varies in degree of length, but I have not been able to use the trophi.

2. *The Thorax.*—The pronotum is variable in shape, but does not afford generic characters; the presence of basal sulci indicates affinity with both Erotylidæ and Endomychidæ, but is also with many of the characters common in a less degree in the Phytophaga. The prosternum and mesosternum bear a singular resemblance to those of the two first-named families, and, as in them, afford good and constant generic characters; the reflexed edge of the pronotum has no lines nor plication (such as is found in certain Malacoderms), and I do not find any characters of more than specific value there.

The metasternum with its episterna and epimera will no doubt ultimately prove as valuable as the prosternum; I regret that I cannot work out the characters of this part, mainly because it cannot be done properly without spoiling the specimens by dissection.

3. *The Abdomen.*—This is remarkably uniform in all the genera, yet affords two most trenchant and easily observed distinctions, viz. the presence or absence and variety of two lines, sometimes raised, sometimes impressed upon the intercoxal process of the basal segment; their presence is a peculiarity of the Asiatic species. And, secondly, the excision of the apical segment, which rarely takes place and usually in the male sex only.

4. *Appendages.*—The elytra: these are sometimes quite smooth at the apices, or they are denticulate, excised, truncate, or divaricating; these are partly generic but partly divisional characters. Thus the finely denticulate apex is nearly, or quite, a peculiarity of the American species. The legs: the femora are either smooth in both sexes, or finely granulate or denticulate in the males; the tibiæ very rarely bent or sinuous like those of Endomychidæ, often incrassate as in Erotylidæ, never toothed as in the former. The tarsi: I have examined the soles with the view of ascertaining if any such differences as Mr. Bates has used in the Carabidæ exist; and I find two types of feet, one with spongiose close-set papillæ, the other similar but with ragged rough hairs in addition, and much hairier above and on the sides. The latter is the usual American type, the former the Eastern or Asiatic: modifications occur in both parts of the world; and I venture to think that in this I have found a clue to the natural arrangement of genera in this subfamily, but yet one that must be taken in combination with the more important of the characters mentioned, as in certain genera an intermediate form occurs. This is, however, the case whatever be the distinctive structure selected for the purpose of classification; cases will always present themselves in which any one character fails to give any response, and we must have recourse to others known to be correlated with it to satisfy our inquiries.

I may here acknowledge the contributions to our knowledge of this group made by Mr. Lewis and the Rev. W. W. Fowler. Of course I have made use of every kind of information I could find already published, for which I feel no apology is needed.

The following is an attempt to place the general results of my examination in a tabular form. The North-American genera will be more fully characterized in an early part of the 'Biologia Centrali-Americana.' The genera which I wish to suggest for adoption for the eastern species which have been described as *Languriæ* are indicated also by a type species as well as in the table; it must here be observed I do not regard any species I have yet seen from Asia or Africa as belonging to *Languria* proper, of which *L. mozardi* is the type. It is not to be supposed that I have studied more than a limited number of the Asiatic species; my examination of them, so far as it has gone, leads me to expect that many more genera than are here suggested will have to be made, but that their arrangement will be much facilitated by attention being paid to the sectional characters now proposed.

Family EROTYLIDÆ.

Subfamily LANGURIIDES.

SECTION I.—Spongioso-palmati.

Tarsi (præsertim antici maris) subtus articulis tribus basalibus spongioso-palmatis, haud late ciliatis.

i. Abdominis segmentum ventrale basale lineis duabus:
  a. *impressis*, brevibus; antennarum clava
    ‡ rotundata, lata .... *Pachylanguria*, Crotch.
    ‡‡ elongata .... *Metabelus*, n. gen. (type *P. borrei*, Fowler).
    ‡‡‡ maris femoribus leviter denticulatis. *Languriomorpha*, n. gen. (type *L. lewisi*).
    ‡‡‡‡ elytrorum apicibus excisis .... *Pentelanguria*, Crotch.
  b. *impressis*, longis .... *Tetralanguria*, Crotch.
  c. *elevatis* .... *Languriosoma*, Crotch.
  d. *impressis intus carinulatis* parallelis.
    Oculi subtiliter granulati .... *Neolanguria*, n. gen. (type *Trogosita filiformis*, Fabr.).
    Oculi fortiter granulati .... *Cœnolanguria*, n. gen. (type *L. coarctata*, Cr.).

ii. Abdominis segmentum ventrale basale lineis nullis.
  a. Head asymmetrical.
    † Apex of elytra simple .... *Callilanguria*, Crotch.
    †† Apex of elytra denticulate......... *Goniolanguria*, Crotch.
    ††† Apex of elytra not denticulate ... *Doubledaya*, White.
  b. Head symmetrical.
    Femora maris asperata .... *Oxylanguria*, Crotch.
    Femora simplicia .... *Fatua*, Dej.
  c. Oculi fortiter granulati; apex of elytra simple *Promecolanguria*, Fowler (type *L. dimidiata*, Guér.).

SECTION II.—Trichio-palmati.

Tarsi (præsertim antici maris) subtus villosi, articulis tribus basalibus late vel saltem distincte, ciliatis.

i. Oculi subtiliter granulati; vel modo reticulati.
  a. Elytrorum apicibus denticulatis; lineis abdominalibus nullis.
    ‡ Tibiæ anticæ maris valde sinuatæ .... *Camptocarpus*, n. gen. (type *Trapezidera longicollis*, Mots.).
    ‡‡ Tibiæ utriusque sexus rectæ, maris intus asperatæ; elytrorum apicibus denticulatis .... *Dasydactylus*, n. gen. (type *D. buprestoides*, Gorh.).
    ‡‡‡ Tibiæ maris intus læves;
      maris, abdominis segmento ventrali apicali haud exciso;
        femora præsertim maris, clavata... *Nomotus* (type *N. plutonus*, Gorh.).
        simplicia *Trapezidera*, Mots. (type *T. ænea*).
      utrinque asymmetrice exciso ...... *Teretilanguria*, Crotch.
      tantum emarginato ...... *Ortholanguria*, Crotch.
  b. Elytrorum apicibus oblique truncatis; maris, abdominis segmento ventrali apicali medio rotundato
      exciso .... *Langurites*, Mots.
      simplici .... *Chromauges*, n. gen. (type *L. refulgens*, Fowler).
  c. Elytrorum apicibus muticis:
    † lineis abdominalibus nullis; antennarum clava
      quinque-articulata .... *Languria*, Latr.
      sex-articulata, angusta..................... *Janessa*, Chevr. (type *L. bicolor*, Fabr.).

†† lineis abdominalibus distinctis, cariniformibus.
Anadastus, n. gen. (type *L. cambodiæ*, Crotch).
††† lineis abdominalibus impressis divaricatis. *Stenodastus*, n. gen. (type *L. melanosterna*).

d. Elytrorum apicibus *mucronatis*.
(† lineis abdominalibus nullis) .... *Stenolanguria*, Fowler (type *S. tricolor*, Fowler).
forcipatis .... *Meristobelus*, n. gen. (type *M. forcipatus*, Gorh.).
acuminatis .... *Acropteroxys*, n. gen. (type *Languria gracilis*, Newman).

ii. Oculi grosse granulati.
a. Tarsi, præsertim antici maris, valde hirtuli ;
lineis abdominalibus brevibus............... *Crotchia*, Fowler (type *C. vagabunda*, Fowler).
b. Tarsi vix hirtuli ;
lineis abdominalibus nullis .... *Barbaropus*, n. gen. (type *Languria nyassæ*, Fowler).
lineis abdominalibus brevibus............... *Microlanguria*, Lewis (type *Languria jansoni*, Crotch).

iii. Oculi fortiter granulati ;
lineis abdominalibus impressis, extus elevatis brevibus.
Cladoxena, Mots.

April 19, 1887.

Osbert Salvin, F.R.S., Vice-President, in the Chair.

The Secretary called attention to a set of eleven photographs containing representations of the principal objects of Natural History collected by the celebrated traveller Prejevalski during his recent expedition in Central Asia and an accompanying Catalogue, which had been presented to the Society's Library by Dr. A. Strauch, F.M.Z.S., and read some extracts from a letter addressed to him by Dr. A. Strauch on the subject.

Dr. Strauch stated that after Prejevalski had returned from his fourth journey, and had again given his valuable collection of Vertebrates to the Imperial Academy of Petersburg, it was determined by the Academy to have a special exhibition of all the zoological collections of Prejevalski in the new wing of the Academy buildings. The collection thus arranged contained specimens of 702 Mammals, 5010 Birds, 1199 Reptiles and Amphibians, and 643 Fishes, besides some Ethnological objects. The photographs now exhibited represented these objects as arranged for exhibition in the building of the Academy.

The catalogue, which was in Russian, contained the scientific names of the principal species so far as they had been determined.

Mr. T. D. A. Cockerell exhibited specimens of some Mollusca taken at Isleworth, Middlesex, and read the following notes:—

ARION BOURGUIGNATI, Mabille.—This species, though differing not only superficially, but anatomically, from its nearest relative in Britain, *A. hortensis*, Fér., has, until a few months ago, always been confounded with it, and has consequently not been recorded as British. It differs specially from all others of the genus in being keeled on the back in the young state, and is easily known from *A. hortensis*, of which I have specimens taken in company with *A. bourguignati*, by its perfectly white foot-sole and its narrow side-bands.

A. bourguignati appears to be very well distributed in Britain: up to the present it has been found in Yorkshire, Middlesex, Hampshire, Sussex, Cornwall, and my brother has recently taken a specimen at Coniston, Lancs. It has also been received from the neighbourhood of Clonmel, in Ireland.

HYALINA DRAPARNALDI, Beck.—This species in Britain has appeared to be confined to the western parts (Cornwall, Devon, and Wales), and has not been found further east than Bristol. The occurrence therefore of a colony of the species at Isleworth is very remarkable, unless on the supposition that they were accidentally introduced from elsewhere with plants, as they were found close to a garden. The specimens are remarkable as belonging to a variety which may be called *maculosa*, characterized by having whitish spots irregularly placed all over the surface of the shell. This condition has been recorded by Pascal in the allied species *H. cellaria*, Müll., and is important because it is apparently an intermediate form between the translucent horny shells of this and the opaque calcareous ones of other species, the spots being due apparently to little deposits of carbonate of lime.

The Secretary read the following extract from a letter addressed to him by Mr. Albert A. C. Le Souef, C.M.Z.S., dated Melbourne, 11th March, 1887:—

"You will be interested to know that I have now a pond for living Duckbills (*Ornithorhynchus paradoxus*) in our gardens. The pond is about fifty feet in diameter, and is lined with rough stone; it has a small island covered with ferns and rushes in the centre. In it are artificial burrows, and also boxes with dry grass in them. Water is always flowing through the pond. The Duckbills seem to do very well in it, and are a great attraction. I shall make further experiments in keeping them, with a view, if possible, of sending you some of them by my son Dudley, who, I think, will again visit England about the end of this year."

The following papers were read:—

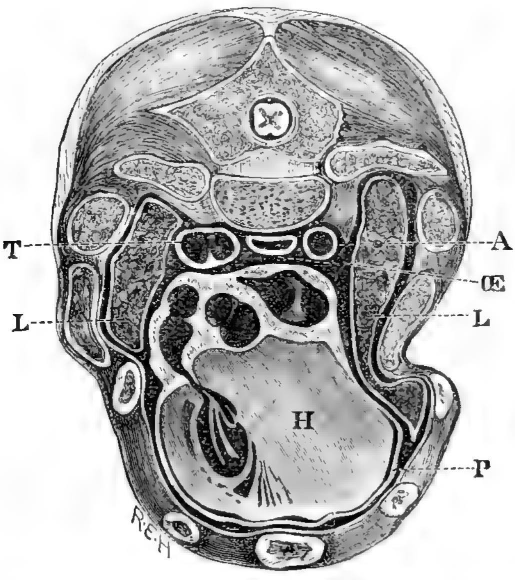
1. On some Specimens of Disease from Mammals in the Society's Gardens. By J. Bland Sutton, F.R.C.S., Erasmus Wilson Lecturer on Pathology, Royal College of Surgeons of England.

[Received February 25, 1887.]

In this communication I again venture to bring under notice a few specimens of diseases obtained from mammals which have died in the Society's collection during the past twelve months. Those only have been selected which appeared to me to possess a zoological as well as a pathological interest.

On several occasions I have drawn attention to the frequency of rickets in mammals living in confinement in this country, and have described some of the peculiar effects due to this disease manifested by the skeleton. Let me now describe two additional specimens. When the skeleton is thoroughly softened by rickets, the ribs are

Fig. 1.

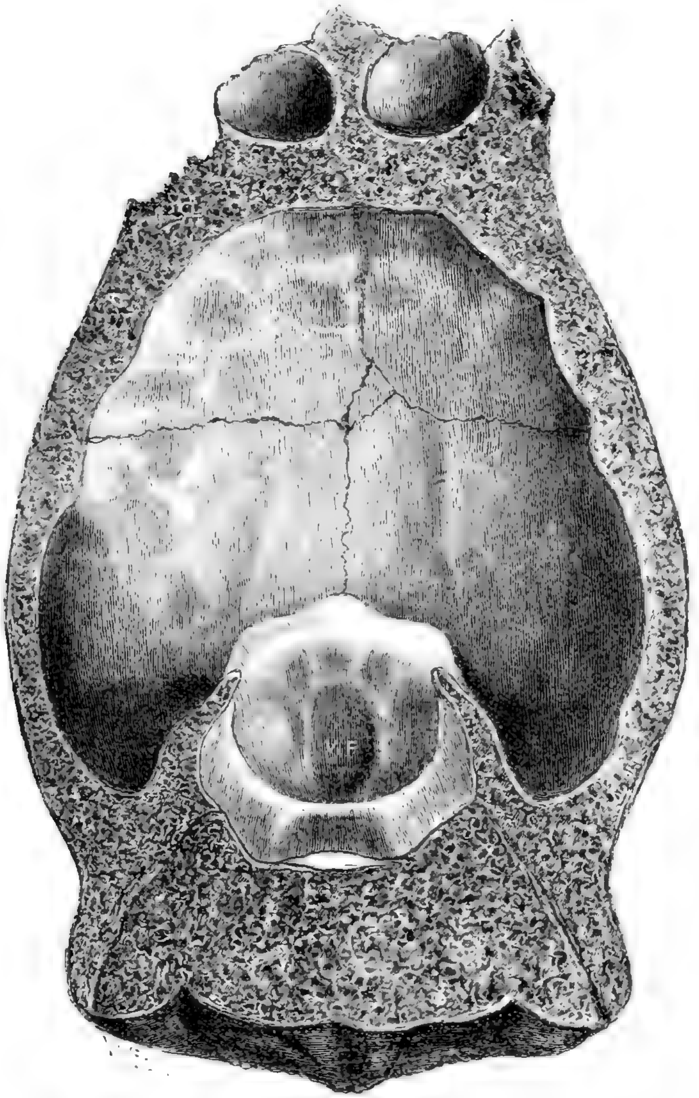


Transverse section of the thorax of a rickety Monkey.
H. Heart. L, L. Lungs. T. Trachea. Œ. Œsophagus. A. Aorta. P. Pericardium.

as yielding as though composed of whalebone. In consequence of this they yield to the pressure of the atmosphere and encroach upon the thoracic cavity, displace the heart, flatten the lungs, and disturb the viscera of the chest generally. In my drawing (fig. 1) a transverse section of the thorax of a Monkey severely affected by rickets is shown. In this drawing the lungs are seen as two narrow bands, the trachea is displaced to the right side, the œsophagus is compressed against the spine, and the heart is pushed forwards, and is in contact with the thoracic parietes all round, instead of hanging almost free in the middle line. It is difficult to imagine how life could continue under such altered conditions of the respiratory and circulatory organs.

The next specimen is, so far as I know, unique. It is a well-recognized fact that when rickets affects the skull, the bones most

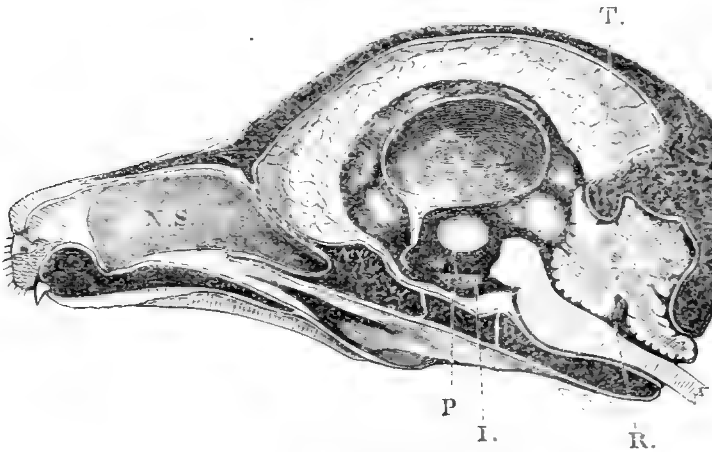
Fig. 2.



Under view of the skull-vault of a rickety Lion, with abnormal thickness of the ossific tentorium.

attacked are those preformed in membrane. Most of the Lions which have been born alive in the Gardens and survived for any length of time have developed rickets. A young Lion which died last winter had for some months previous to its death exhibited marked signs of paralysis of the hind limbs and back. The paraplegia was attributed to pressure on the cord from the overgrown intervertebral disks. The *post-mortem* examination revealed a very curious state of affairs. The skull presented unmistakable evidence of rickets; and on removing the skull-vault, a task of considerable difficulty, it was found that the general overgrowth of bone had extended from the vault of the skull and implicated the tentorium cerebelli. This abnormally thick tentorium had compressed the medulla and cerebellum, producing general paralysis, which terminated fatally.

Fig. 3.



A longitudinal section of the head of a Lion-cub (three months), showing overgrowth of the tentorium cerebelli and dilatation of the lateral ventricle.
T. Tentorium. V. Lateral ventricle. I. Infundibulum. P. Pituitary body.
R. Fourth ventricle. N.S. Nasal septum (cartilaginous).

There are good reasons for believing that the abnormal thickening of the tentorium in Lions born in confinement is not uncommon if sought for. Since detecting the first case a Lion cub three months old has come to hand. The specimen was frozen, and the head divided longitudinally, when a most interesting condition of the brain was observed. It will be seen in the drawing (fig. 3) that, as in the preceding case, the tentorium cerebelli is abnormally thick, and presents at its anterior edge a rounded margin. This overgrowth of bone has pressed upon the vermiform process of the cerebellum, thus occluding the anterior part of the fourth cerebral ventricle, and preventing a free flow of fluid from the remaining cavities. As a consequence the lateral ventricles have become greatly dilated, and the foramen of Mouro, instead of being represented as a slit of the dimensions of a crow-quill, is an oval aperture measuring at least an inch in its major axis. The third ventricle is likewise dilated; and the infundibulum, instead of being a narrow tube ending in the pituitary body, is widely dilated and forms part of the general cavity of the ventricle, to which it is attached.

The bones of the skull-vault are thicker than is usual in Lions of this age; and the skeleton generally presents the appearances characteristic of rickets.

The companion Lion still lives in the Gardens, and there is little reason to doubt that it is similarly affected, for it is paraplegic and can only manage to drag itself a few paces. The head is occasionally drawn to one side, and at intervals oscillates from side to side in a rhythmic manner.

So far as I am aware, the present is the first account of this singular affection that has yet been published, but there is little doubt that if looked for other specimens will turn up. The abnormality is an excellent example of disease modified by anatomical peculiarity.

There is a widespread notion that in the human subject marriages of consanguinity often result in the production of offspring with physical defects. A good deal of evidence can be adduced in support of this opinion. In animals little can be urged in its favour. In them, on the other hand, hybrid offspring are most prone to exhibit congenital defects. The following is a case in point.

In February a female goat gave birth to two kids, the result of a cross between the Common Goat and a Goral Antelope. The kids were dead when born, and each presented enormous enlargement of the thyroid gland. There was general dropsy, affecting not only the subcutaneous tissue of the body, but giving rise to ascites and hydrothorax. The enlargement of the glands was such as is seen in the common form of goître. The disease was not associated with defects in the bones which have been recorded in the calf under the name of sporadic cretinism.

A specimen of overgrowth occurred in the hind feet of a Coati; they are represented in my drawing (fig. 4). The animal suffered from phimosis and suppuration of the scrotum, which prevented it from freely moving about. As a result the papillæ of the callous pad have become enormously overgrown, and in one foot project posteriorly in the form of a blunt spur. These overgrown papillæ cause the feet to assume an appearance similar to the pads on the toes of an Ostrich.

On examining the feet of other Coatis confined in the Gardens, I find that all present on each hind foot, along the inner border, a collection of overgrown papillæ similar to those just described, but by no means so extensive. Whether this overgrowth of papillæ in this situation is found in the wild state I am unable to say, but in Coatis which have been long in confinement it is larger than in those recently added to the collection. The length and extent of this abnormal papillary area, in all probability, depends upon diminished usage of the foot—an inevitable result of captivity.

It is well known that Cows living upon bogs or marshy land are very liable to suffer from overgrowth of the hoofs; the same holds good for Horses. Thus, in a specimen of a Horse's manus preserved in the museum of the Royal College of Surgeons, the overgrown hoof measures from the heel to the tip nearly 12 inches. The feet from which the drawings in fig. 5 were taken belonged to a Goat which, for some time preceding its death, had lived in a muddy paddock. The longer hoof measures no less than 14 inches round the curve, the shorter one 9 inches. They are, so far as I am aware, the longest examples of overgrown hoofs yet recorded.

Fig. 4.

Abnormal growth of papillæ on the hind feet of a Coati.

Fig. 5.

Two Goat's feet with overgrown hoofs. One measures 14, the other 9 inches round the greater curve.

2. On the Arm-glands of the Lemurs. By J. Bland Sutton, F.R.C.S.

[Received February 25, 1887.]

In 1884 Mr. Beddard made a communication to this Society, "On some Points in the Structure of *Hapalemur griseus*"[1]. In this paper attention was drawn to a very singular patch of spines on the flexor aspect of the forearm, represented in the accompaning drawing (fig. 1).

Fig. 1.

The forearm of *Hapalemur griseus*, showing the patch of spine-like processes and the tuft of hairs.

In a postscript to his paper Mr. Beddard was able to state that this collection of spines was not a sexual character, but exists in both sexes of *Hapalemur griseus*, while it is unrepresented in *Hapalemur simus*. Mr. Beddard applied for information to Dr. Jentink and to Prof. A. Milne-Edwards. These gentlemen very kindly examined the large series of examples of the two species preserved in the Museums of Leyden and Paris, and found that *Hapalemur griseus* is distinguished from *H. simus* by a patch of spines upon the arms, which, however, shows certain differences in the two sexes. In the females the spines are replaced by hairs, but the patch as a whole is quite distinct from the rest of the integument of the arm. Dr. Jentink furthermore directed his attention to a possibly similar structure (a climbing-organ?) upon the arm of *Lemur catta*, which has the form of a horny outgrowth somewhat like the spur of a cock. At the time Mr. Beddard was engaged in dissecting *Hapalemur* he kindly afforded me every opportunity for examining this curious structure on its forearm. This part in question Mr. Beddard describes thus:—

[1] See P. Z. S. 1884, p. 391.

"On the inner side of the forearm close to the wrist is an oval patch of spine-like processes, about one inch long and one third of an inch broad in the middle. The spines are longest in the middle portion of the patch, and decrease in length towards both extremities. Examined with a hand-lens they present the appearance of being composed of a number of fine threads closely bound

Fig. 2.

The forearm of *Chirogaleus coquereli*, showing the tuft of long hairs. The larger one is the forearm of *Lemur catta*, showing the raised patch of hairless skin covering the collection of sweat-ducts. The tuft of long hairs is also shown.

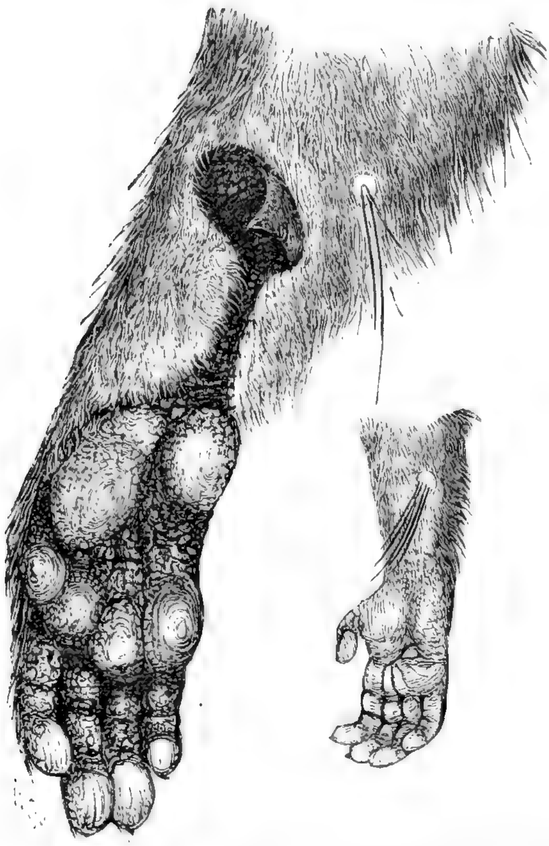
together; the extremity of the spines is blunt, and the longer ones are somewhat curved and overlap each other. The patch of integument which bears these spines is sharply marked off from the surrounding integument, and no transitional forms between the hairs of the general body-surface and these peculiar spines could be observed." When the skin of the arm was removed an oval gland of the size and shape of an almond corresponded to this patch of spines on both arms, but no duct could be detected in connexion with the gland.

These observations possessed for me extreme interest, for I felt assured that the patch of spines was in reality formed by the hardened secretion of the gland underlying them. At once I began to accumulate material for an inquiry into the comb-like organ on the arm of *Lemur catta,* and was enabled to make some preliminary observations concerning it in the 'Journal of Comparative Medicine and Surgery,' New York, Jan. 1887.

The comb-like organ on the arm of *Lemur catta* may be thus described:—

It is situated about two inches above the wrist-joint, on the flexor aspect, and in a young Lemur is about three-eighths of an inch in length. It is of an oval shape, soft, compressible, and

Fig. 3.



Forearm of an adult *Lemur catta*, showing the blunt spur described in the text. The smaller figure is the arm of a fœtal *Lemur catta,* to show the tuft of long hairs.

marked with fine lines like the tip of the finger, and of a black colour. The organ is raised above the general level of the integument to the extent of an eighth of an inch. Its major axis lies in the long axis of the limb, and it is continuous with the palm of the hand by a narrow strip of black hairless skin. The organ is present in the male and female. In older Lemurs a hard callous projecting spur is seen on its inner side.

This spur or projection in *Lemur catta* resembles, on a large scale, the spines on the arms of *Hapalemur,* and I have no doubt that they both arise in the same way, viz. by exposure and subsequent hardening of the secretion peculiar to the gland; for on submitting the smooth oval patch to microscopic examination, I was delighted to find that it covered a collection of glands resembling sweat-glands, each gland being tubular and provided with a distinct duct, but occasionally two ducts would unite near the point where they opened on the patch of smooth skin. As many as fifteen of these ducts can be counted in a single fine section through the patch; therefore the number of the orifices may be estimated at somewhere about seven hundred, and in some cases perhaps as many as a thousand.

On examining the forearm of a fœtal *Lemur catta* I found a cluster of long stiff hairs associated with some large sebaceous glands and at once, though hastily, concluded that this must correspond to those which I have just described. On examining the arm of *Lemur macaco* and *Chirogaleus coquereli* some similar long hairs associated with glands were also detected. On carefully re-examining the arm of *Lemur catta*, it turned out that this peculiar gland is also represented, as seen in fig. 4, which will illustrate its appearance and situation far better than a verbal description.

The tuft of hairs with their glands occurs in all the Lemurs I have been able to examine alive in the Society's gardens and in dried skins in the Prosector's room, as well as in *Hapalemur*. Singularly it is absent in the West-African Lemur, *Perodicticus potto*.

The intention of the paper is two-fold:—1. To call attention to the glands underlying the smooth raised heap of black skin in *Lemur catta*; 2. To draw attention to the tuft of long hairs near it, and its representative in the arm of other Lemurs.

Finally I am of opinion that the spur in *Lemur catta* and the patch of spines in *Hapalemur* are formed of the dried secretions peculiar to the glands.

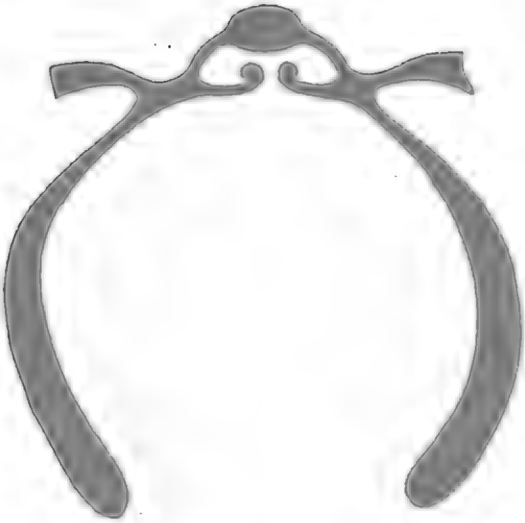
3. Contributions to the Anatomy of Earthworms.—Nos. I., II., III. By Frank E. Beddard, M.A., F.R.S.E., Prosector to the Society, and Lecturer on Biology at Guy's Hospital.

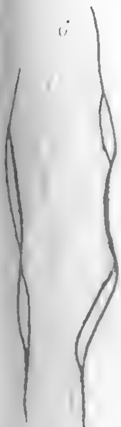
[Received April 1, 1887.]

(Plate XXXIII.)

I. On the Structure of *Eudrilus sylvicola*. (Plate XXXIII.)

Mr. W. L. Sclater has kindly presented me with a number of Earthworms which he collected in British Guiana; among these are a few specimens of a species of *Eudrilus* which proves to be new to science. The worms were carefully preserved and have proved to be in an excellent condition for microscopical investigation.





The genus *Eudrilus* was first described by M. Perrier[1], who, however, had only ill-preserved material to work at, consequently his account of the structure of the worm is imperfect; it is very evident, nevertheless, from what he has written upon the subject, that *Eudrilus* is one of the most remarkable genera of Lumbricidæ, and I was particularly glad to have the opportunity of studying its structure in really well-preserved specimens.

The most important facts which I have to bring forward in the present paper concern the structure of the female generative apparatus. In a note communicated to the 'Zoologischer Anzeiger'[2], I pointed out that Perrier's description of these organs was inaccurate—that it did not, at least, apply to the species (a native of New Caledonia) studied by myself. Perrier was right in stating that the ovary was connected with the spermatheca, and that its contents were set free by passing down the duct of the spermatheca; but he overlooked the fact that the ovary, although apparently sessile upon the duct of the spermatheca, was in reality connected with it by its own duct, a long coiled tube. This latter structure did not indeed escape the attention of Perrier; but he erroneously regarded it as a mere diverticulum of the spermatheca, and failed to make out its connection with the ovary. I was inclined to regard the species of *Eudrilus*[3], upon which my own investigations were made, as distinct from any of those which Perrier has described. On this account I held it possible, though not probable, that Perrier and myself were both right, and that the discrepancies between our observations might be explained by supposing a real difference, as regards the points at issue, between the two species. Now that I have been able to study a second species of *Eudrilus*, I am disposed to think that Perrier was entirely wrong in his description.

§ *External Characters.*

The *Eudrilus* which forms the subject of the present paper is a small worm, not measuring more than 32 millim. in length. It is remarkable for the fact that the body is built up of very few segments; I counted 44, 45, and 46 respectively in each of the three specimens at my disposal.

The *colour* of the worm is a dark bluish purple upon the dorsal surface, fading into a dull yellow upon the ventral surface.

The *setæ* are disposed in pairs, as in *Lumbricus*. I did not notice any tendency to an increased number in any of the pairs which Perrier has referred to.

The *clitellum* occupies segments 14–18 inclusive.

The *nephridiopores* are placed in front of the ventral pair of setæ; in all other species of this genus the nephridial apertures are related to the dorsal pair of setæ.

The *female generative pores* are a pair of conspicuous orifices situated upon the 14th segment, and in front of the dorsal pair of setæ.

[1] Nouv. Arch. d. Mus. t. viii. (1872) p. 71.
[2] No. 224 (1886).
[3] Proc. Zool. Soc. May 18th, 1886, p. 302.

The *male generative pores* are related to the ventral pair of setæ, and are situated upon the 17th segment.

In the position of the reproductive apertures the present species agrees with all the other species except *E. decipiens*, where the female pores are upon the 12th segment.

§ *Integument.*

The *epidermis* is covered, as in other Earthworms, by a delicate cuticle ; the cells of the epidermis are of two kinds, (1) tall columnar cells, (2) oval glandular cells (Plate XXXIII. fig. 14, *b*) : these resemble exactly the epidermic cells of other Earthworms.

In one particular the epidermis of *Eudrilus* differs from *Lumbricus*, and the majority of other genera of Lumbricidæ, and agrees with *Urochæta*, a genus with which it does not show any other marked resemblances. Between the setæ on all the segments of the body is a row of peculiar structures, which appear from the investigations of Véjdovsky to represent degenerate or abortive setæ ; they consist in each case (fig. 14, *a*) of a small spherical body darkly stained by borax carmine, which is lodged in an invagination of the cuticle. The cuticle, however, instead of forming a single layer round the central body, is split into a number of layers like the coats of an onion ; flattened deeply stained nuclei are situated between these layers. These structures are also found upon the clitellum, and they invariably lie at the base of the epidermis, just above the circular muscular layer.

The structure of the clitellum is precisely similar to that of *Lumbricus*.

The *circular muscle-layer* resembles that of other Earthworms ; numerous pigment-granules lie between the individual fibres on the dorsal side of the body.

The *longitudinal muscular coat* shows the bipinnate arrangement of its fibres which Claparède [1] was the first to describe in *Lumbricus*. This fact is worth mentioning, inasmuch as it is unusual in Lumbricidæ ; in by far the majority of instances the longitudinal muscle-layer does not show this bipinnate arrangement. I should remark that in the anterior region of the body, *Eudrilus* does not show the characteristic bipinnate disposition of its fibres.

§ *Alimentary System.*

The most interesting feature about the alimentary canal relates to the calciferous glands, which are, in many respects, rather different from those of other Lumbricidæ. The other subdivisions of the alimentary tract are of no special interest, and do not differ materially from those of the more typical genera, such as *Perichæta*. I may state that I have not observed any traces of a *typhlosole* ; the absence of this structure, which is generally present in Earthworms, allies *Eudrilus* to *Pontodrilus*. Nor are there in the present species intestinal glands such as those which are characteristic of *Eudrilus*

[1] Zeitschr. f. wiss. Zool. 1869.

boyeri[1]. The occurrence of such glands, however, is no more remarkable than their absence, and other genera are known (*Acanthodrilus*) in which such glands may be absent or present.

The *calciferous glands* are present to the number of a single pair in segment 12; these glands are lobed, the furrows running parallel with the long axis of the body; they are lateral in position, but extend dorsally above the level of the œsophagus. The structure of these glands is closely similar to that which is found in other Earthworms; they appear to be rather small in size compared to what they are (for example) in *Acanthodrilus*[2]; in the species of the latter genus investigated by me, the glands nearly fill up the body-cavity of the segments that contain them; they are very far from doing this in *Eudrilus*. M. Perrier makes no mention of the presence of calciferous glands in any of the three species studied by him.

In the tenth and eleventh segments, into which also open the funnels of the vasa deferentia, is a remarkable glandular body; this structure (Plate XXXIII. figs. 5 *a*, 6) consists of a median unpaired gland lying beneath the œsophagus, and evidently opening into it; in dissecting the worm it was necessary to raise the œsophagus, in order to bring into view these glands, which are completely hidden when the œsophagus is left *in situ*. These glands differ in their general appearance, as well as in their position, from the calciferous glands of the twelfth segment, but do not differ in minute structure. The accompanying figure (fig. 3) illustrates the minute structure of one of these subœsophageal glands; the section has been made through the œsophageal orifice, which is very wide. The lining epithelium of the gland differs in its character from the epithelium of the œsophagus, but there is no abrupt break between the two; the epithelium lining the gland gradually passes into the epithelium of the œsophagus. The epithelial cells of the œsophagus are tall and columnar in form, very narrow at the base, and but slightly wider at the distal extremity; on the other hand, the epithelium of the gland is composed of low cubical cells; the lining membrane of the gland is thrown into a series of folds which anastomose here and there; each fold contains a core of connective tissue in which are blood-vessels. The outer walls of the gland are of course in continuity with the muscular walls of the œsophagus, but their thickness is very considerably less. The serous coat of the œsophagus, as of the alimentary tract generally, is formed by a single layer of tall, pear-shaped peritoneal cells—the so-called "hepatic cells" (fig. 3, *p*); these cells, as in other Earthworms, contain numerous olive-brown, highly refracting particles in their interior. The fact that the base of the cell, where it is in contact with the wall of the alimentary tract, is prolonged into a stalk, which is hyaline and devoid of granules, and which rests directly upon the circular muscular layer, the longitudinal fibres being developed between the bases of the cells, probably gave rise to the erroneous supposition that these cells were glandules opening into the alimentary tract. This serous layer is continued over the

[1] P. Z. S. 1886, p. 302. [2] P. Z. S. 1885, p. 811.

subœsophageal gland, but the cells become smaller and more flattened, although they still contain the peculiar yellow granules.

The vascular channels in the walls of the subœsophageal glands appeared to be less developed than in the calciferous glands; I am disposed, however, to think that this was due to accidental causes. As shown in the figure (Plate XXXIII. fig. 3) the contractile "heart" of this segment (*h*) gives off almost immediately after its origin from the dorsal vessel a conspicuous thin-walled vessel (*h'*) on either side, which passes round the œsophagus, and ends upon the surface of the subœsophageal gland; it is doubtless concerned with the blood-supply of the gland.

§ *Vascular System.*

The principal vascular trunks correspond to those of most other intra- and post-clitellian worms; in the œsophageal region there are five longitudinal trunks (I did not observe any lateral vessel), viz. (1) dorsal vessel, (2) supra-intestinal, (3) infra-intestinal, (4) supra-nervian, and (5) subneural. There are five pairs of "hearts" encircling the œsophagus: the first of these lies in segment 8, and connects the dorsal with the supra-nervian vessel; the lateral hearts of segments 10, 11, and 12 are also connected with the supra-intestinal trunk: this did not appear to be the case with the heart of segment 9, although I am not perfectly certain about the point. The walls of the first four pairs of hearts are very muscular and thick; this is not the case with the hearts of segment 12, which are chiefly concerned with the blood-supply of the calciferous glands of this segment.

It is worth pointing out that *Eudrilus* agrees closely with *Thamnodrilus* (see P. Z. S. 1887, pt. i.) in the number of hearts, and in the fact that the three posterior are intestinal hearts, communicating as they do with the supra-intestinal vessel.

The ventral œsophageal glands are supplied (see fig. 3) by a blood-vessel which leaves the supra-intestinal and dorsal trunk; the blood is collected from these glands, and from the walls of the œsophagus generally into the subintestinal vessel.

The supra- and subintestinal vessels are well developed in the region of the œsophagus, being chiefly concerned with the blood-supply of its walls. Each of the vessels (figs. 5, 6, 7) bifurcates in the neighbourhood of the subœsophageal glands.

§ *Nephridia.*

The occurrence of these organs has already been noted by Perrier, who does not, however, give any account of their anatomy.

His division of the Intraclitellians into two groups, which are characterized by the dorsal or ventral position of the nephridiopore, is clearly inadmissible, since the present species agrees with *Titanus* and differs from other species of *Eudrilus* in the fact that the nephridia open by the ventral pair of setæ.

The nephridium itself (fig. 17) consists of a tubule of the ordinary structure and coiled upon itself in a very complicated fashion; the greater portion forms a tuft situated in the neighbourhood of the ventral pair of setæ (*c*), between these and the nerve-cord; the distal extremity of the tubule opens by the ordinary funnel-shaped aperture (*a*) into the next segment in front.

The excretory tubule then widens out, and forms a section (*b*) which presents a close structural agreement with that lettered (*d*) in my figures of the nephridia of *Thamnodrilus*[1]; this opens into the distal section of the organ (*a*) which runs parallel with the last; its walls appear to contain a few muscular fibres. A histological account of the several regions of the nephridium is deferred for the present.

§ *Generative Organs.*

Female Generative Apparatus.—I have investigated the structure of the female generative organs by dissection as well as by means of transverse and longitudinal sections through the region of the body which they occupy. The excellent state of preservation of the specimens enables me to add some few facts to those which I have already published[2] concerning the anatomy of the female reproductive organs. I have also been able to observe some facts bearing upon the development of the ovarian ovum, but these I propose to make the subject of a separate paper.

The main facts with respect to the anatomy of the female reproductive organs stated in my former papers, I am able to confirm from the study of the present species. In *E. sylvicola* as in *E. boyeri* (and probably in all other species) the ovary is continuous with a much-coiled duct with ciliated lining epithelium and muscular walls (Plate XXXIII. fig. 12); this opens on to the exterior in common with a large spermatheca, upon the duct of which a small gland is sessile.

A dissection of the present species shows that the female reproductive organs, although opening on to the exterior in the 14th segment, occupy both this and the 13th segment; the mesentery between the two segments is apparently absent. An examination of a series of longitudinal sections shows that the mesentery is not entirely aborted; the large spermatheca lies in both segments, and the mesentery dividing them is attached to the sides of the spermatheca; lower down (see woodcut, fig. 1, p. 381) the mesentery, when present, divides off the ovary, which lies in the 14th segment, from the oviduct, the greater part of which lies in the 13th segment, and from the glandular diverticulum of the spermatheca which lies in the same segment (*sp*, fig. 1). Since the female generative aperture lies in the 14th segment as well as the ovary, it is clear that the oviduct, the greater part of which lies in the 13th segment, must perforate the intersegmental mesentery twice.

It is clear from my sections that the relative positions of the ovary and its duct are precisely the reverse of that which is indicated in

[1] Woodcuts, figs. 5, 6, P. Z. S. 1887 (pp. 160, 161).

[2] Zool. Anzeiger, Bd. ix. p. 342; P. Z. S. 1886, p. 202; Proc. Roy. Soc. Edinb. no. 122, p. 6.

Perrier's figure (*loc. cit.* pl. ii. fig. 26); Perrier places the ovary in the same segment as that which contains the external orifice, and is so far in accord with myself; but the oviduct is represented as lying behind the ovary instead of in front of it.

In one of the two specimens which I investigated by means of sections, I found a body corresponding exactly in position to the ovary in the majority of Lumbricidæ; a pair of small cellular bodies exist on the anterior mesentery of segment 13 near to the ventral median line; these bodies are composed of small indifferent cells, and resemble very closely the testes of the same worm; each of these is surrounded (Plate XXXIII. fig. 4) by a muscular sac which is continuous with a duct; the duct appears to open into the duct of the spermatheca opposite to the orifice of the glandular diverticulum; I succeeded in tracing it forward nearly to this point, but did not observe its actual orifice. The cellular body was attached to the mesenteric wall, and was entirely free from its enveloping muscular sac; this fact, as well as the evident immaturity of the gland, naturally suggested that the connection with the duct was secondary. Three were no traces of cilia in the duct. These glands occupy a position exactly corresponding to that of the testes, *i. e.* just above the ventralmost setæ, while the ovary of segment 14 has a similar relation to the dorsal setæ (see woodcut, fig. 1, p. 381).

It might easily, therefore, be suggested that the structure on the 13th mesentery is the true ovary, and that the supposed ovary in the next segment is really the equivalent of the receptaculum ovorum. The position of the different organs referred to is in accord with such an interpretation; that is to say, their position so far as concerns the segments which they occupy. The position of the several structures within the segment, however, differs: the glandular body of the 13th segment corresponds exactly with the testes (see below, p. 381, fig. 1); a straight line connecting the testes and the glandular body of the 13th segment would run exactly parallel with the long axis of the body; on the contrary the ovaries of the 14th segment are placed much further away from the ventral median line of the body, and are placed not very far from the female generative pore.

This alteration of position, however, may have been produced during the growth of the ovary and its duct; and in any case it is a fact which may be used with equal force as an argument either for or against the supposition that the ovaries of segment 14 are ovaries or receptacula. The principal arguments in favour of regarding the ovaries of segment 14 as real ovaries are:—

(1) The fact that the ova undergo their whole course of development in those bodies; indifferent germinal cells can be traced through all the intermediate stages into fully developed ova. The *receptacula* of other Earthworms, on the contrary, contain only adult or nearly adult ova.

(2) The presence of rudimentary ovaries (?) in segment 13, whose structure and relation to their duct suggests how the continuity between the supposed ovary and its duct of segment 14 may have been

brought about. The adult structure of the supposed ovary of segment 14 might otherwise be regarded as an exaggeration of the partial continuity of the receptaculum ovorum and the oviduct which exists in *Lumbricus* &c.[1]

The continuity between the oviduct and the ovary is a fact of some little importance in the comparative morphology of Annelids. In no other form that I am aware of is there a similar connection between the gland and its duct, the two being invariably separate. There is therefore a difference between *Eudrilus* and other Lumbricidæ, like that which exists between *Lepidosteus* and many Teleosteans on the one hand, and *Osmerus* and *Amia* on the other[2]. It may also be remarked that, at any rate in this particular, it is impossible to draw a hard-and-fast line between the Hirudinea and Annelida: hitherto the Hirudinea have been regarded as differing from Annelids in the possession of what have been termed "tubular ovaries," where the duct was supposed to be an outgrowth or continuation of the gland itself. Recently Nussbaum[3] has stated that the reproductive organs in certain Hirudinea are developed independently of their ducts, which have a resemblance to nephridia.

It is plain therefore that in this case, at any rate, the distinction between tubular and other ovaries falls to the ground. It is interesting to note that the condition which is characteristic of the Leech may also occur in a Chætopod.

Male Generative Apparatus.—In spite of the fact that Hering[4] clearly demonstrated the true testes of *Lumbricus*, and distinguished them from the vesiculæ seminales, the latter structures have until very lately been called "testes." The rediscovery by Prof. Bourne[5] of the testes of the common Earthworm, and a number of subsequent researches, particularly those of Dr. R. S. Bergh[6], have firmly established the exactness of Hering's statements. With regard to exotic genera of Lumbricidæ, however, our knowledge is still very imperfect. The fact that the so-called "testes" are, in the majority of forms, apparently unconnected with the funnels of the vasa deferentia, and the frequently racemose structure of the former bodies, has probably influenced those writers who have (in my opinion erroneously) described the vesiculæ seminales as "testes." Dr. Horst appears to be the first who has noticed the true testes in any post-clitellian or intra-clitellian Earthworms; in his account of the anatomy of *Perichæta*

[1] It is quite impossible to regard this body as a receptaculum, containing as it does indifferent cells, unless it be admitted that the receptaculum coincides in position with the ovary, as in the case of the testes and vesiculæ; in this case the continuity of the duct and the sac which envelops the ovary will have to be regarded as secondary. I am quite disposed to regard this as a possible view, but it does not affect the anatomical fact of the continuity of the ovary and its duct in the adult condition.

[2] "Contributions to Morphology. Ichthyopsida.—No. 2. On the Oviducts of *Osmerus*; with Remarks on the Relations of the Teleostean with the Ganoid Fishes," P. Z. S. 1883, p. 132.

[3] Zool. Anzeig. Bd. viii. p. 181.

[4] Zeitschr. f. wiss. Zool. Bd. viii. (1852).

[5] Quoted by J. E. Bloomfield, Quart. Journ. Micr. Sci. 1880.

[6] Zeitschr. f. wiss. Zool. 1886; Zool. Anzeig. 1886, p. 231.

indica[1] this naturalist plainly perceived that the structure of the male generative glands in *Perichæta* was essentially similar to that of *Lumbricus*. Mr. Benham[2] was also able to discover the true testes in *Microchæta*, situated on the anterior wall of the segments which contain them, and enclosed in a common sac with the vesiculæ seminales and the terminal funnels of the vasa deferentia. More recently Dr. Bergh[3] has given a full account of the male reproductive organs of *Perichæta*, which establishes without any doubt the correctness of Horst's observations.

In *Eudrilus* there are three pairs of white glandular-looking bodies in segments 10, 11, and 12, which evidently correspond to the structures termed testes by Perrier in his notes on the anatomy of this genus[4]. In the dissected worm these bodies were very friable; and for that reason I have found it impossible to give an accurate idea of their naked-eye appearances. These bodies are not testes, but vesiculæ seminales; their structure resembles that of the vesiculæ seminales of *Lumbricus* (fig. 11, *a*); they consist of a delicate fibrous network of trabeculæ, in the compartments of which are lodged the developing spermatozoa. In the case of the two anterior pairs of vesiculæ seminales, the fibrous sheath of the organ was found to contain (fig. 2, *t*) a small irregularly-shaped body composed of small uniformly-sized cells; these bodies were attached firmly to the ensheathing fibrous tunic, and at one point the fibrous tunic was seen to be continuous with the intersegmental septum close to the nerve-cord; and here the cellular body appeared to be attached also to the mesentery. These two pairs of organs seem to be without doubt the true *testes*. Their position, attached to the anterior wall of segments 10 and 11, as well as their enclosure by the tunic of the vesiculæ seminales, is entirely in favour of such an identification.

In both the 10th and 11th segments the vesiculæ seminales were united by a median unpaired region, lying beneath the alimentary tract and enclosing the ventral blood-vessel, but not the nerve-cord; it is with this portion of the vesiculæ that the funnels of the vasa deferentia are connected, as will be described shortly. In the case of the anterior pair of vesiculæ this median region was closely packed with bundles of developing spermatozoa; the median region of the 11th segment, on the contrary, was nearly empty of developing spermatozoa.

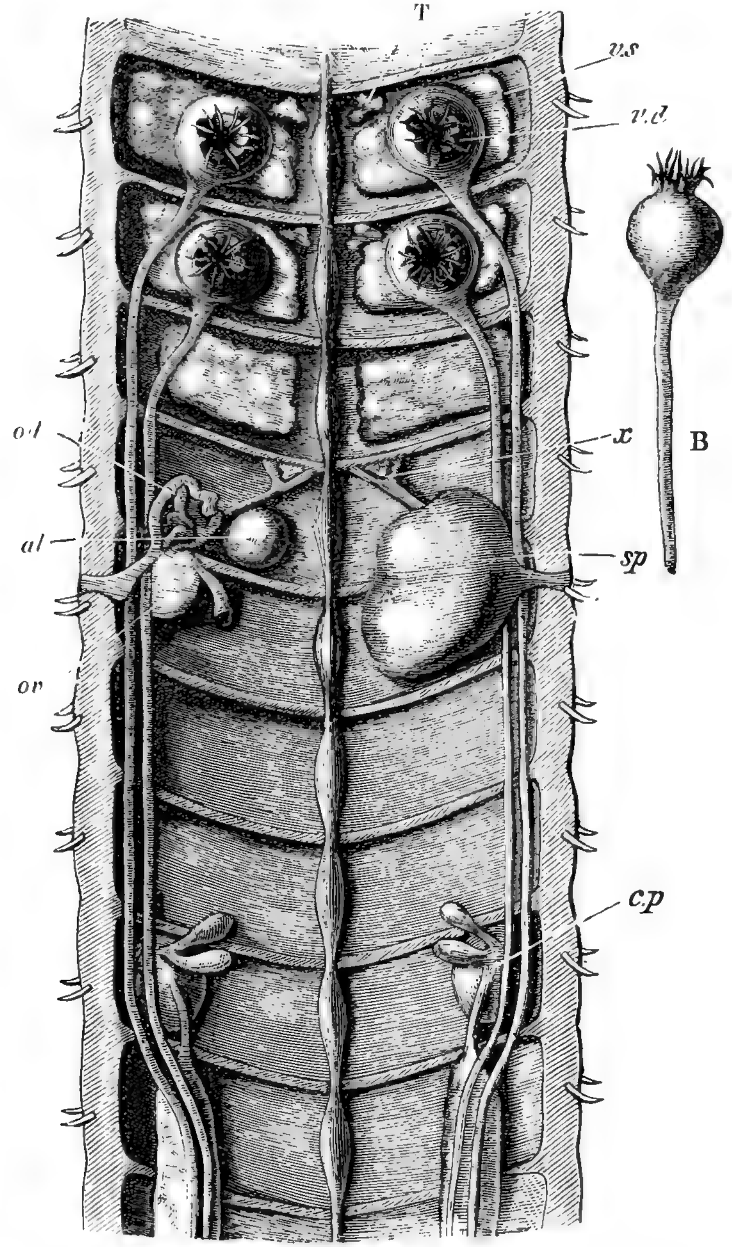
The two vesiculæ of the 12th segment do not enclose any testis; they appear to be unconnected with the vesiculæ of the two anterior segments; they are in all probability, however, to be regarded as outgrowths of the latter, and not as constituting an independent third pair of vesiculæ.

It is important to notice that *Eudrilus*, although so abnormal in the structure of the female generative apparatus, conforms to the ordinary type in the structure of the male generative organs. The facts detailed above, coupled with the researches of Horst, Benham,

[1] Niederl. Archiv f. Zool. Bd. iv. (1877–78).
[2] Quart. Journ. Micr. Sci. vol. xxvi. (new series.)
[3] *Loc. cit.* [4] *Loc. cit.*

and Bergh, appear to render it extremely probable that in other Lumbricidæ the structures generally described as testes will ultimately prove to be vesiculæ seminales.

Fig. 1.



Dissection of genital region of *Eudrilus sylvicola* (diagrammatic).

T, testis; *v.s*, vesicula seminalis; *v.d*, vas deferens; *x*, rudimentary ovary; *sp*, spermatheca; *ov*, ovary; *od*, oviduct; *al*, "albuminiparous" gland; *c.p*, bursa copulatrix; B, funnel of vas deferens, lateral view.

In the present species, as well as in *Eudrilus boyeri* [1], the 10th and 11th segments are occupied by a pair of thin-walled vesicles (woodcut, fig. 1), situated close to each other on either side of the nerve-cord and largely concealed by the superjacent vesiculæ seminales. These vesicles in both species alike were filled with a chalk-white mass, which rendered them far more visible than they would have been if void of contents. In *Eudrilus boyeri* I was unable to ascertain the nature of these structures, and accordingly have not referred to them in my notes on the anatomy of that species. M. Perrier gives no description or figures of any such structures in his species of *Eudrilus*. I was at first inclined to regard these structures as spermathecæ, with which they have not a little resemblance; my sections, however, show that they are really the much-dilated extremities of the vasa deferentia just before they open into the funnel.

Fig. 11 (Plate XXXIII.) illustrates a transverse section through one of these structures, and shows the continuity between the cavity of the vesicle and the terminal funnel. The funnel of the vas deferens is (fig. 11, *c*), as usual, a much plicated membrane, composed of ciliated cells with an underlying layer of muscular fibres, among which are numerous blood-capillaries; the terminal vesicle of the vas deferens (fig. 11, *b*) has exactly the same structure; it is lined by a single row of cubical ciliated cells; in the interior of each of these is a distinct nucleus. Outside the layer of ciliated cells is the muscular coat, composed of fibres running in different directions; the thickness of the muscular coat is not much greater than that of the cellular layer. The anterior pair of vasa deferentia funnels, as shown in the figure (fig 11), project into the interior of the vesicula seminalis; there is, however, a space left between the masses of spermatophores and the ciliated cells; the whole of the vesicle of the vas deferens, with the exception of the under surface, is completely surrounded by the vesicula seminalis; the delicate fibrous wall of the latter appears to be here in actual contact with the muscular wall of the vesicle; there is, at any rate, no space left between the masses of spermatophores and the wall of the vesicle. The posterior pair of vas-deferens funnels appear at first sight to be completely free from all connection with the vesiculæ seminales of their segment. The vasa deferentia, however, do not open freely into the body-cavity, but into a delicate fibrous sac (which encloses the ventral blood-vessel, and is consequently perforated by the lateral "hearts" of this segment, which unite the ventral with the dorsal vessel). This sac is median and unpaired; it is connected with a short diverticulum on either side, which contains the testis; groups of spermatophores are found in the interior of the sac; and although I have not succeeded in tracing its continuity with the vesiculæ seminales, I have little doubt that the separation is only secondary, if not altogether accidental; it corresponds to the median portion of the vesiculæ in segment 10. The vasa deferentia remain separate for the whole of their course; the two vasa deferentia of each side only become united within the tunic of the prostate gland. They are furnished with an unusually

[1] P. Z. S. 1886, p. 302.

well-developed muscular coat (fig. 11, *b*); the lining epithelium is ciliated throughout.

The terminal apparatus of the male generative system in *Eudrilus* is extremely unlike what is found in other Earthworms. It has been already partly described by Perrier and by myself; but these descriptions refer only to the rough anatomy of the organs, and not to the minute structure. With regard to one point there is some discrepancy between Perrier's account and my own, and that is the termination of the vasa deferentia. These tubes, as already stated, are remarkable for the fact that they possess a thick muscular coat, which is wanting in the vasa deferentia of other Earthworms; the two vasa deferentia, instead of uniting to form a single tube, as they do in the majority of Lumbricidæ (in all except *Acanthodrilus*), remain distinct and open separately into the terminal region of the prostate gland. M. Perrier has figured (*l. c.* pl. ii. fig. 26, *a*) a *single* vas deferens opening into the muscular sac of the penis in *Eudrilus decipiens*; and there are no statements in his paper which would lead to the inference that in the two other species there was a difference in respect of these organs. Towards their distal extremity the vasa deferentia increase notably in diameter (*cf.* figs. 1, 16).

In *Eudrilus boyeri* I found the important difference in the vasa deferentia and in their relation to the terminal apparatus that has been just referred to, and which is fully described and figured in my paper upon that species; and I am now in a position to state that in *Eudrilus sylvicola* the arrangement of these organs is precisely similar. This fact renders it probable, in my opinion, that the structure of the terminal apparatus of the male sexual organs in *Eudrilus* generally is closely similar to that of *E. sylvicola*, which is now to be described in detail.

On opening the body of the worm the conspicuous prostate glands are to be seen, which extend back from their opening into the bursa copulatrix of the 17th segment for some way. M. Perrier rightly points out the nacreous appearance of this organ, which only resembles the prostate gland of other Lumbricidæ by its position:—" mais qui ne présente en aucune façon l'aspect glandulaire de ces dernières." An investigation of the structure of this sausage-shaped body shows very plainly that it is of a glandular nature and that it resembles in many points the prostate glands of other Earthworms. The glandular nature of the organ is, however, masked by the very great development of its muscular layers, which give to it the peculiar nacreous appearance which is so characteristic. A study of the organ by means of transverse sections (see Plate XXXIII., fig. 13) shows that these muscular layers together form a coat of very considerable thickness; by far the greater part is occupied by the longitudinal fibres, the transverse fibres forming a very delicate layer within these. The glandular tissue of the organ is divided into two layers, which agree very closely in structure with the prostate glands of *Acanthodrilus*, and also present an unmistakable resemblance to the epidermis of the clitellum. The inner row of cells which surround the lumen of the gland are narrow, elongated, highly granular cells; the rest of the epithelium of the gland is composed of glandular cells, rounded and swollen at the base and terminating in a fine slender duct; there are numerous rows of these cells. The lumen of the gland for the posterior half is triangular (Plate XXXIII. fig. 8); further forward (fig. 9) it becomes cross-shaped. In the posterior half of the prostate, however, the gland is divided into two tubes, which are quite independent of each other: rather behind the point at which the vasa deferentia perforate the coats of the prostate the inner circular muscular layer of the gland is deflected inwards (see fig. 10), and cuts up the interior into two parallel chambers; the one contains the continuation of the lumen of the prostate which has just been described, while the other contains at first merely a mass of glandular cells cut off from the outer layers of glandular epithelium by the invasion of the circular muscular layer. Presently a lumen is developed in this part of the gland, which has a crescentic outline; there is absolutely no continuity at this end between the two tubes; the lining epithelium of the second tube ultimately comes to resemble in every particular that of the principal tube; there is no external indication of the division of the prostate into two parallel tubes; the section of the whole organ is an unbroken ellipse. Where the vasa deferentia perforate the walls of the prostate the second tube is already established; the vasa deferentia make their way separately through the muscular coats of the gland, losing their own special muscles: the vasa deferentia become very fine tubes, which are not easy to recognize; they appear to become united in the circular muscular coat of the prostate into a single tube which passes along the muscles dividing up the interior of the prostate; the vas deferens then becomes continuous with the prostate gland, but with the original portion of the gland, and not with the second tube. Theoretically one might suppose that each vas deferens opened into a separate part of the prostate, and that the division of the latter corresponded to the separation of the vasa deferentia; I cannot, however, find any evidence that this is the case.

Each of the two portions of the prostate becomes continuous with a narrow tube that leads to the penis (see fig. 15); in correspondence with the difference in size between the two portions of the prostate, the outermost of the two tubes leading to the penis is smaller than the inner. A little before they enter the penis the two tubes join into a single tube.

The *penis* (*p*, Plate XXXIII. fig. 15) is a muscular process of the walls of the bursa copulatrix; it contains a median canal, which is continuous with the lumen of the duct of the prostate gland. The internal canal of the penis, however, does not alone communicate with the vas deferens; towards the base of the organ, *i. e.* towards its base of attachment to the walls of the bursa, it bears a longitudinal groove, which shortly becomes closed in and forms a canal, ultimately opening into the canal of the penis; there is therefore an open communication between the vas deferens and the interior of the bursa copulatrix; in fact, in the specimen which I studied by means of transverse sections, a mass of spermatozoa partly filled up the canal leading from the internal lumen of the penis to the exterior of the organ. These points are illustrated in the diagrammatic drawing of these parts (fig. 15).

Next to the extraordinary complicated structure of the terminal section of the male generative ducts, the most remarkable fact about these organs in *Eudrilus* is the muscular coat of the vas deferens. In so far as I am aware, there is no Earthworm in which these tubes consist of more than a ciliated cubical epithelium surrounded by a delicate peritoneal investment; the muscular coat of the vas deferens is another point of resemblance to the Leech.

Besides the "prostate" gland, the copulatory apparatus is furnished with another structure—the Y-shaped appendage of Perrier. This body has been correctly stated by Perrier to open into the bursa copulatrix, although his dissections did not enable him to demonstrate its precise relations. In my paper on the anatomy of *Eudrilus boyeri* I stated that the duct of the Y-shaped gland opened into a cushion-like outgrowth of the bursa copulatrix, which Perrier has figured (*l. c.* pl. ii. fig. 27). I find that in the present species the structure is the same. The body in question in *E. sylvicola* appears to be invariably Y-shaped (fig. 15); the two arms of the Y never join at their extremities to form a horseshoe-shaped tube, as is stated by Perrier to occur in his species and by myself in *E. boyeri.* The two arms of the Y remain separate for only a short distance, when they become united into a single tube, which passes through the pad-like outgrowth of the walls of the bursa, and opens at its extremity into the interior of the bursa. The structure of the Y-shaped body is illustrated in Plate XXXIII. fig. 15; its walls are very thick and muscular, and the narrow lumen is lined by a somewhat flattened epithelium; the extreme development of the muscular layers as compared with the epithelial lining rather suggests that its function is not that of a gland. Although the duct of the Y-shaped appendage opens freely into the interior of the bursa, it is really practically continuous with the lumen of the penis; the pad which bears the terminal orifice of the Y-shaped appendage projects so far into the interior of the bursa as nearly to occlude its lumen; only a narrow space is left between the pad and the penis, and this communicates directly with the lumen of the penis by the orifice already referred to above under the description of the penis.

The pad itself is very muscular, and it is easy to imagine that by appropriate contraction of its walls the duct of the Y-shaped appendage might be brought into actual continuity with the interior of the penis. I have no facts at my disposal which enable me to state positively what is the function of the Y-shaped appendage, but I am rather disposed to think from its structure and relations that it serves as a seminal reservoir.

There is no doubt that *Eudrilus* differs very widely from other Lumbricidæ in the structure of the female generative apparatus, and in the terminal apparatus of the male generative organs. In spite, however, of this great divergence, it agrees very closely in other particulars with the ordinary type of structure which characterizes the

Lumbricidæ; the testes and vesiculæ seminales conform in every respect to *Lumbricus* or *Perichæta*; the position of the gizzard, the presence of calciferous glands on the posterior region of the œsophagus, the extent of the clitellum and the relations to it of the male generative apertures, all point to the resemblance of this genus to many Intraclitellian forms. The presence of the peculiar epidermic structures believed by Véjdovsky to represent abortive setæ, ally *Eudrilus* to *Urochæta* in particular among the Intraclitellians. The origin of the lateral "hearts" from the dorsal vessel, and not from a supra-intestinal trunk, is a point in which *Eudrilus* as distinctly assimilates to many Postclitellians and Intraclitellian worms.

The muscular penis of *Eudrilus* is, however, in my opinion, not to be regarded as a new structure; in many species of *Perichæta* the terminal portion of the vas deferens is a thick-walled muscular tube which can be everted, and which doubtless serves as a copulatory organ; from this condition to that which is characteristic of *Eudrilus* is not a wide step, the everted condition of the terminal section of the vas deferens being permanent in the latter genus. Another point of difference from the remaining Lumbricidæ is in the number of accessory organs which open in common with the vasa deferentia; it must be remembered, however, that the vasa deferentia retain their distinctness up to their point of opening on to the exterior, and the presence of *two* prostate glands is therefore not surprising. It is also possible that there is a similarity in this respect between *Eudrilus* and *Perichæta ceylonica*[1], only that in *Eudrilus* all the accessory male glands are concentrated, and come to open on one segment in common with the sperm-ducts.

The female generative apparatus, however, appears to be absolutely unique; there has been nothing like it described in any other Earthworm. So far as our present knowledge goes, it seems necessary to separate *Eudrilus* into a distinct family. Perrier himself has shown reasons for believing that different species of the genus may have the male generative openings either within or behind the clitellum, and in any case *Eudrilus* shows no marked affinities to any Postclitellian or Intraclitellian genera. I am unwilling, however, at present to regard *Eudrilus* as the type of a new family equivalent to either Postclitellians or Intraclitellians, and I think that Véjdovsky's plan of dividing the Oligochæta terricola into several families (Perichætidæ, Urochætidæ, &c.) is most in harmony with our present knowledge of the structure of the group.

The present species cannot be identical either with any of those described by M. Perrier, or with a fourth species recently described by myself, from New Caledonia.

It differs in the position of the nephridiopores, which open in front of the ventral pair of setæ, and not by the dorsal pair as in all the other species of the genus at present known.

If M. Perrier had not, in his description of the genus, particularly stated that the nephridiopores are developed in relation to the dorsal setæ, I should have referred this species to *E. peregrinus*.

[1] Ann. & Mag. Nat. Hist. 1886, xvii. p. 89.

Like *E. peregrinus*, the present species is a native of the continent of South America; in both the clitellum occupies segments 14–18 inclusive. M. Perrier describes in the 10th segment, "une sorte de toute petite masse glandulaire, absolument indéterminable," which may possibly be one of the median ventral œsophageal glands already described (p. 375).

II. Further Note on the Reproductive Organs of *Acanthodrilus*.

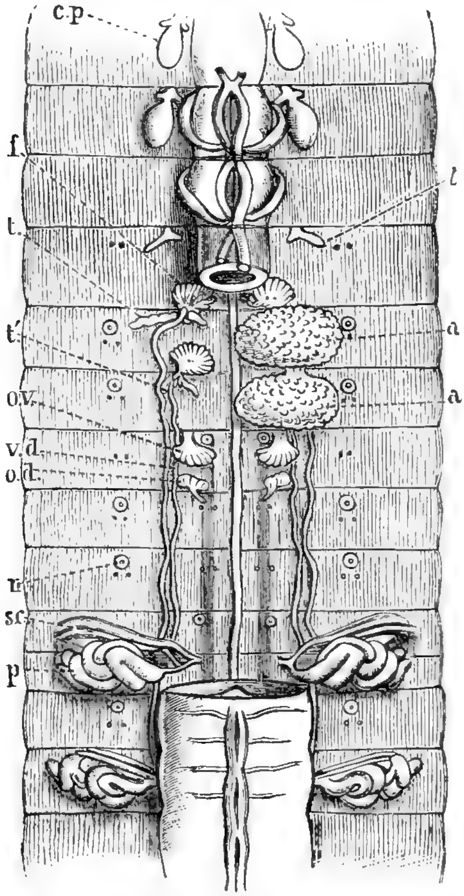
In the 'Proceedings' of this Society for 1885 I published an account of the anatomy of three species of the genus *Acanthodrilus*. On reexamining my preparations, I find that I have misinterpreted the nature of certain structures described in that paper. At the time that I wrote, hardly anything was known of the structure of the male reproductive organs in exotic Lumbricidæ; the only paper on the subject, however, appeared to show that in *Perichæta* at any rate[1] the so-called testes of Perrier and other writers were really the equivalents of the seminal vesicles of *Lumbricus*, and that the testes of the latter were represented by homologous structures. Since then Mr. Benham[2] and Prof. Bergh[3] have brought forward conclusive evidence that the structure of the male generative organs in *Microchæta* and *Perichæta* is essentially similar to those of *Lumbricus*. In both genera there are two pairs of testes, which become enveloped by the seminal vesicles. My own investigations into the structure of *Eudrilus* (*antea*, p. 380), and a genus to be described in a future paper, lead me to confirm in every point the justice of the conclusions arrived at by Benham and Bergh. In the light of these researches I have again examined the structure of the male reproductive organs in *Acanthodrilus dissimilis*, and have to make the following additions to and corrections of my former paper.

In the woodcut which illustrates that paper I have figured two pairs of glands, situated in the 11th and 12th segments respectively, and attached to the anterior mesenteries of these segments and to the vasa deferentia at the point where they perforate the mesenteries (fig. 3). I find that I have omitted both in the figure and in the description (p. 824) which accompanies it another pair of glands, which are situated on the anterior mesentery of segment 10; the accompanying drawing (fig. 2, p. 388), which is an alteration of the original woodcut, illustrates this point. The three pairs of glands are closely similar in structure to each other and to the ovaries, which occupy a similar position in segment 13. In my paper already referred to, I noted the fact that the glands which are situated in segment 12 not only agree in structure with the ovaries, but that in one specimen at any rate they contained fully developed ova. This fact (which I have since verified by a renewed examination of the specimens) led me to infer that the glands, both of this segment and of the one in front, were a rudimentary pair of ovaries which perhaps never reached maturity. In the light of recent researches—I refer to those of

[1] R. Horst, Niederl. Archiv f. Zool. *loc. cit.*
[2] Quart. Journ. Micr. Sci. 1886.
[3] Zeitschr. f. wiss. Zool. 1886.

Benham and Bergh—I am now convinced that the pair of glands in segment 11 represent the posterior pair of testes in *Lumbricus*, and that the glands in segment 10, which I record for the first time in the present communication, represent the anterior pair of testes in *Lumbricus*; it follows, therefore, that the "testes" of my former paper are the vesiculæ seminales. The glands of segment 12 now remain to be accounted for; it seems to me that the clue to the nature of these glands is to be found in Dr. Bergh's paper already referred to. Dr. Bergh describes and figures in *Lumbricus* a pair of

Fig. 2.



Acanthodrilus dissimilis. Dissection of genital region; the œsophagus has been partially removed; the vesiculæ seminales have been entirely removed from segment 10 and from the left side of segments 11, 12.

sp, spermatheca; *a*, vesiculæ seminales; *t*, testes; *t'*, additional pair of ovaries; *ov*, ovaries; *od*, oviduct; *f*, vas deferens funnel; *vd*, vas deferens; *n*, nephridial aperture; *p*, prostate; *sc*, sac containing penial setæ.

rudimentary structures in segment 12, which he regards as an anterior pair of ovaries which do not arrive in that genus at sexual maturity. The fact that in *Acanthodrilus* those glands do produce ova is, to my mind, a very strong confirmation of the correctness of Dr. Bergh's interpretation. I would also recall to the recollection of those interested in the group, the fact that *Perionyx excavatus* possesses occasionally two pairs of fully developed ovaries [1]. The correspondence between the male and female glands in Lumbricidæ is thus closer than was at one time thought; there are two pairs of testes and two pairs of ovaries, although as a general rule only one pair of ovaries arrives at sexual maturity. The occasional presence in *Perionyx* of two pairs of oviducts, if it is to be regarded as a reversion, is a further point of similarity.

It is generally believed that the Oligochæta are to be derived from ancestors resembling in certain points existing Polychæta. One of the essential points of difference between the two groups, so far as we at present know them, is the limitation of the reproductive glands in Oligochæta; in the Polychæta there is an indefinite number of reproductive glands, and most of the segments contain ovaries or testes; in the Oligochæta terricola, on the contrary, the testes are limited to two pairs[2] and the ovaries to a single pair; the occasional presence of rudimentary or fully developed ovaries in the 12th segment is evidently an intermediate step in the reduction of the generative glands.

III. Note on the Genital Setæ of *Perichæta houlleti.*

I have lately received, through the kindness of my friend Mr. W. F. R. Weldon, a large number of Earthworms collected by him during a recent visit to the Bahamas. The collection includes a species of *Eudrilus,* probably identical with one of the species described by Perrier from this quarter of the globe, and two species of *Perichæta.* The *Perichætæ* are referable to two distinct species, both of which have already been described, but have not, so far as I am aware, been recorded from the New World. One of these is *Perichæta affinis,* a species at present only known from India, China, and Luzon; it is interesting, therefore, to notice the occurrence of the same species in the West Indies. The other is *Perichæta houlleti,* recorded by Perrier from Calcutta and Cochin China, and by myself also from the former locality. The structure of this species has been described in some detail by Perrier [3], but his memoir contains no account of the peculiar modification which the setæ upon the clitellar segments undergo.

The specimens at my disposal were not in a fit condition for section-cutting, owing to an accident during their transit; but this was the less to be regretted, as the softened integument allowed the cuticle to be readily stripped off, and the setæ from different parts of the body to be examined; this usually cannot be done in well hardened examples.

The setæ, which are, of course, disposed in a continuous ring

[1] P. Z. S. 1886, p. 308.
[2] In the Limicolæ the testes may be much more numerous.
[3] Nouv. Arch. d. Mus. t. viii. (1872).

round the middle of the body, as in other *Perichætæ*, are much like those of other species on the hinder part of the body, that lying posterior to the clitellum; the setæ of the anterior segments of the body agree very closely in their shape with these, but are very much larger. On the clitellum, however, the setæ are very different in appearance; they are (woodcut, fig. 3) of very small size compared to the setæ of the anterior preclitellar segments, and terminate in a distinctly bifid extremity; the two points in which the seta ends diverge at a considerable angle from each other, but are connected by a delicate membrane. The opposite extremity of the seta, which is imbedded in the body-wall, is abruptly truncated. The whole seta has not the 8-shaped curve which is so constant a character in the group, but is curved only in one direction. As in the other setæ of the same species, and in the setæ of Earthworms generally, the middle part is somewhat thicker; but this region does not lie in the middle of the setæ but is closely approximated to the posterior extremity; the part of the seta which lies behind the dilated region is straight. The general shape of these clitellar setæ, apart, of course, from the bifid extremity, is like that of imperfectly developed ordinary setæ. That this is not really the case with these setæ is, however, clearly shown by the fact that all the setæ of the several rows comprised in the clitellum have precisely the same shape, and also by the fact that in two specimens of the worm, which were the first that came to hand, the structure of these clitellar setæ was precisely identical.

This is, I believe, the first record of any such modification of the

Fig. 3.

Clitellar seta of *Perichæta houlleti.*

clitellar setæ in the genus *Perichæta*. In *P. affinis* I have been able to satisfy myself that the clitellar setæ differ in no respect from the setæ of the general body-surface; in *P. indica* setæ appear to be altogether wanting upon the segments of the clitellum. There are, however, other species of Lumbricidæ in which there is a perfectly analogous modification of the setæ; in *Lumbricus* the clitellar setæ are distinguished from those upon the other segments of the body by being longer and thinner. In *Urochæta* one or more pairs of the clitellar setæ are larger and beset with a number of transverse notches. I have recently described an identical modification in the clitellar setæ of the closely allied genus *Thamnodrilus*[1]. Horst distinguishes[2] the clitellar setæ of *Rhinodrilus* by their greater size. In *Lumbricus* the modification of the setæ is not confined to the clitellum, but is also found in the neighbourhood of the generative orifices.

I believe that in the genus *Perichæta* no modification of the setæ at all comparable has ever been described except by myself in *P. armata* and *P. ceylonica*. The first-named species is remarkable for the fact that the terminal part of the ejaculatory duct opens on to the exterior in common with a thin-walled muscular sac, the interior of which is filled with a number of peculiar setæ, the shape of which can be best appreciated by an inspection of the figure which accompanies my memoir. *Perichæta ceylonica* is the only other species of the genus in which this arrangement is repeated, and the arrangement is practically identical with that which obtains in *P. armata*. It is perfectly clear that these sacs of penial setæ correspond in every way to the penial setæ occasionally developed in other Earthworms for example in the genera *Acanthodrilus* and *Typhœus*. In *Acanthodrilus* it is certain that penial setæ are not supernumerary structures developed only at the period of sexual maturity, but they replace the ordinary setæ of the pair which correspond to the male generative aperture.

EXPLANATION OF PLATE XXXIII.

Fig. 1. Transverse section of vas deferens; highly magnified.

2. Testis (*t*) and vesicula seminalis (*v.s*).

3. Transverse section of œsophagus and ventral gland of 11th segment. *d*, dorsal blood-vessel; *si*, supra-intestinal (double); *h*, heart; *h'*, branch supplying walls of œsophagus and gland; *p*, peritoneal coat.

4. Section through gland (rudimentary ovary?) attached to wall of 13th segment. *b*, gland; *a*, muscular tube enclosing it; to the left the tube is seen to form a bend and to be cut across twice.

5. Ventral aspect of œsophagus in segments 10 and 11, to show subœsophageal glands (*a*). Bifurcation of subintestinal vessel illustrated in this figure.

6. Lateral view of same region. Bifurcation of supraintestinal vessel, as well as subintestinal vessel, illustrated.

7. Transverse section of œsophagus in 10th segment; left-hand figure through opening of subœsophageal gland (highly magnified in fig. 3), right-hand figure in front of or behind opening of gland. Compare with figs. 5 and 6.

8, 9, 10. Transverse sections through prostate gland at various levels.

11. Opening of vas deferens funnel into vesicula seminalis. *a*, vesicula crammed with developing spermatozoa; *c*, ciliated funnel; *b*, vesicle of vas deferens.

12. Section of oviduct, to show ciliated epithelium and muscular walls.

13. A portion of fig. 8 more highly magnified. *l*, lining epithelium; *c'*, glandular cells; *m*, transverse longitudinal muscles.

14. Section of epidermis. *a*, problematical body; *b*, glandular cells.

---

[1] P. Z. S. 1887, pt. i.

[2] Notes from Leyden Museum, 1886.

Fig. 15. Diagram of terminal section of male generative apparatus; *v.d*, vasa deferentia; *p*, prostate; *pr'*, Y-shaped gland; *s*, cushion-like pad on to which latter opens; ♂ bursa copulatrix; *p*, penis.
16. Section through vasa deferentia, less highly magnified than fig. 1.
17. Nephridium; *d*, internal funnel; *m*, mesentery; *a*, muscular duct; *b*, glandular region; *c*, tuft of tubules.

4. Remarks upon the Moulting of the Great Bird of Paradise. By A. D. Bartlett, Superintendent of the Society's Gardens.

[Received April 1, 1887.]

In the second volume of 'The Cruise of the Marchesa,' by Dr. F. H. H. Guillemard (p. 340), a strange statement is made upon the authority of the inhabitants of the Aru Islands respecting the moulting and plumage of the Great Bird of Paradise (*Paradisea apoda*). It is there said that this bird, unlike its nearly allied species *P. minor*, does not wear its adult male plumage all the year, and that its beautiful plumes remain developed for not longer than two or three months.

If I had nothing but my acquaintance with the habits and life-conditions of birds to judge from, I should at once question the accuracy of these statements.

I could not readily believe that two species of birds so closely allied as these two Paradise-birds, and having the same arrangement of their plumes and the same structural peculiarities, and inhabiting the same region, could by any possibility differ so widely in this respect. It is, however, a great pleasure to me to be able to offer a very clear and well-established fact in proof of my previous conviction.

On the 1st of October, 1885, I was fortunate enough to have placed under my charge a male of the larger species *P. apoda*. The bird at that time was in the adult male plumage; the side-plumes were not so long as in the old male birds, but the feathers of the tail, together with the two long wire-like central feathers, were well developed. About the end of November the bird commenced to moult, throwing off the feathers rapidly. The head and throat soon became completely bare, the uppermost side feathers fell off first, the new feathers taking their place before the longest feathers of the plumes fell off. By the end of January the bird had moulted every feather, and the whole plumage was entirely new and beautiful. In this condition the bird was transferred on May 2, 1886, to the Zoological Gardens at Antwerp.

I feel therefore, after giving the foregoing facts, fully justified in calling in question the statement of natives and others who may be ignorant, or from some motive wilfully attempt to mislead strangers.

In conclusion I may add, so far as I am able to ascertain, the bird was the only living specimen of the species *P. apoda* ever brought to Europe.

5. Description of a little-known Australian Fish of the Genus *Girella*. By J. DOUGLAS-OGILBY, Ichthyol. Dept. Australian Museum. (Communicated by F. DAY, Esq., F.Z.S.)

[Received March 26, 1887.]

GIRELLA CYANEA,, Macleay, Descr. Cat. Austr. Fishes, i. p. 109.

B. vi. D. 14–15/13. A. 3/11. V. 1/5. P. 19–20. C. 17.
L. lat. 55–56. L. tr. 11–12/26. Cæc. pyl. num. Vert. 11/16.

Length of head $5–5\frac{1}{3}$, of caudal fin $4–4\frac{1}{2}$, height of body $2\frac{3}{4}–3\frac{1}{3}$ in the total length. *Eye*—$4–4\frac{1}{5}$ diameters in the length of the head, $1\frac{1}{2}–1\frac{2}{3}$ in that of the snout, and $1\frac{1}{2}–1\frac{3}{4}$ apart. Interorbital space convex; upper profile of head rounded. Upper jaw the longer; cleft of mouth small and transverse. The maxilla reaches to beneath the posterior nostril. The height of the preorbital is less than its breadth. Opercle with a small flat spine. Vertical limb of preopercle inclining slightly backwards from the angle, very slightly denticulated in the smaller, smooth in the larger example. *Teeth*—A single row of strong tricuspid teeth in the jaws; behind these, at some distance, a broad band of less developed but similar teeth. *Fins*—Dorsal spines of moderate strength, increasing in length to about the seventh, whence there is little or no difference to the last, which is $\frac{2}{5}$ of the length of the head; the rays are about equal to the spines in height, but the length of their base is little more than half that of the spinous dorsal; the dorsal fin commences above the 7th and ends above the 43rd scale of the lateral line; the anal commences beneath the origin of the soft dorsal, whose rays are not nearly so long as those of the anal, the third spine is much stronger and but little shorter than the highest dorsal spines; the lower margin of the anal rays is obliquely truncate; the ventral fin does not extend to the vent; the pectoral fins are rather less than the length of the head; caudal fin deeply emarginate, with acute lobes. *Scales*—moderate, finely ctenoid, firmly adherent, those on the cheeks small and deeply imbedded; streaks of small scales between each pair of the dorsal and anal spines and rays. Interorbital space, snout, orbital ring, mandibular region, and opercular bones (with the exception of a few on the upper edge of the opercle) scaleless. *Lateral line*—with a long slight curve to beneath the end of the dorsal fin; its tubes simple. *Pseudobranchiæ*—well developed. *Gill-rakers*—short and stout, numbering 28 on the outer branchial arch. The abdominal portion of the vertebral column is two thirds of the length of the caudal portion. *Colours*—Upper parts dark blue, gradually fading to greyish white on the abdominal region; some scattered yellow spots, about three fourths of a scale in size, on the upper half of the body; these probably disappear with age, since in the larger example they are few in number and faint. Fins blue. Irides brown and yellow.

This handsome *Girella* is known to the fishermen along the coast under the name of "Blue-fish," in contradistinction to its congener *G. tricuspidata*, which is the "Black-fish" of New South Wales[1]. It is considered rare by them, and must evidently be so, but two specimens having been brought to the Sydney market within the last eighteen months; both of these fortunately came into my hands, and from them when in a fresh state I have drawn up the above description. The larger specimen measured $23\frac{1}{2}$, the smaller 17 inches.

Putting aside the difference of coloration, *G. cyanea* may be at once distinguished from the common *G. tricuspidata* by the greater number of pectoral rays, the greater length of that fin, the number of scales on the lateral and transverse lines, and the much longer and differently shaped tail-fin; and the necessity for pointing these differences out is the greater that within a few hours of its capture it entirely loses its beautiful tints, even the conspicuous yellow spots, leaving not a trace behind, and becomes to the ordinary observer a "Black-fish." Without the aid of these variations the two described, though not yet a month mounted, would be indistinguishable from their congener.

Habits. These fishes appear to be partial to rocky coasts or islands surrounded by deep water, both my specimens having been obtained in such places by hook; and, so far as I have been able to ascertain, it is never taken in estuaries and lagunes, which are favourite haunts of *G. tricuspidata.*

Food. In respect to this they appear to be of an accommodating disposition, though seaweed, especially the calcareous kinds, undoubtedly form the great bulk of it, along with hydroid zoophytes[2]; but in the larger specimen there was also a good-sized squid[2] and the remains of a fish some six inches long.

Breeding. The smaller example showed no signs whatever of breeding, but the larger was a female with the ova well developed; both were caught in December.

As food. I had a piece of the larger one boiled, but found it coarse and without flavour; smaller individuals would, however, be probably found equally palatable as the "Black-fish," which, however, is not giving it much praise.

Habitat. Botany Heads and Broken Bay. Both Dr. Ramsay and Mr. W. Macleay are inclined to think that a "Blue-fish" said to be very common at Lord Howe Island is this species, but we have no example from that locality.

Finally, I shall take this opportunity of setting right any mistake which might occur through the bad wording of a note in my 'Catalogue of New South Wales Fishes,' 1886, p. 18; in the note on *G. zonata*

[1] The same trivial name being applied to different fishes in the different colonies is liable to cause confusion; for instance the "Yellow-tail" of Sydney is *Caranx trachurus*, while that of Melbourne is *Seriola lalandei*, which goes by the name of "King-fish" here, whereas the Melbourne "King fish" is a *Sciæna*.

[2] To Mr. Whitelegge I am indebted for the information that the greater part of the hydroid zoophytes belong either to *Sertularia elongata* or *Aglaophenia divaricata*; and to Mr. Brazier that the "squid" mentioned was *Sepiateuthis australis.*

the wording makes it appear as if I considered that name to be a mere synonym of *G. tricuspidata*. I had no such intention; what I meant to convey was, that Count Castelnau had mistaken the ordinary banded form of *G. tricuspidata* for *G. zonata*, which is certainly not known in this colony. Regarding this banding, which I had considered to be indicative of youth, as in the case of many other fishes, I am now at a loss, as I have seen many banded examples of equal size with the plain ones; and I am informed that the same haul of a net will frequently take equal numbers of either form, and even the fishermen, who as a rule go by colours, recognize only one species.

Since writing the above I have had an opportunity of seeing a living specimen of this beautiful fish in the Manly Aquarium; it is smaller than either of my specimens, being, I should say, about 14 inches long; is of a brighter blue all over, and has more golden spots.

6. On an undescribed Fish of the Genus *Prionurus* from Australia. By J. Douglas-Ogilby, Ichthyol. Dept. Australian Museum. (Communicated by F. Day, Esq., F.Z.S.)

[Received March 26, 1887.]

The fish which is described below belongs to a small collection obtained some years ago in Port Jackson, and measures over 15 inches. It is very distinct from our common *P. microlepidotus*, and though it agrees with *P. scalprum* in the fin-rays and profile of snout, in other points it approaches nearer to ***P. laticlavius***; I have no choice therefore but to describe it as a new species.

Prionurus maculatus, sp. nov.

B. v. D. 9/24. A. 3/23. V. 1/5. P. 17. C. 17.

Length of head $4\frac{3}{5}$, of caudal fin $5\frac{1}{3}$, height of body $2\frac{2}{3}$ in the total length. *Eye*—diameter $\frac{1}{4}$ of the length of the head, $\frac{2}{5}$ of that of the snout, and $\frac{5}{6}$ of the interorbital space, which is convex. The upper profile of the snout is very slightly concave, that of the occiput as slightly convex. Upper jaw overhanging the lower. *Teeth*—A single series of compressed pluricuspid teeth in both jaws. *Fins.*—The dorsal fin commences above the opercular angle; its spines are moderately strong, the fifth the highest, $\frac{2}{5}$ of the length of the head, the first very short; the rays are nowhere so high as the spines; the base of the spinous portion is $\frac{5}{7}$ of that of the soft. The anal fin commences beneath the last dorsal spine; its third spine is much the longest, equal to the anterior rays and almost as long as the fifth dorsal spine. The ventral fins reach to the second anal spine. Pectorals truncate behind, reaching to a little beyond the ventrals and equal in length to the head. Caudal fin emarginate. *Caudal laminæ*—a series of three keeled bony plates on each side. *Pseudobranchiæ* largely developed. *Colours*—After about five years' maceration in spirit the colours are now, rich brown with numerous round dull yellow spots, broader than the interspaces, on the head and upper half of the sides. Fins darker brown.

May 3, 1887.

Dr. Edward Hamilton, Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of April 1887 :—

The total number of registered additions to the Society's Menagerie during the month of April was 99. Of these 14 were by birth, 50 by presentation, 15 by purchase, 8 by exchange, and 12 were received on deposit. The total number of departures during the same period, by death and removals, was 97.

The most noticeable additions during the month were :—

1. Two young Polar Bears (*Ursus maritimus*), presented by Joseph Monteith, Esq., received April 16th.

2. Two Crested Ducks (*Anas cristata*) from the Falkland Islands, received April 16th, presented by Frederick E. Cobb, Esq., C.M.Z.S. This species is new to the Society's Collection of Waterfowl.

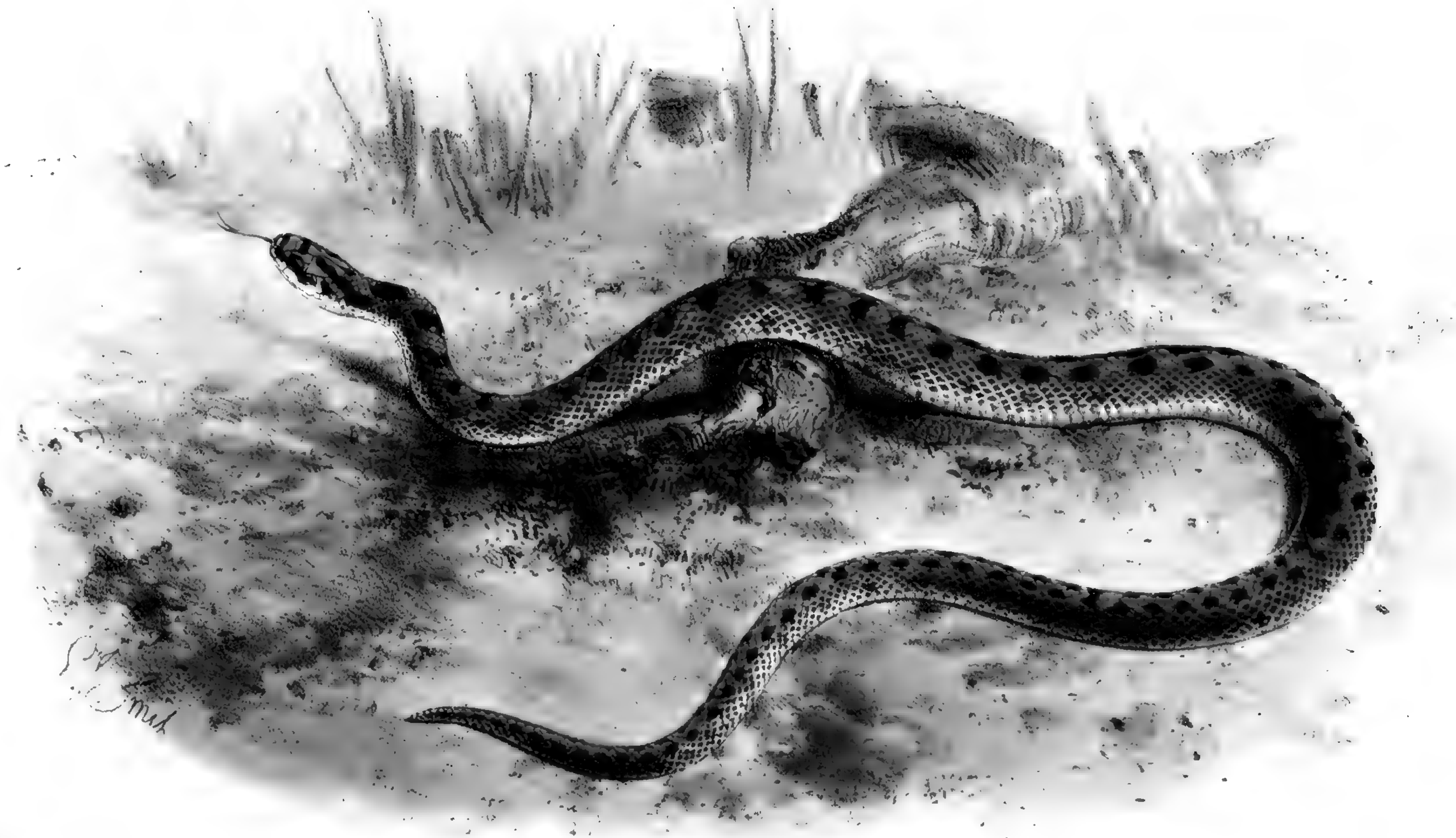
The following extracts were read from a letter addressed to the Secretary by Mr. Roland Trimen, F.Z.S., dated "South-African Museum, Cape Town, 29th March, 1887" :—

"I know that you and other ornithologists will be interested in hearing that a second example of *Laniarius atrocroceus*, Trimen (see Proc. Zool. Soc. 1880, p. 623, pl. lix.), has been obtained.

"It was brought to me yesterday for comparison with the original type specimen by Mr. A. W. Eriksson, who shot it on the Matlabast River, a stream not far north of the junction of the Marico with the Limpopo, and itself a tributary of the latter.

"The label attached to this second known specimen (a ♂) notes that its iris is 'lavender, with a narrow dark brown line next the pupil,' and that it was shot about ten miles from the locality where the late Dr. Bradshaw shot the first example. I can detect no difference between the two specimens.

"Mr. Eriksson gave me a graphic account of his discovery of the bird. *L. atrococcineus* was common in the locality, and when Mr. Eriksson first caught sight of the *L. atrocroceus* it was quarrelling with an individual of that most closely allied bird. The note of the *L. atrocroceus* exactly resembled that of the *L. atrococcineus*; and this seemed to annoy the latter, who was the assailant in the squabble. When the *L. atrocroceus* resisted, it seemed to get the better of the other. So intent were the two birds on their contest that they for some time disregarded Mr. Eriksson's presence, and kept so close to him in a thorny brake that he could not fire without too great a risk



Peter Smit del. et lith.

LAMPROPHIS FISKI.

of damaging the *L. atrocroceus*. At length (several interlacing branches partly screening the birds) he ventured a shot, and had the satisfaction of securing the prize in excellent condition. The *L. atrococcineus* still kept in close proximity, apparently looking out for his opponent. Mr. Eriksson shot this specimen also, in order to make sure of its being a male.

"This discovery of a second example of *L. atrocroceus* in a locality so little removed from that of the first is of much interest; and in the complete absence of any record of so conspicuous and striking a bird from any other part of Africa, tends strongly to localize the race or variety within very narrow limits. [The sex of Dr. Bradshaw's specimen was not ascertained.]

"The case of this *Laniarius* seems much to resemble those of the singular form of Cheetah (*Felis lanea* of Sclater), of which only five specimens are known, all from the very limited area of Nel's Point, in the Beaufort District of the Cape Colony, and the equally aberrant Leopard (*F. pardus*, L., var. *melas*; see Trimen, P. Z. S. 1883, p. 535, and Günther, P. Z. S. 1885, pl. xvi. p. 243), of which only three examples are known, from the neighbourhood of the Koonap River, in the Fort-Beaufort District on the eastern side of the Cape Colony. It is very noticeable that, in all three cases, the abnormal form does not replace the normal one to which it is so nearly related, but occurs in the midst of the latter, quite isolated, yet appearing to maintain and perpetuate (albeit in but very few individuals) its peculiarities of colouring or of pattern."

Mr. J. Jenner-Weir, F.Z.S., exhibited and made remarks on the skull of a feral Boar (*Sus scrofa*) recently obtained at Tauranga, New Zealand, by Mr. Arthur J. Vogan.

The animal was supposed to be a descendant from those introduced by Capt. Cook.

The skull was intended for the British Museum.

The following papers were read —

1. On a new Snake of the Genus *Lamprophis* now living in the Society's Gardens. By G. A. Boulenger.

[Received March 29, 1887.]

(Plate XXXIV.)

Among some S.-African Reptiles recently presented to the Society by the Rev. G. H. R. Fisk was a lovely little Snake, to which its sender directed particular attention, suspecting it to be new, and expressing the desire that, should this be the case, it should be described by me. So far as can be ascertained, without examining the dentition, the Snake is a *Lamprophis*, a member of the Lycodontine group of the Colubroids. I am unable to refer it to any described species, and have much pleasure in naming it in honour of its discoverer.

LAMPROPHIS FISKI, sp. n. (Plate XXXIV.)

Twenty-three series of scales; vertebrals not enlarged; eight upper labials, fourth and fifth entering the eye; two postoculars; loreal a little longer than deep; præfrontals in contact with supraoculars; frontal broad; tail short, ending very obtusely. Lemon-yellow on the five median rows of scales, with large blackish-brown spots forming a single series anteriorly, a double alternating series posteriorly; head lemon-yellow above, with symmetrical blackish-brown markings, viz. an oblique band on each side of the occiput, a horse-shoe-shaped band passing through the eyes and across the snout, and a bar across the frontal; lateral scales of body and tail dark brown in the centre and yellowish white on the borders; upper lip and lower surfaces white. Iris dark bronze.

The specimen, which measures 315 millim., was sent to Mr. Fisk from Touw's River by Mr. G. Atherstone.

2. On the Lepidoptera of Japan and Corea.—Part I. Rhopalocera. By J. H. LEECH, B.A., F.R.G.S., F.L.S., F.Z.S., F.E.S., &c.

[Received April 16, 1887.]

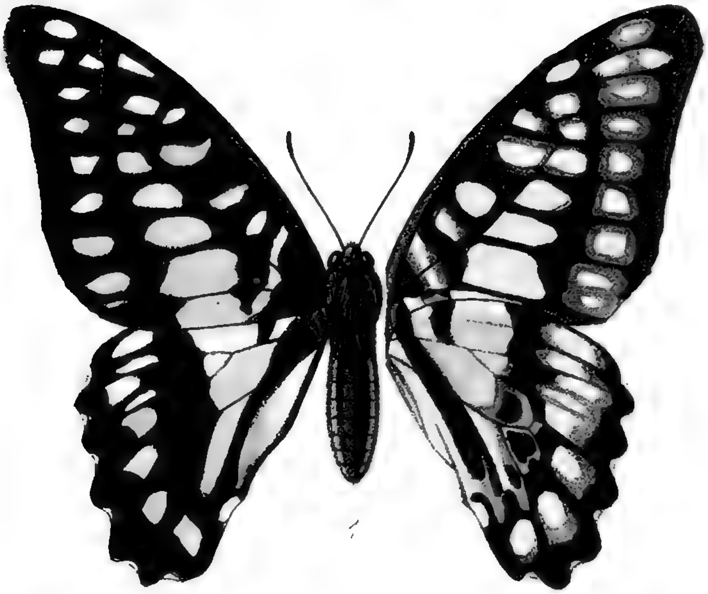
(Plates XXXV. & XXXVI.)

The Lepidopterous fauna of Japan contains so many species common to Corea, that I have deemed it advisable in this paper to unite them.

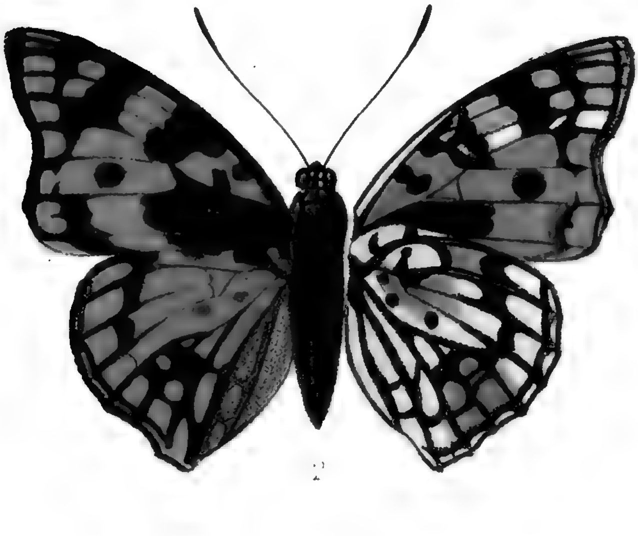
The accompanying tables show how nearly allied the faunas of the three districts, viz. Japan (the main and two southern islands), Yesso, and Corea, are. My work has been greatly facilitated through the kindness of Mr. Elwes, Mr. Butler, and Mr. Kirby. I have also to thank Mr. Fenton for the permission to view his collection, and Mr. H. Pryer, of Yokohama, for much kindness and many valuable hints during my stay in Japan.

The following is a summary of my results:—

Japan (main and two southern islands)	123	species.
Yesso or Hokaido	89	,,
Corea	91	,,
Species (†) which occur in Japan and Amurland, and which may be expected to occur in Corea	22	,,
Common to Japan and Yesso	131	,,



1



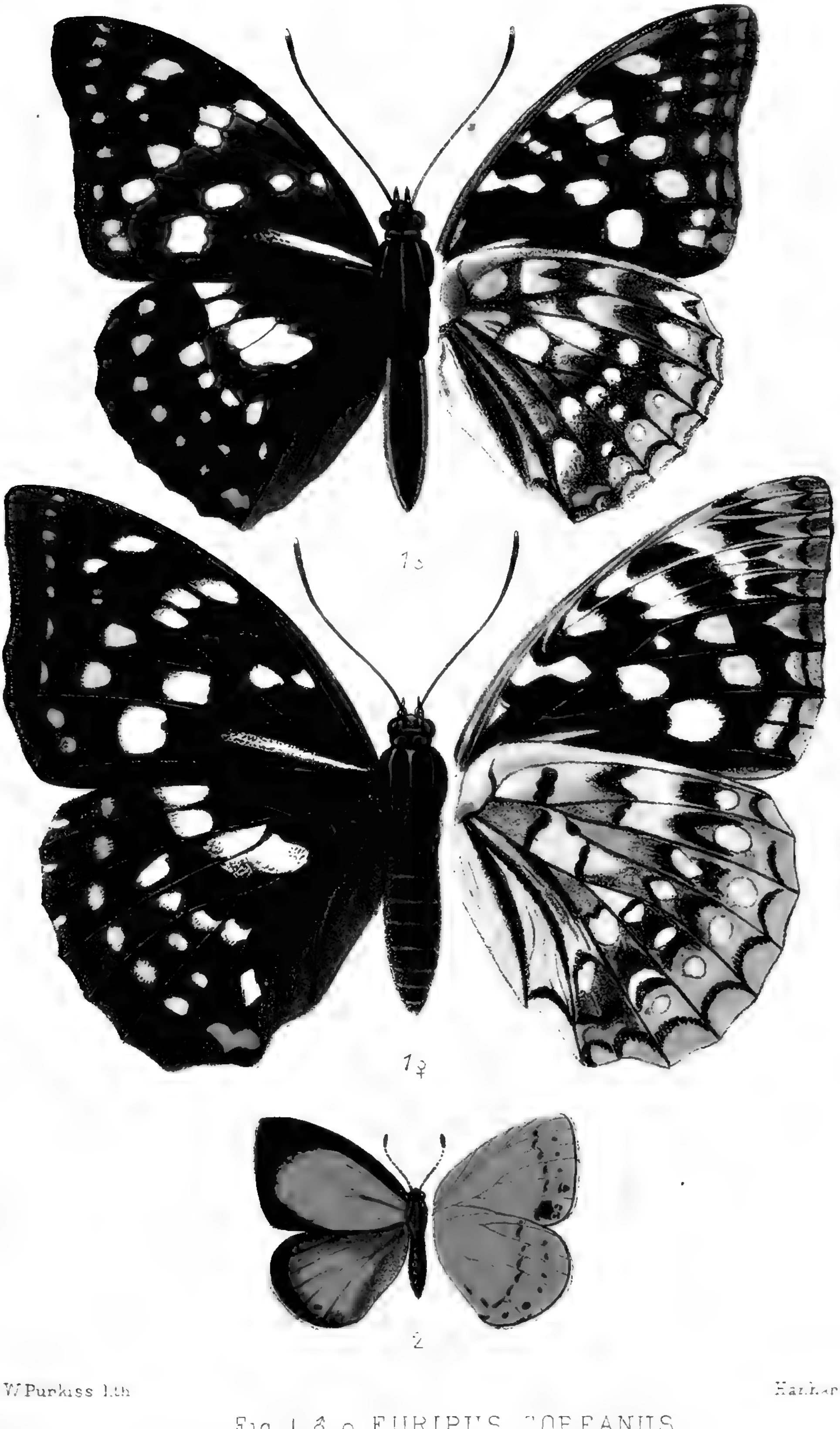
2

3♀

3♂

W Purkiss lith. Hanhart imp.

Fig. 1. PAPILIO MIKADO. Fig. 2. APATURA CAUTA.
Fig. 3. ♂ ♀ POLYOMMATUS AURATUS.



W. Purkiss lith. Hanhart imp.

Fig. 1. ♂ ♀ EURIPUS CORFANUS.
" 2. DIPSAS FLAMEN.

From Japan I have one species (*Papilio mikado*) new to science, and several not hitherto recorded as Japanese.

Of the 91 species from Corea, 71 are common to Japan and Yesso, and 67 to Amurland including Askold, which is only about 300 miles north of Gensan. There are five species which occur in Northern China, but not in Japan or Amurland, and I discovered four new to science.

Of the 89 species which occur in Yesso only the following 8 do not occur in Central Japan :—*Aporia cratægi, Dipsas jonasi, Thecla signata, T. ibara, T. fentoni, T. butleri, Vanessa urticæ, Ismene aquilina*; only *T. signata, T. ibara,* and *T. butleri* are peculiar to Yesso, the remainder are found in Amurland.

I commenced collecting at Nagasaki during April 1886, and found insect-life very abundant wherever a piece of accessible uncultivated ground was to be met with. This is only the case on hill-sides too steep for cultivation. It is wonderful to see the way in which the hills are cut into steps, supported by huge banks and walls, and kept constantly irrigated by small streams of water, especially in the south. Where a good piece of forest occurs it is usually impenetrable on account of the dense undergrowth of bamboo-grasses and ferns, filled with nauseous plants emitting an effluvium that resembles putrid flesh. This sort of collecting-ground occurs nearly all over the main and southern islands of Japan, and when combined with a mixture of tropical sunshine and tropical rains renders an entomologist's pursuit both arduous and unpleasant.

I found at Nagasaki a small native-built schooner, which was placed at my disposal by the kindness of influential friends. On this craft I lived for some six weeks, landing at a different locality each day and moving on at night. I was thus enabled to work a great deal of ground that had never before been visited by a European of any denomination, without wasting any time in travelling. After an uneventful voyage, considering the intricacy of the navigation and the ignorance of the captain, I again landed at Nagasaki.

During the earlier part of June I took passage to Corea. The first port we touched was Fusan, where we were not allowed on shore owing to the cholera. I managed to evade the quarantine by procuring a boat, which landed me on Deer Island out of sight of the town, and had a fine day's collecting. I next reached Gensan, where I spent about a month. It was a great relief to find one's self in a country where rice was not grown, or only in very small quantities. In the neighbourhood of the sea the ground is hilly and covered with low scrub, mostly dwarf oak seldom over a foot in height and with enormous leaves, azaleas, ferns, chiefly common bracken and *Osmunda*, the latter very small, and wild briars. The most conspicuous flowers are Iris, Spiræas, and Tiger-lilies, all very abundant. Here and there a sheltered ravine is met with containing a few trees, and with a stream running through it. These spots were a perfect paradise to a collector. The reason of the bareness of the coast-hills is owing to the fact that the natives mow them for fuel every autumn. At a distance of about fifteen miles from the sea the mountains attain a height of four or five thousand feet, and are densely wooded nearly to their summits, some of the timber being very fine. From the summit of So-ko-San, the highest peak, the view consists of a sea of wooded mountains except near the coast, and scarcely a house or sign of cultivation. The natives are harmless, and dirty to an incredible degree. Travelling is difficult on account of the money, which is all copper, and of so low a value that one man can only carry a few shillings' worth. Scarcely any food is procurable, and the native habitations are too lively even for an entomologist. The traveller must make up his mind to live on what he takes with him, and to sleep in the open air or under the verandah of a temple. However, although the weather was bad and living rather rough, I was amply repaid by the results of my collecting. My one regret is that I spent so short a time in the finest country I have ever visited, both for entomology and sport. Early in July I returned to Nagasaki, and went at once to Shimonoseki, a good locality and less sacrificed to "paddy" than most places. From Shimonoseki, the most southern town of Central Japan, to Awanovi, the most northern, I travelled most of the way overland, with poor results. Owing to the cholera I was quarantined and fumigated from one end of the country to the other. Servants died, others refused to go on, or asked exorbitant prices. The authorities invariably chose the best collecting localities for the purposes of cremation ; in fact, the whole west coast was entirely demoralized.

Early in August I reached Hakodate, where I had a fortnight's good collecting. I then proceeded to Nemoro on the east coast of Yesso, and procured another ship to take me up to the Kurile Islands. Here the whole country was covered with impenetrable bamboo-grass about 8 feet high, and both collecting (there was very little insect-life) and sport were out of the question. After wasting much valuable time trying to get further north, I turned back. The remainder of my Japanese expedition was on the ordinary tourists' routes. In the whole country I only succeeded in finding two really good collecting districts, viz. the neighbourhood of Hakodate and some well-known mountain-resorts in Central Japan, all of which had been thoroughly worked before.

I succeeded in capturing all the Rhopalocera known to Japan with the exception of about six species ; I discovered one species new to science and several hitherto unrecorded from Japan. I procured about 15,000 specimens of Moths, which I propose to treat of in another paper, and an enormous number of Coleoptera. Altogether I consider the results attained to have been fairly satisfactory.

Table showing the distribution of the Diurnal Lepidoptera of Japan, Yesso, and Corea.

		Japan.	Yesso.	Corea.
1.	Papilio machaon, *Linn.*	*	*	*
2.	—— xuthus, *Linn.*	*	*	*
3.	—— bianor, *Cr.*	*	*	*
4.	—— demetrius, *Cr.*	*		
5.	—— macilentus, *Jans.*	*		
6.	—— alcinous, *Klug*	*		
7.	—— helenus, *Linn.*	*		
8.	—— memnon, *Linn.*	*		
9.	—— sarpedon, *Linn.*	*		
10.	—— mikado, *Leech*	*		
11.	Luehdorfia puziloi, *Ersch.*	*	*	†
12.	Sericinus telamon, *Don.*	...	...	*
13.	Parnassius glacialis, *Butl.*	*	*	*
14.	Aporia cratægi, *Linn.*	...	*	†
15.	Pieris rapæ, *Linn.*	*	*	*
16.	—— napi, *Linn.*	*	*	*
17.	—— canidia, *Sparrm.*	...	...	*
18.	—— daplidice, *Linn.*	...	...	*
19.	Anthocharis scolymus, *Butl.*	*	*	
20.	Leucophasia sinapis, *Linn.*	*	*	*
21.	Rhodocera rhamni, *Linn.*	*	*	*
22.	Colias palæno, *Linn.*	*	*	†
23.	—— hyale, *Linn.*	*	*	*
24.	Terias læta, *Boisd.*	*	...	*
25.	—— bethesba, *Jans.*	*		
26.	—— hecabe. *Linn.*	*	...	*
27.	Miletus hamada, *Druce*	*		
28.	Curetis acuta, *Moore*	*		
29.	Amblypodia japonica, *Murray*	*	...	*
30.	—— turbata, *Butl.*	*		
31.	Niphanda fusca, *Brem.*	*	*	*
32.	Dipsas flamen, *Leech*	...	...	*
33.	—— sæpestriata, *Hew.*	*	...	†
34.	—— lutea, *Hew.*	*	*	†
35.	—— jonasi, *Jans.*	...	*	†
36.	Thecla orientalis, *Murray*	*	*	*
37.	—— smaragdina, *Brem.*	*	*	*
38.	—— japonica, *Murray*	*	*	*
39.	—— signata, *Butl.*	...	*	
40.	—— arata, *Brem.*	*	*	†
41.	—— tyrianthina, *Butl.*	...	...	*
42.	—— attilia, *Brem.*	*	*	†
43.	—— ibara, *Butl.*	...	*	
44.	—— orsedice, *Butl.*	*	*	
45.	—— fentoni, *Butl.*	...	*	*
46.	—— mera, *Jans.*	*		
47.	—— stygiana, *Butl.*	*		
48.	—— butleri, *Fenton*	...	*	
49.	—— enthea, *Jans.*	*	*	
50.	—— frivaldskyi, *Led.*	*	*	†
51.	Polyommatus phlæas, *Linn.*	*	*	*
52.	—— auratus, *Leech*	...	...	*
53.	Lycæna bætica, *Linn.*	*		
54.	—— argiades, *Pall.*	*	*	*
55.	—— fischeri, *Eversm.*	...	...	*

		Japan.	Yesso.	Corea.
56.	Lycæna argia, *Mén.*	*	*	*
57.	—— cleobis, *Brem.*	...	...	*
58.	—— argus, *Linn.*	*	...	*
59.	—— ægon, *Schiff.*	*	*	*
60.	—— argiolus, *Linn.*	*	*	*
61.	—— lycormas, *Butl.*	*	*	
62.	—— euphemus, *Hb.*	*	*	*
63.	—— pryeri, *Murray*	*	...	†
64.	Libythea lepita, *Moore*	*		
65.	Dichorragia nesimachus, *Boisd.*	*		
66.	Apatura ilia, *Schiff.*	*	*	*
67.	—— cauta, *Leech*	...	...	*
68.	Euripus coreanus, *Leech*	...	...	*
69.	—— charonda, *Hew.*	*		
70.	—— japonicus, *Feld.*	*	*	
71.	Hestina assimilis, *Linn.*	?	...	*
72.	Adolias schrenki, *Mén.*	...	...	*
73.	Limenitis helmanni, *Led.*	*	...	*
74.	—— sibylla, *Linn.*	*	*	*
75.	Cyrestis thyodamas, *Boisd.*	*	...	*
76.	Neptis aceris, *Lepechin*	*	*	*
77.	—— lucilla, *Schiff.*	*	*	*
78.	—— pryeri, *Butl.*	*	...	*
79.	—— alwina, *Brem. & Grey*	*	...	*
80.	—— excellens, *Butl.*	*	*	
81.	Vanessa burejana, *Brem.*	*	*	*
82.	—— levana, *Linn.*	*	*	*
83.	—— l-album, *Esp.*	*	*	†
84.	—— c-album, *Linn.*	*	*	*
85.	—— c-aureum, *Linn.*	*	*	*
86.	—— urticæ, *Linn.*	...	*	†
87.	—— callirhoë, *Fabr.*	*	*	*
88.	—— cardui, *Linn.*	*	*	*
89.	—— io, *Linn.*	*	*	*
90.	—— charonia, *Drury*	*	*	*
91.	—— antiopa, *Linn.*	*	*	†
92.	—— xanthomelas, *Schiff.*	*	*	*
93.	Melitæa aurinia, *Rott.*	...	...	*
94.	—— phœbe, *Schiff.*	*	*	*
95.	—— parthenie, *Bkh.*	...	...	*
96.	—— dictynna, *Esp.*	...	..	*
97.	—— athalia, *Rott.*	*	*	*
98.	Argynnis niphe, *Linn.*	*		
99.	—— perryi, *Butl.*	...	...	*
100.	—— daphne, *Schiff.*	*	*	*
101.	—— ino, *Esp.*	...	...	*
102.	—— aglaia, *Linn.*	*	*	*
103	—— adippe, *Linn.*	*	*	*
104.	—— nerippe, *Feld.*	*	*	*
105.	—— sagana, *Doubleday*	*	*	*
106.	—— laodice, *Pall.*	*	*	*
107.	—— anadyomene, *Feld.*	*	*	*
108.	—— paphia, *Linn.*	*	*	†
109.	—— ruslana, *Motsch.*	*	*	†
110.	Danais tytia, *Gray*	*	*	†
111.	Melanargia halimede, *Mén.*	...	...	*
112.	Melanitis leda, *Linn.*	*		

		Japan.	Yesso.	Corea.
113.	Mycalesis gotama, *Moore*	*		
114.	—— perdiccas, *Hew.*	*	*	*
115.	Ypthima baldus, *Fab.*	*	*	*
116.	—— motschulskyi, *Mén.*	*	...	*
117.	Erebia sedakovii, *Eversm.*	*	*	†
118.	Satyrus dryas, *Scop.*	*	*	*
119.	—— hyperanthus, *Linn.*	...	...	*
120.	Pararge achine, *Scop.*	*	*	*
121.	—— deidamia, *Eversm.*	*	*	*
122.	—— maakii, *Brem.*	*	*	†
123.	Lasiommata epimenides, *Mén.*	*	*	*
124.	Pronophila schrenkii, *Mén.*	*	*	*
125.	Lethe sicelis, *Hew.*	*		
126.	—— diana, *Butl.*	*	*	*
127.	Neope goschkevitschii, *Mén.*	*	*	
128.	—— callipteris, *Butl.*	*	*	
129.	Cœnonympha œdipus, *Fabr.*	*	...	*
130.	—— hero, *Linn.*	...	...	*
131.	Ismene benjamini, *Guér.*	*		
132.	—— aquilina, *Speyer*	...	*	†
133.	Plesioneura curvifascia, *Feld.*	*		
134.	—— bifasciata, *Brem.*	...	...	*
135.	Pterygospidea sinica, *Feld.*	*		
136.	Daimio tethys, *Mén.*	*	*	*
137.	Isoteinon lamprospilus, *Feld.*	*		
138.	Pamphila mathias, *Fabr.*	*		
139.	—— varia, *Murray*	*	*	
140.	—— guttata, *Brem.*	*	*	*
141.	—— jansonis, *Butl.*	*	...	*
142.	—— pellucida, *Murray*	*	*	*
143.	Hesperia sylvanus, *Esp.*	*	*	*
144.	—— subhyalina, *Brem.*	*	*	*
145.	—— sylvatica, *Brem.*	*	*	*
146.	—— ochracea, *Brem.*	*	...	*
147.	—— rikuchina, *Butl.*	*		
148.	—— flava, *Murray*	*	*	*
149.	Cyclopides morpheus, *Pall.*	...	...	*
150.	—— ornatus, *Brem.*	*	*	†
151.	Pyrgus inachus, *Mén.*	*	...	†
152.	Nisoniades montanus, *Brem.*	*	*	†
153.	Syricthus maculatus, *Brem.*	*	*	*

1. PAPILIO MACHAON, Linn.

Var. *asiatica,* Mén. Enum. i. p. 70 (1855).

Var. *hippocrates,* Feld. Verh. zool.-bot. Ges. Wien, xiv. p. 314.

Occurs commonly all over Japan and Corea: several broods in the course of the year. The first brood, which appears in March and April, does not differ materially from the European form, but the succeeding broods increase both in size and intensity of colour.

I bred a fine series of vars. *asiatica* and *hippocrates* from ova deposited by a female *P. machaon* of the ordinary type in April at Nagasaki. The imagos appeared during the end of June and beginning of July, some specimens had the usual proportion of black and yellow, others were of a much deeper yellow than the ordinary type, and some were nearly all black, being by far the most pronounced var. *hippocrates* I have yet seen. Every specimen was much larger than the parent.

The following description of the full-fed larva does not seem to differ in the slightest degree from the common form of *P. machaon* :—

Larva.—Ground-colour of body pale green, smooth ; head the same marked with black. Each segment of the larva is divided transversely by a broad black band interrupted on each side by three orange spots, that occurring in the spiracular region being the largest. Each segmental division is marked by a black band, extending in most specimens about halfway down the sides and contracting and expanding with the movements of the larva ; legs tipped with black and a black spot above each leg. Each abdominal leg has a broad black band, above which is a large triangular black mark surmounted by two smaller spots ; belly paler than dorsal area and spotted at intervals with black. Feeds on the common carrot.

2. Papilio xuthus, L.

Var. *xuthulus*, Brem. Lep. Ost-Sib. p. 4, t. 1. fig. 2.

Common all over Japan and Corea during the warm months.

The earliest form is "*xuthulus*" in March and April, but this variety does not seem to be nearly so distinct in Japan as in the Amur region, intermediate forms occurring commonly from *xuthulus* to *xuthus*, which continues in turn to vary until a larger and much darker form is reached, which bears the same resemblance to *xuthus* that *hippocrates* does to *machaon*. I have specimens from Nagasaki (July) in which the black markings are very much exaggerated, and the yellow is replaced by a deep buff.

3. Papilio bianor.

P. bianor, Cr. Pap. Ex. ii. t. 103. f. C (1779).
P. maakii, Mén. Schrenk's Reise, p. 10, t. i. (1859).
P. dehaanii, Feld. Verh. zool.-bot. Ges. Wien, xiv. p. 323 (1864).
P. raddei, Brem. Lep. Ost-Sib. p. 3, t. i.
Var. *japonica*, Butl. Journ. Linn. Soc., Zool. ix. p. 50 (1866).
P. alliacmon, De l'Orza (ex Boisd.), Lép. Jap. p. 9 (1869).
P. tutanus, Fenton, P. Z. S. 1881, p. 855.

This species varies to such an extent that it is impossible to form any correct opinion on the subject until our knowledge of its habits and distribution is considerably increased ; the existing arrangements are, however, purely artificial, as none of the characters on which it has been subdivided are constant.

The two most distinct types, viz. *raddei* and *maakii*, have been shown to be seasonal forms of the same species by breeding, which proves the species to be double-brooded. *Dehaanii*, *japonica*, and *alliacmon* are, so far as my knowledge goes, either spring or alpine forms, from which I should infer that they were the first brood of *bianor*, *maakii*, and *tutanus*, which only occur in summer.

Occurs commonly all over Japan and Corea.

4. Papilio demetrius.

P. demetrius, Cr. Pap. Ex. iv. t. 385. f. E, F (1782).

P. carpenteri, Butl. Ann. & Mag. Nat. Hist. ser. 5, x. p. 318.

Common in Southern and Central Japan.

The female varies in the red markings, and blue suffusion of hind wing.

The summer brood is larger than the spring form, which Mr. Butler has named *carpenteri*.

5. Papilio macilentus.

P. macilentus, Janson, Cist. Ent. vol. ii. p. 158.

P. tractipennis, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 139.

P. scævola, Oberthür, Et. Ent. iv. p. 37.

This species inhabits the mountains of Central and Southern Japan, and is rather rare, especially the female. It is easily distinguished from *P. demetrius* by its extremely long narrow wings and tails.

6. Papilio alcinous.

P. alcinous, Klug, Neue Schmett. t. i. 1836.

P. spathatus, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 139.

Common all over Central and Southern Japan.

The summer brood is larger than the spring, and has longer tails. I have some specimens from Southern Japan which are hardly separable from *P. mencius*, Feld., from N. China.

7. Papilio helenus, Linn.

P. nicconicolens, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 139.

This fine species is not rare in April at Nagasaki, and in the Provinces of Higo and Satsuma; it also occurs in Tosa.

The yellow marking on the hind wing, on the strength of which the Japanese form has been described as distinct, is not constant. It is in no way separable from Chinese specimens in my possession from Hong-Kong, Foochau, and Ningpo.

8. Papilio memnon, Linn.

P. thunbergii, Siebold, Hist. Nat. Jap. p. 16 (1824).

Not rare in Southern Japan in April and May.

Of a number of females taken in Kiushiu, no two specimens are alike, some of the males vary also in having the red mark at the base of the fore wing, which is only present in the female sex. Specimens I took also at Ningpo, Foochau, Hong-Kong, Saigon, and Singapore present an equal amount of variation.

9. Papilio sarpedon, Linn.

Very common in Southern and Central Japan. The summer brood are always larger and darker than the spring form, and have hence been confused with *teredon*, Feld.[1], which does not occur in Japan but in Ceylon.

[1] *P. teredon*, Feld. Reise Nov. Lep. i. p. 61 (1865).

10. Papilio mikado, nov. sp. (Plate XXXV. fig. 1.)

Expanse of wings $3\frac{7}{8}$ inches.

Ground-colour of all the wings black; a narrow straw-coloured streak extends across the base of the fore wing interrupted by the veins. All the wings covered with straw-coloured spots, consisting of a submarginal series of fairly uniform spots running round the outer margin of the wing; a subcostal series of eight spots, three of which are situated in the discoidal cell, a discal series of six graduated spots on the fore wing, which is continued on the hind wing in a wedge-shaped mass, tapering to a blunt point near the anal angle and divided into two by the median vein; the first two spots of the submarginal series of the hind wing, the anal lunule, the upper part of the wedge-shaded mass, and the interior of the abdominal fold are very pale yellow. Underside, a reproduction of the upper surface with most of the spots enlarged and whiter, and with the addition of a yellow spot at the base of the hind wing, and an irregular arrangement of yellow markings between the discal and submarginal spots of the hind wing.

I took a single male specimen about May 20th near Kagoshima in the Province of Satsuma. The nearest allied species is *P. eurypylus*.

11. Luehdorfia puziloi, Ersch.

This is a very early species; it occurs in Yesso, and Mr. H. Pryer has recently discovered a new locality for it in Central Japan.

12. Sericinus telamon.

S. telamon, Don. Ins. China, t. xxvii. fig. 1 (1798).

S. montela, Gray, P. Z. S. 1852, p. 71; Cat. Lep. Brit. Mus. i. p. 78, t. xiii. figs. 1, 2.

S. fortunei, Gray, P. Z. S. 1852, p. 72; Cat. Lep. Brit. Mus. i. p. 79, t. xiii. fig. 5.

S. fasciatus, Brem. & Grey, Schmett. nördl. China's, p. 5; Mén. Cat. Mus. Petr. t. vi. fig. 1.

S. cressoni, Reak. Proc. Ent. Soc. Phil. iii. p. 499 (1864).

S. telmona, Gray, P. Z. S. 1852, p. 72; Cat. Lep. Brit. Mus. i. p. 78, t. xiii. fig. 3.

S. greyi, Brem. & Grey, Schmett. nördl. China's, p. 6, t. i. fig. 2.

A very variable species; out of a series of about 33 specimens which I took at Gensan at the end of June and beginning of July, no two specimens are alike, and they all differ slightly from any specimens in the National collection.

13. Parnassius glacialis.

P. glacialis, Butl. Journ. Linn. Soc, Zool. ix. p. 50 (1866).

Occurs at Nikkô and Hakodate in June and July, also in Corea (*H. Strecker*). It is not an alpine species, as its name would lead one to suppose, but occurs at a very slight elevation in Central Japan and on the sea-level at Hakodate.

14. Aporia cratægi, Linn.

Specimens from Hakodate do not seem to differ in any way from European examples.

15. Pieris rapæ, Linn.

P. crucivora, Boisd. Sp. Gén. i. p. 522 (1836).
Var. *orientalis*, Oberth. Et. Ent. v. p. 13 (1880).
Ganoris crucivora, Butl. Ann. & Mag. Nat. Hist. ser. 5, ix. p. 18.

Very common in Japan, Corea, and N. China, especially frequenting market-gardens. It has nothing whatever in common with *P. brassicæ*, which I believe does not occur in Eastern Asia, but is a good local form of *rapæ*, in which the base and all of the fore wing of the female is much suffused with greyish-brown scales, and the second spot of the fore wing of the male shows through the upper surface, as is usual in the typical female. This latter, however, is not a constant character, many males occurring in no way different to the common form, and I took several specimens without any black spots on the fore wing. It is very variable in size. Mr. H. Pryer informs me that the larvæ, which feed on the cultivated Cruciferæ, do not differ from the typical forms, nor does the pupa.

16. Pieris napi, Linn.

P. melete, Mén. Cat. Mus. Petr. ii. p. 113, t. x. figs. 1, 2 (1855).
P. aglaope, Motsch. Et. Ent. 1860, p. 28.
P. megamera, Butl. Cist. Ent. i. p. 173 (1873).
P. castoria, Reak. Proc. Ac. Nat. Sci. Phil. 1866, p. 238.
Ganoris dulcinea, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 96.

Common all over Japan and Corea, and extremely variable. It is difficult to get two specimens exactly alike. In Central and Northern Japan· *napi* seems to be the spring form, and there are specimens in Mr. Fenton's collection in no way separable from British examples, and I have all the intermediate forms between *napi* and *melete* in my own collection. In Southern Japan the larger and darker forms predominate, and there is less difference between the broods. In Central Japan I took specimens identical with *ajaka*, Moore, and at Nemoro, a very bleak place in N.E. Yesso, I found forms varying from small *melete* to typical "*castoria*."

In no single locality, so far as my experience goes, is any one form constant.

17. Pieris canidia, Sparrm.

P. gliciria, Cram. Pap. Exot. ii. t. 171.
P. claripennis, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 96.
P. sordida, Butl.

The black spots on the fore wing of this species vary as much as in *P. rapæ*, var. *crucivora* ♂. I took a very large series in Hong-Kong, Foochau, Ningpo, and Gensan, and they varied equally in every locality. The Corean specimens are usually smaller than Chinese examples.

18. Pieris daplidice, L.

Var. *bellidice*, O.

Anthocharis belemida, var. *orientalis*, Brem. Lep. Ost-Sib. p. 8.

This species occurs at Gensan in June, flying over corn-fields in the neighbourhood of the Japanese settlement; it does not differ from European specimens.

19. Anthocharis scolymus.

A. scolymus, Butl. Journ. Linn. Soc., Zool. ix. p. 52 (1866).

A. thunbergii, de l'Orza, Lép. Jap. p. 14 (1849).

Common all over Japan in early spring; it is very variable in size.

20. Leucophasia sinapis, Linn.

Var. *amurensis*, Mén. Schrenk's Reise, p. 15, t. i. figs. 4, 5.

L. sinensis, Butl. Cist. Ent. i. p. 173 (1877).

L. vibilia, Jans. Cist. Ent. ii. p. 272 (1878).

L. morsei, Fenton, P. Z. S. 1881, p. 855.

Common all over Japan and at Gensan. All the intermediate forms between *amurensis* and *sinapis* exist, and forms without any black apex to the fore wing corresponding to var. *diniensis* are not unusual.

21. Rhodocera rhamni, Linn.

R. nipalensis, Doubl. Gen. Diurn. Lep. p. 71 (1847); Gray, Lep. Nep. t. v. fig. 1 (1831).

R. maxima, Butl. Trans. Ent. Soc. 1885, p. 407.

R. aspasia, Mén. Schrenk's Reise, p. 17, t. i. fig. 8.

R. acuminata, Feld. Wien. ent. Mon. vi. p. 23 (1862).

Occurs all over Japan and Corea. The *rhamni* (*maxima*) form occurs at low elevations in Central Japan. I only took "*acuminata*" in the mountains; from Gensan I have a specimen of true *rhamni*, and I have just received from Ningpo two specimens which resemble *acuminata* in the shape of the wing, and *rhamni* var. *farinosa*[1] in colour. There can be little doubt that these refer to one species, but I can form no opinion with any certainty until I receive larger series.

22. Colias palæno, Linn.

Occurs in Yesso and mountain-districts of Central Japan.

23. Colias hyale, Linn.

C. poliographus, Motsch. Et. Ent. ix. p. 29 (1860).

C. simoda, de l'Orza, Lép. Jap. p. 16 (1869).

C. neriene, Fisch., Motsch. Et. Ent. ix. p. 29.

C. erate, Esp., Murray, Ent. Mon. Mag. xiii. p. 34 (1876).

C. erate ab *helictha*, Led., Brem. Lep. Ost-Sib. p. 93.

C. subaurata, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 138.

C. elwesii, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 135.

C. pallens?, Butl. Journ. Linn. Soc., Zool. ix. p. 50.

Common all over Japan and Corea. The spring form is rather smaller than the summer brood.

[1] *R. farinosa*, Zell. Isis, 1837, p. 5; Mann, Wien. ent. Mon. v. p. 157, t. ii. f. 6.

In one spot near Nagahama (Lake Biwa) I found the forms described as *poliographus*, *simoda*, *subaurata*, and *elwesii* all together; and of six pairs which I took *in copulâ* and kept separately labelled, only two pairs were of the same form, viz., *simoda*; the remainder were as follows:—

2 cases of *simoda* ♂ and *elwesii* ♀.
1 case of *subaurata* ♂ and *elwesii* ♀.
1 case of *simoda* ♂ and *poliographus* ♀.

The inference is that they belong to the same species; otherwise they hybridize in a manner totally unprecedented and highly improbable.

The type of *pallens* is such a bad specimen, that it is impossible to say what it is.

24. TERIAS LÆTA.

T. læta, Boisd. Sp. Gén. i. p. 674.
Var. *jaegeri*, Mén. Cat. Mus. Petr. p. 84, t. ii. fig. 1 (1855).
T. subfervens, Butl.

A common species in spring and autumn all over Southern and Central Japan. A series in the National collection labelled *subfervens*, Butl., do not differ materially from Japanese specimens, and some of the Northern Indian forms are not separable.

Mr. H. Pryer says that it occurs all through the summer.

25. TERIAS BETHESBA.

T. bethesba, Janson, Cist. Ent. ii. p. 272 (1878).

This species, which is very distinct from the other Japanese *Terias*, occurs in Central and Southern Japan in May and again in August.

26. TERIAS HECABE, Linn.

T. hecabeoides, Mén. Cat. Mus. Petr. i. p. 85, t. ii. fig. 2.
T. sinensis, Luc. Rev. Zool. 1852, p. 429.
T. mariesi, Butl. Trans. Ent. Soc. 1880, p. 198, t. vi. figs. 1–7.
T. anemone, Feld. Wien. ent. Mon. vi. p. 23 (1862).
T. mandarina, de l'Orza, Lép. Jap. p. 18 (1869).
T. hobsoni, Butl. P. Z. S. 1880, p. 668.
T. hybrida, Butl. Trans. Ent. Soc. p. 199.
T. connexiva, Butl. Trans. Ent. Soc. p. 199.

Common all over Southern and Central Japan, and recorded from S.E. Corea. It is needless to say anything about this well-discussed question, as Mr. H. Pryer has settled it in the most conclusive manner by breeding all the forms known from Japan, from eggs laid by the same parent.

27. MILETUS HAMADA.

Miletus hamada, Druce, Cist. Ent. i. p. 361 (1875).

I found this species common all up the west coast of Central Japan; it also occurs at Nikko. It seems fond of water, and flew about amongst the thick bamboo-grass on the banks of streams in July and August.

28. Curetis acuta.

Curetis acuta, Moore, Ann. & Mag. Nat. Hist. ser. 4, xx. p. 50.

Not rare in some of the mountain-districts of Central Japan, in July and August.

The female is very scarce, and has, I believe, never before been described.

"Expanse of wings about $1\frac{1}{2}$ inch, narrower than in the male; apex of wings produced to a much sharper point; ground-colour of all the wings black with a brownish tinge. In the centre of fore wings is an elongated bluish-white patch, and a fainter bluish-white crescent occurs on the hind wing starting from the costa; fringes of fore wings black, of hind wings bluish grey. Under surface of all the wings uniform silvery white as in the male."

29. Amblypodia japonica.

Amblypodia japonica, Murray, Ent. Mon. Mag. xi. p. 170 (1875).

This is a common species in Southern Japan in May. I took it also in Gensan, Corea, and again in Central Japan in the autumn.

30. Amblypodia turbata.

Amblypodia turbata, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 133; P. Z. S. 1881, p. 855.

This fine species seems to be very rare in Japan; I found it in May in the province of Satsuma flying in company with the last species, and there are specimens from Nikko in the National collection. It can be instantly distinguished from *A. japonica* by its tails.

31. Niphanda fusca.

Niphanda fusca, Butl. P. Z. S. 1881, p. 883.

Thecla fusca, Brem. & Grey, Schm. nördl. China's, p. 9 (1853); Mén. Cat. Mus. Petr. i. t. iv. fig. 5 (1855).

♀. *Amblypodia dispar*, Brem. Lep. Ost-Sib. p. 24, t. iii. fig. 4 (1864).

Polyommatus fuscus, Oberthür, Et. Ent. ii. p. 20, t. iv. fig. 5.

Common all over Japan and Corea in July and August; some specimens are much larger than others, but the markings and colour seem to be constant.

32. Dipsas flamen, Leech, nov. sp. (Plate XXXVI. fig. 2.)

♀. Expanse of wings $1\frac{3}{4}$ inch.

Ground-colour of all the wings dull orange, deeply bordered round the costal and outer margins with black; veins of the hind wings deeply marked with black towards the outer margin; a small black spot occurs near the outer margin of the hind wing between the first and second submedian veins. Fringes short, dirty white. Underside of all the wings yellowish buff, outer margins bordered by a narrow black line. A submarginal band of bright orange elongated spots bordered on each side by a row of silver spots runs round all the wings, interrupted at the inner angle of the fore wing by a conspicuous black double spot. There is a small black dot between the fifth orange spot of the fore wing and the margin, and a row of three black spots near the anal angle of the hind wing.

This species is allied to *Thecla raphaelis*, and *michaelis*, Oberthür. It agrees with *T. raphaelis* in the absence of tails and in the design of the underside; it is, however, much larger and there is a larger proportion of black on the upper surface. The upper surface of the fore wing agrees with *T. michaelis*.

I only succeeded in taking a single specimen of this species, which was flying over small trees near the monastery of So-ko-San about 14 miles N.W. of Gensan, on June 15, 1886.

33. Dipsas sæpestriata.

Dipsas sæpestriata, Hew. Ill. Diurn. Lep. p. 67, t. xxvi. figs. 7, 8 (1865).

Common about Yokohama (*H. Pryer*). I took it in July near Nagahama, Lake Biwa.

34. Dipsas lutea.

Dipsas lutea, Hew. Ill. Diurn. Lep. p. 67, t. xxvi. figs. 9, 10 (1865).

I took this, together with the next species, near Hakodate in August; it occurs also in Central Japan.

35. Dipsas jonasi.

Dipsas jonasi, Jans. Cist. Ent. ii. p. 157.

This rare species occurs in Yesso. I took it in August flying about small trees.

36. Thecla orientalis.

T. orientalis, Murray, Ent. Mon. Mag. xi. p. 169 (1875).

Occurs plentifully all over Japan and at Gensan during the end of June, July, and the beginning of August. It differs conspicuously in colour, shape, and size from the other green *Theclæ*; the female is variable in colour and markings, and the bar-markings on the centre of each wing on the underside are liable to be either partially or totally absent.

37. Thecla smaragdina.

T. smaragdina, Brem. Lep. Ost-Sib. p. 25, t. iii. fig. 5.

T. taxila, Brem. Lep. Ost-Sib. p. 26, t. iii. fig. 7.

This species, which occurs in Yesso, and I believe at Nikko, occupies an intermediate place between *T. orientalis* and *T. japonica*, from the latter of which it differs in the bar mark of the fore wing on the underside, which mark, however, Mr. Elwes says is not a constant character in the female. As it is not constant in either sex of *T. orientalis*, I fail to see how any great importance can be attached to it. The colour of the underside varies according to the condition of the specimens, the old ones being much paler than freshly emerged examples.

Mr. H. Pryer is of opinion that this insect is a hybrid between

T. orientalis and *T. japonica,* which is quite possible, but his views require verification.

38. Thecla japonica.

T. japonica, Murr. Ent. Mon. Mag. xi. p. 169 (1874).
T. taxila, Brem. Lep. Ost-Sib. t. viii. fig. 2.
T. regina, Butl. P. Z. S. 1881, p. 853.
T. fasciata, Janson, Cist. Ent. ii. p. 272, t. v. fig. 4 (1874).
Ab. b. *T. aurorina,* Oberthür, Et. Ent. v. p. 18.

Occurs all over Japan and at Gensan in June and July. There are four distinct forms of female, none of which are rare:—

α. Uniform brown throughout.
β. With a fuscous patch on fore wing.
γ. With a blue patch containing a fuscous mark.
δ. With a blue patch.

Besides these forms all the intermediates occur.

The Corean specimens are rather smaller than the Japanese form; and in Yesso, and also at high altitudes in Central Japan, occurs a boreal form which is quite similar to the usual type, only on a much smaller scale. I have a series also from Amurland which are identical and present similar variations of the female.

Dipsas taxila, Hew. Ill. Diurn. Lep., Suppl. p. 16, t. iv. figs. 16, 17.

It is absolutely impossible to say which species this is intended for, as the plate is very inferior and the description insufficient. A series of *T. orientalis* are in the Hewitson collection under the name of *T. taxila,* and Oberthür considers the figure and description to represent *T. smaragdina.*

39. Thecla signata.

T. signata ,Butl. P. Z. S .1881, p. 854; Aid to Identif. of Ins. pl. 114.

The type of this species is in Mr. Fenton's collection; it is in bad condition. The fact of the cell of the hind wing being filled in with violet separates it at once from any known Japanese species. I take the type to be a female, and should not be surprised if it had a green male. Recorded from Kuramatsunai, August.

40. Thecla arata.

T. arata, Brem. Lep. Ost-Sib. p. 25, t. iii. fig. 6.

Does not seem to be common; I took it at Hakodate in August. It is also recorded from Central Japan.

41. Thecla tyrianthina.

T. tyrianthina, Butl. Ann. & Mag. Nat. Hist. ser. 5, vol. vii. p. 34, t. iv. fig. 5.

I took this species at Gensan in July. It is very distinct from *T. arata*; on the upper surface it is darker and on the underside it is fawn-coloured with the characteristic bars and markings of a darker shade; whilst the underside of *T. arata* is mouse-coloured with ashy-white markings. The type in the National collection is from Kiukiang.

42. Thecla attilia.

T. attilia, Brem. Lep. Ost-Sib. p. 24, t. ii. fig. 3.

Occurs in Northern and Central Japan. Mr. H. Pryer says it is common in the neighbourhood of Yokohama.

43. Thecla ibara.

Thecla ibara, Butl. P. Z. S. 1881, p. 852; Aid to Identif. of Ins. pl. 113.

This species, which must be extremely rare, differs from the other Japanese *Theclæ* in having a greenish underside with a white submarginal band and a yellowish blotch, containing two black dots at the anal angle of the hind wing.

I believe the only specimen of this species is the type in Mr. Fenton's collection, which was taken in the second week of July on the Ibara pass, Dewa.

44. Thecla orsedice.

T. orsedice, Butl. P. Z. S. 1881, p. 852.

Of this distinct species I only took a single specimen at Tsuruga, on the west coast of Central Japan. The type is recorded from Iwashiro in Yesso.

45. Thecla fentoni.

Strymon fentoni, Butl. P. Z. S. 1881, p. 854; Aid. to Identif. Ins. pl. 115.

Closely allied to *w-album*, but blacker, the tails longer, the line on the underside of fore wing straighter, and the yellowish blotch at the anal angle of the underside of the hind wing quite different. There is an unnamed specimen from Pekin in the National collection which is, I believe, this species. The type, which is in Mr. Fenton's collection, is from Shiribetsu in Yesso. I took a single specimen at Gensan at the end of June.

46. Thecla mera.

T. mera, Janson, Cist. Ent. ii. p. 157 (1877).

This seems a scarce species, and is I believe only recorded from Nikko.

47. Thecla stygiana.

T. stygiana, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 35, t. iv. fig. 6 (1881).

Allied to the last species, but distinct; it is also recorded from Nikko.

48. Thecla butleri.

T. butleri, Fenton, P. Z. S. 1881, p. 853 ; Aid to Identif. of Ins. pl. 115.

This is a very distinct species, the type is in Mr. Fenton's collection. The underside somewhat resembles *T. enthea*, Jans., but has dark bars and stripes in place of many of the spots ; there is a white submarginal band containing five black spots on the upper surface of the hind wing. Mr. Fenton records the capture of this species from the top of the Peak, Hakodate.

49. Thecla enthea.

T. enthea, Jans. Cist. Ent. ii. p. 157 (1877).

I took some very much worn specimens of this insect in Yesso at the beginning of August ; it is also reported from Nikko. It seems rare.

50. Thecla frivaldskyi.

Thecla frivaldskyi, Led. Verh. zool.-bot. Ges. Wien, 1855, p. 100.

Lycæna ferrea, Butl. Journ. Linn. Soc., Zool. ix. p. 57 (1866).

Satsuma ferrea, Murray, Ent. Mon. Mag. xi. p. 168 (1874).

Occurs all over Japan and in Gensan ; it is a very variable species, but I think it is identical with the Amur form.

51. Polyommatus phlæas, Linn.

Var. *eleus*, Fab.

Var. *chinensis*, Feld. Verh. zool.-bot. Ges. Wien, xii. p. 488 (1862).

Common all over Japan and Corea. It is an extremely variable species both in size, colour, and markings ; during the summer the typical form gives way entirely to the var. *eleus* ; a few intermediate forms occur, and the specimens are darker in some localities than in others. The largest and darkest I found at Nagasaki in July.

52. Polyommatus auratus, nov. sp. (Plate XXXV. fig. 3, ♂ ♀.)

Expanse of wings, ♂ $1\frac{2}{5}$, ♀ $1\frac{1}{2}$ inch.

Male. Upper surface of all the wings bright golden copper, with narrow black outer margins ; fringes black, except on the inner margin of hind wings ; on the outer margins of the hind wings are six black dots, the two nearest the anal angle being nearer together than the others.

Female. Fore wings golden copper, much suffused with darker scales, margined broadly on the outer border with black ; two black discoidal spots, followed by a band of broad black dashes extending across the wing ; hind wing sooty black, bordered by a broad golden copper band notched at the edges.

Underside of both sexes : fore wings yellowish buff, bordered on the outer margin with dirty grey, inside of which is a row of seven very distinct black spots; on the disk is a second irregular row of black spots; there are three spots in the discoidal cell, the outer one of which is the largest. Hind wings greyish buff, outwardly margined by a broad orange band, bordered on each side with a row of black dots; an irregular arrangement of black spots, margined with dirty white, is scattered over the remainder of the wing.

I took this species, during heavy rain, at rest on stems of coarse grass in a swampy gully near the monastery of Chang-Do, about 25 miles south of Gensan, in July 1886.

This species is allied to *P. dispar*, but its colour resembles *ochimus*; the fringes are black, the discoidal spots are absent on all the wings of male, the female has a row of dashes on the fore wings instead of spots, and the disk of hind wings is not suffused with copper; the underside is also different.

53. Lycæna bætica, Linn.

Occurs in several parts of Japan, but is very local; it does not seem to occur in Corea.

54. Lycæna argiades, Pall.

L. hellotia, Mén. Cat. Mus. Petr. ii. p. 124, t. x. fig. 6 (1857).

L. praxiteles, Feld. Verh. zool.-bot. Ges. Wien, xii. p. 489 (1862); Reise Nov. ii. p. 281, t. xxxv. fig. 5.

Everes hellotia, Butl. Ann. & Mag. Nat. Hist. ser. 5, ix. p. 17.

Common all over Japan and Corea during the warm months. It varies in size from $\frac{3}{4}$ in. to $1\frac{1}{2}$ inch. The female also varies in colour and markings, some specimens being much suffused with blue.

55. Lycæna fischeri, Eversm.

Lycæna filicaudis, Pryer.

Occurs at Gensan in June. It is also very common in the Snowy Valley, Ningpo, in April. The pale band on the outer margin of the hind wing may be either very distinct, faint, or totally absent. The spots on the underside have a great tendency to coalesce in the manner common to many of this genus.

56. Lycæna argia.

L. argia, Mén. Cat. Mus. Petr. ii. p. 125, t. x. fig. 7.

L. japonica, Murray, Ent. Mon. Mag. xi. p. 167 (1874).

L. alope, Fenton, P. Z. S. 1881, p. 851.

Of this difficult species I have only been able to form an opinion by collecting a series of over 200 specimens, being representatives from every locality I visited, both in China, Japan, and Corea, and ranging from the beginning of March to the end of October.

L. japonica, Murray, is said to differ from *argia* in the absence of the marginal spots of the hind wing in female; this distinction is without the least scientific value, and every grade occurs, from the most distinctly marked to those destitute of any spots whatever.

In spring and autumn there is a large pale form of male (connected by grades with typical *argia*), which has been allotted to *japonica*, Murray (which was described from a single female).

The females in spring and autumn seem to be much suffused with blue, which is not the case with the summer broods.

Although I have not seen Mr. Fenton's type of *alope*, yet I have no hesitation in including it as a form of this species. The principal points Mr. Fenton enumerates as differences between *alope* and *argia* are (1) the deeper violet colouring, (2) the broader border to primaries, (3) the black spot absent from cell of primaries (underside). The colour of *argia* is very variable in intensity, and the width of the marginal border seems to vary in proportion to the depth of the ground-colour. With regard to the black spot in the cell of primaries (underside), I have specimens with spots of varying sizes and intensity, specimens without spots, and several specimens with a spot on one wing and not on the corresponding one. The female of *alope* has, I believe, not yet been described.

57. Lycæna cleobis.

L. cleobis, Brem. Bull. Acad. Petr. iii. p. 472 (1861).

L. argonides, Brem. Lep. Ost-Sib. p. 28, t. iii. fig. 8 (1864).

Common at Gensan in June and July; the specimens are far larger than those from the Amur region. The males cannot possibly be confounded with *ægon* or *argus*, on account of their darker colouring; and the females differ on the underside by their brighter colour, sharper defined markings, and larger spots.

58. Lycæna argus, Linn.

Occurs commonly at Gensan in June and July; also in Central Japan (Oiwake, Oct.), and is reported from Yesso. The Corean specimens are rather smaller than the Japanese, and have a broader black margin to hind wing.

59. Lycæna ægon, Schiff.

L. micrargus, Butl. Cist. Ent. ii. p. 283 (1878).

L. pseudægon, Butl. P. Z. S. 1881, p. 851.

Common in Gensan in June and July. It occurs also in Yesso and in mountain districts of Central Japan. Corean specimens are usually much above the average size.

Lycæna iburiensis, Butl. P. Z. S. 1881, p. 852; Aid Identif. Ins. pl. 113, is a form of *ægon*. The type is in Mr. Fenton's collection.

60. Lycæna argiolus, L.

L. ladonides, de l'Orza, Lép. Jap. p. 20.

L. levetti, Butl. Ann. & Mag. Nat. Hist. ser. 5, xi. p. 111.

Common all over Japan and Corea during the warm season, and as variable in Eastern Asia as it is in Europe.

61. Lycæna lycormas.

L. lycormas, Butl. Journ. Linn. Soc., Zool. ix. p. 57 (1866).
L. scylla, Oberth. Et. Ent. v. p. 22.

Occurs in Yesso, and I believe also in the mountains of Central Japan. It is found also on the Amur. Its nearest European ally is *cyllarus*, Rott., a very variable species, which also occurs in Amurland.

62. Lycæna euphemus, Hb.

L. kazamoto, Druce, Cist. Ent. i. p. 361 (1875).

Occurs in Gensan, Yesso, Kurile Islands, and in mountain districts of Central Japan; some specimens are remarkably dark, and resemble the alpine forms of Europe.

63. Lycæna pryeri.

L. pryeri, Murray, Ent. Mon. Mag. x. p. 126 (1873).

Mr. H. Pryer says that this species is common about Yokohama in the spring. The only specimens I took of it occurred near the summit of Ibuki Yama (Lake Biwa) at about 5000 feet above the sea in July (about the 18th).

64. Libythea lepita.

L. lepita, Moore, Cat. Lep. E. I. C. Mus. i. p. 240.

Occurs in Central Japan and also in Yesso. I saw it flying in September in the mountains near Oiwake.

65. Dichorragia nesimachus, Boisd.

Fairly common in Central Japan; it occurs in mountain districts. I have never seen a living female; they seem to be very scarce.

66. Apatura ilia, Schiff.

Var. *clytie*, Schiff.
A. here, Feld. Wien. ent. Mon. vi. p. 27 (1862).
A. substituta, Butl. Cist. Ent. i. p. 159 (1873).

Common at Gensan and in Yesso in July and August; also in Central Japan. The typical form seems to be much rarer than var. *clytie* (*substituta*) just as it is in Europe.

67. Apatura cauta[1], nov. sp. (Plate XXXV. fig. 2.)

♂. Expanse of wings $3\frac{1}{4}$ inches.

Fore wing with a very deep indentation on its outer margin; ground-colour of all the wings light brown, with a purplish reflection in certain lights. Fore wing—a large irregular-shaped black patch extends from the base to about the middle of the wing, suffused

[1] [While this paper was passing through the press, vol. 3 of Romanoff's 'Mémoires sur les Lépidoptères' (St. Pétersbourg, 1887) has been received in London, including a paper by Fixsen, in which 93 Butterflies (besides Moths) from the Corea are enumerated. *Apatura princeps*, Fixsen, *l. c.* p. 289, pl. xiii. figs. 7*a*, *b*, is apparently identical with *A. cauta*, Leech.—W. F. K.]

down its centre with paler scales; beyond this patch is a circular black spot; a black double spot occurs in the cell, beyond which are two large black patches touching the costa; margins of all the wings black; an irregular black submarginal band runs round all the wings, dividing near the anal angle and enclosing two circular spots of the ground-colour; veins deeply marked with black, especially near the outer margins. Underside—markings of the fore wing reproduced, with the addition of a white costal mark, and six white spots about the apex: hind wing—all the veins broadly marked with black; the ground-colour replaced over a great part of the surface by dirty white. Underside of the abdomen white.

Allied to *Castalia* (nom. præocc., Moore) *dichroa*, Koll., and *chandra*, Moore, both Himalayan species.

I managed after much difficulty to secure a single male, which was flying strongly about some oak trees at Chang-Do, south of Gensan, Corea, beginning of July.

68. Euripus coreanus, nov. sp. (Plate XXXVI. fig. 1, ♂ ♀.)

Expanse, ♂ $4\frac{1}{2}$, ♀ 5 inches.

Wings of male dark brown, the basal half suffused with purple; a straight white streak, originating at the base of fore wing, traverses about $\frac{1}{3}$ of its width; a submarginal row of spots runs round all the wings, terminating at the anal angle in a bright carmine elongated spot; the discal area of both wings is traversed by two series of spots arranged irregularly, but concavely to the base of the wings, besides which there are two (sometimes three) spots near the apex of the fore wing and near the anal angle of the hind wing, situated inside the submarginal band. The two discoidal spots are often confluent. All spots situated on the purple colouring are pure white, those on the remainder of the wings pale yellow. Wings of the female dark brown, spotted as the male; all the spots about the costa and disk of both wings white, the remainder pale yellow; anal lunule carmine. Underside of both sexes—fore wings black; costa, apex, and outer margin pale bluish green, all markings of the upper surface reproduced; hind wings pale bluish green; veins very prominent, markings of the upper surface reproduced, mostly bordered with black; anal lunule carmine.

The underside of this species is sufficiently distinct to prevent any possible confusion with *Euripus charonda*. I took a large series of both the species (one in Japan, the other in Corea) and they seem to be quite constant.

This insect occurs commonly in a large forest about 15 miles south of Gensan in July; it frequents the tops of trees, and is very difficult to take in good condition on account of its powerful flight.

69. Euripus charonda.

Euripus charonda, Hew. Ex. Butt. iii. t. 4. fig. 1 (1863).

This large species is common about Yokohama, Lake Biwa, and the province of Kaga; it flies very high, only occasionally descending, like *Apatura*.

70. Euripus japonicus.

Euripus japonica, Feld. Wien. ent. Mon. vi. p. 27 (1862).

Common in Southern and Central Japan. I found it plentifully in the provinces of Higa and Satsuma in May, and again in Central Japan in July, where the specimens were smaller and darker. It is also recorded from Yesso and N. Japan.

71. Hestina assimilis, Linn.

Recorded from Japan. I never met with it, and it is not included in Mr. Pryer's catalogue of the Lepidoptera of Japan. I have specimens taken at Ningpo in June; also recorded from S. Corea.

72. Adolias schrenki.

A. schrenki, Mén. Bull. Acad. Petr. xvii. p. 215 (1859); Schrenk's Reise, ii. p. 31, t. iii. fig. 2.

I took this rare species at Port Lazaref near Gensan, in July; it did not appear to be very plentiful.

73. Limenitis helmanni.

L. helmanni, Lederer, Verh. zool.-bot. Gesellsch. Wien, 1853, p. 356, t. i. fig. 4.

L. homeyeri, Tancré, Ent. Nachr. 1881, p. 120.

Very common at Gensan in June and July, I also took it at Fusan (S.E. Corea) and at Nagasaki; in the Nagasaki specimens the bands and spots are narrower and smaller.

74. Limenitis sibylla, Linn.

Occurs commonly all over Japan and Corea. In many of the Japanese specimens the fourth white spot from the costa of the fore wing is as large as the rest, thus causing the band to be continuous.

75. Cyrestis thyodamas.

C. thyodamas, Boisd., Doubl. & Hewit. Gen. Diurn. Lep. t. 32. fig. 3 (1848).

Recorded by Mr. H. Pryer from Yamato and Kiushiu.

76. Neptis aceris.

N. aceris, Lepechin, Reise, i. p. 203, t. xvii. figs. 5, 6.

Var. *intermedia,* Pryer.

A good local form of *aceris,* occurring very commonly in Japan and Corea, also N. China.

The underside is much darker than in European specimens, being almost chocolate-colour; it is very variable in the proportion of black and white, also in size. A succession of broods occurs during the warm months.

77. Neptis lucilla, Schiff.

Var. *ludmilla,* Herr.-Schäff.

Occurs in Japan, Yesso, and Corea; it is not nearly so common as *aceris.*

78. Neptis pryeri.

N. pryeri, Butl. Trans. Ent. Soc. 1871, p. 561; Lep. Ex. t. 63. fig. 4; Jans. Cist. Ent. ii. p. 155.

Limenitis arboretorum, Oberthür, Et. Ent. ii. p. 24, t. iii. fig. 3.

Occurs in June and July. Very common in Gensan, where it occurs on the sea-level. In Japan it seems to be a mountain insect, and I took it near Lake Biwa. I have specimens from Ningpo which do not vary from the Japanese and Corean specimens.

79. Neptis alwina, Brem. & Grey.

Limenitis kæmpferi, de l'Orza, Lép. Jap. p. 40.

Not rare in Central Japan; it occurs also in Gensan in June, though not common.

80. Neptis excellens.

N. excellens, Butl. Cist. Ent. ii. p. 282 (1878).

This species, which appears to be distinct from *alwina*, is recorded from Nikko, Fujesan, and Yesso.

81. Vanessa burejana.

V. burejana, Brem. Lep. Ost-Sib. p. 15, t. i. fig. 8.

V. fallax, Jans. Cist. Ent. ii. p. 271 (1878).

V. strigosa, Butl. Journ. Linn. Soc., Zool. ix. p. 54 (1866).

Occurs both in Corea and Japan in a variety of forms; it is difficult to tell whether some of the forms belong to this species or the next without an enormous series from different localities.

82. Vanessa levana, Linn.

Var. *prorsa*, Linn.

Ab. *porima*, Ochs.

Araschnia obscura, Fenton, P. Z. S. 1881, p. 850.

This species also occurs both in Japan and Corea. The only form under which I took it was var. *prorsa*; the specimens are absolutely identical with European ones in my own collection.

83. Vanessa l-album, Esp.

I took this species in the mountains near Oiwake in October. Mr. H. Pryer records it also from Nikko and Yesso.

84. Vanessa c-album, Linn.

V. fentoni, Butl. Cist. Ent. ii. p. 281 (1878).

V. hamigera, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 92.

V. lunigera, Butl. P. Z. S. 1881, p. 850.

Common in mountain-districts of Central Japan in September and October. Occurs also in Yesso. As variable in Japan as in Europe.

85. Vanessa c-aureum, Linn.

V. angelica, Cr. Pap. Ex. iv. t. 388. figs. G, H.

V. pryeri, Janson, Cist. Ent. ii. p. 269 (1878).

Occurs commonly in Gensan. I took it also at several localities in

Central Japan and Yesso. *V. "pryeri"* is only taken in autumn or after hybernation. The other forms of this variable species occur all through the summer.

86. Vanessa urticæ, Linn.

V. connexa, Butl. P. Z. S. 1881, p. 851.

This is a very good local form of *urticæ*. I took it about half-way up the volcano near Hakodate in September, and I believe it does not occur in other parts of Japan. I hear that the same form occurs in Amurland with the intermediate forms. An English entomologist in Hakodate informed me that the larva was like that of *urticæ*, and fed upon nettles.

87. Vanessa callirhoë, Fabr.

Papilio atalanta indica, Herbst.

Common all over Japan and Corea.

88. Vanessa cardui, Linn.

This is not a common species; I took it at Yesso and Corea, and it occurs near Yokohama.

89. Vanessa io, Linn.

Not very common in Central Japan, where it keeps to the mountains, but plentiful in Yesso and Corea. It does not vary in the least from European specimens.

90. Vanessa charonia.

V. charonia, Drury, Ex. Ent. i. t. 15 (1773); Brem. Lep. Ost-Sib. p. 18.

Var. *glauconia*, Motsch. Et. Ent. ix. p. 28 (1860).

Common all over Japan and Corea. It is a variable species in the width of the blue submarginal bands and the size and colour of the costal spots, which may be either blue or white; the blue submarginal band of the fore wing, which usually ceases at its junction with the larger costal spot, is in some specimens carried up as far as the apical spot, noticeably so in specimens taken in the mountain-districts of Central Japan in October.

91. Vanessa antiopa, Linn.

I took this species at Hakodate in August and in Oiwake (Central Japan) in October. It does not differ from European examples, and has the same habit of settling on the road, and, when disturbed, taking a short flight and returning to the same spot.

92. Vanessa xanthomelas, Schiff.

Common all over Japan and Corea. Some specimens are remarkably large and bright.

93. Melitæa aurinia.

M. aurinia, Rott. Naturf. vi. p. 5 (1775).

Occurs at Gensan in June; the specimens seem larger and paler than European ones.

94. Melitæa phœbe, Schiff.

Var. *sibirica*, Staud. MSS.
Var. *ætherea*, Ev. Lep. Ross. p. 73, t. ix. figs. 5, 6.
M. scotosia, Butl. Cist. Ent. ii. p. 282 (1878).

Common at Fusan and Gensan (Corea) in June and July, and extremely variable, some specimens being the true var. *ætherea*, with few markings, others nearly black. Nearly all the specimens are much larger than European examples. It occurs in Yesso, and, I believe, in mountain-districts of Central Japan.

95. Melitæa parthenie, Bkh.

Var. *orientalis*, Mén. Schrenk's Reise, p. 23, t. ii. fig. 5.

I took what I believe to be this species commonly at Fusan, S.E. Corea, at the beginning of June.

96. Melitæa dictynna.

M. dictynna, Esp. t. 48. fig. 2, *a*, *b* (1779).
Var. *protomedia*, Mén. Schrenk's Reise, p. 23, t. ii. figs. 6, 7.

This occurred commonly with the last species in June at Fusan.

97. Melitæa athalia, Rott.

Var. *dubia*, Staud.
Var. *orientalis*, Mén. Schrenk's Reise, p. 23, t. ii. fig. 5.
M. niphona, Butl. Cist. Ent. ii. p. 281 (1878).

Occurs commonly at Fusan and Gensan (Corea), also in Yesso and in mountain-districts of Central Japan. Corean specimens are usually paler than Japanese; but this species is so variable that it is impossible to form a correct opinion concerning it without longer series than at present exist in this country.

98. Argynnis niphe, Linn.

I took this species commonly at Nagasaki and in the provinces of Higo and Satsuma in May. On one occasion I found the larva, pupa, and imago all together in the same place.

Larva of *Arg. niphe*, Kagoshima, May 10, 1886:—

Length $1\frac{1}{2}$ inches.

Ground-colour of body, head, and legs velvety black; dorsal stripe deep orange; abdominal legs externally tipped with a brownish-orange spot; spines branched, four on each of the first three segments, six on each of the remainder, with the exception of the anal segment, which has only four; the two dorsal spines of the second segment point forward; spines on the first three segments and the dorsal pair of the fourth segment black, the remainder are of a bright dark red, tipped with black; on each side of the body, from the fifth segment onwards, is an irregular network of faint pale markings.

Pupa. Light brown, with darker markings, having two spines on the under surface of each abdominal segment; the thoracic segments have each two bright gold spots on the under surface; the head terminates in two short horny projections.

Remains ten days to a fortnight in pupa.

Food-plant: *Viola* sp.

99. ARGYNNIS PERRYI?

? *Brenthis perryi*, Butl. Ann. & Mag. Nat. Hist. ser. 5, ix. p. 16 (1882).

This insect, which is fairly common at Gensan in July, seems close to *A. oscarus*, Eversm., but is larger, paler, and differs on the underside. It is not a constant species.

100. ARGYNNIS DAPHNE, Schiff.

A. rabdia, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 93.
Var. *fumida*, Butl. Ann. & Mag. Nat. Hist. ser. 5, ix. p. 16.

Not rare in Central Japan and Yesso, and very common at Gensan, where the specimens are remarkably fine.

101. ARGYNNIS INO, Esp.

Common at Gensan in June and July. The specimens are far larger than European examples.

102. ARGYNNIS AGLAIA, Linn.

A. fortuna, Janson, Cist. Ent. ii. p. 154 (1877).

Occurs plentifully at Gensan in June. I took the same species in N.W. Japan in July; they compare well with Amur specimens.

103. ARGYNNIS ADIPPE, Linn.

Var. *chlorodippe*, H.-S.
Var. *cleodoxa*, Ochs.
Var. *cleodippe*, Staud.
A. pallescens, Butl. Cist. Ent. i. p. 164 (1873).
A. vorax, Butl. Trans. Ent. Soc. 1871, p. 403.
A. locuples, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 134.

This very variable species is extremely common all over Japan and Corea, as well as several other forms quite as distinct as many named ones, which have so far escaped being separated. I have a fine series from Amurland, which compare well with the Japanese and Corean specimens, of which I took about 250, among which were some wonderful aberrations and varieties.

104. ARGYNNIS NERIPPE.

A. nerippe, Feld. Wien. ent. Mon. vi. p. 24 (1862).
A. coreana, Butl. Ann. & Mag. Nat. Hist. ser. 5, ix. p. 15 (1882).

A very distinct species, common all over Japan and Corea. It differs markedly from *adippe*, the only species with which it could be confounded, by its larger size, smaller spots, and markings, and general paler appearance. *Adippe*, except when faded, has always a bright chestnut tint; *nerippe* is fawn-coloured. The female is very rare in proportion to the male, and is far larger than any *adippe* I have ever seen.

Coreana, Butl., is said to differ from *nerippe* in the prominence of the sexual patch on the first median branch of the fore wing; this character is variable and may be altogether absent. I brought home over a hundred specimens, which show a good deal of variation, but none of any specific importance.

105. ARGYNNIS SAGANA, Doubleday.

Damora paulina, Nordm. Bull. Mosc. 1851, iv. p. 440, t. xii. figs. 1, 2, ♀.

Very common all over Japan and Corea. I have a large series also from Ningpo and Amurland; they are remarbably constant, although the Amur specimens are smaller.

106. ARGYNNIS LAODICE.

A. laodice, Pall. Reise, i. p. 470 (1771).

Var. *japonica*, Mén. Cat. ii. p. 152, t. x. f. 3.

Common all over Japan and Corea. The largest specimens represent *japonica*, and from Ningpo I have a larger form still.

107. ARGYNNIS ANADYOMENE, Feld.

A. ella, Brem. Lep. Ost-Sib. p. 94, t. viii. fig. 1 (1864).

Common all over Japan and Corea. Identical with Amur and North-China specimens.

108. ARGYNNIS PAPHIA, Linn.

A. paphioides, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 134.

Common in Japan and Corea. They are rather larger than the European form and darker. The female is intermediate between the usual type and var. *valesina*. I have the true var. *valesina* from Ningpo.

109. ARGYNNIS RUSLANA.

A. ruslana, Motsch. Bull. Mosc. 1866, iii. p. 117.

A. lysippe, Jans. Cist. Ent. ii. p. 154 (1877).

This species shares the characters of *paphia* and *laodice*—the shape of the wings and markings of upper surface being allied to *paphia*, the underside of hind wings reminding one of *laodice*. It is not rare at Hakodate in August, and I took it also at Nikko in September. It is the same size as *paphia*.

110. DANAIS TYTIA.

D. tytia, Gray, Lep. Ins. Nep. p. 9, t. ix. fig. 2.

This fine species occurs all over Japan. I observed a curious habit this Butterfly has, on the island of Kami Koshigi, off the coast of Satsuma. Just at dusk they ceased flying, and each chose out a small dead branch of a fir tree, on which it hung close to the trunk with the wings folded over its back. They were very easy to see and appeared never to choose a large branch or one more than about fifteen feet above the ground. By working with my net on a long bamboo I succeeded in procuring a long series in a very short time (in May). I also took it in Hakodate in August. Pryer says it is very common in mountain-districts of Central Japan.

111. Melanargia halimede.

M. halimede, Mén. Schrenk's Reise, p. 37, t. iii. figs. 6, 7.

This species is extremely common at Gensan in July. It is very variable, some specimens being much blacker than others.

112. Melanitis leda, Linn.

Var. *ismene*, Cram. Pap. Ex. i. t. 26. figs. A, B (1775).

Recorded from Nikko by Maries, and from the island of Shikoku Ohodaisan in Yamato by Mr. H. Pryer.

113. Mycalesis gotama.

M. gotama, Moore, Cat. Lep. E. I. C. i. p. 232 (1857).
Sadarga gotama, Moore, Trans. Ent. Soc. 1880, p. 157.

Common in Southern and Central Japan.

114. Mycalesis perdiccas.

M. perdiccas, Hew. Ex. Butl. iii. *Myc.* t. iii. fig. 15 (1862).
Gareis perdiccas, Moore, Trans. Ent. Soc. 1880, p. 157.
Mycalesis sangaica, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 95.
Mortanda sangaica, Moore, Trans. Ent. Soc. 1880, p. 169.

Occurs all over Japan and at Gensan. It appears to me to be quite distinct from the last species. Out of a very large number I have not a single intermediate form.

115. Ypthima baldus, Fabr.

Y. argus, Butl. Journ. Linn. Soc., Zool. ix. p. 56 (1866).

Common all over Japan and Corea. Very variable in the size and position of the ocelli, and the shade of the ground-colour of the underside.

116. Ypthima motschulskyi.

Y. motschulskyi, Brem. & Grey, Schmett. nördl. China's, p. 8; Mén. Cat. Mus. Petr. i. t. vi. fig. 5.

A very distinct species, common at Gensan and Fusan. I also took it at Nagasaki. It is a good deal larger that *baldus*, and has only one ocellus on the hind wing.

117. Erebia sedakovii.

E. sedakovii, Eversm. Bull. Mosc. 1847, ii. p. 70, t. i. figs. 5, 6.
E. niphonica, Jans. Cist. Ent. ii. p. 153, t. v. fig. 5 (1877).
E. scoparia, Butl. P. Z. S. 1881, p. 849.

This species occurs in mountain-districts of Central Japan and also in Yesso.

118. Satyrus dryas.

Papilio dryas, Scop. Ent. Carn. p. 153 (1763).
S. bipunctatus, Motsch. Et. Ent. ix. p. 29.
S. sibirica, Staud. Cat. p. 29.

Very common all over Japan and Corea. Amongst a large series I took some very fine aberrations.

119. Satyrus hyperanthus, Linn.

This species is recorded from Possiet Bay, N.E. Corea.

120. Pararge achine, Scop.

P. achinoides, Butl. Cist. Ent. ii. p. 283 (1877).

Occurs in Gensan, and also in Central and Northern Japan. The form is the same as that which occurs in Amurland.

121. Pararge deidamia.

P. deidamia, Ev. Bull. Mosc. 1851, i. p. 617.
P. menetriesi, Brem. & Grey, Schmett. nördl. China's, p. 8; Mén. Cat. i. t. 6. fig. 4.

Occurs at Gensan, Yesso; also in Central Japan.

122. Pararge maakii.

P. maakii, Brem. Lep. Ost-Sib. p. 22, t. iii. fig. 2.
Lasiommata marginalis, Motsch. Bull. Mosc. 1866, i. p. 190.

I found this species in Yesso, and Mr. H. Pryer has it from Yamato.

123. Lasiommata epimenides.

L. epimenides, Mén. Schrenk's Reise, p. 39, t. iii. figs. 8, 9.
Neope fentoni, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 91.

This is not a common species. I have taken it at Gensan, Hakodate, and it occurs on the volcano Assamayana in Central Japan.

124. Pronophila schrenkii.

P. schrenkii, Mén. Schrenk's Reise, p. 33, t. iii. fig. 3.

Common in Gensan, North-west Japan, and Yesso. It flies in dense underwood, and is hence rather hard to take, and seldom in fine condition. The Japanese specimens are larger and paler than those from the Amur and Corea.

125. Lethe sicelis.

Debis sicelis, Hew. Ex. Butt. iii. *Deb.* t. i. fig. 3.

Occurs commonly in mountain-districts of Central Japan in July and August.

126. Lethe diana.

L. diana, Butl. Journ. Linn. Soc., Zool. ix. p. 55 (1866).

L. whitelyi, Butl. Ann. & Mag. Nat. Hist. ser. 3, xix. p. 403, t. ix. fig. 8.

L. consanguis, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 133.

Common all over Japan during the warm weather; very variable in size, shade, and markings, and extremely difficult to take in good condition.

I took it also in Corea, both at Gensan and Fusan.

127. Neope goschkevitschii.

N. goschkevitschii, Mén. Cat. Mus. Petr. ii. p. 121, t. x. fig. 4 (1855).

N. niphonica, Butl. Ann. & Mag. Nat. Hist. ser. 5, vii. p. 133.

Common all over Japan. There are several broods, and some specimens are much darker than others.

This species is very fond of settling on tree-trunks with its wings folded, where it is difficult to detect on account of its protective colouring.

128. Neope callipteris.

N. callipteris, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 92.

This is a mountain species, and occurs in Yesso and Central Japan.

129. Cœnonympha œdipus, Fab.

C. annulifer, Butl. Ann. & Mag. Nat. Hist. ser. 4, xix. p. 91.

Occurs in mountain-districts of Central Japan, and at Fusan and Gensan, Corea, in June and July.

Rather larger than European examples.

130. Cœnonympha hero, Linn.

C. hero, var. *perseis*, Led. Verh. zool.-bot. Ges. Wien, 1853, p. 360.

Common at Gensan in June.

131. Ismene benjamini.

I. benjamini, Guér. Deless. Souv. Inde, ii. p. 79, t. 22. figs. 2, 2 *a*.

I. benjamini, var. *japonica*, Murray, Ent. Mon. Mag. xii. p. 4 (1875).

Common in Southern Japan in May; also at Nikko and Yamato (*Pryer*).

132. Ismene aquilina.

Ismene aquilina, Speyer, Stett. ent. Zeit. 1879, p. 346.

Proteides chrysæglia, Butl. P. Z. S. 1881, p. 856.

Ismene janowskii, Oberthür, Et. Ent. v. p. 23, t. i. fig. 2 (1880).

I only met with this species at Hakodate in August.

133. Plesioneura curvifascia.

P. curvifascia, Feld. Wien. ent. Mon. vi. p. 29. n. 29 (1862).

P. alysos, Moore, P. Z. S. 1865, p. 789.

Hesperia alysos, Boisd. MS.

This species, which is new to Japan, occurs plentifully in a small ravine close to the sea, near the port for Kumamoto in Kiushiu. I found the specimens just out in May.

134. Plesioneura bifasciata.

Plesioneura bifasciata, Brem. P. Z. S. 1881, p. 910.

Eudamus bifasciatus, Brem. & Grey, Schmett. nördl. China's, p. 10.

Gonoloba bifasciatus, Mén. Cat. Mus. Petr., Lep. i. t. v. fig. 3 (1855).

Very common in June about fifteen miles from Gensan at the foot of the mountains. I have also received it from Ningpo; it is recorded from Jinchuen, N.W. Corea.

135. Pterygospidea sinica.

Pterygospidea sinica, Feld. Wien. ent. Mon. vi. p. 140 (1862).

Pterygospidea moori, Mab. Bull. Soc. Ent. France, sér. 5, vi. p. clii (1876).

Daimio felderi, Butl. Ann. & Mag. Nat. Hist. ser. 4, vii. p. 140.

I believe I am right in uniting the above, although the specimens in the National collection marked *sinica* are too old to be of any use. I found it very plentiful at Foochau and Ningpo, and there are specimens from Nikko in the Museum.

136. Daimio tethys.

Pyrgus tethys, Mén. Enum. p. 126, t. x. fig. 8 (1855).

Daimio tethys, Murr. Ent. Mon. Mag. xi. p. 171 (1875); P. Z. S. 1881, p. 911.

Common all over Japan and Corea; there are several broods.

137. Isoteinon lamprospilus.

Isoteinon lamprospilus, Feld. Wien. ent. Mon. vi. p. 38 (1862).

Pamphila vitrea, Murr. Ent. Mon. Mag. xi. p. 171 (1875).

I found this very distinct species fairly plentiful in July at Tsuruga on the west coast of Japan. Mr. H. Pryer says it is common about Yokohama.

138. Pamphila mathias, Fabr.

Appears common in Southern and Central Japan. The male can readily be distinguished from any other Japanese species by the sexual bar on the fore wing; the arrangement of spots is also quite different to any other species.

139. Pamphila varia.

P. varia, Murray, Ent. Mon. Mag. xi. p. 172 (1875).

I found this species widely distributed, but not common; I have specimens from Satsuma, Nagasaki, Tsuruga, Hakodate, and Yokohama. It can be easily recognized by the dark veins on the underside of the hind wings.

140. Pamphila guttata.

Pamphila guttata, Murr. P. Z. S. 1881, p. 912.

Eudamus guttatus, Brem. & Grey, Schmett. nördl. China's, p. 10 (1855).

Goniloba guttata, Mén. Cat. Mus. Petr. i. t. v. fig. 4 (1855).

Common all over Japan and Corea; it can be easily distinguished from *P. pellucida* by its longer, narrower wings, and by the spots of the hind wing, which are almost in a straight line, while in *P. pellucida* the arrangement is most irregular.

141. Pamphila jansonis.

Pamphila jansonis, Butl. Cist. Ent. ii. p. 284.

I took a single specimen at Gensan in June of what I consider the male of the type in the National collection, which is a Japanese specimen.

It is very closely allied to *P. pellucida*, the only difference of any importance being a conspicuous pale spot near the base of the hind wing on the underside. I have a large series of *P. pellucida* and *P. guttata*, but can find no trace of this spot in any of them.

142. Pamphila pellucida.

P. pellucida, Murray, Ent. Mon. Mag. xi. p. 172 (1875).

This species is common all over Japan, Corea, and the Kurile Islands during the warm months.

143. Hesperia sylvanus, Esp.

Pamphila herculea, Butl. Ann. & Mag. Nat. Hist. ser. 5, vol. vii. p. 140.

Pamphila venata, ♂, Brem. & Grey, Schmett. nördl. China's, p. 11; Mén. Cat. Mus. Petr. i. t. v. fig. 8.

Pamphila florinda, Butl. Cist. Ent. ii. p. 285 (1878).

Occurs in Central Japan and Yesso, and is common at Fusan and Gensan, Corea, in June and July; a very variable species.

144. Hesperia subhyalina.

Pamphila subhyalina, ♀, Brem. & Grey, Schmett. nördl. China's, p. 10; Mén. Cat. Mus. Petr. i. t. v. fig. 7.

Allied to *sylvanus*, but easily distinguished by its larger size and the semitransparent patches on the fore wings of both sexes. Common in Corea; occurs also in Yesso, and I believe in Central Japan.

145. Hesperia sylvatica.

Pamphila sylvatica, Brem. Lep. Ost-Sib. p. 34, t. iii. fig. 10.

Pamphila leonina, Butl. Cist. Ent. ii. p. 286 (1878).

I took this species in Gensan in July, and Hakodate in August; it is recorded from Tokio.

146. HESPERIA OCHRACEA.

Pamphila ochracea, Brem. Lep. Ost-Sib. p. 33, t. i. fig. 11.

This seems to be rather a rare species; I took it at Gensan in June, and Nagahama, on Lake Biwa, in July.

147. HESPERIA RIKUCHINA.

Pamphila rikuchina, Butl. Cist. Ent. ii. p. 285 (1878).

This species is very distinct from the last. I took a long series of it at Nagahama and Tsuruga in July, and none of the specimens have one-third as much yellow as *ochracea*; there is scarcely any on the hind wings and none on the costal and inner margins of the fore wings.

This species occurs also at Nikko (*Pryer*).

148. HESPERIA FLAVA.

Pamphila flava, Murray, Ent. Mon. Mag. xii. p. 4 (1875).

Common all over Japan; I also took it at Fusan, Corea, in June; there appear to be several broods.

142. CYCLOPIDES MORPHEUS.

Papilio morpheus, Pall. Reise, i. p. 471 (1771).

Common at Gensan in June.

150. CYCLOPIDES ORNATUS.

C. ornatus, Brem. Lep. Ost-Sib. p. 33, t. ii. fig. 5.

This species occurs in Central Japan and Yesso.

151. PYRGUS INACHUS.

P. inachus, Mén. Schrenk's Reise, p. 46, t. iv. fig. 2.

Occurs in several localities in Central Japan, but is far from common.

152. NISONIADES MONTANUS.

Pyrgus montanus, Brem. Lep. Ost-Sib. p. 31, t. xi. fig. 4.

Nisoniades rusticanus, Butl. Journ. Linn. Soc., Zool. ix. p. 58 (1866).

Common all over Japan in spring. I have specimens from Ningpo, Japan, and Amurland; they all show a tendency to variation, but nothing of any specific importance.

153. SYRICTHUS MACULATUS.

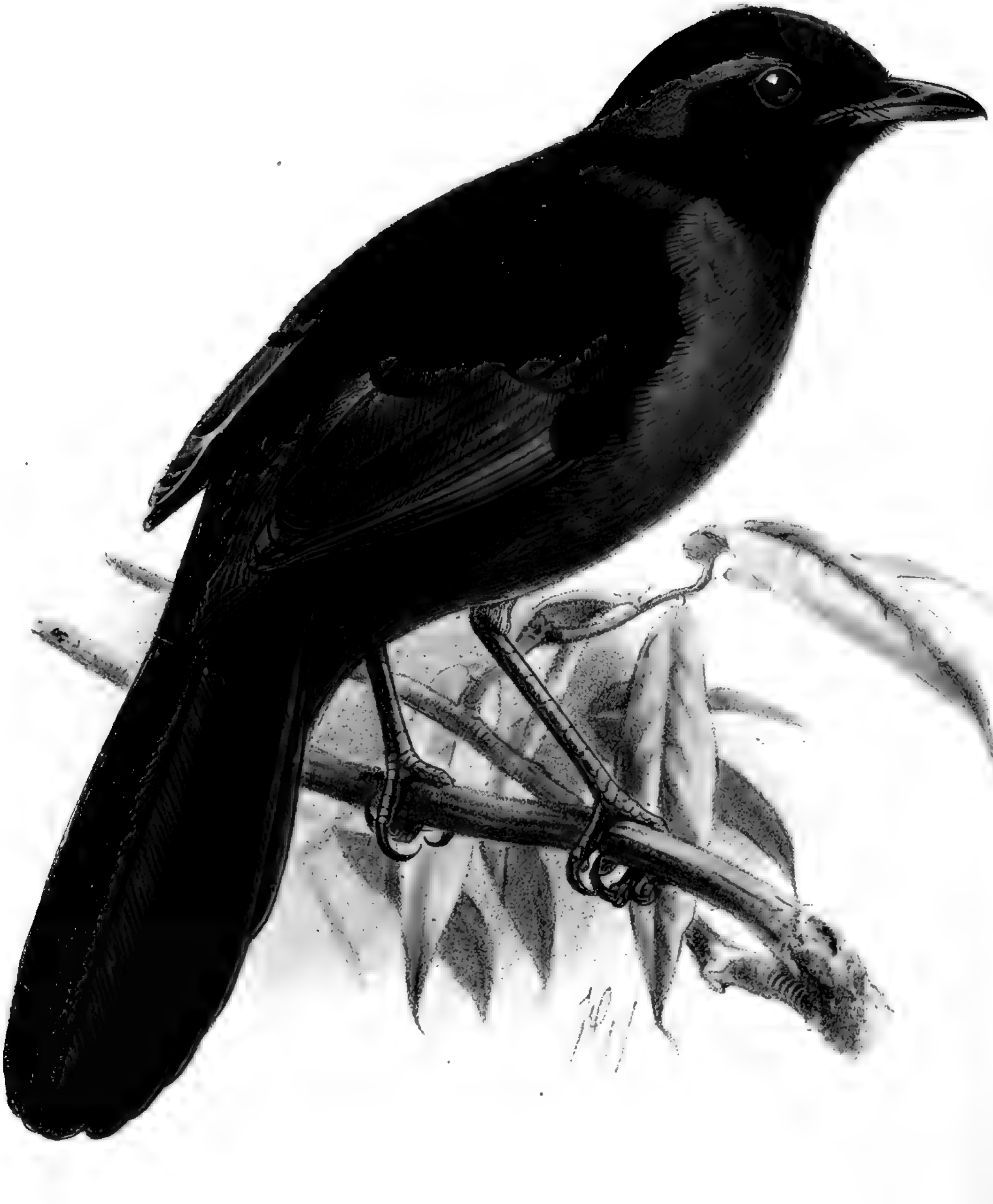
Syricthus maculatus, Brem. & Grey, Schmett. nördl. China's, p. 11.

Pyrgus maculatus, Mén. Cat. Mus. Petr. i. t. v. fig. 5.

P. sinicus, Butl. Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 96.

Common in Japan and Corea.

Sinicus differs from *maculatus* in its smaller spots, and in the absence of a second (submarginal) white band on the underside of



J. G. Keulemans del. et lith.

Mintern Bros. imp.

TROCHALOPTERUM PENINSULÆ.

J. G. Keulemans del. et lith.

Mintern Bros. imp.

1. MINLA [illegible]
2. AETHOPYGA WRAYI

the hind wing. The usual Japanese and Corean form is much larger than either of the forms mentioned, has much smaller and fewer spots, and no trace of a second white band on the underside of hind wing; the underside is very variable. No definite opinion on this difficult species can be formed without longer series than at present exist.

EXPLANATION OF THE PLATES.

PLATE XXXV.

Fig. 1. *Papilio mikado*, p. 406.
2. *Apatura cauta*, p. 417.
3. ♂ ♀ *Polyommatus auratus*, p. 414.

PLATE XXXVI.

Fig. 1. ♂ ♀ *Euripus coreanus*, p. 418.
2. *Dipsas flamen*, p. 410.

3. On a Second Collection of Birds formed by Mr. L. Wray in the Mountains of Perak, Malay Peninsula. By R. BOWDLER SHARPE, F.L.S., F.Z.S., &c., Zoological Department, British Museum.

[Received April 15, 1887.]

(Plates XXXVII. & XXXVIII.)

Mr. L. Wray, the Curator of the Perak Museum, has forwarded me another interesting collection of birds, amongst which are several novelties. The circumstances under which the collection was made are best explained by the following letter from Mr. Wray himself:—

"Perak Museum,
"Perak, Straits Settlements,
Nov. 15, 1886.

"MY DEAR SIR,—

"In accordance with the promise contained in my last letter, I now send you a collection of 51 bird-skins, which I made during a six weeks' stay on the hills in the months of September and October. Although it is not to be considered a complete collection, still, from the difficulty experienced in getting fresh species during the latter part of the time, I fancy it is a fairly representative one.

"The house in which I have been staying, and near which the collection was made, is about 4400 feet above the sea-level, and there is only one other peak near which is higher, and that reaches to 4700 feet. No other hills in the range, at least for many miles, rise higher than 5600 feet. This range, which is known as the Larut Range, is more or less connected on the north at the watershed of the Perak River with the main range of the peninsula. It is covered with dense unbroken forest from base to peaks, without any elevated open or grass lands.

"Besides the birds mentioned in the list, I repeatedly heard the cry of the Argus Pheasant (*A. giganteus*), and I found their dancing-places at about 3000 to 5000 feet. I saw also examples of three or four species of Hornbills and a Green-headed Bee-eater, but was not able to get any specimens of them.

"Below 3000 feet the hill forms become scarce, and the low-country ones begin to appear. The temperature at 3300 feet on the hills ranges from about 56° to 76° in the shade, and at the higher stations from 50° to 72°. Judging from the records of the past six years, there are no regular seasons in Perak. The rainfall on the Larut hills is from 200 to 250 inches per annum.

"I am, yours truly,
"L. Wray, Jun."

Mr. Wray's collection is divided into two parts, the first consisting of some low-country forms, a list of which I give for the sake of the notes appended by the collector. The latter are placed in inverted commas.

1. Oriolus xanthonotus, Horsf.

"No. 77. Larut. Irides and bill red."

2. Lalage culminata.

"No. 74. ♀. Larut. Irides dark brown."

3. Trichixus pyrrhopyga.

"No. 76. ♀. Blanja. Irides brown."

4. Pitta granatina.

"No. 72. ♂. Blanja. Irides brown; bill and legs black."

5. Calyptomena viridis.

"No. 73. ♂. Larut. Irides dark brown; bill yellowish."

6. Eurylæmus ochromelas.

"No. 75. ♀. Larut. Irides pale yellow; bill cobalt-blue, with yellow markings on the upper mandible."

7. Harpactes kasumba.

"No. 68. ♂. Larut. Irides crimson; bill and skin of face cobalt-blue. Fairly common in big jungle."

8. Halcyon concreta.

"No. 70. ♂. Bill black above, bright yellow beneath; irides brown."

9. Ptilopus jambu.

"No. 69. ♂ ♀. Irides white; bill yellow; feet and legs red. Very rare in Perak. These specimens were collected in Kinta in July."

10. Osmotreron fulvicollis.

"No. 71. ♂. Kinta. Irides white; feet and legs red. I have only seen two or three of these Pigeons.

I have quoted the following papers, which relate to the ornithology of the Malayan Peninsula, though most of them treat of the lower country on the western side:—

Hume, A. O. A First Tentative List of the Birds of the Western Half of the Malay Peninsula. Str. F. 1879, pp. 37–72.

——. The Birds of the Western Half of the Malay Peninsula. *Tom. cit.* pp. 151–163.

Kelham, H. R. Ornithological Notes made in the Straits Settlements and in the Western States of the Malay Peninsula. Ibis, 1881, pp. 362–395, 501–532.

——. The same. Ibis, 1882, pp. 1–18, 185–204.

Salvadori, T. Catalogo di una collezione di Uccelli fatta nella parte occidentale di Sumatra dal Prof. Odoardo Beccari. Ann. Mus. Civic. Genov. xiv. pp. 169–253 (1879).

The following is a list of the second collection made by Mr. Wray in the mountains, examples of some species not being sent to the British Museum:—

Neopus malayensis (Temm.); Sharpe, Cat. B. i. p. 257; Hume, Str. F. 1879, p. 44.

"No. 18. ♂ ♀. This Eagle is the only large species that I have seen on the hills. It is fairly common, and usually flies about in small parties of four or five." [Not sent.]

Spizaetus limnaetus (Raffl.); Sharpe, Cat. B. i. p. 272.

Limnaetus caligatus, Hume, Str. F. 1879, p. 44; Kelham, Ibis, 1881, p. 366; Salvad. Ann. Mus. Civic. Genov. xiv. p. 172 (1879).

"No. 19. On opening my window early one morning I saw one of these Hawk-Eagles sitting with crest erected on a stump of a tree, only about thirty yards from the house, and brought it down with a shot from my revolver. A second specimen was shot by my collector while perched on a branch of a tree quite near the ground, but was never found, as in searching for it the man got bitten on the leg by a Snake (*Trimeresurus gramineus*), and gave up the search. These were the only two birds seen of this species." [Not sent.]

Spilornis bacha, Sharpe, Cat. B. i. p. 290; Hume, Str. F. 1879, p. 44; Salvad. *t. c.* p. 173.

"No. 64. ♀. Irides bright yellow. I only saw one pair of these birds, one of which I was fortunate enough to be able to shoot."

The specimen sent is very dark and almost as deeply coloured as typical Javan birds, certainly exceeding that of Malaccan specimens. The feathers on the hind neck and mantle are edged with sandy rufous. Wing 14·5 inches.

Glaucidium brodiei (Burt.); Sharpe, Cat. B. ii. p. 212 (1875).

"No. 57. ♂. Irides yellow. Only one specimen of this Pygmy Owlet was seen."

Syrnium newarense (Hodgs.); Sharpe, Cat. B. ii. p. 281 (1875).

"No. 65. ♀. Irides yellow. I found this Owl seated on a branch of a small tree in a very dark ravine, and I was some time before I could decide whether it was a bird or some dead leaves."

This specimen is rather small, but there can scarcely be any question about its being identical with *S. newarense* and not with *S. maingayi*, which is the yellow-faced form found in the Malay Peninsula (*cf.* Hume, Str. F. vi. p. 27). As a rule *S. maingayi* and *S. indranee* have perfectly uniform faces of a deep ochreous colour, but one specimen (♀) from Coonoor has the face dusky and barred with blackish, exactly as in *S. newarense*, and therefore it shows either that *S. newarense* occurs in the Nilghiris, or else that the latter range contains an intermediate form between *S. newarense* and *S. indranee*.

The specimen sent by Mr. Wray has the wing 4 inches. It is evidently a very old bird, being very dark above and very coarsely barred below, with a dark band across the chest, where the cross-bars are not so distinct. The face is deep rufous-ochre, with a few indistinct blackish cross-bars. Altogether the specimen may be said to belong to the eastern race of *Syrnium newarense*, with a tolerably uniform ochreous face. Such specimens are found in Formosa, Assam, Manipur, and Sikkim, where a perfect gradation takes place between them and typical *S. newarense*, leaving it absolutely impossible to draw any line between eastern and western examples.

Oriolus consanguineus, Wardlaw Ramsay.

"No. 59. ♂. Irides crimson; bill pale blue-grey. The female is black, without the red breast- and wing-spots. It is not a common bird. The range seems to be from 3000 to 4000 feet, but I have a specimen shot in Kinta at not more than 100 or 200 feet above the sea-level, at the foot of the central range of the peninsula."

The specimen sent is identical with one of the typical specimens collected by Mr. Carl Bock, and now in the British Museum.

Bhringa remifer (Temm.); Sharpe, Cat. B. iii. p. 257 (1877).

"No. 46. ♂ ♀. Irides red-brown. The long tail-feathers of most of the males have no webs on their shafts, excepting on the racket-ends, the portion covered by the ordinary tail being quite naked. I obtained two males with webs on the shafts, under the shorter tail-feathers, and was at first uncertain whether there might not be two species; but as no difference was observable in the tails of the females (the upper portion of the long tail-feathers being webbed in every specimen), it seems more probable that the birds with the webbed upper parts of the long feathers are young males."

This is interesting, as continuing the range of the species southwards from Tenasserim, but it is also known from Java.

ARTAMIDES LARUTENSIS, sp. n.

"No. 30. ♂. Irides brown. The female has a lighter head than the male. Fly usually in pairs or small parties."

A large representative of *A. larvatus*, from which it differs in its purer grey coloration, blacker chin and cheeks, and by the colour of the under tail-coverts, which are white washed with ashy grey. The under wing-coverts are also for the most part white, but in both these cases the plumage may not be fully mature.

Adult male. General colour above uniform dark pearly grey, lesser wing-coverts like the back; median and greater coverts dark cindery grey, edged with pearly grey; bastard-wing, primary-coverts, and quills black, fringed with ashy grey, margined with broader and paler grey on the secondaries, the innermost narrowly fringed with whitish at the ends; upper tail-coverts like the back; centre tail-feathers ashy grey, blackish towards the ends, the remainder black tipped with an ashy-grey spot, increasing in extent towards the outermost, which is also pale ashy along the outer web; crown of head like the back; a line across the base of the forehead, lores, feathers round the eye, and fore part of cheeks black; sides of face, ear-coverts, cheeks, and throat blackish, with an ashy shade, shading off paler on the lower throat and fore neck; remainder of under-surface of body deep pearly grey, a little lighter than the back; thighs dark slaty grey; under tail-coverts white, grey near the vent, the rest of the coverts marked with ashy grey; under wing-coverts grey, or grey varied with white bars; axillaries grey; quills below dusky, ashy white along the inner edge. Total length 11 inches, culmen 1·05, wing 6·45, tail 4·4, tarsus 0·95.

PERICROCOTUS IGNEUS, Blyth; Sharpe, Cat. B. iv. p. 78; Hume, Str. F. 1879, p. 57.

"No. 53. ♂. Irides brown. Not common. Only one specimen of this Minivet was obtained."

CRYPTOLOPHA TRIVIRGATA (Strickl.); Sharpe, Cat. B. iv. p. 396; Salvad. *t. c.* p. 204.

"No. 44. ♀. Irides dark brown."

Compared with specimens from West Java and Sumatra.

RHIPIDURA ALBICOLLIS (V.); Sharpe, Cat. B. iv. p. 317.

"No. 31. ♀. Irides brown. These Fantails are restless and active in their habits, flitting about with their tails spread out and hardly ever for a moment still. This species and the one found in the low country (*R. javanica*) are said to be mad by the Malays, from the absurd and restless way in which they are always hopping and turning about. The present species I always found in small flocks, and almost invariably with Quaker Thrushes (*Alcippe*), Racket-tailed Drongos, *Rhinocichla mitrata*, and other birds. It frequents dense jungle and has a sweet clear little song."

The only difference between the specimen sent and others from various parts of India seems to be that the white tips to the tail-feathers are rather larger and not ashy white, but pure white. Tenasserim specimens, however, seem to be intermediate.

NILTAVA GRANDIS, Hodgs.; Sharpe, P. Z. S. 1886, p. 351.

"No. 38. ♂. Irides brown. Only one specimen seen in this stage of plumage."

The specimen is a young bird in spotted dress.

MUSCICAPULA MACULATA (Tick.); Sharpe, Cat. B. iv. p. 207; Salvad. *t. c.* p. 203 (1884).

"No. 36. ♂. Irides brown. Quite common about 3500 feet."

COPSYCHUS MUSICUS (Raffl.); Sharpe, Cat. B. vii. p. 63; Hume, Str. F. 1879, p. 64; Kelham, *t. c.* p. 515; Salvad. *t. c.* p. 236.

"No. 52. Only found on clearings of the hills." [Not sent.]

MYIOPHONEUS, sp. inc.

"No. 54. ♂ ♀. It is found in the rocky ravines and river-beds of the hills from 1000 feet or so to nearly 4000 feet, but is a rare and shy bird." [Not sent.]

Mr. Wray supposes this bird to be *M. temmincki*, and says that it agrees with Jerdon's description of that species. I think it will probably be *M. eugenii*.

IOLE TICKELLI (Blyth); Sharpe, Cat. B. vi. p. 60.

Hypsipetes tickelli, Hume & Davison, Str. F. vi. p. 296.

"No. 39. ♂ ♀. Irides red-brown. Has an erectile crest. It is common above 3500 feet, either solitary or in pairs. It hawks for insects, and also eats vegetable matter."

There is a slight difference between the birds of Perak and typical *I. tickelli* from Tenasserim. The Perak birds are rather darker, more ashy below, and decidedly more dingy olive on the flanks. These dull colours may, however, be due in great part to worn nesting-plumage, of which Mr. Wray's specimens bear evidence.

TROCHALOPTERUM PENINSULÆ, sp. n. (Plate XXXVII.)

"No. 25. ♂ ♀. Irides brown. Usually seen in the undergrowth, but sometimes on the higher trees. One pair that I shot on a fair-sized tree had been feeding on some large green seeds. There were also partly digested remains of insects in both of their stomachs. This bird has a pretty clear song, and roosts low down in the undergrowth."

This species finds its nearest ally in *T. melanostigma* of Tenasserim, resembling that species in the black wing-spot formed by the primary-coverts, but it differs in many important points, which may be summarized as follows:—

1. A darker chestnut crown.
2. The back chestnut-brown instead of ashy.
3. Ear-coverts dingy rufous-brown, not ashy.
4. Breast chestnut-brown instead of ashy.

The following is a description of the sexes of *T. peninsulæ*:—

Adult male. General colour above reddish brown, a trifle more olivaceous towards the lower back and rump; scapulars like the back; lesser and median coverts like the back, the latter slightly washed with rufous, greater coverts maroon-red; bastard-wing black, externally golden or maroon, the outer feather olive, greenish externally; primary-coverts black, forming a large patch; quills blackish, externally olive-yellow with a golden lustre, rather brighter on the primaries; inner secondaries inclining to ashy grey towards the ends, which are edged with black; upper tail-coverts like the back; tail-feathers dusky, externally golden olive; crown of head deep chestnut as far as the occiput; nape and hind neck like the back, the former slightly tinged with rufous; lores and feathers over the eye black; sides of hinder crown dark ashy, forming a patch converging on the nape; sides of face, ear-coverts, and cheeks dark rufous-brown, blackish below the eye and on the chin; throat and fore neck deep chestnut, becoming paler and more rufous-brown on the breast and abdomen; the sides of body and flanks somewhat duller brown; thighs and under tail-coverts dull rufous-brown; under wing-coverts and axillaries like the sides of the breast; quills below blackish, ashy along the inner edge. Total length 10 inches, culmen 0·95, wing 4·1, tail 4·5, tarsus 1·5.

Adult female. Similar to the male. Total length 10 inches, culmen 0·95, wing 3·8, tail 4·3, tarsus 1·4.

POMATORHINUS WRAYI, sp. n.

"No. 24. ♂ ♀. Irides brown. This bird has a loud, clear, and rather pleasing song. It frequents the undergrowth and often the ground, going about in pairs. Stomach contained insects."

This species represents *P. tickelli* in the Perak Mountains, but it is everywhere much darker in plumage, the head being dusky brown, inclining to dark ashy. The tail is black instead of rufous-brown.

The following is a description of the typical pair of birds:—

Adult female. General colour above reddish brown, with indistinct dusky cross-bars under certain lights; lower back and rump slightly more olivaceous; upper tail-coverts again reddish brown; lesser and median coverts reddish brown like the back; greater coverts, bastard-wing, primary-coverts, and quills blackish brown, externally reddish brown, inclining to chestnut on the quills; tail-feathers blackish, washed externally with reddish brown, especially towards the base of the feathers, which are indistinctly barred with dusky under certain lights; crown of head more dusky brown than the back, and only slightly washed with rufous; lores ashy whitish; behind the eye a bare spot; no distinct eyebrow, but a streak above the ear-coverts, formed by the white longitudinal centres of the feathers, larger and more distinct down the sides of the neck; ear-coverts pale brown, followed by a reddish band down the sides of the neck; cheeks, throat, breast, and centre of abdomen white; sides of neck dusky brown, with some longitudinal white stripes intermingled;

fore neck and breast with dusky margins to some of the feathers; sides of breast and of abdomen ashy grey, mottled with lanceolate streaks of white, narrower on the latter; sides of body and flanks uniform reddish brown; thighs and under tail-coverts also reddish brown; under wing-coverts and axillaries dark ashy; quills below dusky blackish, more ashy along the inner edge. Total length 10 inches, culmen 1·7, wing 4·1, tail 3·95, tarsus 1·55.

Adult male. Similar to the female, but not so strongly streaked with white down the sides of the neck. Total length 10 inches, culmen 1·65, wing 4·0, tarsus 1·6.

I have described the female, as the male is moulting and has not got its perfect tail.

Corythocichla leucosticta, sp. n.

"No. 37. ♂ ♀. Irides crimson. Frequents the undergrowth usually in pairs, and has an unusually loud song for such a small bird."

Compared with *C. striata* the present species is more ashy both above and below, and is easily distinguished by the white dots on the coverts and quills, these being fulvous in *C. striata*. The throat is distinctly mottled with blackish (not ashy) centres to the feathers.

Adult male. General colour above ashy brown, with a slight ruddy tinge; all the feathers edged with black, producing a mottled appearance; rump not so distinctly mottled; wing-coverts like the back, and edged with black in the same manner, each having a tiny white spot at the tip; bastard-wing, primary-coverts, and quills blackish, externally olive-brown, a little more ruddy on the latter; all the quills with a tiny white spot at the end, larger on the inner secondaries; tail-feathers dark brown, externally reddish brown; head like the back, and mottled with black edgings in the same manner; lores and a distinct broad eyebrow ashy grey; sides of face dull ashy, shaded with brown on the ear-coverts, and having a faint moustache of whitish near the gape; cheeks uniform ashy grey; throat white, mottled with dark ashy-grey centres to the feathers; remainder of under surface of body dull ashy brown, with dusky centres; the sides of the body browner, becoming more rufous on the flanks and under tail-coverts; axillaries and under wing-coverts olive-brown. Total length 5·4 inches, culmen 0·7, wing 2·5, tail 1·8, tarsus 0·95.

Adult female. Similar to the male, but rather paler in colour. Total length 5·2 inches, culmen 0·7, wing 2·55, tail 1·75, tarsus 0·9.

Siva sordida, Hume; Sharpe, Cat. B. vii. p. 641.

"No. 33. Irides white. This Hill-Tit is not often seen, so far as my experience goes. During bad stormy weather it seems to disappear altogether, probably taking refuge in the sheltered valleys."

A young bird, belonging to *S. sordida* or a closely allied species, and certainly quite distinct from *S. cyanoptera*. It has rather a long tail, and is yellower underneath than the type of *S. sordida*, and a comparison of fully adult birds is desirable.

ALCIPPE PERACENSIS, sp. n.

"No. 32. ♂. Irides brown. This bird is common on the higher parts of the hills. It has a loud and musical song."

By the absence of the white eyelids this new species ought to be allied to *Alcippe phæocephala* and *A. cinerea*; but it has a very distinct black band running down the sides of the neck, thus showing its affinity to *A. nipalensis*. It is, in fact, closely allied to the latter species, but may be distinguished by the want of the white ring of feathers round the eye.

Adult. General colour above warm brown from the lower mantle downwards; the upper tail-coverts like the back; wing-coverts like the back; bastard-wing, primary-coverts, and quills dusky brown, externally like the back; the primaries edged with fulvous brown; tail-feathers brown, externally like the back; crown of head, occiput, nape, hind neck, and upper mantle dark slaty grey, with a black streak extending from above the eye to the upper back; lores ashy white; feathers round eye, ear-coverts, and sides of neck ashy grey, lighter on the cheeks, which incline to ashy white like the throat; fore neck, breast, and abdomen creamy white; the sides of body and flanks light brown, darkening on the latter; thighs and under tail-coverts light brown; under wing-coverts and axillaries whity brown; quills below dusky, ashy whitish along the inner edge. Total length 5·4 inches, culmen 0·5, wing 2·5, tail 2·5, tarsus 0·75.

MINLA SOROR, sp. n. (Plate XXXVIII. fig. 1.)

"No. 42. ♂. Irides dark brown."

Closely allied to *M. castaneiceps*, from which it differs in its much larger size, darker olive-brown coloration, and deep chestnut, not orange, edging to the quills.

Adult. General colour above olive-brown, more distinctly olive on the lower back and rump; the mantle with narrow pale shaft-streaks, not very distinct; lesser and median coverts like the back; external greater coverts black, the inner ones olive-brown; bastard-wing and primary-coverts black; quills dusky blackish, externally olive-brown; the primaries edged with chestnut towards the base; the outer primaries margined with white; upper tail-coverts like the back; tail-feathers ashy brown, externally olive-brown; crown of head and nape bright chestnut, the feathers mesially streaked with rufous shaft-lines, white towards the forehead; lores and feathers round and below the eye sulphur-yellow; ear-coverts with a black streak along the upper part, surmounted by a streak of sulphur-yellow; remainder of ear-coverts yellow streaked with black, and with a black stripe below, separating them from the cheeks, which, with the throat and under surface of body, are pale yellowish buff; the feathers of the cheeks and throat slightly mottled with brown tips; sides of body and flanks olive-brown; thighs olive-brown; under tail-coverts yellowish white, with dusky centres; under wing-coverts and axillaries pale yellow; quills below dusky, ashy yellowish along the inner edge. Total length 4·7 inches, culmen 0·55, wing 2·6, tail 2·0, tarsus 0·85.

STACHYRIS NIGRICEPS, Hodgs.; Sharpe, Cat. B. vii. p. 532 (1883).

"No. 56. ♂. Irides brown."

Apparently identical with Himalayan specimens.

CYANODERMA CHRYSÆA (Hodgs.); Sharpe, Notes Leyden Mus. vi. p. 176 (1884).

Stachyridopsis chrysæa (Hodgs.); Sharpe, Cat. B. vii. p. 601.

"No. 35. Irides brown. Male and female similar."

The specimen sent seems to me to be inseparable from *S. chrysæa*. It is a trifle less distinctly streaked on the head, showing an approach to *S. assimilis*; but it has the brilliant throat of *S. chrysæa*.

PHYLLERGATES CUCULLATUS (Temm.); Sharpe, Cat. B. vii. p. 229 (1883).

"No. 50. ♂. Irides light brown. Only seen in dense jungle."

Identical with Javan specimens.

SUTORIA MACULICOLLIS (Moore); Sharpe, Cat. B. vii. p. 218 (1883).

"No. 51. ♀. Irides light brown. Shot in a clearing at 3300 feet."

PTERUTHIUS ÆRALATUS, Tickell; Hume and Davison, Str. F. vi. p. 368 (1878).

"No. 34. ♂. Irides brown. This bird is fairly common on the higher parts of the hills."

Slightly smaller than the typical *P. æralatus* (wing 3·1), but not specifically separable. *P. cameranoi*, of Salvadori (*t. c.* p. 232), is undoubtedly the same.

ÆTHOPYGA WRAYI, sp. n. (Plate XXXVIII. fig. 2.)

"No. 41. ♂. Irides dark brown. This Honey-sucker is very plentiful in the jungle, on the tops of the hills, and in the clearings. I have not observed it lower than 3000 feet. There is another species of Honey-sucker, but I was not able to get a specimen of it."

This species is the Malayan representative of *Æthopyga sanguinipectus*, from which it may be distinguished by its black, non-metallic throat and fore neck.

Adult male. General colour above dark crimson on the mantle and back; scapulars black; on the rump a patch of sulphur-yellow; bastard-wing, primary-coverts, and quills blackish, a little browner on the edge of the latter; upper tail-coverts metallic violet-blue; tail-feathers black, the long centre ones externally metallic violet-blue; crown of head metallic violet-blue, with a purple reflexion; lores, sides of face, and ear-coverts black; cheeks metallic blue, forming a moustachial streak; throat, fore neck, and chest velvety black, the sides of the latter dark crimson enclosed by black; breast, abdomen, sides of body, and flanks pale olive-greenish, yellower on the centre of the breast, which is also streaked with black, and just below the velvety black of the upper breast are some tiny longitudinal streaks of scarlet; on the sides of the body and flanks a tuft of pale yellow; thighs and under tail-coverts like the breast; under wing-coverts and axillaries yellow, with white bases; quills below dusky blackish, white along the inner edge. Total length 5 inches, culmen 0·7, wing 2·0, tail 1·6, middle feathers 2·6, tarsus 0·5.

ARACHNOTHERA MAGNA, Hodgs.; Shelley, Monogr, Nect. pl. 112. fig. 1.

"No. 26. Irides brown. Feet and legs bright orange; bill black. Female much larger than the male. A very active bird, with a loud harsh note."

ARACHNOTHERA LONGIROSTRIS (Lath.); Shelley, *t. c.* pl. 114; Hume, Str. F. 1879, p. 55; Kelham, *t. c.* p. 501; Salvad. *t. c.* p. 214.

"No. 25. Irides brown. I only saw these Spider-hunters once, when a large party of them were fluttering on the tops of some small trees, making a continual chirping."

DICÆUM IGNIPECTUS (Hodgs.); Sharpe, Cat. B. x. p. 41.

"No. 49. ♂. Irides brown."

A specimen in bad condition, but apparently identical with others from the Himalayas.

DENDROPHILA AZUREA (Less.); Salvad. *t. c.* p. 211.

"No. 55. ♀. Irides white; skin round eyes white; legs and bill blue-grey. Sexes alike. This pretty little Nuthatch frequents the densest parts of the jungle, usually in the ravines, and seems to prefer the trunks of the largest trees to hunt for insects &c. Is seen singly or in small parties of three or four."

Count Salvadori finds fault with Gray's figure of this species, and says that the feet in the dried skins from Sumatra were greenish, not yellow; but it is probable that they became yellow in time, and certainly our Java skins have yellow legs; but a Timor specimen has them dark, like the Perak bird. Both the last-named specimens are duller blue on the back than the Java specimens.

ZOSTEROPS AURIVENTER, Hume; Sharpe, Cat. B. ix. p. 163.

"No. 43. ♀. Irides yellow-brown."

MOTACILLA MELANOPE, Pall.; Sharpe, Cat. B. x. p. 497 (1885).

Calobates melanope, Hume, Str. F. 1879, pp. 65, 161; Salvad. *t. c.* p. 236.

"No. 40. ♂. Irides dark brown. Males and females alike."

Hirundo gutturalis (Scop.); Sharpe, Cat. B. x. p. 134 (1885); Hume, Str. F. 1879, p. 47; Kelham, *t. c.* p. 372.

"No. 62. ♂. Irides dark brown. Very plentiful on the summits of the hills."

Apparently an adult male before the winter moult.

Nyctiornis amictus (Temm.); Dresser, Monogr. Merop. pl. i.

"No. 29. ♀. This bird is partial to the lower trees and bushes in the forest, and extends from the plains up to the very top of the hills. The nest is made in a hole excavated in a bank of earth, in the same way as with the *Merops*.

"It makes a sort of laughing noise, something like 'Kār-kă-kă-kă-kă-kă-kār.' It was some time before I was able to identify this bird as the caller, until I shot one in the act. The amount of red on the head and throat varies very much; and in one the plumage was wholly green, excepting the tail, which was the same as in the normally coloured bird."

Hierococcyx fugax, Horsf.; Hume, Str. F. 1879, p. 53; Kelham, *t. c.* p. 391; Salvad. *t. c.* p. 185.

"No. 61. ♀. Irides brownish yellow. This was the only member of the family Cuculidæ that I met with."

Cyanops ramsayi.

Megalæma ramsayi, Wald.; Hume and Davison, Str. F. vi. p. 152.

"No. 20. ♂ ♀. Irides brown. This Barbet is common above 3500 feet."

This is a Tenasserim species, not previously known to occur to the south of that province.

Megalæma ooti.

Cyanops ooti, Salvad. *t. c.* p. 180.

"No. 21. ♀. Irides red-brown. I did not meet with this species higher than 3500 feet nor lower than 3000 feet. It is plentiful, but, from its frequenting the tops of tall trees, is difficult to shoot. Both of these Barbets are very noisy birds."

Psilopogon pyrolophus, S. Müll.; Sharpe, P. Z. S. 1886, p. 352; Salvad. *t. c.* p. 178.

"No. 14. I observed one male of this species with the under tail-coverts scarlet; and another with them green, with the extreme tips of the feathers tinged with scarlet. It is a very silent bird, and only occasionally utters a harsh note, something like that of a Woodpecker."

Chrysophlegma malaccense (Lath.); Hargitt, Ibis, 1886, p. 276.

Callolophus malaccensis, Hume, Str. F. 1879, p. 52; Salvad. *t. c.* p. 182.

"No. 23. ♀. Irides brown. A low-country form. The specimen sent was shot at nearly 4000 feet."

GECINUS CHLOROLOPHUS.

"No. 22. ♂. Irides crimson. The only Woodpecker seen in the higher parts of the hills."

LEPOCESTES PORPHYROMELAS.

Blythipicus porphyromelas, Hume, Str. F. 1879, p. 52.

"No. 58. ♂. Irides brown."

MIGLYPTES GRAMMITHORAX, Malh.; Hargitt, Ibis, 1884, p. 191.

Meiglyptes tristis, Hume, Str. F. 1879, p. 52; Kelham, *t. c.* p. 388; Salvad. *t. c.* p. 184.

"No. 63. ♂. Irides brown."

VIVIA INNOMINATA (Burt.); Salvad. *t. c.* p. 184.

"No. 48. ♀. Irides brown. This pretty little Piculet seems to be rare, as I only met with it once. I saw a small bird on the almost vertical branch of a shrub, pecking at it in the same way as a Woodpecker, and took it to be a Nuthatch until I shot it."

I showed Mr. Wray's specimen to my friend Mr. Hargitt, who pronounced it identical with Himalayan examples. By the discovery of the species in the Larut mountains its range to the southward is much extended, though it occurred to Dr. Beccari in Sumatra.

CARPOPHAGA BADIA (Raffl.); Hume, Str. F. 1879, p. 67.

"No. 45. Irides greyish white; feet and eyes crimson-red. I have also collected this Pigeon on the plains near the mangrove-swamps in May and June, though it is not by any means common, and does not seem to have been noticed by collectors in the Straits. Like *C. insignis* of Hodgson, it appears to descend from the hills to the plains during the months of April, May, and June."

MACROPYGIA, sp.

"No. 60. ♂. Irides pale brown, with an inner ring of white; legs dull lake-red. Only one specimen of this handsome Tree-Dove was procured, so it is probably rare. I shot it at upwards of 4000 feet.

"Some three years ago I shot a small reddish-brown Dove, about 9 or 10 inches in length, near the top of the Larut hills, but unfortunately the skin was not preserved. I also found a nest belonging to the same species, which was built of twigs and contained white eggs. It was on the top of a small palm tree, about 5 feet from the ground. These two species and *Carpophaga badia* are the only representatives of the Columbæ which I have seen in the upper parts of the mountains."

So far as I can see, this Dove is *M. tusalia* of Hodgson; but I must confess that the variations of plumage in this genus require more time to work out than I have at present at my disposal.

4. Description of some new Lepidoptera from Sikkim. By H. J. Elwes, F.Z.S.

[Received May 3, 1887.]

The species described in this short paper are from a large collection made by myself in the rainy season of 1886, whilst waiting at Darjiling for the departure of the Tibet Mission. They will be included in a Catalogue of the Lepidoptera of Sikkim, of which I have nearly completed the first part containing the Rhopalocera, and, taken in connection with those now described by Mr. De Nicéville, prove that, notwithstanding the great activity which has been shown by Messrs. O. Möller, De Nicéville, and Knyvett in that country, its very long list of Butterflies is not yet complete.

I hope to be able to give figures of the new species in my Catalogue of the Lepidoptera of Sikkim.

Lethe tristigmata, n. sp.

This very distinct insect, of which the male sex only is known, had been already distinguished by Möller in 1885 as a new species, and was described by Mr. De Nicéville in MS.; but as I found it in 1886 myself and was about to publish it under the present name, Mr. De Nicéville has kindly allowed me to transfer the description (which I give below) to my own paper. I took it on Tonglo, from about 8500 to 9500 feet, in July, when most of the specimens were no longer fresh; but its time of appearance is in June. It frequents open spots in the bamboo-jungle and low dripping forest, and settles on the path like other species of *Lethe*. Though I searched carefully I never saw a female: this sex probably remains concealed in the thick foliage, in these forests often too dense to allow one to go off the path; and I found here, as elsewhere, that a good open path is even more essential to success in collecting forest Butterflies than it is for plants or birds.

Male. Upperside: *both wings* brown, with a golden gloss in certain positions. *Fore wing* with the bar towards the end of the cell and the dorsal band of the underside showing through by transparency; a submarginal series of five small round ochreous spots or dots from the costa to the second median interspace; a diffused and indistinct marginal dark band, its outer edge somewhat sharply defined. *Hind wing* with a dark bar defining the discocellular nervules, and an obscure discal irregular band; a submarginal series of round, equal-sized, somewhat small, black spots, those towards the anal angle sometimes absent; two fine dark marginal lines enclosing an obscure ochreous line, the inner dark line defined inwardly by a pale line.

Underside: *both wings* paler, being ochreous brown without any gloss. *Fore wing* with two darker bars crossing the cell beyond its middle, enclosing a paler space; a discal irregular dark band, with its inner edge diffused, its outer edge sharply defined, its direction from the costa to the first median nervule straight, then directed inwardly to the submedian nervule, the ground beyond this band paler than the rest of the wing; the submarginal subapical dots as above but violet-white; a very fine violet-white line, then a broad ochreous line, then a fine dark line on the margin. *Hind wing* with an oval ring-spot at the base of the costal interspace, a band in continuation across the cell, another band beyond from the costal to the median nervure towards the end of the cell, dark brown, outwardly pale ochreous, and very straight; a short irregular band from just before the base of the first median nervule towards the abdominal margin; a highly irregular discal band, its outer edge sharply defined, its inner edge diffused; beyond which is a series of six ocelli, composed of a black centre with a violet-white pupil, an ochreous, a dark brown, and a violet ring, the latter ring widest outwardly, the sixth ocellus at the anal angle geminated; a fine marginal violet line, expanding into lunules at the anal angle, two fine dark lines beyond the violet line enclosing an ochreous broad line.

Lethe tristigmata is nearest to *L. nicetas*, Hewitson; but the male is at once distinguished from that species in possessing a very conspicuous "male mark" on the upperside of the fore wing just beyond the cell, which is composed of more or less wedge-shaped clumps of large black scales, placed one below the third median nervule, one on each side of the second and first median nervules, and one above the submedian nervure, these marks sometimes coalescing and forming a continuous band divided only by the veins.

Expanse 2·3 inches.

ZOPHOESSA MÖLLERI, n. sp.

This species is very nearly allied to *Z. jalaurida*, de Nicév., but differs constantly in the following particulars. The tawny bands and markings of the upperside are paler and less defined. Beneath, the ocelli of the fore wing are absent, the ground-colour is paler, the silvery bands are straighter and broader, and in the outer one, which is broadest, the discocellular nervule which it encloses is distinctly marked by a brown streak in the silver band, which is free and not connected with the brown band next the silver as in *Z. jalaurida*. I found this species mixed with *jalaurida*, but not so abundant or reaching so high an elevation, on the Singalelah range, and did not at first recognize its distinctions, which Möller afterwards noticed. After comparing 12 fresh specimens with 10 perfectly fresh males and 6 females of *Z. jalaurida* taken with it, and one from the Jalauri Pass, I have no hesitation in saying that it is a perfectly distinct species, and have much pleasure in naming it after Mr. Möller. The two sexes are nearly alike, but the females, of which I only took two, are a trifle larger and paler than the males.

CHILADES? PONTIS[1], n. sp.

Male above dull purplish black with faint green or (in some lights) purple reflection, darker towards the body. Fringes alternated with black and white.

Beneath dull grey, with irregular darker markings, which on the hind wing coalesce into a blackish patch powdered with grey on the inner half of the wing.

Body black, with grey hairs and palpi. Antennæ faintly ringed, with a short distinct club.

Expanse $\frac{9}{10}$ inch.

The shape of the hind wing is very peculiar, the costal margin, which is straight, forming almost a right angle with the outer margin. I know of no other species in which the character is so well marked.

Described from three males (a fourth exists in Godman's collection ex coll. Lidderdale) taken by me on May 27, 1886, on the bridge crossing the Rangbi river on the way from Darjeeling to Mongpo, at about 6000 feet elevation, in dense dripping evergreen-forest.

This curious little insect is unlike anything found in India or the Himalaya, but has a very near ally in China, which, as it is undescribed, I will here characterize as follows:—

CHILADES SINENSIS, n. sp.

Resembles *C. pontis*, but has a broad border of darker colour than the wings, no green reflections, and a rounder apex to the fore wing. Beneath, the markings are very similar but more continuous, and there is an outer band near the margin of the fore wing not found in *C. pontis*. The dark markings on the hind wing also come nearer to the margin.

Described from a specimen taken by Mr. H. Leech near Ningpo in May 1886. This agrees perfectly with several others from Kiukiang on the Yangtse river taken by Maries, which have for some years been in the collection of the British Museum.

HYPOLYCÆNA VIRGO, n. sp.

Female. Fore wing above black, with a large discal patch of French-grey extending to the hind margin inwardly. Hind wing grey powdered with black, and becoming dull black on the costal margin, with a single narrow black tail tipped white, and a small fuscous lobe at anal angle. Fringes white, narrow towards the apex of fore wing.

Beneath bright French-grey, with a distinct transverse sinuous yellowish band, narrowly edged black on both sides about two thirds of the length, not extending quite to the hinder margin; a short

[1] I include this in the genus *Chilades* (Moore, Lep. Ceylon, i. p. 71) with doubt. It seems, on a superficial examination, to have most affinity to *Chilades laius*, Cram.; but without sacrificing a specimen I cannot be sure that the apparent resemblance is real. And many of Moore's distinctions are so trivial that I do not think they can be adopted without an independent study, not only of the insects in question, but of the whole of the Eastern Lycænidæ.

double-lined bar at the end of the cell and an indistinct outer band near the edge. Hind wing with similar bands, of which the first extends in the usual broken W to the inner margin, and in addition a short band of three blackish spots within the discal bar; at the anal angle two blue spots, of which the outer is half black. Antennæ ringed black and white, with a fuscous tip to the club. Body above black, with grey hairs; pale grey beneath.

Expanse 1·4 inch.

Described from a single perfectly fresh female, which I took on May 27 in the same place as *Chilades pontis.* Though I visited the spot on several occasions, I never saw another, and the male will probably be found earlier in the season.

Notwithstanding the very numerous species of this group of Lycænidæ which have been described from Sikkim, I think this is so well distinguished by the pattern of the underside that it cannot be the female of any known species.

Saturnia royi, n. sp.

Male. Above deep chocolate-brown, with a darker band running from near the apex parallel to the margin of fore and hind wings. The upper half of the hind wings grey, with an ocellus in the centre composed of a small grey pupil, a broad ring of black, a narrow ring of grey, and another narrow black ring, the whole being surrounded by a dark circle which coalesces with the band crossing the wing. In the fore wing is a round membranous but not transparent patch at the end of the cell about two lines in diameter; close to the apex is a triangular patch of grey scales, a few of which are continued in a sinuous line across the fore wing parallel to the margin.

Beneath, the whole surface is chocolate-brown, with the band as above, powdered throughout with grey scales, which take the form of a downy fur towards the inner part and are longest on the discal area. The pupil only of the ocellus shows on the under surface, and the margin is free from grey powdering. Antennæ broadly pectinated. Thorax covered with long chocolate hair, yellowish behind the head. Breast covered with long rusty fur; tarsi grey outside.

Expanse nearly 5 inches.

Described from a fresh specimen, one of three which were taken on Tonglo near Darjeeling, at an elevation of 10,000 feet, by Babu Dewan Roy, a Nepalese in the service of the Forest Department, after whom I name this beautiful and distinct species, as a recognition of the interest he has shown in the natural history of his district, and of the great assistance he has rendered me in collecting insects there.

5. Descriptions of some new or little-known Butterflies from India, with some Notes on the Seasonal Dimorphism obtaining in the Genus *Melanitis*. By Lionel de Nicéville, F.E.S.

[Received May 3, 1887.]

(Plates XXXIX. & XL.)

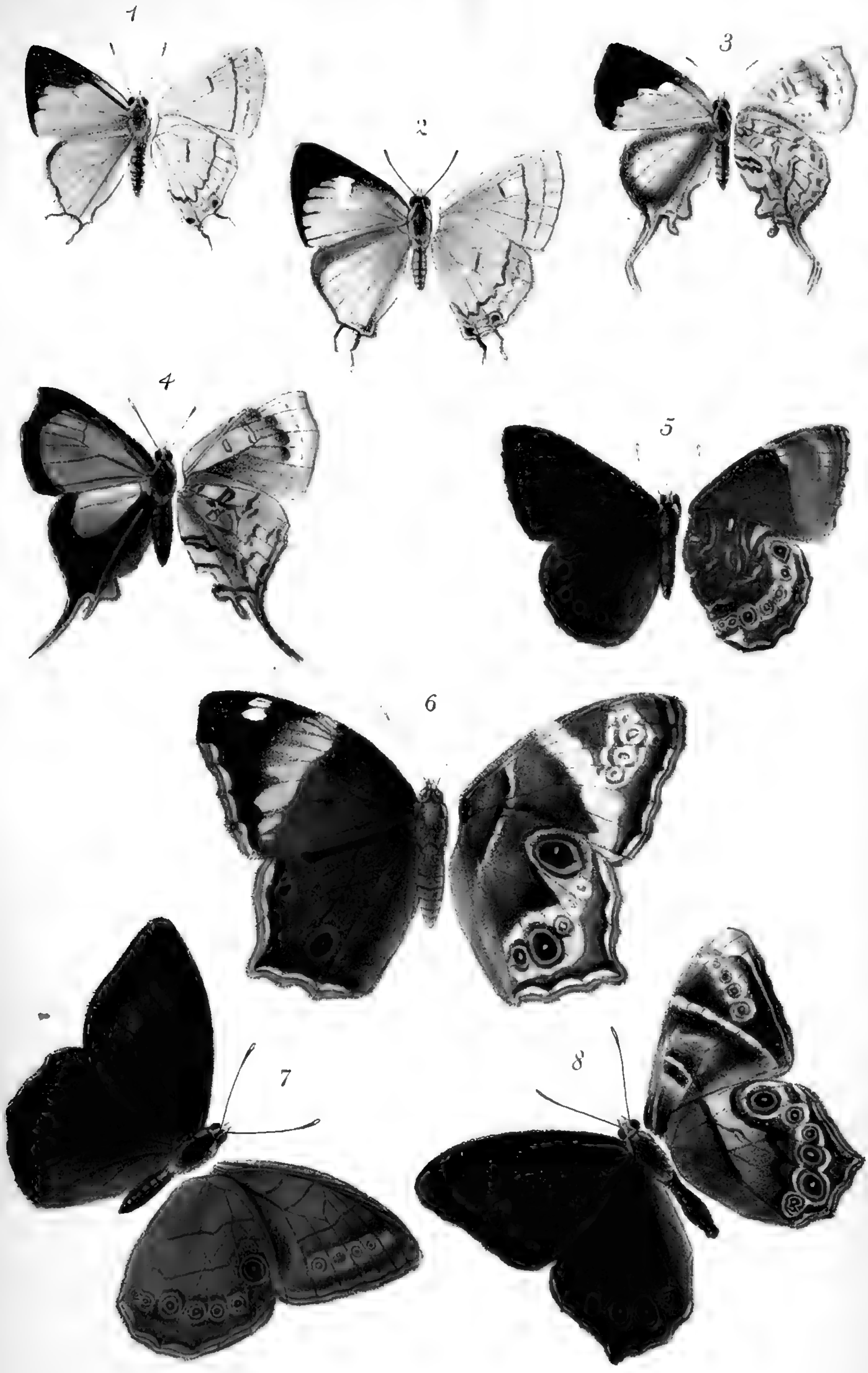
Lethe nicetella, n. sp. (Plate XXXIX. fig. 5, ♂.)

Hab. Sikkim.

Expanse. ♂ ♀ 1·8 to 2 inches.

Male. Upperside: *both wings* brown, with a brilliant golden-bronzy sheen when fresh, the outer margins with a regular band of the ground-colour devoid of this gloss. *Fore wing* with a short obscure ochreous subapical fascia at the bifurcation of the fourth and fifth subcostal nervules. *Hind wing* with a submarginal series of five round black spots with pale outer rings, of which the second from the apex is the largest, the uppermost and the fourth subequal, and the next largest, the third the smallest, though but little smaller than the fifth or anal. Underside: *both wings* paler than above. *Fore wing* with an obscure dark bar across the middle of the cell, an oblique discal band beyond the cell, prominent at the costa, becoming obsolete towards the anal angle, beyond this band the ground-colour is abruptly paler; the subapical fascia as on the upperside, but more extended violet-white; two marginal fine dark lines enclosing a line of the ground-colour, the inner one defined with a somewhat coarser pale line, all these lines extending from the second median nervule to the apex. *Hind wing* with two basal and two discal highly irregular violet lines, the one furthest from the base with an irregular dark brown fascia placed outwardly against it; the discocellular nervules defined on both sides with a fine violet line; a submarginal series of six ocelli, the first, second (usually), fifth, and geminated sixth composed of a black centre with a pure white pupil, an ochreous, a dark brown, and an outer violet ring; the second (occasionally), third, and fourth ocelli composed of a small dark brown centre with a violet pupil, a violet, a dark brown, and an outer violet ring; marginal lines as in the fore wing, but the innermost line violet, very prominent towards the anal angle. *Cilia* cinereous, dark brown at the ends of the veins.—Female. Upperside: *both wings* paler. *Fore wing* with the discal band of the underside showing through. Underside: *both wings* also paler.

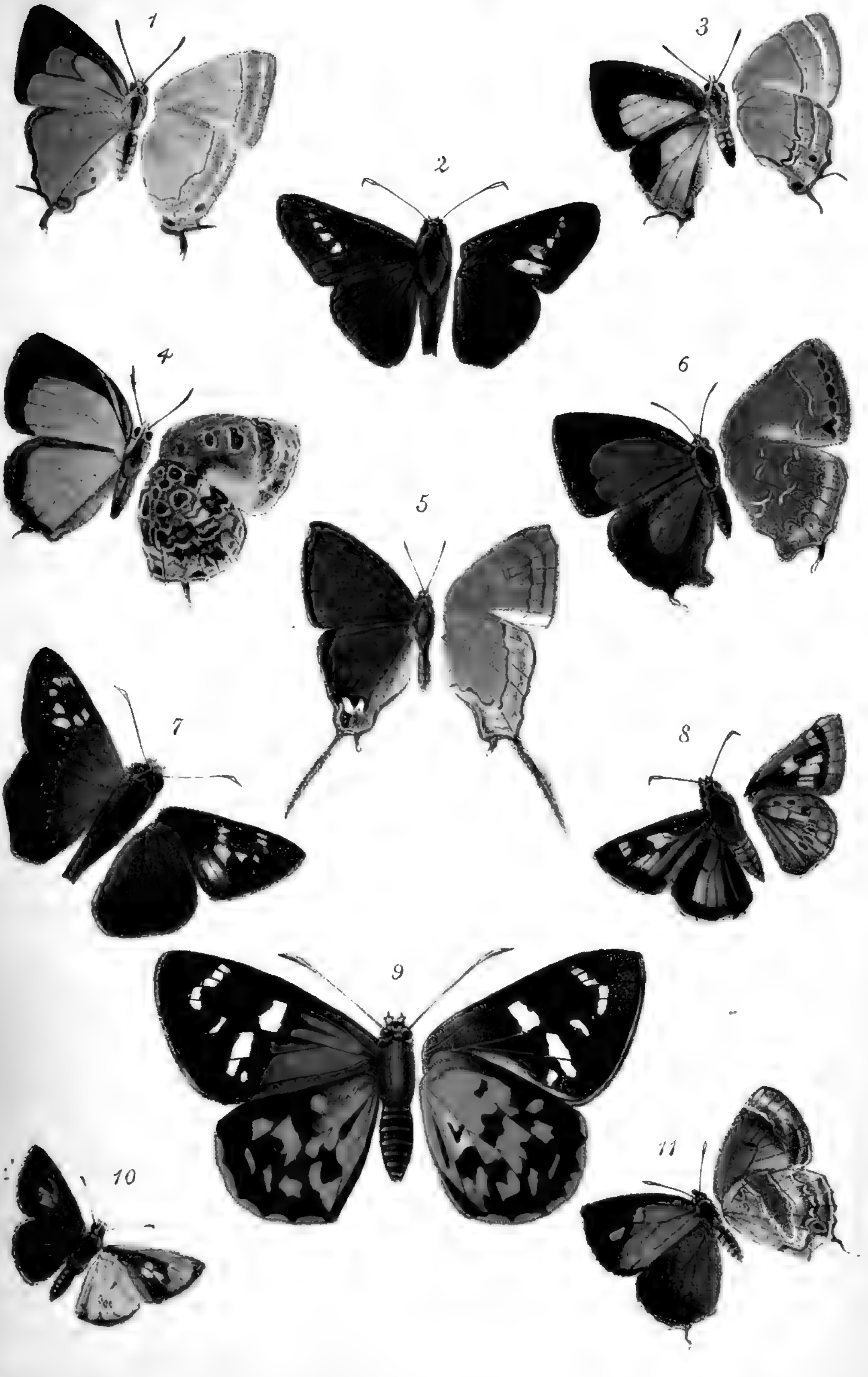
L. nicetella may be known from *L. nicetas*, Hewitson, from Kulu and Sikkim, on the underside of the fore wing in both sexes by not possessing three small subapical ocelli divided by the discoidal nervules, and in the discal band being much less prominent (in *L. nicetas* it is broadly outwardly defined with ochreous); in the hind wing in having at least two and often three of the ocelli with small dark brown instead of deep black centres (in *L. nicetas* all the ocelli are



W. Purkiss lith.

Hanhart imp

NEW INDIAN BUTTERFLIES.



W. Purkiss del. Hanhart imp.

NEW INDIAN BUTTERFLIES

similarly formed), and in the outer discal violet line having a dark brown fascia placed against it (in *L. nicetas* this fascia is much more deeply scalloped and of a rich ochreous colour).

I have described *L. nicetella* from a large series of males and a single female collected in Sikkim by Mr. Otto Möller. In Sikkim, judging from the number of specimens before me of each species, *L. nicetella* is much the commoner of the two.

Lethe tamuna, n. sp. (Plate XXXIX. fig. 6, ♀.)

Hab. Little Nicobar.

Expanse. ♀ 2·7 inches.

Female. Upperside: *both wings* dull dark fulvous. *Fore wing* with the apical half fuscous, bearing two pure white spots below the costa, placed midway between the apex and the median ochreous band, the upper of the two spots much the smaller, and divided into two portions by the fourth subcostal nervule; below these spots in the upper discoidal interspace is an obscure oval black spot; near the margin are four bright ochreous lunules placed between the veins from the lower discoidal nervule to the inner angle, beyond these lunules in each interspace is a fine ochreous line; across the disk of the wing, from the middle of the costa to near the inner angle, is a broad bright ochreous band, its inner edge nearly straight and even, its outer edge produced into points between the veins, the lower portion of the band composed of two spots (the lower one very small) in the submedian interspace. *Hind wing* with the ocelli of the underside more or less showing through by transparency; a series of bright ochreous lunules with inner dark borders placed near the outer margin between the veins, with a darker ochreous line beyond. Underside: *both wings* dull brown. *Fore wing* with a whitish subbasal line crossing the middle of the discoidal cell from the subcostal to the submedian nervure; the broad discal band as above, but with its edges more even and wider at its lower end; beyond it are four ill-shaped ocelli with black pupils dotted with white, a pale violet ring, then a browner ring and an outer pale violet ring; the margin marked much as above. *Hind wing* with a subbasal line in continuation of that on the fore wing, not reaching the abdominal margin; a discal series of ocelli placed on a pale violet band, which more or less follows their outline; the upper ocellus very large, its centre deep black dotted with white, then a broad rich ochreous ring, outwardly defined with a fuscous ring; the next largest ocellus is in the first median interspace, with two small, equal-sized ocelli in the interspaces above and below it, and two very small and indistinct ocelli divided by the discoidal nervule; the bright ochreous lunules on the margin of the upperside white, almost silvery, on the underside.

Lethe tamuna is a local form of the widely-distributed *L. europa*, Fabricius, which occurs in the Andamans (but is replaced apparently in the Nicobars by the species under notice), almost throughout India (though not in Ceylon), the Malay peninsula and islands, and has been recorded from China. *L. tamuna* ♀ may be at once distinguished from the same sex of *L. europa* by its more tawny coloration on the upperside, the discal band bright ochreous instead of white, with its outer edge more irregular, and by the underside of the hind wing having four well-formed perfect ocelli; in *L. europa* the black middle portion of all the ocelli except the upper one is entirely disintegrated and broken up into black dots.

Mr. E. H. Man obtained a single specimen of this interesting species on Little Nicobar.

LETHE GULNIHAL, n. sp. (Plate XXXIX. fig. 7, ♂.)

Hab. Bhutan.

Expanse. ♂ 2·45 inches.

MALE. UPPERSIDE: *both wings* dark brown, with a distinct rich vinous gloss. *Fore wing* unmarked, except that the narrow discal band of the underside shows through paler on the upperside, the wing being somewhat paler beyond. *Hind wing* with the four middle ocelli of the underside showing through indistinctly. UNDERSIDE: *both wings* dull brown without any vinous gloss. *Fore wing* with a short narrow ferruginous line across the middle of the cell, another similar one towards its end, the lower discocellular nervule marked with ferruginous; a slightly outwardly-curved discal line from the subcostal nervure to just below the first median nervule, beyond which are four somewhat obscure small perfect ocelli placed between the nervules from the upper discoidal to the first median nervule; a fine dark brown marginal line bordered on either side with paler and an anteciliary similar dark line. *Hind wing* with a pair of narrow ferruginous lines across the disk from the costal to the submedian nervure, the outer one very irregular; the lower discocellular nervule marked with ferruginous; a series of six small distinct perfect ocelli composed of a black centre with a white pupil, a yellow, a black, and lastly a pale violet ring; the upper ocellus out of line, placed furthest from the margin and the largest, the three following subequal, the fifth a little larger, but not so large as the first, the sixth the smallest of all and geminate; two fine dark marginal lines enclosing a fine ochreous line, the inner one inwardly defined with pale lunules.

The secondary sexual characters ("male marks") of *L. gulnihal* are very peculiar and interesting. On the upperside of the hind wing it possesses the tuft of long black hair which is found in *L. scanda, L. bhairava, L. latiaris, L. minerva, L. sihala,* and *L. dynsate*; in addition it has a large oval patch of deep black lustrous scales, which is bounded above by the first subcostal nervule, partially inwardly and beneath by that portion of the subcostal nervure between the bases of the first subcostal and discoidal nervules, the patch not nearly reaching the margin (this feature occurs in *L. bhairava* in a somewhat modified form); lastly, the inner margin of the fore wing is deeply outwardly bowed, which is a unique feature, the bowed portion beneath the submedian nervure clothed with differently formed and modified scales to those on the rest of the wing, this portion of the wing being clearly defined on the underside by a large deep black oval patch. In *L. bhairava* there is a large patch of black scales on the inner margin of the fore wing on the upperside, but it extends into the submedian interspace. *L. gulnihal* is nearest to *L. bhairava*, its markings being very similar; but it is smaller, and the bowed inner margin of the fore wing will at once distinguish the males of the two species.

Two male specimens have been obtained in Bhutan by the native collectors of Messrs. Otto Möller and A. V. Knyvett, in whose collections the specimens above described are deposited.

LETHE BRISANDA. (Plate XXXIX. fig. 8, ♂.)

L. brisanda, de Nicéville, Journ. A. S. B. vol. lv. pt. ii. p. 249. n. 1, pl. xi. fig. 13, *female* (1886).

Hab. Bhutan.

Expanse. ♂ 2·4 inches.

MALE. Differs from fresh native Sikkim specimens of *L. dinarbas* on the UNDERSIDE of the *fore wing* in the lilac band across the middle of the discoidal cell being much narrower, with uneven instead of straight edges; the discal oblique band lilac throughout, straight, and of equal width throughout (in *L. dinarbas* the upper portion of the band only is lilac, this portion too in that species being wider); in having an additional ocellus in the subcostal interspace (in a long series of *L. dinarbas* before me there are always three ocelli only). On the *hind wing* the discal bands are deep brown instead of ferruginous, and the lilac washings throughout much more brilliant.

Should the above-given characters prove constant in a large series of specimens, the males of *L. brisanda* and *L. dinarbas* will be easily distinguishable, the latter species being apparently very uniformly marked. The females are abundantly distinct.

A single male has been obtained near Buxa, Bhutan, by Mr. A. V. Knyvett's native collectors.

MELANITIS BETHAMI, n. sp.

Hab. Pachmarhi, Central Provinces, 3500 feet.

Rainy-season form.

Expanse. ♂ 2·8, ♀ 3 inches.

MALE. UPPERSIDE: *both wings* sooty black. *Fore wing* with the outer margin paler, the apex very slightly truncate, there being a small notch only below the lower discoidal nervule, a well-defined subcostal nearly round ochreous patch beyond the cell divided into three portions by the discoidal nervules. *Hind wing* unmarked. UNDERSIDE: *both wings* paler than above, densely and evenly striated with darker, the outer margin ferruginous. *Fore wing* with four small obscure discal ocelli, of which the two in the second median and upper discoidal interspaces are the largest. *Hind wing* with a series of six submarginal ocelli, the second from the apex minute, the anal one geminated, the other four subequal and much larger.—FEMALE. UPPERSIDE: *both wings* much paler than in the male. *Fore wing* slightly more truncate than in the male, with the whole apical third of the wing ochreous, on which is placed a round black spot with a white centre in the second median interspace, with one small obsolete ocellus in the interspace below and three above it. *Hind wing* with the outer margin paler, a round black spot with a white centre in the first median interspace. UNDERSIDE: *both wings* with the ground-colour pale purplish, thickly striated with brown. *Fore wing* with an obscure ochreous fascia before the middle of the wing, a more prominent discal one from just beyond the middle of the costa directed towards the anal angle, which it does not reach; the ocelli as in the male, but rather larger, the outer margin broadly ochreous. *Hind wing* with an outwardly curved discal ochreous fascia, its outer margin sharply defined; the ocelli as in the male; the outer margin broadly ochreous. *Cilia* throughout blackish in both sexes.

Dry-season form.

Expanse. ♂ 3·3, ♀ 3·2 to 3·3 inches.

MALE. UPPERSIDE: *both wings* deeper black than in the rains form, the outer margins ashy. *Fore wing* highly falcate; with a large rich ochreous, inwardly almost ferruginous, patch, wide at the costa, narrowed to a point at the first median nervule, outwardly banded by the ashy marginal area, and just extending into the apex of the cell. *Hind wing* unmarked, the tail much longer than in the rains form. UNDERSIDE very dark, very irregularly striated; all the ocelli obsolete. *Fore wing* with a large wedge-shaped subapical pale violet patch, behind which are three obscure straight fasciæ composed of pale mottles. *Hind wing* with the basal half of the wing much darker than the outer half, and sharply defined, a patch of ochreous mottles at the end of the cell. The general character of the markings of the underside is similar to that of *M. duryodana*, Felder, and as they show but little variation in a long series of specimens, I have described them somewhat minutely. —FEMALE. UPPERSIDE: *both wings* much paler than in the male, and somewhat purplish, with no distinct outer ashy margin. *Fore wing* even more falcate than in the male, enormously more so than in the corresponding sex of the rains form. The apical two thirds rich ochreous, extending well into the discoidal cell, and reaching the anal angle, enclosing spots as in the female of the rains form, but which, however, so far as the two lower ones are concerned, are variable in size, in one specimen having their black portions much lengthened inwardly; the outer margin just mottled with ashy. *Hind wing* with the outer margin narrowly mottled with ferruginous and ashy, a small submarginal white dot in the first median interspace (sometimes present in the male), sometimes with another smaller one in the interspace above. UNDERSIDE: *both wings* with all the ocelli obsolete and much paler than in the male, being ferruginous-ochreous, fairly evenly covered with blotches of dark brown irrorations; the fasciæ as in the female of the rains form, but blackish instead of ochreous. The markings of the underside of this sex, too, seem to be fairly constant in a number of specimens.

My recent experiments proving by breeding from the egg that *M. leda* and *M. ismene* are but seasonal forms of one species, and the acquisition of both forms of *M. bethami*, has thrown a flood of light into my mind regarding the Butterflies of this difficult genus. It may now, I think, be accepted as an axiom that in all tropical and subtropical countries in which the year is divided into two well-marked seasons, a dry and a wet, the *Melanites* that occur there will also have two well-marked forms,—a rains form, with slightly falcated fore wing, short tail to hind wing, and prominent ocelli on both wings on the underside; and a dry-season form, which has the fore wing highly falcate, a long tail to hind wing, and obsolete ocelli below. In the 'Lepidoptera of Ceylon,' in addition to *M. leda* and *M. ismene* (one species), Mr. Moore records only *M. tambra*; but in the Indian Museum, Calcutta, is a specimen marked by Mr. Moore himself "*M. suyudana*," which certainly differs from the form Mr. Moore has figured and described as *M. tambra*. I possess in all six specimens of this group from Ceylon, and though they present but slight variation in the size of the ocelli (it should be remembered that Ceylon has a very equable climate throughout the year), there is a well-marked difference in outline, what I should call *M. tambra* being the rains form, and *M. suyudana* the dry-season form. In Sikkim we have, besides *M. leda* and *M. ismene*, *M. zitenius*, of which Herbst has figured the dry-season form and Mr. Distant[1] the rains form; and *M. aswa*, Moore, the strongly ocellated rains form, and *M. bela*, Moore, and *M. duryodana* (the two latter I now believe to be but varieties of one form), the dry-season form of a third species.

An intimate knowledge of the species of *Melanitis* occurring in other parts of the Old World, to be obtained only by living amongst them and carefully noting their different forms and the seasons when they occur, and by breeding them from the egg, would, I feel sure, reveal the fact of the seasonal dimorphism which occurs in all the species of the genus, and I trust that notice being now drawn to the subject, collectors and entomologists will devote attention to it.

To return to *M. bethami*, I have described the rains form from a pair taken on the 8th August, and the dry-season form from five pairs taken between the 15th and 27th October at Pachmarhi, by Mr. J. A. Betham, after whom I have much pleasure in naming the species.

CYLLOGENES JANETÆ, n. sp.

Hab. Bhutan.

Expanse. ♂ 3·5, ♀ 3·55 inches.

MALE. UPPERSIDE: *both wings* deep dull brown, almost black. *Fore wing* with a broad rich ochreous curved subapical band, attenuated towards the anal angle, which it hardly reaches, the rich

[1] Rhopalocera Malayana, p. 412. n. 3, pl. xxxviii. fig. 2, ♂ (1886).

ochreous colour extending along the first median nervule for a short distance; *cilia* black. *Hind wing* with the outer margin somewhat broadly ochreous, sprinkled with dark-brown or blackish irrorations; *cilia* black, tipped with white on the three upper indentations between the veins. UNDERSIDE: *both wings* very variegated, the ground-colour apparently being ochreous, thickly irrorated with dark-brown striæ; a discal obscure purplish fascia, inwardly bounded by a dark line. *Fore wing* with three short subcostal bands reaching the middle of the cell, and a broader subapical one, ochreous (these fasciæ are formed by those portions of the ground being free from irrorations), an obscure purplish patch at the apex, an irregular series of five round violet-white spots placed between the veins midway between the cell and the outer margin, the two in the median interspaces large, the other three very small. *Hind wing* with the inner edge of the black discal line marked with an ochreous bar at the costa, the outer margin showing more of the ochreous ground-colour than the rest of the wing; five discal violet-white spots between the veins, the three lower ones large, the two upper small, the lower ones surrounded by a black ring, the spot in the first median interspace the largest of all.—FEMALE. UPPERSIDE: *fore wing* with the subapical band broader, richer-coloured, and extending along the costa; the black apical patch crossed by yellow veins; the median nervules also marked with yellow near the band. *Hind wing* with the outer margin richer ochreous. UNDERSIDE much paler; the darker irrorations far less dense; no trace of the diffused purplish fasciæ.

I have placed this species somewhat doubtfully in the genus *Cyllogenes*, the chief recorded structural character of which is the presence of a large deep black patch in the male, this "sexual mark" being entirely absent in my species, the sexes being practically marked alike. *C. janetæ* is, however, much more closely allied to *C. suradeva*, Moore (hitherto the type and only species in the genus), than to any other described species, the yellow band on the fore wing and the upperside being a striking feature, which is common to both species. On the underside the blind ocellated spots are precisely similar in both species; and the purplish fasciæ on the underside of the male of *C. janetæ* is of the same tint as obtains on the upperside of both sexes of *C. suradeva*. The truncation of the apex of the fore wing in both sexes of *C. janetæ* (more especially in the male) is a good structural character by which to separate the two species in both sexes. It agrees also structurally with *Cyllogenes suradeva* in the almost similar extraordinary character which obtains also in the genus *Parantirrhæa* of Wood-Mason, and which for *Cyllogenes* has not hitherto been noticed, viz.: in the male the three median nervules of the fore wing are considerably further apart at their apices than in the female, owing to the fact that the lower one has to supply the place normally taken by the submedian nervure, as it reaches the outer margin but a very short distance anterior to the anal angle; while the submedian nervure is very short, slightly sinuous, and reaches the inner margin at considerably less than half the length of the margin from the base. In the female, however, the median nervules and submedian nervure are quite normal, the neuration being very similar to that of *Melanitis.*

Described from two male examples in the collection of Mr. A. V. Knyvett (after whose wife I have named it), and a female in that of Mr. Otto Möller.

Euthalia duda.

E. duda, Staudinger, Ex. Schmett. part i. p. 152, pl. liii., *male* (1886).

Hab. Near Buxa, Bhutan ; Sikkim.

Expanse. ♀ 4·5 inches.

Female. Upperside : *fore wing* differs from the same sex of *E. durga*, Moore, which also occurs in the same locality, in the four white spots between the veins beyond the discoidal cell being much smaller, their inner ends excavated ; the lowest one in the lower discoidal interspace the smallest and most deeply excavated, and shifted outwards, thus breaking the line of the spots ; the four spots from the third median nervule to the inner margin also much smaller, the two lower ones with their outer edges highly diffused instead of having them sharply defined. *Hind wing* with the discal white band narrower, its outer edge not defined with a line of the ground-colour as in *E. durga* ; its inner edge much more even ; the diffused fascia immediately beyond it bluish purple instead of green. Underside : *fore wing* with the black increasing submarginal band springing posteriorly from the two apical white spots twice as wide ; the discal macular band on *both wings* as on the upperside.

A single female of this quite distinct species was obtained by Mr. A. V. Knyvett's native collectors near Buxa.

Since my description was written, I have received Dr. O. Staudinger's work quoted above ; and from it I learn that he has described this species from two male specimens from Sikkim, collected many years ago by the late W. S. Atkinson.

Catapœcilma delicatum, n. sp.

C. bubases, de Nicéville (*nec* Hewitson), Journ. A. S. B. vol. liv. pt. ii. p. 118, pl. ii. figs. 11, *male,* 1, *female* (1885).

Through the kindness of Mr. W. L. Distant in sending me an advance copy of the figure of the true *C. bubases,* Hewitson, which is shortly to appear in the final part of his 'Rhopalocera Malayana,' I am at once enabled to see that Hewitson's description of his species does not apply to the species which occurs in Sikkim, but to which it is somewhat closely allied. When redescribing and figuring this species I was very uncertain whether or no to give it a name, and wrote:—"Hewitson's description of *C. bubases* is very meagre ; a comparison of his Malaccan female type with Sikkim specimens may disclose specific differences." This latter conjecture turns out to be a correct one, so I name the Sikkim species *C. delicatum.*

CHERITRELLA, nov. gen.

FORE WING with the *costal margin* slightly and regularly arched; the *outer* margin highly truncated from the apex to the termination of the third median nervule, this truncated portion, moreover, being concave; below the third median nervule to the inner angle the margin is nearly straight and oblique; *inner* margin straight. *Costal* nervure very short, not nearly reaching to opposite the apex of the cell; the *first, second,* and *third subcostal nervules* at regular distances apart before the origin of the upper discocellular nervule, the *fourth* springing from the third about the middle of its length; *upper discocellular* nervule directed outwards, *middle* and *lower* upright and concave; the bases of the *second* and *third median* nervules half the distance apart of the bases of the second and first; *submedian nervure* straight. HIND WING with the *costal margin* strongly arched at the base, thence to apex nearly straight; *outer* margin to base of long tail at termination of first median nervule straight but waved from thence to anal lobe at right angles; *abdominal* margin strongly convex at base and highly excavated above the anal lobe; a short tail at termination of submedian nervure. *Costal nervure* strongly arched at base, afterwards nearly straight; *first subcostal nervule* originating some little distance before apex of cell, nearly straight; *discocellular* nervules of nearly equal length, concave, outwardly oblique, the origin of the *third median* nervule at the lower end of the cell, the *second* just before its end, that of the *first* being fully four times as distant from that of the second as is the latter from the third; *submedian nervure* nearly straight; *internal* nervure very short, ending on the abdominal margin above the deep excavation, and highly sinuous.

Nearest to *Ticherra,* with which it agrees in having no secondary sexual characters in the male, in the neuration of the hind wing; also in the length and position of the tails, the anal lobe, and the deep excavation above it, but differs from it in the truncation of the fore wing, the costal nervure terminating long before the apex of the cell, and the fourth subcostal nervule springing from the third about its middle instead of considerably nearer the apex.

CHERITRELLA TRUNCIPENNIS, n. sp. (Plate XXXIX. figs. 4, ♂; 3, ♀.)

Hab. Sikkim.

Expanse. ♂ 1·5 to 1·6, ♀ 1·45 inch.

MALE. UPPERSIDE: *both wings* black. *Fore wing* with all but the costa narrowly, and the outer margin broadly deep dull purple, with a very slight gloss in certain positions. *Hind wing* with a large brilliantly iridescent, rich bright steel-blue[1] patch from the base of the wing, not reaching the outer margin, anteriorly bounded by the costal nervure, extending into the upper portion of the discoidal

[1] Very similar to the colour exhibited in the male of *Jamides bochus,* Cramer, on the upperside, but not quite so brilliant, and more purple in shade rather than blue.

cell and into the upper portion of the second median interspace; the anal lobe and short tail beyond it deep ferruginous; the long tail becoming white towards its termination, pure white at its tip; an obscure round black spot between the bases of the two tails. UNDERSIDE: *both wings* umber-brown, *Fore wing* with a darker brown pair of lines across the middle of the discoidal cell, another pair enclosing the discocellular nervules, a discal irregular fascia from the costa to the first median nervule, very broad and dark posteriorly, a submarginal series of dark dots between the veins, the inner margin very broadly pale fuscous without markings. *Hind wing* more or less covered with fuscous, dark brown, and umber fasciæ and spots, the most conspicuous of which are two black spots in the subcostal interspace, a ring-spot at the middle, and an oblong one at the end of the cell, a very dark oblique band from the middle of the abdominal margin to the middle of the wing, a discal irregular fascia recurved upwards to the abdominal margin, and a marginal dark fascia more or less sprinkled with whitish scales towards the anal angle.—FEMALE. UPPERSIDE: *fore wing* with the purple area in the male replaced by a smaller pale blue patch, leaving the apical half of the wing and the outer margin at the anal angle black, a diffused white spot at the end of the cell and another beyond it divided by the second median nervule into two portions. *Hind wing* also pale blue, all except the costa widely and the outer margin decreasingly, which are black. UNDERSIDE: *both wings* paler than in the male, but similarly marked. *Cilia* pale ferruginous throughout.

There are single males of this very beautiful species in the collections of Major Marshall and Messrs. Otto Möller and A. V. Knyvett, and a single female in that of Mr. Möller, all of them taken in Sikkim, Mr. Möller's specimens in June. It is quite unlike any species known to me.

TICHERRA, nov. gen.

Closely allied to *Cheritra*, Moore, but differs in the male in the absence of the secondary sexual characters on the costal margin of the hind wing on the upperside; the fourth subcostal nervule of the fore wing springing from the third much nearer its apex, consequently being shorter; the cell of the hind wing longer, the discocellular nervules being much more awkwardly oblique.

Type *Ticherra acte*, Moore.

TICHERRA ACTE. (Plate XL. fig. 5, ♂.)

Myrina acte, Moore, Horsfield & Moore, Cat. Lep. Mus. E.I. C. vol. i. p. 47. n. 77, *female* (1857); id. Hewitson, Ill. Diurn. Lep., *Lycænidæ*, p. 30. n. 10, pl. xii. figs. 8, 9, *male*, wet-season form (1863).

Dry-season form.

MALE and FEMALE. UNDERSIDE: *both wings* differ from the typical rainy-season form of the species in the ground-colour being cinnamon-brown instead of rich ochreous-orange; the markings in the cells and the fine linear discal fasciæ are also much more prominent.

Described from specimens from Sikkim, Assam (Shillong), and the Dafla Hills. I considered these specimens at first to constitute a species distinct from *T. acte*, but Mr. Otto Möller pointed out to me that all his dated specimens with the orange underside were captured in Sikkim during the rainy months, while all those with brown-coloured undersides were taken in either the spring or autumn, so I have but little doubt that this is another case of the extensive seasonal dimorphism which takes place in many of the Lycænidæ occurring in the oriental tropical and subtropical regions.

Tajuria istroidea, n. sp. (Plate XL. fig. 3, ♀.)

Hab. Sikkim.

Expanse. ♀ 1·45 inch.

Female. Upperside: *both wings* deep black. *Cilia* greyish fuscous. *Fore wing* with the disk and base rich blue, with hardly any gloss. *Hind wing* with the disk and base also rich blue, outwardly nearly to the margin sprinkled with blue scales between the veins; an anteciliary fine blue line from the anal angle to the third median nervule; anal lobe rufous, with a black centre sprinkled with white scales; tails black, tipped with white. Underside: *both wings* rufescent or cinnamon-coloured; *cilia* of the colour of the ground. *Fore wing* with a prominent, slightly outwardly curved, discal line of a deeper shade of red than the ground, outwardly defined by brilliant white, this line does not quite touch the costa, and ends posteriorly at the submedian nervure; a submarginal indistinct somewhat macular fascia. *Hind wing* with the discal band as in the fore wing, its upper portion as far as the third median nervule straight, below highly zigzag, and curved upwards to the abdominal margin; the submarginal fascia as in the fore wing, ending in a small round deep black spot, broadly surrounded with ferruginous in the first median interspace; the anal lobe entirely occupied by a large round deep black spot, crowned with a very few greenish-silvery scales; the area between the two spots and beyond the anterior one as far as the third median nervule thickly irrorated with black and white scales; a fine black anteciliary line from the anal angle to the third median nervule, defined on both sides by an equally fine pure white line.

Most nearly allied to *Iolaus ister* of Hewitson [1], from "India," but differing therefrom in its broader wings, the apex of the fore wing less acute, the outer margin convex, the blue coloration of the upperside deeper and richer in shade and confined to the basal and discal areas of the wings (all these are female characters); the markings of the underside much the same, but the discal line on the fore wing considerably further from the margin, rather less so on the hind wing. I have described this species with some hesitation, solely owing to the fact that Hewitson, in describing *I. ister*, seems

[1] Ill. Diurn. Lep., *Lycænidæ*, p. 43. n. 13, pl. xix. figs. 15, 16, *female* (1865).

to have gone out of his way to emphasize the fact that his species is a female; judging from his figure alone, I should have said that it was taken from a male, and that my specimen (which is unquestionably a female) was of the opposite sex. The matter must remain in abeyance till some one will examine the sex of Hewitson's type.

Described from a single example in the collection of Mr. Otto Möller.

TAJURIA ALBIPLAGA, n. sp. (Plate XXXIX. figs. 1, ♂; 2, ♀.)

Hab. Sikkim.

Expanse. ♂ 1·5, ♀ 1·6 inch.

MALE. UPPERSIDE: *both wings* cerulean blue with hardly any gloss; *cilia* grey throughout. *Fore wing* with the costa bounded posteriorly by the subcostal nervure, the apex broadly (including the anterior portion of the cell) and the outer margin decreasingly to the anal angle black. *Hind wing* with the costal margin and apex light fuscous, the two fine tails black, tipped with white, a fine anteciliary black line. UNDERSIDE: *both wings* grey, of the same shade as in *T. jehana,* Moore [1]; a prominent narrow, straight, dark line on the discocellular nervules. *Fore wing* with a similar discal line not reaching the costa anteriorly, touching the submedian nervure posteriorly; beyond this line is a somewhat similar, but indistinct line. *Hind wing* with a discal line much as in the fore wing, but reaching the costa and recurved to the abdominal margin, the upper portion straight as far as the third median nervule, below this the line is formed of outwardly convex lunules; beyond the discal line is an obsolete submarginal line as in the fore wing; a small deep black round spot in the first median interspace, close to the margin and another on the small anal lobe, both outwardly margined with pale yellow; no secondary sexual characters.—FEMALE larger, both wings broader, the apex of the fore wing less acute. UPPERSIDE: *both wings* of a slightly darker shade of blue than in the male; *cilia* white throughout. *Fore wing* with a large quadrate diffused white patch on the disk, its inner margin well defined by the discocellular nervules, and that portion of the median nervure between the bases of the first and second median nervules. UNDERSIDE marked exactly as in the male.

Near to *Tajuria diæus,* Hewitson [2], from Sikkim, but the blue coloration of the upperside is much lighter; the discal line on the underside of the fore wing in *T. diæus* is much straighter, its edges more even, and it increases in width to the costa, which it quite reaches; the colour of all the lines being somewhat rufous also in that species. In *T. diæus* female, which sex I have not seen, there is a submarginal band of brown spots on the upperside of the hind wing. *T. albiplaga* is also allied to *T. jehana* [3], Moore, but the sexes of the former differ considerably, while in the

[1] Proc. Zool. Soc. 1883, p. 529, pl. xlix. fig. 7.

[2] *Iolaus diæus,* Ill. Diurn. Lep., *Lycænidæ,* p. 45. n. 17, pl. xx. figs. 27, 28, ♂, 26, ♀ (1865).

[3] Proc. Zool. Soc. 1883, p. 529, pl. xlix. fig. 7.

latter they are described as being nearly alike. The three black marginal spots from the anal lobe on the upperside of the hind wing are also absent in *T. albiplaga* in both sexes.

A single pair of this very distinct species is in Mr. Otto Möller's collection.

TAJURIA MELASTIGMA, n. sp. (Plate XL. fig. 1, ♂.)

Hab. Sikkim, Nilgiris.

Expanse. ♂ 1·5 inch.

MALE. UPPERSIDE: *both wings* cerulean blue[1]. *Fore wing* with the costal, the apical half of the wing, and the outer margin decreasingly to the anal angle black; a large quadrate shining black "sexual mark" on the disk, bounded on two sides by the discocellular nervules and the first median nervule. *Hind wing* with the outer margin very narrowly black, widening at the apex; the abdominal margin whitish; the anal lobe and inner tail dull reddish, the outer tail black, both tails tipped with white. UNDERSIDE: *both wings* dull pinkish. *Fore wing* with the inner margin somewhat broadly greyish; a discal straight narrow deep Indian-red line, outwardly defined with whitish, from near the costa to the submedian nervure; an extremely obscure pale fascia near the margin. *Hind wing* with the discal line in continuation of that on the fore wing, the portion between the median nervules very irregular, from the third median nervule oblique to the abdominal margin; the anal lobe marked with a rust-red spot, crowned obscurely with orange; a smaller very obscure spot on the first median interspace, between which the ground is obscurely sprinkled with white scales; two indistinct series of dark spots between the veins above the second median nervule on the margin; an anteciliary fine dark line. *Cilia* fuscous throughout. *Body* blue above, pale red below, whitish at the sides.

T. melastigma has no secondary male sexual characters between the wings, and so far as I am aware the peculiar shining black quadrate patch on the disk of the fore wing on the upperside is unique amongst Indian Lycænidæ. Judging from Hewitson's figure alone it is closely allied to his *Iolaus ister*, the type of which is from "India," and is a female; *T. melastigma* may be the hitherto unknown opposite sex of that species.

The type and only perfect specimen of *T. melastigma* is in the collection of Mr. Otto Möller. I have received a single male fore wing of this species from Mr. G. F. Hampson, collected in the Nilgiri Hills, South India.

ZEPHYRUS PAVO, n. sp. (Plate XL. fig. 11, ♀.)

Hab. Bhutan.

Expanse. ♀ 1·35 inch.

FEMALE. UPPERSIDE: *both wings* black. *Fore wing* with the costa somewhat widely, the apical third of the wing, and the outer

[1] Of almost the exact shade of the common "*Polyommatus*" *cleobis* of Godart.

margin at the anal angle black, the rest of the wing rich peacock-purple; a quadrate spot beyond the end of the cell and an elongated one beyond and below it in the second median interspace, orange. *Cilia* black. *Hind wing* unmarked, the tail tipped with white. *Cilia* white, tipped with black, except at the termination of the veins from the second median to the second subcostal nervule, where the cilia are entirely white. UNDERSIDE brownish fuscous. *Fore wing* with the discocellular nervule defined with a white line on each side, an obscure darker broad discal fascia outwardly defined with a narrow white line from the costa to the first median nervule, beyond which the wing is sprinkled with pale violet scales; another dark fascia from near the anal angle, decreasing in width from the inner margin to the third median nervule, where it becomes obliterated, also outwardly defined with a whitish line. *Hind wing* sprinkled almost throughout with pale violet scales; a broad irregularly wedge-shaped discal fascia, free of violet sprinkling, broad on the costa, narrowing to a bluntly rounded point above the anal angle, its margins defined with a fine violet-white line; another similar fascia beyond, inwardly defined with violet-white lunules; two subbasal ring-spots, one of which is with the discoidal cell, and a pair of lines on the abdominal margin, all violet-white; an oval black spot in the first median interspace, surrounded by a deep orange ring; a deep orange patch at the anal angle extending a short distance up the abdominal margin; a fine anteciliary dark line, inwardly defined by a white line.

Zephyrus pavo is nearly allied to the *Z. katura* of Hewitson[1], that species being probably the female of *Z. ataxus*, Doubleday and Hewitson, but differs on the upperside of the fore wing in having the basal area of a richer shade of purple, of greater extent, and not divided by the black veins; on the underside the silvery bands in *Z. katura* are replaced in *Z. pavo* by violet irrorations; they also differ in other minor particulars.

The type specimen is unique, and is deposited in Mr. A. V. Knyvett's collection, by whose native collectors it was obtained near Buxa in Bhutan.

RAPALA DISTORTA, n. sp. (Plate XL. fig. 6, ♀.)

Hab. Sikkim.

Expanse. ♀ 1·6 inch.

FEMALE. UPPERSIDE: *both wings* almost black, somewhat paler on the hind wing. *Fore wing* with all but the costa widely, the apex and outer margin still more widely (which are of the ground-colour), rich bluish purple. *Hind wing* with a lengthened discal patch of bluish purple, which occupies the lower half of the discoidal cell and extends beyond it into the discoidal and median interspaces, but does not nearly reach the outer margin. Tail dull ferruginous, tipped with white. UNDERSIDE: *both wings* dull ferruginous or cinnamon-coloured, glossed with vinous. *Fore wing* with a narrow

[1] *Dipsas katura*, Hewitson, Ill. Diurn. Lep., *Lycænidæ*, p. 65. n. 4, pl. xxvi. figs. 1, 2, *female* (1865).

white discal line formed of short lunules between the veins, that portion below the first median nervule shifted inwards; a double submarginal series of short white lines, more diffused than the discal line, placed between the veins, which give the appearance of six increasing spots of the ground-colour defined with white. *Hind wing* with a discal white line as in the fore wing, but much more distorted and irregular; an obscure similar basal line, and a submarginal very dentate one; the area beyond the latter irrorated with whitish, including an obscure rounded ferruginous spot in the first median interspace; a fine white anteciliary line obsolete anteriorly. *Cilia* brownish ferruginous throughout.

Allied to *Rapala amisena*, Hewitson, who describes and figures the female[1], while Mr. Distant figures the opposite sex[2], from Singapore. Differs from the same sex of that species, judging from the figure and description only, in having the purple area of the upperside of the fore wing of less extent and sharply defined (in *R. amisena* it appears to be suffused over nearly the whole wing, with no sharp edges), and on the underside of both wings in the markings being fewer and white throughout, instead of dark fuscous, with no trace of the dull light-blue irroration at the anal angle of the hind wing, with a lunular black spot between the tails, described by Hewitson as occurring in his *Amblypodia amisena*.

Mr. Otto Möller took two female specimens of *R. distorta* on 22nd March, in Sikkim, at about 1500 feet altitude.

NILASERA WIMBERLEYI, n. sp. (Plate XL. fig. 4, ♀.)

Hab. South Andaman Isles.

Expanse. ♀ 1·65 inch.

FEMALE. UPPERSIDE: *both wings* rich cerulean blue. *Fore wing* with the costa as far as the subcostal nervure, the apex, and outer margin widely black. *Hind wing* with the costal and outer margin less broadly black, that colour ascending a short distance into the blue colour between the veins; tail black, tipped with white. UNDERSIDE: *both wings* pale olivaceous. *Fore wing* with a round spot at the base, an oval one at the middle, and a quadrate one at the end of the cell, with a small one between these two latter placed on the subcostal nervure; a spot at the base of the first median interspace, and another quadrate one in the middle of the submedian interspace; a discal regular macular band composed of six conjoined spots from the costa to the first median nervule, its inner edge almost straight, its outer edge scalloped; a submarginal macular band very prominent about its middle: all these markings fuscous, outwardly defined with sordid white; a fine black anteciliary line. *Hind wing* with the usual spots and bands, the chief of which are two series of four round spots, each towards the base, an elongated spot closing the cell, and a much broken discal macular

[1] *Amblypodia amisena*, Hewitson, Cat. Lycænidæ B. M. p. 13. n. 62, pl. vii. figs. 74, 78, *female* (1862).

[2] *Rapala amisena*, Distant, Rhop. Malay. p. 277. n. 1, pl. xxiii. fig. 13, *male* (1885).

band; all these spots composed of a pale centre, then a narrow black line, outwardly defined with a pale line; beyond the discal macular band is a fuscous diffused fascia, outwardly defined from the abdominal margin to the second median nervule by a pale lunular line; in the next two interspaces the fuscous fascia almost reaches the margin and encloses two of the pale lunules; a series of black marginal lunules between the veins; a fine anteciliary black line; the very small anal lobe with a deep black round spot, with a few obsolete silvery scales crowning it; a few also in the two next interspaces. *Cilia* of the colour of the ground throughout.

Apparently nearest to the *Amblypodia ocrida* of Hewitson[1], from which it differs in the colour of the upperside, that species being "silvery cerulean blue;" there also appears to be some difference in the details of the markings of the underside.

I have named this species after Mr. R. Wimberley, who captured two specimens of this beautiful species in the South Andamans, together with several other species which had not been previously obtained on those islands, not the least interesting of which is a female specimen of the *Deudorix smilis* of Hewitson, described ambiguously from "East India."

ISOTEINON FLAVALUM, n. sp. (Plate XL. fig. 10, ♂.)

Hab. Sikkim.

Expanse. ♂ 1·2 inch.

MALE. UPPERSIDE: *both wings* dark brown. *Fore wing* with three small subapical increasing spots, the upper one minute; a small quadrate spot at the lower outer end of the cell, an elongated one at the base of the second median interspace, a much larger quadrate one below it and placed nearer the base of the wing in the first median interspace, all semitransparent diaphanous ochreous. *Hind wing* with the middle of the disk clothed with long greenish-ochreous hairs. *Cilia* cinereous throughout. UNDERSIDE: *fore wing* also dark brown, the spots as above, the costa narrowly and the apex widely (but not reaching the anal angle or the outer margin) yellow. *Hind wing* yellow throughout except the outer margin, which is increasingly dark brown, widening to the anal angle; a conspicuous though small black spot on the discoidal cell, three small dark-brown ring-spots placed very close together below it, and a fourth minute black spot well separated from the others towards the apex. No secondary male sexual characters. *Head* and *body* above dark brown, below with *legs* yellow. *Antennæ* black, the club tipped beneath with white.

This pretty and very distinct little species is nearest allied to *Isoteinon satwa,* mihi[2], but is abundantly distinct; the underside has no purple washing, and on the hind wing the yellow coloration occupies nearly the entire surface; in *I. satwa* it is confined to the anterior half of the wing.

[1] Ill. Diurn. Lep., *Lycænidæ*, p. 14 *b*. n. 80, pl. iii. *a*. figs. 38, 39 (1869); from Mindanao, one of the Philippine Islands.

[2] Journ. A. S. B. vol. lii. pt. 2, p. 86. n. 31, pl. x. fig. 15, *male* (1883).

Described from a single specimen in the collection of Mr. Otto Möller.

HALPE HONOREI, n. sp. (Plate XL. fig. 8, ♀.)

Hab. Pulni Hills, South India.

Expanse. ♀ 1·5 inch.

FEMALE. UPPERSIDE: *both wings* fuscous. *Fore wing* with the base clothed with yellow hair-like scales, more or less forming streaks between the veins; a large rhomboidal spot at the outer end of the discoidal cell, two elongated ones, the upper twice the size of the lower, in the median interspaces, two or three subapical conjugated increasing spots, all semitransparent glistening yellow. *Hind wing* with all but the costal margin as far as the second subcostal nervule and the outer margin somewhat narrowly and the abdominal margin clothed with long yellow setæ; a large discal yellow patch beyond the cell divided by the dark nervules and enclosing a blackish dot in the second median interspace. UNDERSIDE: *fore wing* black, all except the costal margin increasingly, the apex widely and the outer margin decreasingly, which are yellowish ochreous; the semitransparent spots as above, with two additional somewhat diffused opaque spots placed one above the other near the middle of the submedian interspace, which appears in a somewhat constricted form on the upperside in one specimen. *Hind wing* yellowish ochreous throughout; a black spot at the end of the cell, and about six between the veins outside the cell; some obscure submarginal blackish spots; the abdominal margin and a streak in the submedian interspace black.

The markings of this species remind one at once of those of *Plastingia noëmi*, mihi[1]; but there is only one spot in the cell of the fore wing, and the yellow patch in the hind wing is larger in the species now described.

Described from somewhat worn specimens collected by Father D. Honoré, S.J., in the Pulni Hills of South India.

PLESIONEURA FLAVOCINCTA, n. sp. (Plate XL. fig. 9, ♀.)

Hab. Bhutan.

Expanse. ♂ 2·3, ♀ 2·7 inches.

MALE. UPPERSIDE: *both wings* black. *Fore wing* with the base (all except a round spot in the submedian interspace just beyond the origin of the first median nervule and touching it) thickly clothed with large tawny scales; a quadrate transverse spot beyond the middle of the cell, five conjoined subapical quadrate spots divided by the veins, the two lower ones shifted outwards, a narrow linear spot in the second median interspace, a quadrate one equal in size to that in the cell in the first median interspace, two much smaller ones placed obliquely (in one specimen conjoined in the right-hand wing) in the submedian interspace, all semi-diaphanous pale ochreous white. *Cilia* black, all except a small portion on the submedian interspace, which is yellow. *Hind wing* with

[1] Journ. A. S. B. vol. liv. pt. 2, p. 120, pl. ii. fig. 15, ♂ (1885).

numerous more or less quadrate large orange spots disposed over the disk; the base of the wing clothed with long fur-like orange setæ. *Cilia* broadly orange, just marked with black at the end of the veins. UNDERSIDE: *fore wing* with the ground-colour paler, the spots as above, the inner margin below the submedian nervure ochreous, with two obscure ochreous diffused spots placed one above the other near the base of the wing in the submedian interspace. *Hind wing* with the colour of the ground apparently reversed, being orange, leaving a broad irregular black outer margin; a large black spot at the end of the cell, and a series of eight black spots placed one in each interspace (except the uppermost and lowest interspaces, which have two each) round the cell. *Head* black, marked with whitish at the base of the antennæ. *Antennæ* with the shaft above and club entirely, except the tip, creamy white, the shaft below and tip of club black. *Palpi* whitish, marked anteriorly with three black lines, which meet at the apex. *Thorax* clothed above with long ferruginous setæ. *Abdomen* black, ringed with orange.—FEMALE. Differs only from the male in being larger.

P. flavocincta is the largest species of the genus described from India. It is most nearly allied to *P. pulomaya*, Moore, and *P. sumitra*, Moore; but differs from both in the very large size of the orange spots on the hind wing on the upperside, these spots on the underside coalescing and occupying the greater portion of the wing, thus reducing the black ground-colour of the upperside to a band on the outer margin and to nine discal spots; in the two species just mentioned there is no tendency to this feature, the orange spots being all comparatively small and well separated, and the base of the wing is black. The cilia in *P. flavocincta* are also very much broader, and orange throughout, except the bases of those cilia at the termination of the veins on the hind wing, which are black.

Described from a pair in the collection of Mr. A. V. Knyvett and a single male in that of Mr. Otto Möller, all of which were obtained near Buxa, Bhutan, by the native collectors of those gentlemen.

PARNARA PAGANA, n. sp. (Plate XL. fig. 7, ♂.)

Hab. Sikhim.

Expanse. ♂ ♀, 1·9 to 2·2 inches.

MALE. UPPERSIDE: *both wings* rich dark brown glossed with purple, the base clothed with long deep ochreous-ferruginous setæ. *Cilia* ochreous yellow in the fore wing, becoming orange towards the anal angle in the hind wing. *Fore wing* with a spot at the end of the cell sometimes almost quadrate, sometimes constricted in the middle and forming a figure of 8, sometimes quite divided into two spots; three small subapical dots; three increasing discal spots, the anterior one sometimes absent; a spot placed above and against the middle of the submedian nervure, usually round, sometimes oval, rarely entirely absent; all these spots semitransparent yellow. *Hind wing* unmarked. UNDERSIDE: *both wings* ochreous brown without any purple gloss, the yellow setæ also absent. *Fore wing* with the base (all except the costa) black; the semitransparent spots as above, but the one in the submedian interspace developed into a large diffused patch. *Hind wing* unmarked. FEMALE with the wings a little broader, otherwise exactly as in the male.

Nearest to *P. narooa*, Moore [1], and *P. assamensis*, Wood-Mason and de Nicéville [2], but differing from both in the hind wing being unspotted.

P. pagana is a common species in Sikkim throughout the year at low elevations.

PARNARA PLEBEIA, n. sp. (Plate XL. fig. 2, ♂.)

Hab. Sikhim.

Expanse. ♂ ♀, 1·7 to 1·8 inch.

MALE. UPPERSIDE: *both wings* dark brown. *Fore wing* with two or three increasing subapical dots, three increasing discal spots somewhat variable in size and shape; *cilia* cinereous. *Hind wing* unmarked; *cilia* cinereous anteriorly, becoming ochreous towards the anal angle. UNDERSIDE: *both wings* paler than above, sometimes tinged with ochreous. *Fore wing* with the semitransparent spots as above, a diffused large pale patch in the middle of the submedian interspace, sometimes divided into two distinct spots one above the other, sometimes obsolete. *Hind wing* unmarked.—FEMALE: *fore wing* with all the spots larger, always with an additional spot in the submedian interspace and touching that nervure about the middle of its length, often with another smaller spot placed above and beyond the first in the same interspace, these two spots sometimes conjoined. Otherwise as in the male.

Near to *P. pagana* (*suprà*, p. 465), but always smaller, the diaphanous spots white instead of yellow, no spot in the cell, and with no ferruginous setæ at the base of the wings on the upperside. Near to *P. austeni*, Moore [3], which also occurs commonly in Sikkim, but lacking the two spots in the cell of the fore wing, these spots being present also in *P. cahira*, Moore [4], *P. farri*, Moore [5], and *P. moolata*, Moore [6]. Nearest of all to *P. kumara*, Moore [7]. From Ceylon specimens of the latter species it differs in the ground-colour of the underside being dull dark brown, sometimes tinged with ochreous, instead of deep ochreous brown. Mr. Wood-Mason has kindly examined a Ceylon male specimen of the latter species, also a

[1] *Hesperia narooa*, Moore, Proc. Zool. Soc. 1878, p. 687, pl. xlv. fig. 4.

[2] Journ. A. S. B. vol. lv. pt. 2, p. 382. n. 214, pl. xviii. figs. 5, 5*a*, ♂; pl. xvii. 7, 7*a*, ♀ (1887).

[3] *Baoris austeni*, Moore, Proc. Zool. Soc. 1883, p. 533; from the Khasia Hills and Cherrapunji.

[4] *Hesperia cahira*, Moore, Proc. Zool. Soc. 1877, p. 593, pl. lviii. fig. 8; from the South Andaman Isles.

[5] *Hesperia farri*, Moore, Proc. Zool. Soc. 1878, p. 688; from Calcutta and Cherrapunji.

[6] *Hesperia moolata*, Moore, Proc. Zool. Soc. 1878, p. 843; from Upper Tenasserim and the Malay Peninsula.

[7] *Hesperia kumara*, Moore, Proc. Zool. Soc. 1878, p. 687; from Ceylon, Canara, Nilgiri Hills, and Mergui Archipelago.

male of *P. plebeia*, and writes regarding them as follows:—"I regard these two specimens as belonging to quite distinct species. The male genital somites and appendages differ very considerably in detail, though identical in plan; in the Sikkim species the terminal dorsal segment is furnished with a pair of conspicuous conical spines which curve upwards, forwards, and backwards from the disk, and is shorter, and the upper lobe of the claspers is smaller and is embraced at its lower border by the commensurately developed spine of the lower lobe; while in the Ceylon species the terminal dorsal segment is furnished with shorter spines, from the base of each of which a small cusp is given off backwards, and the sclerite is of greater antero-posterior extent; and the upper lobe of the claspers is more curved and longer, extending much beyond the spine of the lower lobe; and the intermittent organ ends in a bilobed spiny brush in the one, and is apparently simple in the other." *P. plebeia* is also near the *P. seriata*, Moore [1]; the latter, however, is known to me only by the description and figures.

P. plebeia is a common species in Sikkim at low elevations.

EXPLANATION OF THE PLATES.

Plate XXXIX.

Fig. 1. *Tajuria albiplaga*, ♂, p. 459.
2. —— ——, ♀, p. 459.
3. *Cheritrella truncipennis*, ♀, p. 456.
4. —— ——, ♂, p. 456.
5. *Lethe nicetella*, ♂, p. 448.
6. —— *tamuna*, ♀, p. 449.
7. —— *gulnihal*, ♂, p. 450.
8. —— *brisanda*, ♂, p. 451.

Plate XL.

Fig. 1. *Tajuria melastigma*, ♂, p. 460.
2. *Parnara plebeia*, ♂, p. 466.
3. *Tajuria istroidea*, ♀, p. 458.
4. *Nilasera wimberleyi*, ♀, p. 462.
5. *Ticherra acte*, dry-season form, ♂, p. 457.
6. *Rapala distorta*, ♀, p. 461.
7. *Parnara pagana*, ♂, p. 465.
8. *Halpe honorei*, ♀ p. 464.
9. *Plesioneura flavocincta*, ♀, p. 464.
10. *Isoteinon flavalum*, ♂, p. 463.
11. *Zephyrus pavo*, ♀, p. 460.

---

[1] *Hesperia seriata*, Moore, Proc. Zool. Soc. 1878, p. 688; from Ceylon.

May 17, 1887.

Prof. W. H. Flower, LL.D., F.R.S., President, in the Chair.

The President read some extracts from a letter which he had received from Dr. Emin Pasha, dated Wadelai, Nov. 8, 1886.

Dr. Emin stated that he was forwarding along with the letter some objects of Natural History procured in Monbottu, amongst which were the skull of an old male Chimpanzee, killed by his party on the 13th of July, some skulls and bones of natives of the Akka tribe, together with some boxes of mammals' skins, birds' skins, and butterflies.

Mr. A. Thomson exhibited specimens of *Papilio porthaon* (Hewitson, Exotic Butterflies, vol. iii. *Papilio*, nos. 21 & 22) reared in the Society's Insect-house, together with the empty pupa-cases. Eighteen specimens of the pupa of this fine insect had been deposited in the Insect-house by Mrs. J. Monteiro in September last, having been brought home by her on her return from Delagoa Bay. Out of these 2 had died, and 3 emerged in October last. The remaining 13 remained in the pupa stage all through the winter, and had emerged at various dates, from the 19th of April of this year till this day (May 17th).

Prof. G. B. Howes, F.Z.S., exhibited and made remarks upon an original drawing of the head of a *Palinurus* (*P. penicillatus*; Mauritius), originally described by M. Alphonse Milne-Edwards[1], F.M.Z.S. Having recently had occasion to correspond with M. Milne-Edwards concerning the same, that gentleman, with great courtesy, had sent the sketch especially made in reply. As the interest of the case was very great and as the original paper had been published without illustration, he thought it desirable to bring the drawing before the notice of the Society[2].

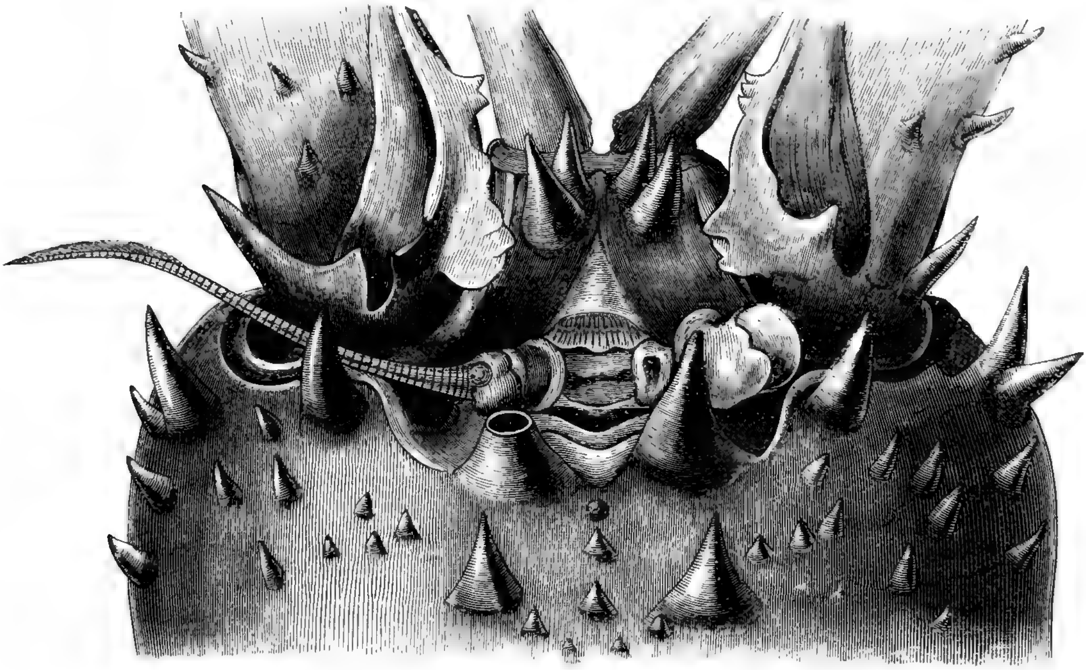
The chief interest of the specimen lay in the fact that the left ophthalmite had taken on antenniform characters, this being the only Crustacean yet recorded in which that had been observed. Prof. Howes stated the facts of the case, and recapitulated the leading arguments for and against the supposition that the ophthalmite is the homologue of an appendage, and its supporting skeleton that of a somite. He wished especially to draw attention to one feature which it appeared to him M. Milne-Edwards had not noted. It was well known that the cornea of the decapod crustacean eye does not, in many instances, surmount the entire free end of the eye-stalk; a portion of the latter (generally the outer free border) is often destitute of corneal facets, and frequently swollen and well differentiated. Comparison with the drawing which he had the honour to exhibit, and which he had ascertained was a faithful representation of fact, showed that the filiform appendage was derived from a similar non-

[1] Compt. Rendus, vol. lix. (1864).

[2] The Society is indebted to the generosity of M. Milne-Edwards for permission to reproduce the same.

faceted inner free border, and that it had all the characters and relations of an endopodite.

If this were so, and if the homology between a typical appendage and the eye-stalk was accepted, the eye-bearing (corneal) portion was clearly exopoditic in position, and it became a question as to how far it might, or might not, represent that segment of the typical appendage [1].



Cephalon of *Palinurus penicillatus*, bearing an antenniform ophthalmite.

Prof. Howes held that the only logical conclusion which could be drawn from the study of the specimen was that it supported what M. Milne-Edwards tersely calls, "les vues théoretiques relatives à la similitude fondamentale des parties susceptibles de revêtir des caractères différentes" [2].

[1] The only reference to this specimen made by subsequent writers was one by Rolleston in his remarkable work 'Forms of Animal Life.' Dealing with the eyes of Crustacea, Prof. Rolleston had cited it as an example "of the occasional replacement of their facets by a flagellum such as the antennæ carry." This, Prof. Howes had ascertained from M. Milne-Edwards, was a misinterpretation of the original description, the cornea and flagellum being, in reality, discontinuous.

[2] The 'Challenger' Reports have recently brought to light the following. Sars has shown that, among the Schizopods, highly organized luminous organs appear (ex. *Euphasia*) at the bases of certain appendages and elsewhere; concerning those of the appendages, it is significant to find that they are borne upon the eye-stalks in addition to the true visual organs, and that in a position identical with those of the post-oral series. Beddard records in the Isopods *Arcturus, Astrurus*, and *Munna* a condition essentially intermediate between the typically Edriophthalmous and Podophthalmous types.—G. B. H.

Prof. Howes then pointed to the interesting fact that the ophthalmite had assumed more nearly the characters of the antenna than those of the more modified antennule, and concluded by saying that while in his opinion the specimen did not finally settle the morphology of the eye-stalk, he had nevertheless brought the drawing forward in the hope that study of it might curb the eagerness with which, in our craving for novelty, we were sometimes too ready to reject the older interpretation.

A paper was read by Mr. W. F. Kirby, F.E.S., entitled "A Revision of the Subfamily *Libellulinæ*, with descriptions of new Genera and Species."

Mr. Kirby stated that the last compendium of this group had been published by Dr. Brauer in 1868, in which 40 genera were admitted. This number was now raised to 88. All of these were fully characterized in the present paper, in which 52 new species were also described. Mr. Kirby likewise gave a short sketch of the characters of the *Libellulinæ*, and especially of the neuration of this group, which he considered to be of primary importance.

This paper will be published entire in the Society's 'Transactions.'

The following papers were read :—

1. Notes on Specimens in the Hume Collection of Birds.—No. 5*. On *Syrnium maingayi*. By R. Bowdler Sharpe, F.Z.S.

[Received April 15, 1887.]

This is a perfectly good species, and was described by Mr. Hume in the sixth volume of 'Stray Feathers' (p. 27). At the time of writing the 'Catalogue of Birds' I had seen but one specimen, collected by Dr. Maingay, in Lord Tweeddale's Museum, and I came to the conclusion that it was not to be separated from *Syrnium indrani* of Southern India and Ceylon. Since the advent of the Hume Collection to the British Museum, with its increased series of these Wood-Owls, I have come to the conclusion that the Malaccan species is distinct, and in fact that it is the best characterized of any of the *Bulaca* group.

1. Syrnium maingayi.

Syrnium indrani, pt., Sharpe, Cat. B. ii. p. 282.

Syrnium maingayi, Hume, Str. F. vi. p. 27 (1878); id. Str. F. 1879, p. 46.

Adult (type of species). General colour above warm chocolate-brown, more or less distinctly barred across with rufous-buff cross markings, predominating on the hind neck and forming a tolerably

[1] For No. 4, see P. Z. S. 1886, p. 354.

distinct collar; scapulars with slightly indicated whitish shaft-lines, several of them white externally, narrowly barred with rufous-brown; lesser wing-coverts uniform chocolate-brown; median and greater coverts rufous-brown, with reddish-buff cross bars, the ends slightly vermiculated with dusky dots; bastard-wing and primary-coverts nearly uniform blackish, with slight indications of rufous-brown bars near the ends; quills dark chocolate-brown, regularly barred with rufous-brown, paler on the outer web of the primaries; upper tail-coverts chocolate-brown, numerously barred with reddish-brown cross bands, whitish on some of them; tail-feathers brown, crossed with well-marked bars of fulvous, ten in number on the centre feathers and twelve on the outside ones; crown of head and hind neck uniform chocolate-brown; lores black, as well as the feathers around the eye, surmounted by an eyebrow of rufous, impinging on the forehead; ear-coverts and cheeks chestnut-rufous, slightly fulvescent on the lower parts of the latter; the whole of the rufous face surrounded by a chocolate-brown ruff, joined to the chin, which is chocolate-brown also, followed by a band of white across the lower throat; fore neck and remainder of under surface of body tawny buff, regularly and narrowly barred with dark brown, some feathers with intermediate white spaces instead of buff; thighs obscure brown; under tail-coverts buffy white, with narrow brown cross bars; under wing-coverts and axillaries rather deeper buff than the breast, barred with darker brown; a patch of dark brown near the edge of the wing on the outer greater coverts; quills below dark brown, barred with tawny buff, broader on the inner web. Total length 21 inches, wing 14·3, tail 8·4.

Both Captain Pinwill's specimens are more uniform on the mantle than the type, and one of these shows indications of uniformity on the chest, as is usual with *S. newarense* when it gets very old. The wing in both examples is 13·1 inches.

Hab. Neighbourhood of Malacca.

a. Ad. sk.	Malacca, July 1877 (*W. Davison*).	Hume Collection. (Type of species.)
b, c. Ad. sk.	Malacca.	Capt. Stackhouse Pinwill [P.].

I also give a list of the specimens of *Syrnium newarense* and *S. indrani* now in the Museum, with remarks on and measurements of each individual specimen, showing how difficult it is to draw the line between these two species, notwithstanding that the typical forms of each are well characterized and distinct from each other.

2. Syrnium newarense.

Syrnium newarense, Hodgs. Icon. ined. Accipitres, pl. 34 (no. 59); Sharpe, Cat. B. ii. p. 281 (1875); Hume, Str. F. 1879, p. 83; Scully, *t. c.* p. 229.

Bulaca newarensis, David & Oust. Ois. Chine, p. 46 (1877); Blanf. Str. F. 1877, p. 483.

Syrnium indranee, Blyth, B. Burm. p. 67 (1875); Walden, Ibis, 1876, p. 342; Hume & Davison, Str. F. vi. p. 27 (1878); Scully, Str. F. 1879, p. 229; Oates, B. Brit. Burm. ii. p. 164 (1883); Marshall, Ibis, 1884, p. 407.

Syrnium hodgsoni, Scully, Str. F. 1879, p. 231.

It is most difficult, if not impossible, to state the exact limits of size in the sexes of this species, for carefully-sexed males in the Hume collection measure from 13·7 inches to 15·5 inches, and the females from 15 inches to 16·6 inches. Dr. Scully procured a male (and there is no reason to doubt the determination of this careful observer) with the wing 15·7. One specimen has the wing 13·3, and this would doubtless be a male. On the other hand, a specimen with the sex undetermined has the wing 14·8 inches, and this might be either a very small female (the smallest in the Himalayan series having the wing 15 inches) or an ordinary male. In any case the measurements of the sexes overlap, and large males measure more than small females. To the eastward the species diminishes in size perceptibly, and the colour of the face is more permanently ochreous. The males have the wing 14 inches, and the females 14–14·5, which is a decidedly smaller average than with the series from the Himalayas.

In the Nilghiris the measurements are still smaller; the males have the wing 12·8 inches, and the females 13·0–13·9 inches. The Nuwara-Eliya skins are of about the same dimensions, but the ochre-faced skin from Kandy has the wing 11·9.

The tendency in eastern birds, first seen to any extent in some Nepal specimens, to be more fulvous underneath, is developed to a greater extent in specimens from Shillong, all of which are fulvescent below, but no generalization from this fact can be arrived at, as the Bussahir example matches one of the Shillong birds. It can therefore only be said that, as with the case of many other birds, there is a slight tendency to paler coloration in the specimens from the North-western Himalayas.

Accompanying the ochreous tint on the underparts there is generally a slight increase in the fulvous tinge on the face, which becomes more or less washed with ochreous buff. It never, however, becomes uniform, but is always more or less barred with dusky, showing at the same time a distinct approach to *S. indrani*. I have below referred to the specimen from Coonoor which has dusky bars on the face, and which it is impossible to divide from *S. newarense*. The question arises, therefore, whether we are not compelled to recognize the presence of *S. newarense* in the Nilghiris, if not in Ceylon; for one of the specimens from Nuwara Eliya has a certain amount of barring on the face. Colonel Legge writes:—"Examples from the upper hills (whether as a rule or not, I cannot say) are darker on the disk, ruff, and lores than the low-country birds, and exhibit at the same time the facial barring which Mr. Hume found to be absent in his examination of the specimen on which he founded his Ceylonese race or subspecies *S. ochrogenys*."

With regard to Scully's *Syrnium hodgsoni*, I must say that I cannot see any character by which the species can be recognized from

S. newarense; and yet the yellow iris is an extraordinary phenomenon in a *Bulaca*, but it is confirmed by Mr. Wray's notes on the bird procured by him in the mountains of Perak.

The following is a detailed list of the specimens of *S. newarense* in the British Museum.

a. Ad. sk. Kotegurh. Hume Collection.

An adult bird, probably ♂; wing 15·6 inches. Sides of face whity brown, barred with blackish, the edge of the ear-coverts white. Fore neck pale, with the cross bars distinct.

b. Ad. sk. Kotegurh. Hume Collection.

Supposed ♂; wing 15·0 inches. Sides of face as in preceding bird, but the fore neck much more clouded with brown, especially on the sides, which are uniform.

c. Ad. sk. Kotegurh. Hume Collection.

Supposed ♀; wing 16·6 inches. Markings as in the foregoing specimen, but all the bars rather more coarsely indicated.

d. Ad. sk. Kotegurh. Hume Collection.

Apparently a female; wing 16·6 inches. All the cross bars rather fine; the sides of the fore neck and breast also barred.

e. ♀ ad. sk. Bussahir. Hume Collection.

Wing 15·75 inches. A small bird, if correctly sexed. The under surface has a somewhat yellowish tinge, of which there is also a slight indication on the sides of the face. The sides of the fore neck tolerably uniform.

f. ♂ ad. sk. Simla, Oct. 3, 1868 (*A. O. H.*). Hume Collection.

This is the specimen described by Mr. Hume (Rough Notes, p. 348). Wing 15 inches. Face brown, barred with blackish, with a fringe of white towards the edge of the ear-coverts. Under surface pale. Fore neck pale, the cross bars very distinct, and the sides of the fore neck only showing uniform brown.

g. ♂ juv. sk. Simla, Oct. 5, 1868 (*A. O. H.*). Hume Collection.

Described by Mr. Hume (*t. c.*). Wing 15·6.

h. ♂ ad. sk. Nagkunda, Oct. 19, 1870. Hume Collection.

A very coarsely marked bird, and somewhat tinged with ochreous buff below. Wing 15·5 inches.

i. Ad. sk. N.W. Himalayas. Capt. Stackhouse Pinwill [P.].

Wing 15·8 inches. Similar to the paler Kotegurh birds. Very white underneath, with the brown bars very distinct.

k. ♀ ad. sk. Kumaon (*W. Thompson*). Hume Collection.

Wing 16·5 inches. The specimen alluded to by Mr. Hume (Rough Notes, p. 353). It is just like the specimen presented to the Museum by Captain Stackhouse Pinwill.

l. ♂ ad. sk. Nepal, Dec. 5, 1877 (*Dr. J. Scully*). Hume Collection.

"Wing 14·4 inches" (*J. S.*). Of general pale aspect, very distinctly barred with brown. The face is very dark and indistinctly barred, but without any ochreous tinge. This specimen is the type of Scully's *Syrnium hodgsoni,* and had the iris "golden yellow." This accords with Mr. Wray's finding of the specimen from Perak; and the whole subject is worth inquiry from field-naturalists, for the Nepal specimen is a typical *S. newarense* in plumage, and has no ochreous tinge on the face, whereas the Perak specimen shows a decided tendency towards *S. indrani.*

m. ♂ ad. sk. Nepal, June 19, 1877 (*Dr. J. Scully*). Hume Collection.

"Wing 15·7 inches in the flesh" (*J. S.*). Quite as dark as the preceding bird in the face, and much darker on the fore neck, which inclines to uniform brown. Were it not for the known accuracy of Dr. Scully's determinations, I should have judged this bird to be a female from its size and colour.

n. Ad. sk. Nepal. Hodgson Collection.

Wing 14 inches. Of the dark-chested kind, with a decided ochreous tinge on the face.

o. Ad. sk. Nepal. Hodgson Collection.

Wing 14·0 inches. A dark bird, with the face strongly barred and slightly tinged with ochreous. A considerable part of the fore neck uniform brown.

p. Ad. sk. Nepal. Hodgson Collection.

Wing 13·3 inches. Similarly marked to the foregoing, with a considerable amount of uniform brown on the fore neck and a decided tinge of ochreous on the face.

q. Ad. sk. Nepal. Hodgson Collection.

Wing 14·0 inches. Very pale in colour, and resembling the Kumaon bird in appearance but very much smaller.

r. Ad. sk. Nepal. Hodgson Collection.

Wing 16·0 inches. Only differs in size from the foregoing example, like which it has a generally pale tone.

s. ♂ ad. sk. Native Sikhim, Jan. 1874 (*L. Mandelli*). Hume Collection.

Wing 13·7 inches. Very dark in colour, strongly washed with ochre on the under surface and with rufous on the face; the eyebrow also slightly fulvescent. Across the chest is a tolerably well-defined and nearly uniform brown band.

This specimen has the appearance of being an extremely old bird, and on the crown are some curious white-tipped hairs protruding from the midst of the feathers.

t. ♀ ad. Native Sikhim, Jan. 1874 (*L. Mandelli*). Hume Collection.

Wing 15 inches. Chest nearly uniform. Face very dark, with a rufous tinge.

u. Ad. sk. Native Sikhim, Feb. 1875 (*L. Mandelli*). Hume Collection.

Wing 15·0 inches. Strongly tinged with ochreous buff, the bars very plain, and only the sides of the chest uniform. Face extremely dark and almost uniform blackish brown, with scarcely any shade of rufous.

v. Ad. sk. Native Sikhim, Feb. 1875 (*L. Mandelli*). Hume Collection.

Wing 15·4 inches. A very dark specimen, with the sides of the chest inclining to uniform brown and the face very dark, with no ochreous tinge.

w. Ad. sk. Native Sikhim, March 1876 (*L. Mandelli*). Hume Collection.

Wing 14·2 inches. Rather dark brown on the chest, but not entirely uniform. On the face a strong tinge of ochreous as well as on the under surface of the body.

x, y. Ad. sk. Native Sikhim, March 1874 (*L. Mandelli*). Hume Collection.

Wings 14·2–14·3 inches. Remarkable specimens, with a broad uniform band of dark brown across the chest. Face also dark and without ochreous tinge.

z. Ad. sk. Native Sikhim, March 1874 (*L. Mandelli*). Hume Collection.

Wing 14·1 inches. The chest-band not so complete as in the foregoing specimens, but still nearly uniform. The face very dark but with a slight rufous tinge. This specimen also has white-tipped hairs on the crown.

a'. ♀ ad. sk. Native Sikhim, March 1876 (*L. Mandelli*). Hume Collection.

Wing 15·4 inches. Rather a pale specimen, but with a well-formed band of light brown across the chest. Face dark, excepting the hinder fringe to the ear-coverts, which is conspicuously white.

b'. Ad. sk. Native Sikhim, April 1873 (*L. Mandelli*). Hume Collection.

Wing 15·2 inches. In appearance this specimen almost exactly matches Mr. Wray's bird from Perak, but is a little more uniform brown on the chest. There is a distinct rufous tinge on the face.

c'. Ad. sk. Native Sikhim, April 1874. Hume Collection.

Wing 15·3 inches. Pale underneath, but with the sides of the chest nearly uniform brown; face dark, but with a slight rufescent tinge.

d'. Ad. sk. Native Sikhim, April 1874 (*L. Mandelli*). Hume Collection.

Wing 15 inches. A dark bird with nearly uniform chest and dark face, with scarcely any ochreous tinge on the latter.

e'. Juv. sk. Native Sikhim, April 1874 (*L. Mandelli*). Hume Collection.

f'. Juv. sk. Native Sikhim, May 1875 (*L. Mandelli*). Hume Collection.

g'. Ad. sk. Native Sikhim, July 1874 (*L. Mandelli*). Hume Collection.

Wing 13·9 inches. Decidedly ochreous buff underneath, with the chest narrowly barred across like the rest of the under surface. Face dark, without any ochreous tinge.

h'. Ad. sk. Native Sikhim, July 1874 (*L. Mandelli*). Hume Collection.

Wing 15·5 inches. Chest nearly uniform brown. Face very dark, with not a tinge of ochreous.

i'. Juv. sk. Native Sikhim, July 1874 (*L. Mandelli*). Hume Collection.

k'. Juv. sk. Native Sikhim, Aug. 1875 (*L. Mandelli*). Hume Collection.

l'. Ad. sk. Native Sikhim, Nov. 1874 (*L. Mandelli*). Hume Collection.

Wing 14 inches. Underneath decidedly ochreous, and having also a strong reddish tinge on the face. No tendency to uniform brown on the chest.

m'. Ad. sk. Sikhim, Dec. 1874 (*L. Mandelli*). Hume Collection.

Wing 14·8 inches. Rather pale, with barred chest and face and no ochreous colour on the latter.

n'. Ad. sk. Sikhim, Dec. 1873 (*L. Mandelli*). Hume Collection.

Wing 13·9 inches. Rather dark, with a strong ochreous tinge on the face and underparts, the barring being very distinct on the breast and not strongly pronounced on the face. There is a great similarity between this specimen and the Coonoor bird alluded to below, and it is even less strongly barred on the face than that specimen.

o'. ♀ ad. sk. Darjiling. Hume Collection.

Wing 15·75 inches. Very pale-coloured, quite as light as the birds from the North-west Himalayas. Face very dark, and not tinged with rufous.

p'. Ad. sk. Darjiling, Sept. 1872. Hume Collection.

Wing 14·4 inches. The palest specimen examined, the under surface quite white, with dark brown bars everywhere; the scapular markings also white and very conspicuous; the face white, with dark cross bars.

q'. ♂ ad. sk. Darjiling. Hume Collection.

Wing 14·5 inches. Entire aspect very light, with the whole of the breast barred like the abdomen; face also light and strongly barred, without any rufous tinge.

r'. Juv. sk. Darjiling (*Pearson*). India Museum.

s'. ♂ ad. sk. Shillong, Assam, Aug. 17, 1877 (*J. Cockburn*). Hume Collection.

Wing 14 inches. Very ochreous underneath, with the sides, but not the centre of the chest, uniform brown. Face deep ochreous, lighter towards the edge of the frill, where it becomes whitish. The face almost uniform, with scarcely any indication of cross-bars; eyebrow white. White-tipped hair-like feathers are plentiful on the head and also on the wing-coverts and sides of neck.

t'. ♀ ad. sk. Shillong, Dec. 17, 1877 (*J. Cockburn*). Hume Collection.

Wing 14·5 inches. Tinged with ochreous buff below, but not nearly so bright as in the preceding specimen. Face strongly washed with deep ochre, but distinctly barred with blackish.

u'. Ad. sk. Machi, Munipur, May 7, 1881 (*A. O. H.*). Hume Collection.

Wing 14·5 inches. Barred on the chest and distinctly tinged with ochreous below. Face deep ochreous, with very few dusky blackish bars.

v'. ♀ ad. sk. South Formosa (*R. Swinhoe*). Seebohm Collection.

Wing 15·3 inches. Fulvescent below, the cross-bars not very strongly marked, the chest being similarly barred. Face deep ochreous brown, with scarcely any indication of blackish cross-bars.

3. Syrnium indrani.

Syrnium indrani (Sykes); Sharpe, Cat. Birds, ii. p. 282 (1875); Legge, Ibis, 1874, p. 11, 1875, p. 273; Rainey, Str. F. 1875, p. 332; Butler, *t. c.* p. 439; Butler, Str. F. 1878, vol. ii. p. 94; Hume, Str. F. 1879, p. 229; Vidal, Str. F. ix. p. 35 (1880); Davison, Str. F. xi. p. 342 (1883).

The following is a list of the specimens of this species in the British Museum:—

a. ♂ ad. sk. Ootacamund, April 19, 1883 (*W. D.*). W. Davison, Esq. [P.].

Wing 12·8 inches. A pale brown bird, the chest barred like the rest of the under surface. Face uniform deep ochreous buff, with scarcely any white posterior line between the ear-coverts and the ruff.

b. ♀ ad. sk. Ootacamund, April 19, 1883 (*W. D.*). W. Davison, Esq. [P.].

Wing 13 inches. Similar to the male, but with a little fringe of white behind the ear-coverts, which are uniform ochreous buff.

c. ♀ ad. sk. Ootacamund, Jan. 20, 1881 (*W. D.*). Hume Collection.

Wing 13·1 inches. Also very pale below, the chest narrowly barred with brown like the rest of the underparts. Face uniform deep ochreous, with scarcely any indication of dusky cross-barring anywhere.

d. ♀ ad. sk. Kotagherry, Nilghiris, Feb. 28, 1874 (*Miss Cockburn*). Hume Collection.

e. ♀ ad. sk. Coonoor, Nilghiris, Jan. 28, 1881 (*W. Davison*). Hume Collection.

Wing 13·9 inches. Very pale below, with whitish cross-bars, somewhat coalescing on the chest, which is consequently more uniform. Face deep ochre, barred across with blackish.

f. Ad. sk. Southern India (*Dr. Jerdon*). J. Gould, Esq.

Wing 13·6 inches. Very tawny in appearance, the face being deep ochreous buff, rufous near the eye, with scarcely any sign of white on the frill of the ear-coverts.

g. Ad. sk. Nuwara Eliya, Ceylon. Mr. E. Boate [C.].

Wing 13·2 inches. A dark bird, with the chest barred like the rest of the under surface; face deep ochreous buff, with evident traces of dusky cross bars.

h. Ad. sk. Nuwara Eliya, Ceylon. Mr. E. Boate [C.].

Wing 12·5 inches. A darker bird, with the chest coarsely barred with dark brown, somewhat uniform on the sides. Face uniform deep rufous ochre, with a slight indication of white on the lower part near the frill.

i. Ad. sk. Kandy (*A. White*). Hume Collection.

Wing 11·9 inches. Strongly tinged with ochreous below. Face bright orange-rufous, with scarcely any white on the lower margin. No sign of cross-barring on the face.

2. On the Presence of a Canal-System, evidently Sensory, in the Shields of Pteraspidian Fishes. By A. Smith Woodward, F.Z.S., F.G.S., of the British Museum (Natural History).

[Received April 28, 1887.]

In his well-known monograph on the Cephalaspidæ, Professor Ray Lankester described and figured[1] a number of small depressions or "pits," arranged in double series upon the external surface of certain head-shields pertaining to the Heterostracous or Pteraspidian division of the group; and three years subsequently, in making known a new generic type, *Holaspis*[2], he remarked still further upon the same curious pittings, which were shown in this fossil with unusual distinctness. These he naturally regarded as "the sites of soft tegumentary structures, in all probability of those characteristic sensory-follicles of fishes," with which they agreed in disposition; and then followed another inference, "that a secreting membrane was closely attached to the striated calcareous material" of the outer layer of the shield in the original living fish.

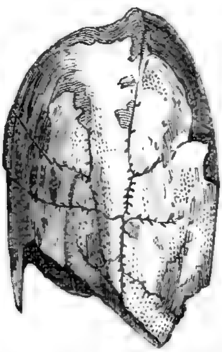
Some of these fossils are now in the British Museum, the fine

[1] E. Ray Lankester, "The Cephalaspidæ" (Mon. Palæont. Soc., 1868, 1870), pp. 17, 22, pl. i. figs. 1, 4, 8; pl. vi. figs. 1, 6; pl. vii. figs. 8, 9.

[2] E. Ray Lankester, "On *Holaspis sericeus*," Geol. Mag. vol. x. (1873), pp. 241–245, pl. x.

shield of *Holaspis* having been presented by its discoverer Dr. D. M. MacCullough, and the originals of Lankester's pl. i. fig. 8, pl. vi. fig. 6, having been acquired by purchase and bequest; and there are several other important specimens, likewise displaying in a greater or less degree the same peculiar superficial marks. With one exception, however, they afford no more precise information as to the character of the sensory lines thus indicated; and the extreme rarity of the combination of circumstances by which a single example is made to throw further light upon the subject renders this fossil of unusual interest and value. I have lately met with it among a number of more or less broken shields obtained from the collection of the late Mr. E. Baugh, and the biological significance of the features it presents seems to render it worthy of some brief notice.

The specimen in question is a fragmentary median plate, referable



Fragmentary Median Plate of Shield of *Pteraspis crouchii*, Lower Old Red Sandstone, Herefordshire. [Brit. Mus. no. 42163 *a*.]

to the cephalic buckler of *Pteraspis crouchii*, and is in the ordinary mineral condition of the Pteraspidian fossils from the Lower Old Red Sandstone of Herefordshire, whence it was derived. The striated outer layer is mostly removed, only occurring in small isolated patches, and the median "cancellated" layer[1] is thus very completely exposed to view. But, unlike all other similarly abraded examples in the collection, this fossil shows not merely the innumerable small polygonal cavities, with their partitions, constituting the middle portion of the shield, but also a branching system of wide canals, which have no connection with these chambers, though distinctly ramifying through them. The latter have been most beautifully rendered evident by a dark infiltration of the oxides of iron and manganese (a kind of natural "injection"), and they are seen to have opened upon the external surface in a double series of orifices of considerable size. The "pits" or "depressions" described by Lankester, in fact, are proved to be really the openings

[1] T. H. Huxley, "On *Cephalaspis* and *Pteraspis*," Quart. Journ. Geol. Soc. vol. xiv. (1858) pp. 267–280.

of an extensive canal-system, which indicates a more highly specialized development of the "lateral-line" structures than has hitherto been suspected.

As shown by the drawing (p. 479), there are four longitudinal canals, two marginal, and two situated close together in the median area of the plate; and the latter pair diverge in front, perhaps meeting the former at the edge, while more posteriorly they are all connected at irregular intervals by similar transversely-directed passages. The median commissural branches extend directly across the space between the two longitudinal canals they unite; but those proceeding to the lateral canals take a slightly more devious course, being inclined either backwards or forwards. Throughout their extent the tubular excavations give rise to short diverticula, alternately left and right, which place them in connection with the external pores; and these are most numerous in the median portion of the shield and the great marginal trunks, being relatively further apart in the lateral commissures.

The complexity and widely-spread character of the system is still more satisfactorily demonstrated in the almost perfect specimen of *Holaspis* already referred to; and here, it will be observed, there is an essentially similar arrangement. Our fossil corresponds to the central portion of this shield, which appears to consist of the homologues of the seven plates of *Pteraspis* wholly fused together. And it is perhaps worthy of note that neither here nor in any other Pteraspidian have distinct traces of the pores been detected upon the rostral region in advance of the "orbital" notches or apertures.

Finally, it is interesting to institute a comparison between these ancient traces of a "lateral-line" system and the various structures adapted for the protection of the corresponding sense-organs in existing fishes. Chimæroids possess merely the primitive open groove; but in Selachians the canal is complete, and there are also present the short secondary diverticula leading to the external pores. The last-named branches, however, are all directed to one side (outwards or downwards) of the main canal in the Rays and upon the trunk of the Sharks; and there is no very close agreement with *Pteraspis* even in the cephalic region of the latter group, where the branches are given off in both directions, but are not completely closed, being perforated by a series of small orifices in addition to the terminal one[1]. Moreover, it is scarcely likely that these canals in the old Devonian fish had the Selachian mode of development. In bony fishes, where the structures bear a similar relation to the hard skeletal parts, in most cases excavating them, there is naturally a much greater resemblance; and some of the most specialized Teleostei (*e. g.* the Pleuronectidæ) exhibit an almost precisely corresponding "feather-barb" arrangement[2]. Unfortunately, however, the character of the sense-organs themselves necessarily remains unknown, for the palæontologist can rarely give much sure

[1] P. C. Sappey, 'Etudes sur l'Appareil Mucipare et sur le Système Lymphatique des Poissons,' 1880, p. 55, pl. ii. fig. 2, pl. x. fig. 1.

[2] P. C. Sappey, *op. cit.* p. 44, pl. xi. figs. 3, 4.

information as to the perishable tissues originally associated with the skeletal fragments he finds in the rocks; and such is all the more to be regretted in the present instance, since the Pteraspidian fishes are the earliest undoubted members of the class that have hitherto been recognized in geological history.

3. Note on the "Lateral Line" of *Squaloraja*. By A. Smith Woodward, F.Z.S.

[Received April 28, 1887.]

In my description of the fossil Liassic Selachian *Squaloraja*, read before this Society in October last (see P. Z. S, 1886, p. 527), some series of very minute dermal ringlets are noted in the cephalic and caudal regions, and these are regarded as designed for the strengthening of the edges of those flattened parts of the body. They are marked by the letter *d* adjoining the rostral cartilages in fig. 1, pl. lv. *loc. cit.*, and are also shown in connected series along the tail, parallel to an irregular dermal ridge which is similarly designated. They are, moreover, seen in the original of fig. 3, and in the caudal region of the specimen previously figured by Davies.

Subsequent studies have led me to determine that these curious structures are truly the supports of the canal of the "lateral line." In the living *Chimæra*, the open groove in which the sense-organs are lodged is strengthened throughout by precisely similar rings, as originally observed by Stannius[1] and Leydig[2], and figured and described by the latter; and von Meyer[3] has likewise discovered these calcifications in a closely-allied fossil form from the Upper Jurassic of Bavaria. They have been aptly compared with the tracheal rings of some small air-breathing vertebrate. Their remains upon the tail show that they were incomplete, exactly as in the existing genus just mentioned; and we may therefore conclude that *Squaloraja* was characterized by an open sensory canal of the essential Chimæroid type. The circumstance adds one more to the series of points in which the old Selachian seems to be related to the last-named order, and it is thus particularly worthy of note.

[1] H. Stannius, Lehrb. vergl. Anat. Wirbelthiere, 1846, p. 49.

[2] F. Leydig, "Zur Anatomie und Histologie der *Chimæra monstrosa*," Müller's Archiv, 1851, p. 251, pl. x. fig. 2.

[3] H. von Meyer, "*Chimæra* (*Ganodus*) *avita*, aus dem lithographischen Schiefer von Eichstätt," Palæontographica, vol. x. (1862), p. 92, pl. xii.

June 7, 1887.

E. W. H. Holdsworth, Esq., in the Chair

The Secretary read the following report on the additions to the Society's Menagerie during the month of May 1887:—

The total number of registered additions to the Society's Menagerie during the month of May was 90. Of these 10 were by birth, 53 by presentation, 18 by purchase, 4 by exchange, and 5 were received on deposit. The total number of departures during the same period, by death and removals, was 77.

The most noticeable additions during the month were:—

1. A Tooth-billed Pigeon (*Didunculus strigirostris*), brought home from the Samoan Islands and presented to the Society by Mr. Wilfred Powell, C.M.Z.S., H.B.M.'s Consul for those Islands. But three specimens of this rare and now nearly extinct Pigeon have previously reached the Society's collection.

2. Two Red-spotted Lizards (*Eremias rubro-punctata*), obtained at Moses's Well, in the Peninsula of Sinai, and presented to the Society by Mr. G. Wigan, 17th May, being the first examples of this Lizard that we have as yet received.

3. An example of a small scarlet Tree-Frog (*Dendrobates typographus*), from Costa Rica, presented by Mr. C. H. Blomefield. Mr. Boulenger, who kindly undertakes the determination of the Reptiles received by the Society, tells us that this beautiful little Frog, which is of a nearly pure scarlet colour, is a rare species, of which there are no examples in the National Collection. (See Cat. of Batrachia Salientia, 2nd ed. p. 143.)

Mr. Sclater called attention to two North-American Foxes now living in the Society's Gardens, in adjacent cages, which had given him some trouble in determination.

One of these, received in exchange January 18th, 1885, and stated to come from Dakota, had been entered in the Register as the Virginian Fox, *Canis virginianus* (see P. Z. S. 1885, p. 934), but was certainly, as it now appeared, a Kit Fox (*Canis velox*). The second, received in exchange October 23rd, 1886, was the true Virginian Fox (*Canis virginianus*).

Mr. Sclater exhibited furriers' skins of these two Foxes, which had been kindly sent to him by Mr. Henry Poland, F.Z.S., and pointed out their differences.

The following papers were read:—

1. Remarks on certain Asiatic Ruminants.—I. BUDORCAS TAXICOLOR, Hodgson. The Gnu-goat or Takin. By A. O. HUME, C.B., F.Z.S.

[Received May 2, 1887.]

The very peculiarly shaped horns of the adult male *Budorcas taxicolor* (fig. 1, p. 484) are well known. The older the animal grows the longer do the terminal straight portions become. The pair figured measure (taken from the base of the main ridge behind, along this ridge over the front of the horn so far as this ridge is traceable, and thence along the curve of the horn outside to the tip) 22 (right) and 22·5 (left horn) inches in length, and 13 and 13·5 in girth at base; they are 10·75 wide from tip to tip, with a greatest interior width of 11·25 inches. The largest pair that I have met with measured 24·25 inches in length, had a basal girth of 12·75, a tip to tip width of 12·75, and a greatest interior width of 13 inches[1].

My second drawing (fig. 2, p. 484) shows the horns, *according to Blyth* (as named by him in the Calcutta Museum), of the female. They are very similar, it will be observed, to those of the male, but smaller, stumpier (if I may use such a word), the terminal portions less developed. Two pairs of this type measure:—

Length, R. 16, L. 16; basal girth, R. 10, L. 10; spread 8·75; greatest width inside 9·75.

Length, R. 16·25, L. 16; basal girth, R. 9, L. 9·25; spread 7·25; greatest width inside 8·75[2].

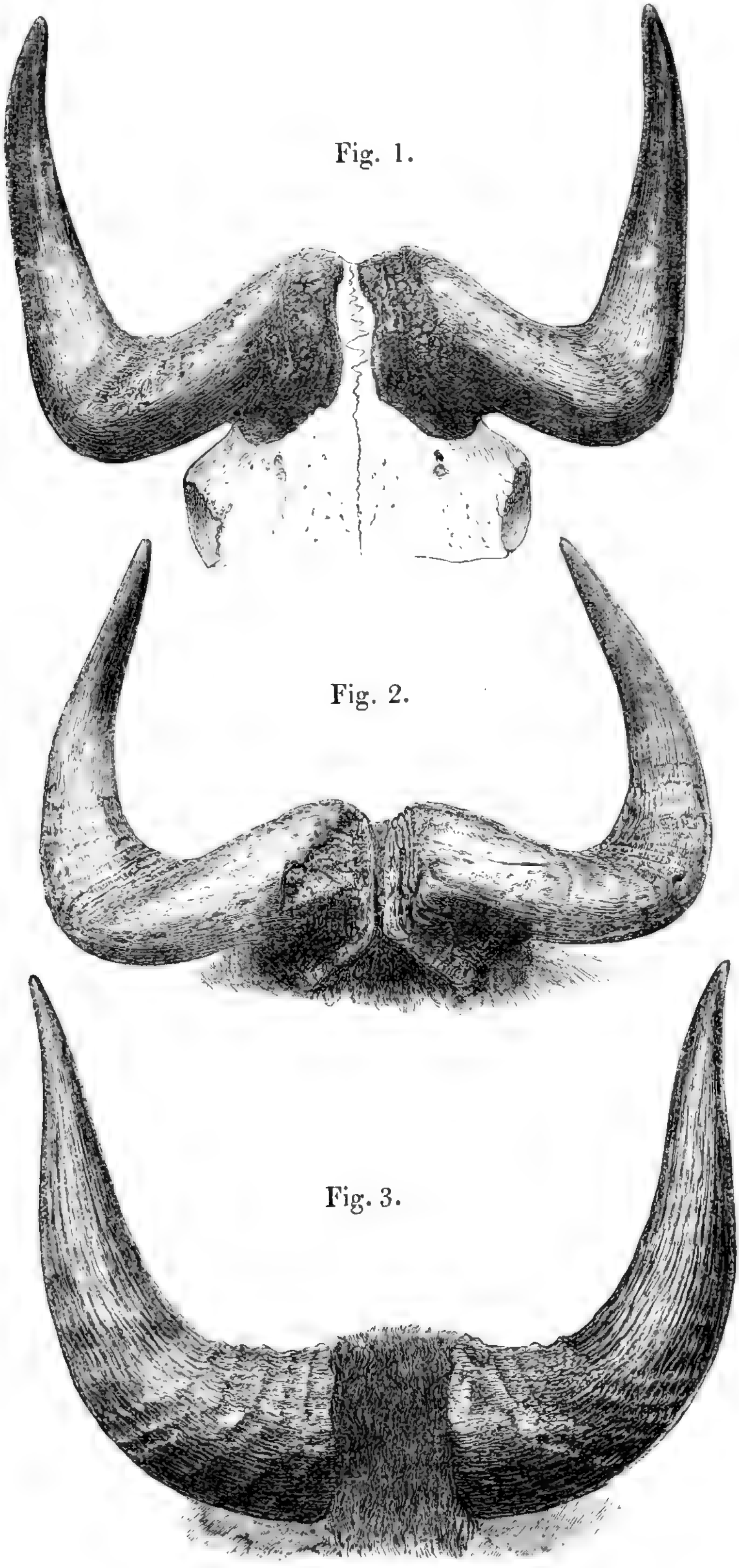
Milne-Edwards also, in his 'Recherches des Mammifères,' p. 369, says, "Chez la femelle, les cornes ont à peu près la même forme que chez le mâle, mais elles sont peu courbes et moins robustes." So he, like Blyth, considered the horns of the two sexes to be similar.

But there is a wholly different type of horn in this species, accurately represented in my third drawing (fig. 3, p. 484), and which Blyth (who, however, had only a miserable wreck of a specimen to go by) set down as those of the young. There is here none of that apparent bending down on themselves of the horns near their bases which characterizes the two other forms. The horns in this case have no gnu-like twist, are circular in section throughout, comparatively short, and, beyond the basal bend, straightish, with only a slight sigmoidal flexure, set very wide apart, diverging widely from each other, very thick and more or less ribbed at base, diminishing rapidly in thickness, and their terminal portions more or less smooth, with longitudinal striæ greatly resembling those of the Himalayan Capricorn (or Serow).

Now I venture to submit that by no possible process of growth could horns of this third type develop into horns of either the first or second types.

[1] In some horns of this type the terminal portions incline inwards much more decidedly.

[2] This is the pair figured.



Horns of *Budorcas taxicolor*.

The pair figured (and I have seen one larger) measure (along the curve outside from base to tip):—Length 12·5; basal girth 9·25; spread 12; and have their bases 2 inches apart. They are actually larger horns than some of the other (supposed adult) form.

Is Blyth likely to have been mistaken? At the time he wrote no one knew anything of the beast; to this day no European, in this part of the world at any rate, has shot it. All he had to go on were the rough skins brought down by the Mishmees. I have examined over a dozen such, and not one has left on it any trace of the sex of the animal to which it belonged. Either he guessed, judging by the analogy of the Serow, in which the horns of both sexes *are* very similar, or he was misinformed by those who sent the skin down.

But about Mr. Milne Edwards? He figures as an *adult male* of this species an animal with horns of our No. 3 type, and which, if the species he deals with be really the same as ours, must belong to the young, if Blyth is right, or to a female, if I am correct. But I attach less weight to this, because, on plate 68 of the same volume, he figures also as a *male* what, judging from the horns, must, I think, be an old *female* of the Bharal (*Ovis nahoor*[1]).

But is his species of Gnu-goat the same as ours? Certainly *not*, *if* his plate be reliable. I have examined 13 skins of animals of different ages, and exhibiting all three types of horns, and in not one was the head coloured as he figured it. In his figure the entire face and cheeks and sides of the head are a light yellow dun, only on the nose is a strongly contrasting black patch. In our Mishmee Hills Gnu-goat, the entire face, cheeks, sides of head, chin, and throat are black or blackish, only just at the base of the horns is a little brownish hair intermingled, or in one or two cases a *small* dark brownish patch appears. I have found many horns intermediate between 1 and 2, but not one in any degree intermediate between 2 and 3.

I believe that there is no doubt, despite anything previously written anywhere to the contrary, that my first figure represents the horns of an adult, but not *very* large, male, my second those of a younger, but not very young, male, and my third those of a fine old female.

It is worthy of note that, to judge from the skins, this latter was a *very much* smaller animal than others with horns (of certainly, I should say, no greater cubic contents) of the other type, and this is exactly what we should expect in the case of females and males of this group. Of course the *animal* might grow; but it is physically impossible, it seems to me, for horns of the No. 3 type to *grow* into smaller and wholly different-shaped horns of the No. 2 type.

Whether at an earlier stage the horns of the male and female resemble each other more closely, and what the horns of the male in its earliest stages are like, my present materials do not enable me to decide, but I soon hope to have a complete series. The smallest

[1] That is, if the animal figured really be *O. nahoor*; but it must be admitted that I have never seen any male horns of this species at *all* like the plate, and no female horns so thick and large.

horn of the Nos. 1 & 2 types that I have seen measured 14 inches in length, measured in the manner (already explained) that we measure this type, and this means a smaller horn than a 12·5 horn of the No. 3 type measured as we measure these.

However large the horn of the No. 3 type, it can be readily taken off its core, which is of the shape figured by Milne-Edwards; however small the horns of a No. 2 type, it is always impossible, owing to the twist in the cores, to get the horns off them.

The peculiar shape of what I suppose to be the male horns is just what one would expect to be developed in males butting together; the females do not require to fight, and hence the total absence of that great thickening to the front and close approach which the horns of the male show at that precise point where the shock of battle has to be sustained.

As to the pelage, I cannot yet be certain; the black or blackish heads are constant, from kids to the largest males, and (*selon moi*) females; but the body in some is a yellow dun, much as in Milne-Edwards's plate, while in others it is a deep dusky reddish brown, with a great deal of black intermingled, and some intermediate shades occur. These differences are not, I think, due either to age or sex, but are, I believe, seasonal.

2. Notes on some Species of South-African Snakes. By Edmond Symonds, of Kroonstad, Orange Free State. (Communicated by J. H. Gurney.)

[Received April 30, 1887.]

[The following notes were accompanied by specimens of the Snakes referred to, which have been kindly identified for me by Dr. Günther. With one exception, they were all collected in the vicinity of Kroonstad, where Mr. Symonds resides.—J. H. G.]

1. Coronella cana.

Length from head to end of tail 4 feet 6 inches; from vent to tail 8 inches.

Tail rather short and stumpy.

Iris brown; pupil circular.

Teeth.—Lower jaw a single row on each side, about 12; upper jaw a double row on each side, about 8; no fangs posterior or anterior.

Colour very dark brown, on the back almost black, sides rather lighter, belly a glossy slaty black.

Habits.—As a rule rather sluggish until thoroughly roused and irritated, when it strikes rapidly, but will always get away if possible; does not dilate the neck. Common near Kroonstad, but not so common as the copper-coloured variety; one I had in a cage for some time ate frogs.

The Dutch give them the name of "Cobra Papl;" others call them "Mole-vreter." I think they are harmless.

In this specimen a small gland, solid, about the size of a small pea, was found just under the skin at the posterior end of the upper maxilla on both sides.

A second specimen.—Length 4 feet 10 inches; from vent to tail 12 inches.

Back dark reddish brown, sides dull salmon-colour, centre of belly slate-blue; on the sides of the belly-plates a row of dark spots; the whole skin very glossy during life.

A third specimen.—Length 4 feet 7 inches; from vent to tail 10 inches.

Back yellowish brown, very like the colour of sandy ground and difficult to see when the Snake is not moving, from its similarity to the soil; belly bright yellow with a pinkish tinge, and an irregular black mark down the centre of the belly on the upper edge of the shields; this begins 3 or 4 inches beyond the neck, becoming more and more marked towards the vent, where it becomes a narrow line on the lower edge of the shields; beyond the vent it disappears.

The shields below the vent are double, and each shield has a dark brown line at its lower edge.

This colour is not common; the specimen sent was killed close to the river at Kroonstad.

A fourth specimen, immature.—Length 23 inches; vent to tail $4\frac{3}{4}$ inches.

Back yellowish brown, with black spots forming a zigzag line down the centre of the back; belly dirty yellow with a reddish tinge.

Killed whilst going into a house in the town of Kroonstad.

2. Psammophis crucifer.

Length $26\frac{1}{2}$ inches; from vent to tail $6\frac{1}{4}$ inches.

Head long, flat and small.

Teeth.—Upper jaw with two rows on each side; lower jaw with one row on each side; the exterior row on the upper jaw has the last tooth larger than the rest.

Pupil circular, iris brick-red. Neck slightly narrower than the head.

Colour.—Back pale olive greenish-brown, with one broad stripe down the back and a narrow stripe on each side chocolate-brown; belly dirty white, with a few black spots extending from the neck halfway to the tail.

Habits.—This seems to be a kind of grass-snake and is rather common here; it eats frogs, but, on the other hand, a specimen $18\frac{1}{2}$ inches long was found dead in the mouth of a large bull-frog, which much resented being done out of its meal.

3. Psammophis sibilans.

This species and the preceding are known here under the name of Schaaf-sticker (sheep-sticker).

Length 31 inches; from vent to tail 8 inches.

Head long, almond-shaped, supraorbital ridge very prominent.

Teeth.—Upper jaw with two rows on each side; lower jaw with one row on each side.

Pupil circular; iris light brown, with the inner edge yellow.

Colour.—Back striped as follows—in the centre a yellow line, then a brown stripe, next to that an orange one, then an olive-green stripe, next to that a very clean dead-white one adjoining the belly, which is greenish brown; all the colours being very bright and clear.

Habits.—Found in the long grass, very quick in its movements; and said to kill sheep !!

I had one of these Snakes for some time in confinement, but it would not eat, though it drank a little milk; I never saw it strike or try to bite. I often handled it, and it got tame after a time.

4. LEPTODIRA RUFESCENS.

Length 18½ inches; from vent to tail 2½ inches.

Head heart-shaped, like a Viper's.

Teeth.—Upper jaw with two rows on each side, at the back of the exterior row a large tooth which is movable; lower jaw with one row on each side. At the back of the jaws there was a small solid body rather like a gland, but I could not find a duct.

Pupil a vertical slit.

Colour.—Back and sides light greenish brown with fine white spots; belly dirty white.

Habits.—Very similar to those of the Vipers; it coils itself up, making a hissing noise loud for its size; it seems sluggish, but strikes very suddenly and rapidly; it is often found at night in little foot-paths, and is hence called by the Dutch "Padlooper," or "Path-walker;" it eats frogs.

5. LAMPROPHIS AURORA.

Length 24 inches; from vent to tail 3½ inches.

Head flat and blunt; body thick and tail stumpy.

Teeth.—Upper jaw with two rows on each side; lower jaw with one row on each side.

Pupil circular.

Colour.—Back olive-green, with a light yellow stripe down the centre; belly yellowish white.

I have only seen two specimens of this Snake, both killed close to the town of Kroonstad; I know nothing of its habits.

6. NAJA HAJE.

This specimen was given to me by Mr. Thomas Ayres, of Potchefstroom; I regret that I have never seen this species alive.

7. SEPEDON HÆMACHATES.

Length 4 feet 2 inches; from vent to tail 8 inches.

Head flattened, triangular. Neck narrower than the base of head, flattened out like a hood when disturbed.

Teeth.—One palatine row on each side of the upper jaw; in front, on each side of upper jaw, a conical hollow tooth, immovable, slightly curved, and partially covered by the gum, which is apparently retractile; lower jaw with one row on each side. Behind the jaws is situated, one on each side, a gland or bag containing a jelly-like fluid, with a duct leading to the large tooth in the upper jaw; the lining membrane of this gland is rather gelatinous; on pressing the gland fluid oozes out of the tooth; the gland, which is almond-shaped, rounded at the posterior end, lies between two small muscles, the fibres of which cross one another, apparently acting as an ejector or compressor.

Pupils circular.

Colour.—Back a dull slaty black; belly bright glossy black, with two white bands, the first 6 inches from the nose, consisting of about four shields, beyond which the white colour does not extend, these are followed by four black shields, and then by the second white band consisting of about five shields; the shields below the vent are double.

Habits.—This is one of the commonest Snakes about Kroonstad; it often does not move until it is approached pretty closely, when it will creep into a hole if not molested, but if frightened stands up with neck much dilated, and if, in trying to hit it, you miss it, it comes straight at you rather rapidly and will spit with remarkable accuracy for your face; one that I caught alive spat 5 feet. The fluid seems acrid and may blister slightly on a tender skin; if it goes into the eye, it occasions a good deal of smarting for perhaps a day. These Snakes are said to be very poisonous, but I know of no authenticated case of any one being bitten, and, according to my experience of several live ones that I have had, they very rarely bite, but always spit until the saliva is exhausted. On several occasions I gave them live mice for food, and they have spat at them until their fur was quite wet; but only on one occasion did one of them bite a mouse, and then the mouse rolled over dead instantly. They would not eat a mouse, but seemed very fond of frogs; they are also rather fond of hen's eggs, and I have seen them curled up on a nest of eggs.

These Snakes do not strike with very great rapidity, and certainly not with the accuracy of a Puff-Adder (which is not only most accurate but also strikes with fearful rapidity). They grow to a good size, the largest I have seen being nearly 6 feet long; the younger ones are of a grey-brown colour mottled with black. They generally live in holes, but sometimes take to water and swim well. Their Dutch name is "Ringhals."

3. List of a small Collection of Coleoptera obtained by Mr. W. L. Sclater in British Guiana. By Martin Jacoby. With the Description of a new Species by H. W. Bates, F.R.S.

[Received May 9, 1887.]

Mr. Sclater's collection, made principally at Maccasseema on the Pomeroon River, contains examples of the following species :—

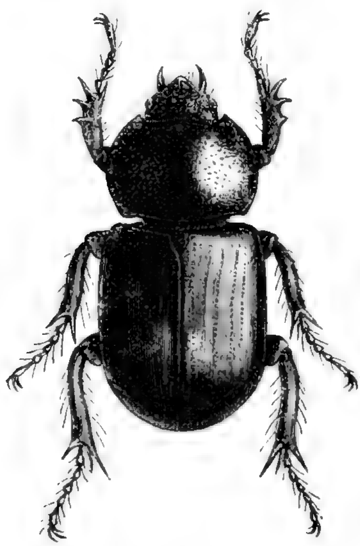
1. Theropsophus complanatus, *F.*
2. Tetracha violacea, var., *Reiche.*
3. Rhynchophorus palmarum, *L.*
4. Rhina barbicornis, *F.*
5. Cœlosis biloba, *F.*
6. Strategus alceus, *L.*
7. Phileurus didymus, *L.*
8. Phileurus depressus, *F.*
9. Phileurus sclateri, sp. nov.
10. Veturius platyrhinus, *Hope.*
11. Stenocrates laborator, *F.*
12. Zophobas morio, *F.*
13. Nytobætes variolosa, *F.*
14. Megaderus stigma.
15. Logocheirus araneiformis.
16. Chlorida festiva, *L.*
17. Orthomegas cinnamomeus, *Oliv.*
18. Eumolpus surinamensis.

The following description of the new *Phileurus* has been drawn up by Mr. H. W. Bates, F.R.S. :—

Phileurus sclateri, sp. nov.

Oblongus, subdepressus, nigro-nitidus ; elytris minute seriato-punctatis nec striatis, interstitiis subtilissime alutaceis et granulatis. Long. 23 millim.

Distinguished from all other described species by the fine sculpture



Phileurus sclateri.

and subopaque surface of the elytra. It belongs to Burmeister's Section I A. of the genus, the anterior tibiæ having three sharp teeth and the head two frontal tubercles, which, however, are much smaller than in any other species of the group, and followed behind by a broad but shallow frontal cavity. The clypeus is pointed and recurved; the mandibles without trace of tooth on their outer edge. The thorax is as broad as the elytra, broadly rounded on the sides, slightly narrowed to the base, with acute hind angles; the surface free from furrows and strongly and sparsely punctured, the punctures on the disk larger and transverse-oval or oblong; on each side of the anterior disk is a small round fovea. The rows of small circular punctures on the elytra are obliterated on the sides posteriorly and on approaching the apical callus. The hind tibiæ have no trace of spine on their outer edge (only a few short setæ), but there is a long spine at their outer apex. The species therefore is intermediate between Burmeister's subgroups *a* and *b*. The basal joint of the hind tarsi is not prolonged into a spine. The pygidium is opaque and punctured; the apical ventral segment very finely punctured, the rest of the abdomen (except the extreme sides) being smooth. The metasternum is punctured on the sides and clothed with reddish hair.

4. On a hitherto unrecognized Feature in the Larynx of the Anurous Amphibia. By G. B. Howes, F.Z.S., F.L.S., Assist. Prof. of Zoology, Normal School of Science and R. School of Mines, S. Kensington.

[Received June 2, 1887.]

The general structure of the respiratory organs in the Amphibia was first carefully analyzed by Henle, nearly fifty years ago[1]. He showed that well-developed laryngeal cartilages are nearly always present, and that the trachea and bronchi, though subject to considerable variation, may be supported by cartilaginous elements also. Conspicuous among recent investigators in the same field is Wiedersheim. He has shown[2] that in the Gymnophiona, as in some Urodeles (e. g. *Siren* and *Amphiuma*), trachea and bronchi are well differentiated, and that fully formed cartilaginous rings may be developed in connection therewith. To him we are also indebted for a description of the larynx of *Rana esculenta* in all its details[3], and for a number of other observations upon the subject generally; while he has summed up our knowledge of this in his Text-book of Vertebrate Anatomy. Dubois is now engaged upon a searching investigation into the morphology of the larynx. He calls attention in his preliminary notes[4] to the presence, among other things, of

[1] 'Vergleichende anatomische Beschreibung des Kehlkopfs:' Leipzig, 1839.
[2] 'Die Anatomie der Gymnophionen:' Jena, 1879. *Cf.* also his 'Lehrbuch d. vergleich. Anatomie d. Wirbelthiere.'
[3] Originally in his 'Lehrbuch,' edit. i. vol. ii. 1882, pp. 640–645.
[4] "Zur Morphologie des Larynx," Anat. Anzeiger, vol. i. 1886. See also Van Bemmelen, Zoolog. Anzeiger, vol. x. 1887, p. 91.

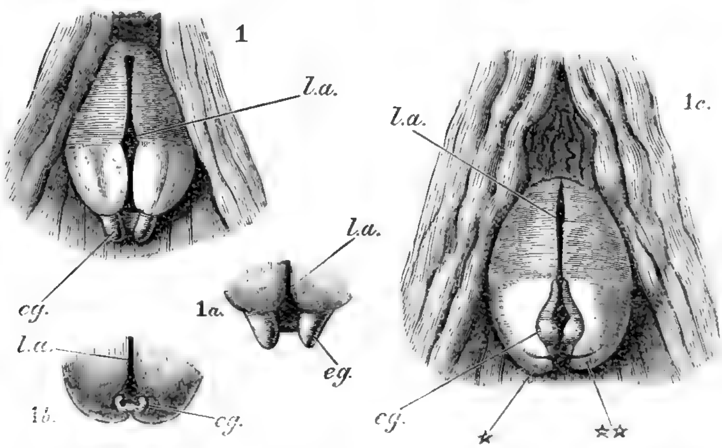
median procricoid (interarytenoid) elements in the Amphibia—an interesting feature of comparison with the higher types.

The Amphibian larynx is, like that of Reptiles, chiefly remarkable for the absence of a distinct thyroid cartilage; but the above *résumé* shows that with this exception there are represented in the respiratory organs of the Amphibia, as a group, the leading constituents of those of the higher Amniota. The epiglottis would, however, appear to be absent; and it is the object of this paper to inquire how far this is really the case.

It is necessary to point out that Henle wrote[1] of '*Engystoma*' that "die Constrictoren des Stimmladeneingangs sind bei diesen Species nur sehr lose an die Stimmlade befestigt, sie liegen in einer Querfalte der Schleimhant hinter der Zunge und dem Eingang der Stimmlade, und diese Falte bedeckt, wie eine Epiglottis, der vordersten Theil des Eingangs der Stimmlade."

My attention was first drawn to this subject two years ago, while dissecting a male of the Grass-Frog (*R. temporaria*). In that specimen (fig. 1 *a*)[2] the front wall of the larynx was prolonged forwards

Fig. 1.



The larynx in *Rana*. 1. *R. esculenta*, young ♂. 1 *a*. *R. temporaria*, ♂. 1 *b*. *R. temporaria*, ♂. 1 *c*. *R. temporaria*, ♀. All magnified three times. *eg*, epiglottis; *l.a*, aditus laryngis.

into two papillate folds (*eg.*), which were tumid and connected together by a thin film, the whole constituting a forward prolongation of the laryngeal mucous membrane apparently superadded to that which is customary. Wiedersheim, in describing the larynx of *R. esculenta*, points out[3] that it lies immediately behind a deep depression of the mucous membrane which corresponds with the

[1] *L. c.* p. 28.

[2] Originally figured in 'Atlas of Elem. Biology,' pl. i. fig. 13 (1885).

[3] 'Die Anatomie des Frosches,' Ecker and Wiedersheim, pt. 3, p. 8 (Brunswick, 1882).

hinder border of the body of the hyoid. This was so in the specimen to which I have just referred, and the anterior prolongation described overhung this depression, in a manner strikingly suggestive of the epiglottis.

Holl [1] and Royer and Bambecke [2] have most recently studied the anatomy of the mouth in the Anurous Amphibia: the first-named author deals chiefly with histological details in *R. temporaria*; the last-named deal with the subject in general; but I fail to find mention, in their writings, of those facts with which I am concerned. I am satisfied that the structures described above may or may not be present in individual examples of the common Frog, and have found, to my surprise, that the free anterior extremity of the larynx is subject to no inconsiderable amount of variation in it, to say nothing of the Anura as a group.

If the lips of the laryngeal aditus be examined with care in *R. temporaria* there will generally be found at its anterior end folds identical with those here figured, but more or less marked. They are sometimes so small that there is little wonder they should have been so long overlooked. They are well differentiated from the rest of the larynx; of a yellowish colour in life and soft and fleshy, projecting freely beyond those parts which are supported in cartilage (*cf.* figs. 1, 1 *a*, *eg*). There generally passes between them a thin transverse fold of mucous membrane, and occasionally, when very minute, they are, together with the same, erected and closely applied to the front face of the larynx (figs. 1 *b* and 3). I was for some time disposed to think that they might be peculiar to the males; but that this is not the case the larynx of an adult female, represented in fig. 1 *c*, will show. That specimen is further remarkable, among the larynges of a number of females which I have examined, for the fact that the folds were continued along the sides of the aditus, the anterior half of that being thus embraced by a hood-shaped lip.

On examining other members of the group, it early became obvious that the structure with which we here have to deal was by no means exceptional. In *Leptodactylus pentadactylus* and the Bull-Frog (*R. pipiens*), for example (figs. 2 and 3), two papillate elevations were found to be present; these were in both cases small and erected, and united by a transverse fold as in the first-named example. Comparison of figs. 1 *b* and 2 reveals an absolute identity between individuals of *R. temporaria* and *Leptodactylus pentadactylus*.

In two of the above-named species I found, in addition to the foregoing, a couple of other folds which were related to the hind half of the aditus (*ep*, figs. 2 and 3). In the Bull-Frog (fig. 3) they passed insensibly into the mucous membrane posterior to the larynx; but in *Leptodactylus* (fig. 2) they united behind so as to form an insignificant lip which embraced the hind boundary of the aditus, much as did the supposed epiglottis its front one. I have not seen

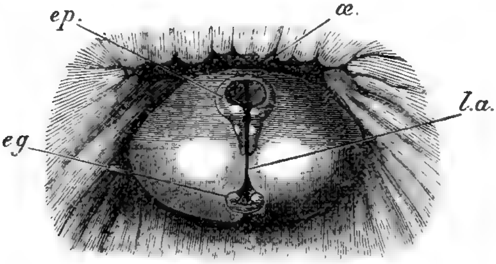
[1] Sitzungsb. Wien. Akad., Jan. 1887.

[2] "Sur les caract. fournis par la bouche des têtards des Batraciens anoures d'Europe," Bullet. Soc. Zool. d. France, 1881, p. 75.

these folds in either the Grass or Edible Frogs. I propose to term them, in accordance with their position, *epilaryngeal folds*.

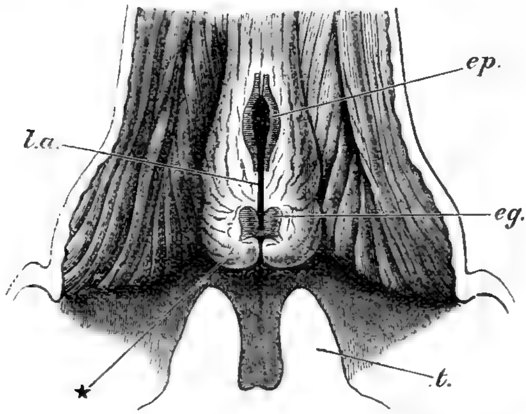
At this stage two difficulties presented themselves. Firstly, as to the epilaryngeal folds. Their condition, as seen in the Bull-Frog, might conceivably be such as would have resulted from puckering of a loose membrane under muscular contraction; while their symmetry and union in *Leptodactylus* pointed, no less distinctly, to the conclusion that they were definite and permanent structures. Doubt was dispelled on examination of other genera, for in a male of *Ceratophrys americana* (fig. 4) the two folds not only united behind but gave rise to a clearly differentiated overhanging lip, *ep.*, such as could only have been a permanent structure.

Fig. 2.



The larynx in *Leptodactylus pentadactylus*, ♂, front view. Magnified two and a half times.

Fig. 3.



The larynx in *Rana pipiens*, ♀, top view. Magnified twice.

eg, epiglottis; *ep*, epilaryngeal folds; *l.a*, aditus laryngis; *t*, tongue; *œ*, œsophagus.

Secondly, as to the anterior folds, *eg*. As already stated, I at first took these to represent the epiglottis of the higher Amniota; but their paired nature, which is most conspicuous throughout, remained for some time a stumbling-block in the way of that interpretation. His, however, has shown that the human epiglottis and plicæ ary-epiglotticæ are formed from a primarily paired structure. He describes them[1] as arising within what he terms the 'mesobranchial area,' from the modification of a couple of conjoined papillate folds or 'furcula.' In other words, the human epiglottis is, according to him, a strictly bilaterally symmetrical structure. Comparison of his description and figures (see especially fig. 44, p. 66, *l. c.*) with those here given shows that there is no important difference, either in position or origin, between the developing human epiglottis and the epiglottidean folds of the Anura; but it also introduces a fresh difficulty, on account of the presence in the latter of a couple of tumid

Fig. 4.

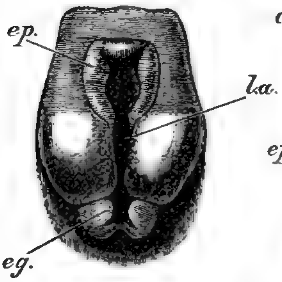


Fig. 5.

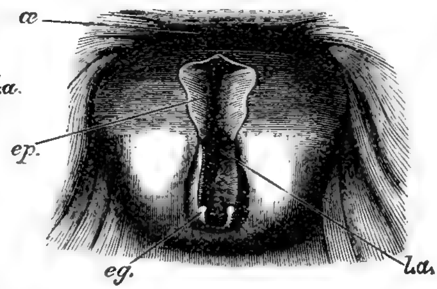


Fig. 4. The larynx in *Ceratophrys americana*, ♂. Magnified three times.
Fig. 5. The same in *Calyptocephalus gayi*, ♂. Magnified twice.
References as in figs. 2 and 3.

folds below those which I have thus far described (* figs. 1 *c* and 3). These might conceivably represent the furcula of His. They are, however, exceedingly inconstant, and in numerous instances unrecognizable; fig. 3 represents their maximum development observed. In one instance I noted (*R. temporaria*, ♀, fig. 1 *c*) that they were asymmetrical, that of the left side being much the smaller of the two[2]; and this at once suggested that they might be accidental and due to displacement. From careful study of both living and preserved specimens, I am fully satisfied that this is the case. Careful dissection has shown me that they are mere displacements of the mucous membrane, varying with the degree of contraction of the constrictor laryngis and petrohyoid muscles, and I regard them, moreover, as identical with that fold described by Henle in *Engystoma*, and likened by him to the epiglottis, as already stated.

The facts before us go far to justify the view that the epiglottidean folds of the Anura are homologous with the epiglottis of Mammals in its most typical form; a striking difference, however, suggests itself when comparing the two more closely. The Mammalian epiglottis is always chondrified, and in direct relationship with the

[1] 'Anatomie menschlicher Embryonen,' pt. 3, p. 60 *et seq.* Leipzig, 1885.
[2] Insufficiently expressed in the woodcut, at **.

thyroid cartilage; in the Amphibia, on the other hand, the epiglottidean fold is entirely membranous and in direct connection with the arytenoids, the front faces of which it surmounts (fig. 9, *eg.*). This difficulty, however, vanishes when it is considered that all recent investigation goes to show that the epiglottis is a secondary structure, formed independently of the rest of the larynx, and subject to the greatest variation. Dubois states[1] that in Mammals it represents a chondrification of the submucous tissue of the glosso-laryngeal fold, and that it only secondarily comes into connection with the thyroid cartilage. Clearly, then, the absence of a thyroid cartilage in the Amphibia cannot militate against my view. The same author further states that the epiglottis is present only in Mammals; but comparison of figs. 1, 1 *a*, 4, with His's figures of the human embryo referred to, shows that that is certainly not the case. Consideration of the above facts, taken collectively, forces us to the conclusion that the epiglottis may be represented in Anurous Amphibians, and that in a form most nearly realizing, so far as our present knowledge carries us, the initial stage in its development in man himself.

The interest attaching itself to the discovery of the epiglottis in Amphibia is self-evident, and it opens up questions of no little morphological importance. Future investigation must decide how far that which is customarily termed the epiglottis in some Reptiles[2] and Birds may or may not correspond with that of Mammals.

A consideration of the functional significance of this organ, as here described, reveals some interesting facts. Examination of the figures shows at once that the Amphibian epiglottis cannot have much, if anything, to do with deglutition. The classical Johannes Müller was one of the first to insist[3] upon the functional importance of the Mammalian epiglottis as a voice-organ; and it is now clearly established[4] that while that structure is not essential to deglutition, either of solids or liquids, it is indispensable to the full exercise of the voice, playing a part in phonation of unexpected importance.

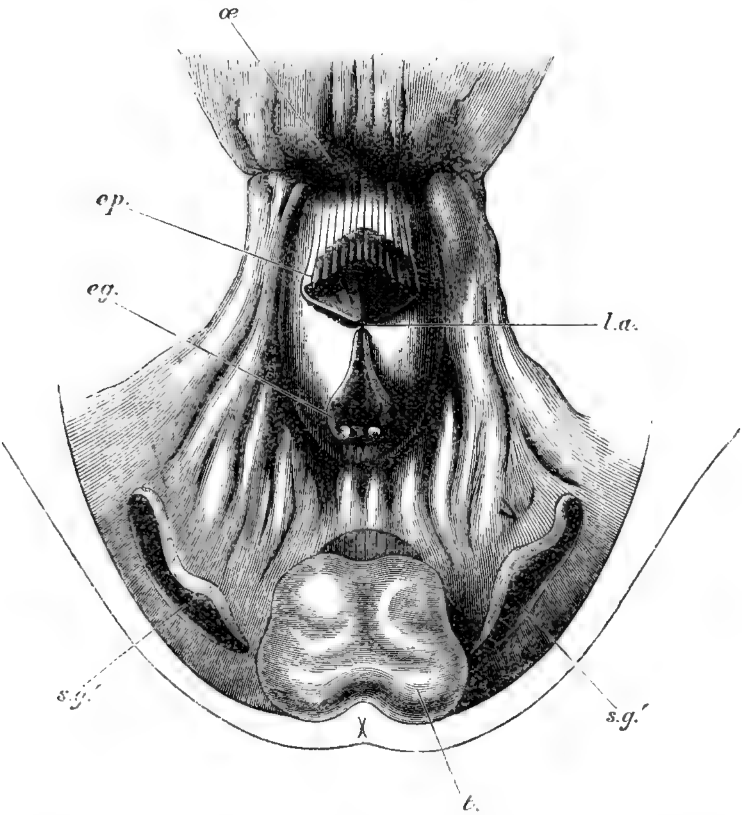
Turning to the Amphibia, it is satisfactory to note that nothing at all comparable to that which I have described is forthcoming among the tailed forms. The epiglottis is clearly appearing among the Anura; and it becomes a question of the highest interest to inquire, in the knowledge of the above physiological facts, whether its relative development is in any way associated with that of other accessories to the voice, so well known in the males of certain genera.

Henle long ago called attention (*l. c.*) to the existence of minor sexual differences in the laryngo-tracheal skeleton in *Pipa* and other Anura. I have already shown that traces of both the epiglottis and epilaryngeal folds may be found in females of certain species (figs. 1 *c* and 3); and, on turning my attention to the proposition above named, I was, at first, awarded with unexpected success. In a male of

[1] *L. c.* p. 186.
[2] *Cf.* Henle, *l. c.* pp. 51, 52, and 60, 61.
[3] Handbuch d. Physiologie, 1840.
[4] Walton, "The Function of the Epiglottis," Journ. of Physiology, vol. i. 1878–9.

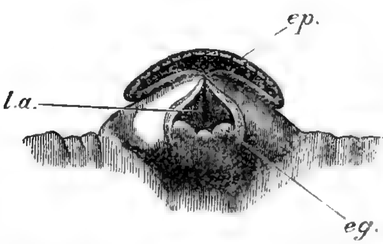
Ceratophrys americana (fig. 4, p. 495) both epiglottis and epilaryngeal folds were found to be well developed; but though conspicuous, they remain comparatively insignificant beside those of an adult male of

Fig. 6.



The larynx and floor of the mouth in *Chiroleptes australis*, adult ♂.

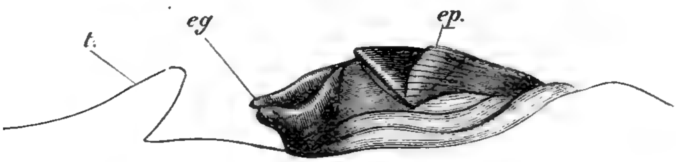
Fig. 7.



The larynx in the same, seen *en face*. Both figs. magnified twice.
References as in previous figures. *s.g′*, orifice of gular sac.

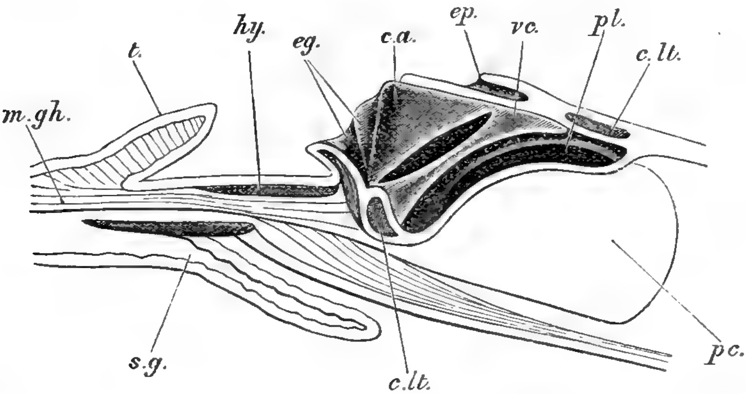
Chiroleptes australis, that being one of the genera possessed of the well-known gular sac (*s.g*, *s.g′*, figs. 6 and 9). This specimen presents the maximum development observed, and I have accordingly figured it (figs. 6 to 10) in all its important aspects. The interest of it is vastly increased when it is stated that in a female which I have examined the folds were absent, while in a second male they were insignificant [1]—facts which point to the conclusion that their development takes place comparatively late in life, in all probability correlatively with sexual maturation.

Fig. 8.



The larynx in *Chiroleptes australis*, side view.

Fig. 9.



The same, in longitudinal section.

References as in previous figures. *c.a*, right arytenoid; *c.lt*, cricoid (laryngotracheal) cartilage; *hy*, body of hyoid; *m.gh*, genio-hyoglossus muscles; *pc*, pericardium; *pl*, entrance to right lung; *s.g*, gular sac; *vc*, right vocal cord.

Figs. 6 to 9 will show how fully the two structures may be developed. The epiglottis, *eg.*, stands out prominently in front; the epilaryngeal fold is hood-shaped, overhanging the hinder third of the aditus, and the two together embrace the lateral walls of the aditus for nearly its whole extent—so much so, that I at first took them to be continuous. This, however, is not the case, and here, as in all other examples with which I have met, the two structures, although they may approximate, are perfectly distinct (*cf.* fig. 5). The epilaryngeal fold is entirely membranous, exhibiting on its upper part, which is

[1] For the opportunity of examining these two specimens, as for further assistance, I am indebted to the courtesy of Mr. Boulenger, F.Z.S., of the National Museum at South Kensington.

thinner and more vibratile than the rest, a beautiful parallel striation; the epiglottis is also membranous, but supported upon a connective-tissue framework, which is densest along the lines of development of its paired outgrowths. Neither epiglottis nor epilaryngeal folds appear to have given attachment to definite muscles; the epiglottis was very flexible in life; and although unable to trace a direct muscular connection, I incline to the belief that it was under muscular control.

What may be the precise function performed by these interesting structures, I do not pretend to say, but I hold it indubitable that they are concerned in phonation. If this be admitted, a most interesting parallelism becomes obvious between the higher Amniota (Mammalia) and the higher Ichthyopsida (Anura) with respect to the appearance of the epiglottis as an accompaniment of specialized laryngeal activity; and we have good reason for believing that organ to have been primarily connected with phonation—a deduction which all recent investigation into the function of the Mammalian epiglottis upholds.

While the epiglottis makes its appearance in the Amphibia as an accessory voice-organ, its development does not appear to be of necessity related to a high development of the vocal sac. Heron Royer has lately described[1] the larynx of *Hyla meridionalis* (*barytonus*, Royer); in it, in spite of the immense development of the gular sac, there does not appear to be anything present of the nature described above. Royer has further pointed to specific differences between the larynges of *H. arborea* and *H. meridionalis*; Mr. Boulenger, however, informs me that he has found the same to be of no specific value, and I fully share that belief.

Thanks to Prof. Huxley and Mr. Boulenger, I have been able to examine a series of specimens, with the result set forth in the following table[2]:—

a. Epiglottis present: epilaryngeal folds confluent behind.

Calyptocephalus gayi. ♂.	*Heleioporus albopunctatus.* ♂.
Ceratophrys americana. ♂.	*Leptodactylus pentadactylus.* ♂.
Chiroleptes australis. Adult ♂.	

b. Epiglottis present; epilaryngeal folds not confluent behind.

Hyla cærulea. ♂.	*Hyla lichenata.* ♀.
*—— *dolichopsis.* ♂, ♀. (A second ♂ showed no traces.)	**Rana pipiens.* ♂, ♀.

c. Epiglottis present, but small; epilaryngeal folds absent.

**Bombinator bombinus.* ♂.	**Rana esculenta.* ♂, ♀.
Chiroleptes alboguttatus. ♂.	*—— *temporaria.* ♂, ♀.
—— *australis.* ♂ juv.	

[1] "Note sur une forme de Rainette nouvelle pour la faune française," Bullet. Soc. Zool. d. France, vol. ix. 1884.

[2] One specimen only examined, excepting those marked *.

d. Epiglottis and epilaryngeal folds both absent.

Bufo typhonius. ♀.
Cornufer vitianus. ♀.
**Hyla meridionalis.* ♂, ♀.
—— *venulosa.* ♂.
**Hylodes martinicensis.* ♀ juv.
Nannophrys ceylonensis. ♂.
Phryniscus lævis. ♀.
Phyllomedusa bicolor. ♂ juv.
**Rana esculenta.* ♂, ♀.
*—— *temporaria.* ♂, ♀.
—— *temporalis.* ♂.
Rappia marmorata. ♀.
Rhacophorus maculatus. ♂, ♀.
Rhinoderma darwini. ♂.
Xenophrys monticola. ♀.

Perusal of the above brings into prominence a wide range of individual and specific variations. The former are, however, less striking than appears at first sight, and little more remarkable than those of the Amphibian manus and pes, or of the Batoid intestinal valve[1]; the latter find a near parallel in the modifications of the larynx in certain fruit-eating Bats recorded by Dobson[2]. That observer has obtained a satisfactory explanation of the phenomena upon purely physiological grounds, and the analogy suggests that an investigation into the habits of the living Anura under consideration might furnish a similar clue. If, as the analogy to *Chiroleptes* would suggest, the folds in question are associated with the development of vocal sacs, it is difficult to reconcile their absence in *Hyla meridionalis* and *H. venulosa,* with their presence in *H. dolichopsis* and *Bombinator*; while the combination met with in *Heleioporus* would appear to negative the supposition. It may be held that the structures are developed periodically or with sexual maturation; but, if so, it becomes hard to account for their insignificance in the male of *Leptodactylus* (fig. 2), in which the accessory spurs had attained a considerable development. The facts adduced in *Chiroleptes australis,* while they appear to favour this belief, are, in themselves, capable of a different interpretation, for that the differences between the two males which I have examined are due to age is a surmise. The facts are very puzzling; but who is to say that, in the most marked cases recorded, we may not be dealing with a character of taxonomic value, fit at least to rank with those customarily relied upon[3].

Apart from the above considerations, examination of the figures shows most conclusively that, in the specimens which I have described, a gradational modification can be traced. *Chiroleptes* (fig. 6) and *Rana* (fig. 1 *b*) stand at opposite ends of a series, the intermediate steps in which are furnished by *Ceratophrys, Leptodactylus,* and *Rana pipiens,* in succession. The question therefore arises as to which of the two first-named typifies the more primitive arrangement.

[1] T. J. Parker, T. Z. S. 1880, pp. 49-61.
[2] P. Z. S. 1881, pp. 685-93.
[3] *Cf.* remarks by Huxley on the "Taxonomy of the Canidæ" (P. Z. S. 1880, p. 286), and by Herdman, "On the Specific and Local Variations in the Tunicata (First Report of the Liverpool Marine Biological Committee, 1886, pp. 355, 356).

If the apparatus be held to be of none but physiological significance, the clue to its meaning has yet to be found; it is clearly in no way associated with the development of the vocal sac, nor is it confined to the males, as might be supposed. In the higher forms, however, it is vestigial and of little or no functional importance; and there is nothing forthcoming in any one specimen which is not represented in the male of *Chiroleptes*. These facts, in view of the uniformity of development of the parts in the latter, would seem to me to suggest that the apparatus has an important morphological significance, and that in the admittedly lowly Australian type the primitive condition is most nearly exemplified. The problem is an interesting one, and further investigation is necessary for its solution.

Turning, finally, to the question of general morphological importance, it is clear that the discovery of the epiglottis in the Amphibia, in the form and under the conditions here recorded, carries back a stage further the initiation of one more structure peculiarly characteristic of Mammals. The interest of this is increased when we reflect upon the identity of the Amphibian epiglottis, which is clearly bilaterally symmetrical, if not actually paired, with the initial phase in development of that organ in the human subject as observed by His. The facts show that the origin of this typically Mammalian structure must be sought in animals lower than the living Lizards [1]. It would be wide of the mark to form data for discussing the question of Mammalian affinities upon it. In view, however, of the anticipation of the cæcum coli in the Common Frog [2], and of the excursions made by those Amphibia with suppressed larval metamorphoses [3], in which it is highly probable there may have been foreshadowed the fœtal membranes of the Amniota (*cf.* Huxley, P. Z. S. 1880, p. 660), the facts here recorded can best be regarded as indicative of similar excursions towards the elaboration of the voice-organ, anticipatory, as has been shown, of the characteristically Mammalian condition.

[1] It is of interest here to note the existence of an epiglottis-like fibro-cartilaginous plate in *Protopterus*. Attention was first drawn to it by Henle (*l. c.* pp. 5, 6), and it was shortly afterwards described in full and figured by Bischoff ("Descr. Anat. du *Lepidosiren paradoxa*," Ann. Sci. Nat. t. xiv. Zool. 1840 p. 136). Wiedersheim has refigured it ('Lehrbuch') and recorded (*ibid.*) the discovery of an analogous structure in *Lepidosteus*.

[2] Huxley, in Huxley and Martin's Elem. Biology, 1875, p. 166.

[3] Especially *Nototrema*, Weinland, Archiv f. Anat. und Phys. 1854; *Hylodes*, Peters and Gundlach, Monatsb. Berlin. Acad. 1876; *Rana opisthodon*, Boulenger, T. Z. S. vol. xii. 1886; *Phyllomedusa*, v. Ihering and Boulenger, Ann. & Mag. Nat. Hist. vol. xvii. 1886.

For a *résumé* of the subject generally, with full references and list of species, see Boulenger on *Phyllomedusa*, *op. cit.* p. 464. *Cf.* also Smith and Cope on *Dendrobates*, Amer. Naturalist, 1887, pp. 307–311.

June 23, 1887.

Prof. W. H. Flower, LL.D., F.R.S., President, in the Chair.

Mr. Sclater laid upon the table the skin of a White-nosed Monkey of the genus *Cercopithecus*, which had been presented to the Society's Menagerie by the Rev. W. C. Willoughby, December 9, 1883, and had died on the 13th November last year.

Mr. Sclater had now ascertained from Mr. Willoughby that this specimen had been obtained by him in Unyamwezi, Eastern Equatorial Africa, and was said to have been brought from Manyuema, on the western shore of Lake Tanganyika. It was undoubtedly different from the ordinary form of *C. petaurista* of West Africa, hitherto received by the Society, and was at once recognizable by having the last two thirds of the tail red. It appeared to be the species designated by Schlegel (Mus. des Pays-Bas, Simiæ, p. 87) *Cercopithecus ascanias*, but Mr. Sclater much doubted whether it was legitimately entitled to bear that name.

Until the synonymy of the West-African Monkeys was more completely worked out, it was not advisable to give it a new name, but it was interesting to have ascertained the correct locality of this Monkey.

Mr. Sclater exhibited a specimen of the Pheasant from Northern Afghanistan which he had described in 1885 (P. Z. S. 1885, p. 322, plate xxii.) as *Phasianus principalis*, and stated that he was pleased to find that his name for this bird antedated that bestowed upon ti by Bogdanow, *Phasianus komarovi*[1], and must therefore be adopted. M. Menzbier had compared typical specimens of *P. komarovi* with birds from the Murghab and had found them identical.

The specimen now exhibited had been kindly presented to Mr. Sclater by Gen. Sir Peter Lumsden, G.C.B., F.Z.S.

The following extract was read from a letter addressed to the Secretary by Mr. A. Everett, C.M.Z.S., dated Labuan, April 21st, 1887:—

"You will be interested to know that Mr. John Whitehead has recently returned from the Kina Balu mountains in Northern Borneo, where he made a stay of two months on one of the spurs, at an elevation of 5000 feet. Mr. Whitehead has collected birds chiefly, and there appears to be a considerable proportion of novelties among the skins, although perhaps many of them are only new to the Bornean avifauna. Among those which seem to me to be really new to science are a huge *Calyptomena*, six times the size of the common Green Manakin, but, like it, coloured brilliant green and velvety black, only the coloration is differently disposed; a long-tailed Eurylæmid, which is a very beautiful bird about the size of

[1] Bull. Acad. Sci. St. Pétersb. xxx. p. 356.

Cymborhynchus, but coloured with very pure tints of blue, green, and yellow; a green-and-blue *Ploceus* (*Munia?*), a large sooty *Turdinus,* a very large *Arachnothera* of peculiar style of coloration, a Barbet, a *Leucocerca,* and a number of others. The only ground-birds obtained were a pair of Partridges. The only *Pitta* was *P. arcuata.* The only *Nectarinia* at all abundant was *N. temmincki,* of which the ♀ was also secured. The only mammals obtained were two or three species of Rats, Squirrels, and a *Tupaia,* with a Shrew. The *Tupaia* seems to be new, as also one of the Squirrels, an animal not much larger than the pigmy *Sciurus exilis,* and having long tufts of hair to the ears."

Dr. Günther exhibited a hybrid specimen produced by a male Golden Pheasant (*Thaumalea picta*) and a female Reeves' Pheasant (*Phasianus reevesi*). It was a male in its second year, and had been bred by Ralph Saunders, Esq., of Exeter, who had presented the specimen to the British Museum.

Dr. Günther exhibited also a hybrid specimen produced by a male white Fantail Pigeon and a female Collared Dove (*Turtur risorius*). The specimen was the survivor of the last of three broods reared by these birds in Dr. Günther's aviaries.

Dr. Günther, F.R.S., V.P.Z.S., communicated a paper by Mr. Arthur Dendy, B.Sc., F.L.S., Assistant in the Zoological Department of the British Museum, containing Observations on the West-Indian *Chalininæ,* with Descriptions of new Species, which will appear in full, with illustrations, in the 'Transactions' of the Society.

The paper was divided into two sections—(1) Introductory Remarks; (2) Description of Genera and Species. It was based upon the study of the large collection of West-Indian Chalinine Sponges accumulated in the Natural-History Museum.

In the first part of the paper it was pointed out that the species described in the second part were especially interesting from two points of view:—(1) they afforded excellent illustrations of the great variability in external form to which species of Sponges living in shallow or comparatively shallow water are subject; and (2) they illustrated in a very striking way the manner in which the siliceous spicules gradually degenerate and ultimately completely vanish as the horny skeleton becomes more and more strongly developed.

The first of these two general laws was best exemplified in the cases of *Spinosella sororia,* D. & M., and *Pachychalina variabilis,* n. sp. The second was clearly demonstrated, first, by the genus *Siphonochalina,* in which the various species described showed different degrees of degeneration in the spicules, ranging from *Siphonochalina spiculosa,* n. sp., with great numbers of well-developed spicules, constituting a most important part of the skeleton-fibre, to *Siphonochalina ceratosa,* n. sp., in which the skeleton consisted almost entirely of spongin, the spicules being represented by the merest vestigial traces lying in the horny fibre.

But this law was illustrated in a still more striking manner by two species of the genus *Spinosella*, viz. *Spinosella plicifera*, D. & M., and *Spinosella maxima*, n. sp., which sometimes still contained traces of spicules imbedded in the horny fibre, and apparently on the verge of disappearance, while at other times they contained no spicules whatever, the skeleton-fibre being entirely horny; and yet specimens with spicules and specimens without were specifically undistinguishable. It appeared that spicules might persist as vestigial structures long after they had ceased to be of any functional importance, and that they disappeared first from the secondary fibres of the skeleton.

The bearing of these facts upon the systematic position of the so-called "*Keratosa*" was pointed out, and was, indeed, sufficiently obvious.

The immediate cause of the disappearance of the spicules appeared to be the development of the spongin to such an extent as to form by itself a sufficiently strong skeleton. In such a skeleton spicules would probably be not only useless, but actually harmful, in that they would tend to make the fibre rigid and brittle when it is desirable that it should be elastic and flexible, in order to facilitate the free contraction and expansion of the various parts of the canal-system, and in order better to withstand the action of the waves and currents in the shallow water in which horny-fibred Sponges occur. Spongin appeared to be developed to a large extent only in warm climates and in tolerably shallow water; and under such conditions Sponges with a strongly developed horny skeleton are abundant.

In the second part of the paper eight species were fully described, five of them being new. The following is an enumeration of the genera and species, together with brief diagnoses of the new species[1].

Genus Pachychalina, Schmidt.

Pachychalina variabilis, sp. n.

External form extremely variable; usually the same specimen is both lobose and digitate. Size of largest specimen 38 cm. high by 37 cm. broad. Colour (dry) light yellowish grey. Texture hard, fibrous, somewhat elastic. Surface smooth. Oscula large and round, about 5 millim. in diameter; for the most part scattered irregularly over one surface of the specimen.

Main skeleton a very irregular reticulation of strong spiculo-fibre, containing both a large amount of spongin and a great number of spicules. Primary and secondary lines much confused, longitudinal fibres strongly developed. The dermal skeleton also forms an irregular network.

Spicules long and very slender, normally oxeote or strongylote; size 0·126 by 0·003 millim. Occurring in the fibre and scattered outside it.

Nassau, Bahamas.

[1] All the specimens were examined in the dry condition.

Genus SIPHONOCHALINA, Schmidt.

SIPHONOCHALINA SPICULOSA, sp. n.

Sponge consisting of a number of long, smooth, upright cylindrical tubes, united together at the base a n also at points of contact. Height 27 cm., greatest width 21 cm. Diameter of tubes at top 3 cm. Colour (dry) light yellowish grey. Texture rather brittle.

Main skeleton consisting of a network of coarse spiculo-fibre, composed of very numerous spicules with rather a small proportion of spongin. Primary and secondary fibres distinct, giving rise to more or less rectangular meshes. Diameter of primary fibres about 0·06 millim., of secondaries somewhat less; both contain much foreign matter, grains of sand &c., imbedded amongst the spicules. The dermal skeleton (on the outer surface) is a polygonally meshed network of stout spiculo-fibre, 0·03 millim. in average diameter.

Spicules slightly curved, sharp-pointed oxea; size 0·138 by 0·006 millim. Occurring in the fibres and scattered between.

Turk's Island, Bahamas.

SIPHONOCHALINA PROCUMBENS, Carter, sp.

1882. *Patuloscula procumbens*, Carter, Ann. & Mag. Nat. Hist. ser. 5, vol. ix. p. 365.

West Indies, Grenada.

SIPHONOCHALINA CERATOSA, sp. n.

Sponge consisting of a number of upright, cylindrical, thick-walled tubes, united together in an irregular basal mass, and also united laterally in places by the development of horizontal trabeculæ or by direct fusion. Total height 24 cm., breadth about 30 cm. Diameter of orifice of tubes averaging about 1·5–2 cm. Surface smooth but uneven. Colour clear, pale yellow. Texture firm but elastic.

Main skeleton a regular, rectangularly and close-meshed reticulation of stout horny fibre. Primary fibres about 0·053 millim. thick, secondaries but little less. Dermal skeleton (on the outer surface) a polygonally meshed reticulation of stout fibre, not distinguishable from the main.

Spicules represented by mere traces of slender oxea, which appear to have been almost completely absorbed.

Nassau, Bahamas.

Genus SPINOSELLA, Vosmaer.

1864. *Tuba*, Duchassaing and Michelotti, &c.

SPINOSELLA SORORIA, Duchassaing and Michelotti, sp.

1864. *Tuba sororia*, Duchassaing and Michelotti, Spong. Mer Caraïbe, p. 46, pl. viii. fig. 1.

1870. *Siphonochalina papyracea*, Schmidt, Spong. Atlant. Gebiet. p. 33.

West Indies.

SPINOSELLA SORORIA, var. DILATATA.

Differing from the typical form of the species in its more luxuriant and bushy habit, and in the much greater width of the larger tubes.

Bahamas.

SPINOSELLA SORORIA, var. FRUTICOSA.

This variety also differs from the typical form in its bushy habit. The tubes are cylindrical and somewhat narrow, their walls are thicker, and the venation on the inner surface is not strongly marked.

SPINOSELLA SORORIA, var. ELONGATA.

Differs from the typical form in having the tubes much elongated and rather narrow; moreover they are cylindrical and of approximately the same width all the way up. The margin of the tubes is usually smooth, and the spines on the outer surface are almost entirely obsolete. The venation on the inner surface of the tubes is usually not discernible.

SPINOSELLA PLICIFERA (? Lamarck, sp.), Duchassaing and Michelotti, sp.

1813. ?*Spongia plicifera*, Lamarck, Ann. Mus. Hist. Nat. tom. xx. p. 435.

1864. *Tuba plicifera*, Duchassaing and Michelotti, Spong. Mer Caraïbe, p. 53, pl. x. fig. 2.

Bahamas.

SPINOSELLA MAXIMA, sp. n.

Sponge forming great irregular masses, composed of a number of tubes of various shapes and sizes, all united at the base and some united laterally at points of contact. Tubes usually wide, either funnel-shaped or constricted at the mouth, commonly the wider ones are compressed. Greatest height 45 cm., greatest breadth nearly 50 cm. Outer surface aculeated by very numerous blunt, spinous processes, of various lengths up to 1·25 cm. Margin of orifice extremely thin and papyraceous. Colour pale yellow. Texture firm and hard, but elastic.

Main skeleton very irregular, consisting of a large-meshed reticulation of very stout fibres (0·12 millim. thick), and a smaller-meshed reticulation of fine fibres (0·013 millim. thick) which take their origin from the stout ones. Dermal skeleton a network of stout horny fibres, with comparatively small, rounded meshes.

Spicules entirely absent in the typical examples.

Nassau, Bahamas.

There is also a slight variety which differs from the types in two respects—(1) the spinous processes are represented only by low warts and ridges, (2) there still exist within the fibre a very few vestigial oxea.

Jamaica.

J. Smit del. et lith.

Mintern Bros. imp.

MUS MACLEARI.

J G Keulemans del et lith

Mintern Bros. imp.

CARPOPHAGA WHARTONI.

Peter Smit del. et lith.   Mintern Bros. imp.

PACHYCHALINA SPINOSISSIMA.

SPINOSELLA VELATA, sp. n.

Sponge consisting of a number of irregularly cylindrical or compressed tubes, united basally and sometimes laterally. Height 19 cm., breadth 13 cm. Largest tube 4·5 cm. in diameter at top. Tubes provided with broad, horizontal, circular diaphragms, projecting inwards at a short distance below the margin. Outer surface of tubes distinctly spinose.

Main skeleton a network of fairly stout fibre; network usually irregular, sometimes rectangular. Local concentrations of the skeleton network form longitudinal veins, as in *S. sororia*, &c. Fibres about 0·044 millim. thick. Dermal skeleton (on the outside) an irregular reticulation of slender fibre.

Spicules slightly curved, sharp-pointed oxea; size 0·1 by 0·0045 millim., but usually slenderer. Occurring in the fibres and scattered outside.

Bahamas.

The following papers were read:—

1. Report on a Zoological Collection made by the Officers of H.M.S. 'Flying-Fish' at Christmas Island, Indian Ocean. Communicated by Dr. A. GÜNTHER, V.P.Z.S., Keeper of the Zoological Department, British Museum.

[Received May 27, 1887.]

(Plates XLI.–XLIV.)

At the suggestion and through the kind mediation of Capt. Wharton, F.R.S., Hydrographer of the Admiralty, advantage was taken of a recent visit to Christmas Island of H.M.S. 'Flying-Fish,' under the command of Captain Maclear, to make observations on, and collect specimens of, Natural History. This oceanic island is so far out of the usual track of navigation and so unattractive to those interested in commercial pursuits that no naturalist seems to have had an opportunity of visiting it. Even the time and circumstances of its discovery and the man who named it are unknown.

From its geographical position it was not to be expected that its littoral fauna would prove to be in any way differentiated from that of the tropical Indo-Pacific Ocean; but it seemed desirable to pay special attention to any terrestrial animals that might be observed; and considering the short time at the disposal of the visitors, and the narrow limits of the portion of the island which was accessible to them, the collection is larger than could have been expected.

The best thanks of naturalists are due to Capt. Maclear and the other officers of the ship for having undertaken this task in addition to the primary object of their visit.

Unfortunately one of the most interesting portions of the Collection, viz. the Lepidoptera, was destroyed on its way home, some pieces of camphor having become loose and smashed all the specimens with the exception of two. The remainder of the Collection consisted of 95 specimens, viz. 4 Mammals, 4 Birds, 4 Reptiles, 12 Crustaceans, 4 Arachnids and Myriopods, 27 Insects, 31 Mollusca, 8 Echinoderms, and 1 Sponge. Twelve of the species proved to be undescribed, but at present it would be premature to represent them as isolated forms peculiar to the island, because some of them may yet be found to occur also in some unexplored portion of the Moluccas. The specimens have been deposited in the British Museum, and examined by the staff of the Zoological Department.

I am indebted to Capt. Wharton for the communication of Capt. Maclear's report and for his kind permission to reproduce here the valuable information contained therein. His observations leave no doubt that a rich harvest might be gathered if a collector should be able to make a longer stay and to reach the interior of the island.

Report on Christmas Island. By Captain Maclear, of H.M.S. 'Flying-Fish.'

Observation spot, the middle of the beach, Flying-Fish Cove, about two miles westward of the north point of the island.

Lat. 10° 23′ 19″ S., long. 105° 42′ 52″ E.; dependent on Batavia.

Christmas Island is 190 miles from the nearest point of Java, from which it is separated by a depth of 2450 fms. It is formed of coral-limestone, has no fringing reef, but rises abruptly from the sea in cliffs about 30 feet high, very much underworn, and in many places hollowed out in caverns; the shore is steep; generally a depth of 100 fms. is found at one to two cables from the cliffs.

In appearance it is somewhat saddle-shaped, rising from a long back in the middle, 700 to 800 feet high, to hills at the north-eastern and at the western sides: the western summit is double, and is the best defined mark; its height is 1580 feet. The shape is irregular quadrilateral; it extends through 12′ lat. and about the same in long.

The island is densely wooded all over except where the cliffs are too steep to allow anything to grow. From the northern side the ascent is gradual to the highest parts; but on the southern side, after rising gradually for half a mile from the sea-cliffs, a second wall of limestone cliffs is met, estimated at 200 to 300 feet high; and then slope goes on gently again to the top.

The shore cliffs are almost continuous, making the island inaccessible except at a few places. These cliffs are split by deep fissures, extending several feet below water; where these have become enlarged and the adjacent cliffs have fallen in, a small white beach of fragmentary rock is thrown up, and at such places on the lee side landing can be effected.

From the blown direction of the trees on the south side, and from the weather-worn aspect of rocks exposed to the southward, it is manifest that the south-eastern is by far the most prevailing wind.

The north side of the island forms a large bight in which the water is quite smooth, so that a boat can go close up to the cliffs, but on the southern and eastern sides a heavy sea dashes against the rocks.

The 'Flying-Fish' steamed close round the island looking for anchorage, but found none except in a small cove two miles to the westward of the north point of the island; this has been named 'Flying-Fish' cove; here she anchored in 22 fathoms, with her stern secured by hawser to the trees to prevent her slipping off the bank.

The hill rises nearly perpendicularly at the head of the cove in the form of a horseshoe, and slopes gradually down to the two arms forming the cove. The bare beach is not more than 20 yards wide, and from the look of the fragments that compose it must be thrown up in northerly gales; the upper part of the beach to the foot of the hill, a distance of some hundred yards, is of just the same material, viz. fragments of coral-rock and coral-limestone, but it has a covering of mould from fallen leaves, and is thickly wooded, many of the trees on it being forest trees of 12 feet girth and 300 feet high, apparently hundreds of years of age, showing that a very long time must have elapsed since that beach was raised from the water.

One very large tree had something like the letters WW cut inside a scroll, and nearly illegible from time; this was the only sign of the island having been visited before. One of our officers heard at Batavia that a Dutch vessel was wrecked on the south-east point of the island in a calm about fifteen years ago, and that the crew escaped and lived many months on the island before they were taken off, but I have no other details about the affair.

No running water was seen, but the droppings from the leaves during rain and dew must be great, as holes in the rocks and cup-shaped leaves were filled with water. As it was raining over some part of the island (generally the western) during a great part of the time the 'Flying-Fish' was in the neighbourhood, and clouds were continually being formed over the island from the moist air driven up the side by the south-east wind, a great deal of water must be deposited, and probably be absorbed by the soil. At the eastern end of the cove among the trees, where had seemed at first the most likely place for a water-course, a few volcanic stones were found; but everywhere else the only rock seen was coral-limestone, the cliffs above, from which detached pieces had fallen to the beach, were the same; the soil under the trees was a rich moist mould, apparently formed from decaying vegetation.

Landing was also effected at another small beach in the northern bight near the north-west point; the general features were the same, but there was no anchorage at half a cable from the shore. A few cocks and hens were landed here, but as the crabs immediately began to chase them, I doubt if they will survive and produce.

No large animals were seen nor marks of any. An iguana, said to be four feet in length, was seen in a tree high up, but was not captured. Rat-holes were numerous and one rat was secured, also a large bat; several insects—spiders, flies, beetles and butterflies—were collected; there were sand-flies but no mosquitos. Large crabs were very plentiful, and appeared equally at home running over the sea-cliffs and climbing up the trees; they were very ravenous, pouncing quickly on a dead gannet and devouring other injured crabs, and they must be terrible enemies to the birds generally.

Gannet and Frigate-birds frequent the island, and evidently breed there; but it was not the breeding-season, and very few eggs were found; the young birds were nearly grown. Besides the sea-birds, there was the large green Torres-Strait Pigeon; one was shot with three large red berries in its crop; these pigeons seemed to frequent the higher trees well up the hill; also a Ground-thrush of a sooty-brown colour, just the colour of the fallen leaves, among which it ran nimbly, apparently looking for insects; and a little Flycatcher of the same sombre colour. As evening advanced, a small Swift appeared, which flew about the jungle on the margin of the beach, fly-catching. None of these three last were secured [1]. No bones were found on the beach nor remnants of any animal, not even turtle-remains.

The flora appeared to be the same as that of the neighbouring islands, the Moluccas. As before stated, the island is densely wooded, and many of the trees attain great size. Chief amongst them I recognized two iron-wood trees, one with straight stem and round trunk, and the other with strong buttresses from the roots; both are natives of Celebes. Creepers were as thick as in the Moluccas and covered the top branches of the trees.

Two palms (one I take to be the sago-palm, growing to a great height) and the pandanus were abundant; cocoanut-trees were not seen, though husks were found on the beach apparently washed up from elsewhere. At a small beach on the eastern side there appeared to be banana-trees, but they looked withered and there were no signs of fruit.

No mangroves were seen. The flora of the coast was generally such as is found on all tropical islands.

I regret to say that nearly all the botanical specimens that were collected were destroyed by insufficient drying in the exceedingly damp weather we experienced. (Signed) J. P. MACLEAR,

Captain.

P.S.—Since writing the above I have learnt that Captain Grenfell, in the 'Amethyst,' in 1857 visited the island, and tried to cut a way to the summit.

[1] A specimen of the Thrush (see p. 515) was fortunately in the collection.—A. G.

I. MAMMALIA.

By Oldfield Thomas.

The Mammals collected at Christmas Island consist of four specimens, of which three belong to a species of Flying-Fox (*Pteropus*) and the fourth is a large Rat. Remarkable to say, both the species are new, but whether it will be found in the future that both are peculiar to the island it is at present impossible to say. On the whole the probability is that the *Pteropus* really is peculiar, since members of this genus are often extraordinarily confined in the extent of their range, while, on the other hand, it is by no means unlikely that the Rat will turn out to be also a native of Java.

As to the affinities of the Christmas-Island fauna to that of other places, no definite conclusions can be drawn from so small a collection; it must therefore suffice to remark that the closest ally of the *Pteropus* is a native of Lombock, while the Rat has its nearest relatives in the Philippine Islands and Celebes.

Pteropus natalis, sp. n. (Plate XLI.)

a, b, c. Two adult females and a new-born male.

Colour (♀) uniformly deep shining black all over, the only variation in tone being that while the head is absolutely black, there is a faint brownish tinge in the fur of the body. Fur thick, soft, and woolly, more so of course upon the head and neck than on the back, but nowhere really straight; on the fore limbs above it extends along the humerus, and thinly along the proximal half of the forearm; on the back its least breadth is about $2\frac{1}{2}$ inches; on the hind limbs it extends thinly to about halfway down the tibia. Below, the humerus, proximal half of forearms, hind limbs to just below the knee, and wing-membranes between the body and a line drawn from the centre of the forearm to the knee are all thinly clothed with scattered woolly black hairs. Muzzle broad and obtuse. Ears rather short, laid forward they barely reach to the posterior canthus of the eye; their anterior edges evenly but slightly convex, their tips pointed or narrowly rounded off, their outer margins straight or faintly concave for their upper half, markedly convex for their lower; their basal half thinly hairy internally; their distal half quite naked, black. Wings arising on the back about an inch apart. Interfemoral membrane narrow, quite hidden in the fur.

Teeth, especially the canines, small and short. Upper incisors forming an evenly curved series, touching one another, their total breadth 5 millim. Canines short, 5 millim. from cingulum to tip behind, thin, and acutely pointed; their postero-internal basal ledge proportionally rather broad. Anterior premolars minute or absent. Posterior premolars and first molar short, evenly oval in section; the surface of the molars and last premolar singularly smooth and rounded; the cusps but little developed, and merely consisting of low rounded ridges; last molar circular in section, rather larger than one of the outer incisors, about 1·5 millim. in diameter.

Lower incisors small, separated in the centre, the inner about half the size of the outer, the combined diameters of those of each side 2 millim. Canines proportionally still shorter than in the upper jaw, 3·5 millim. from cingulum to tip behind; their basal ledge broad. Anterior premolar very large, nearly filling up the space between the canine and second premolar, its size in cross section nearly equal to that of the canine. Molars smooth and rounded, as in the upper jaw. Last molar in section about one-third the size of the anterior premolar, and three quarters that of the last upper molar.

Dimensions of the type, specimen *a*, an adult female in spirit:—Head and body 210 millim.; head 61; muzzle 22; ear, above crown 26, from notch at base 28; forearm 127 (=5·0 in.); thumb, without claw, 43; index finger 90; tibia 62; calcaneum 21.

Skull:—Basal length 52; greatest breadth 30; supraorbital foramen to tip of nasals 24·5; interorbital breadth 6·5; intertemporal breadth 5·0; breadth from tip to tip of postorbital processes 19·1; palate, length 32, breadth outside first molar 16·0; length of first molar 5·0.

It is unfortunate that of this new species the only specimens of any use for description are females, since it might happen that, as is sometimes the case in *Pt. nicobaricus*, while the females are wholly black, the males have the usual yellow or orange tippet. It is therefore much to be hoped that male specimens will soon be obtained and the point settled. In any case, however, *Pt. natalis* is a very well-marked species. From *Pt. nicobaricus* it may be distinguished by its much smaller size and smaller shorter molars, and especially by its much shorter and feebler canines—the latter character, in fact, distinguishing it from all the other allied species except *Pt. lombocensis*. *Pt. pselaphon*, another wholly black species of about the same size, a native of Bonin, may be separated at once by its hairy legs, the hind limbs being closely haired right down to the feet. *Pt. gouldi*, also generally black, has a forearm 165 millim. long, and has also large teeth and long canines bearing no resemblance to those of the present species.

On the whole *Pt. natalis* seems to be most nearly allied to *Pt. lombocensis*, Dobs.[1], as yet only known from Lombock, which also has similarly short canines and is of about the same size. That animal, however, is of a dull light brown colour, with the neck pale yellow. Its teeth, especially the anterior molar, are narrower and lighter than those of *Pt. melas*; the first lower premolar and the last molars both above and below are much smaller, and the basal ledges to the canines are decidedly narrower than in *Pt. natalis*. In the skull, again, *Pt. lombocensis* has a shorter broader muzzle, greater spread of zygomata, broader interorbital space, and larger postorbital processes than the present species. Of course in comparing the colours of these two species the question of sex again arises, as the only known specimens of *Pt. lombocensis* are both males; but considering not only the differences in the skull and teeth, but also the fact that even if the male of *Pt. natalis* have a yellow tippet, it would in all probability have at least its head and body jet-black like

[1] Cat. Chir. B. M. p. 34 (1878).

the female, I should certainly not be justified in assigning the Christmas-Island specimens to *Pt. lombocensis.* It should also be noticed that the little hair that has appeared on the crown and between the shoulders of specimen *c*, a new-born male, is wholly black; its neck is unfortunately still entirely naked.

MUS MACLEARI, sp. n. (Plate XLII.)

a. Adult female.

Fur very long, thick, and coarse, but not or very slightly spinous, thickly intermixed on the back with enormously long piles from 2 to $2\frac{1}{2}$ inches in length. General colour grizzled rufous-brown, belly but little lighter pale rufous. Shorter hairs everywhere pale slaty grey at base, shining red at tip; longer piles uniformly black; the general tint of the dorsal surface not unlike that of *Arvicola amphibius*, except that the median line is a good deal darker owing to the great number of the longer black piles there present. Whiskers very long, many of them more than 3 inches in length, mostly black. Ears naked, black, broad, short and rounded, their breadth about equal to their length; laid forward they fall short of the eye by about a quarter of an inch. Limbs coloured externally like back, internally dull grey; upperside of hands and feet uniform dark brown; sole-pads six, very broad, flat and rounded, evidently adapted for climbing; pad at the base of the fifth toe with a secondary pad at its postero external angle. Claws, both anterior and posterior, short, stout, curved, and sharply pointed, brown horn-colour, that of the hallux markedly shorter than the rest; pollex with a broad nail as usual; fifth hind toe without claw reaching just to the end of the first phalanx of the fourth.

Tail very long, its posterior half black all round, its distal half white or yellow, thinly and finely haired with short grey hairs, not hiding the scales; the scales large, the rings averaging just 10 to the centimetre.

Palate-ridges 3–5. Mammæ 4, one axillary and one inguinal pair.

Skull large and strong. Nasals extending to about a millimetre past the level of the anterior edge of the orbit. Supraorbital edges beaded, but the beading not continued so far forward as in *M. everetti.* Interparietal large. Front edge of the anterior zygoma-root very prominent, projecting forwards. Palatal foramina very long, their posterior end about one millimetre in front of the level of m^1. Bullæ small and flattened.

Incisors thick and strong, much bevelled externally, their faces dull orange-yellow above and yellow below, but apparently the colour has been more or less affected by spirit. Molars of medium size.

Measurements of the type, an adult female in spirit:—Head and body 222 millim.; tail 248; hind foot 48·5; ear 13; head 64; forearm and hand 66; last hind foot-pad 10·5; heel to front of last foot-pad 26.

Skull:—Basal length 47·5; greatest breadth 26·2; nasals, length

19·5, greatest breadth 5·7; interorbital constriction, least breadth 7·0; interparietal, length 6·6, breadth 11·5; length of base of anterior zygoma-root 6·0; palate, length 30·0, breadth outside m^1 10·3, inside 4·4; palatal foramina, length 10·1; back of incisors to m^1 (alveoli) 15·7; upper molar series 9·0.

This fine new Rat belongs to a small group of species inhabiting the East-Indian Archipelago, all of which agree with *Mus macleari* in being of large size, with very long tails tipped with yellow, and with small rounded ears. Their differential characters as compared to *M. macleari* are best put in tabular form:—

M. macleari. Mammæ 1—1=4. Dorsal piles present. Front edge of anterior zygoma-root projecting, very convex. Palatal foramina long. Bullæ very small.
Christmas Island.

M. celebensis, Gray[1]. Mammæ 1—2=6. No dorsal piles. Front edge of anterior zygoma-root not projecting. Palatal foramina short.
Celebes.

M. xanthurus, Gray[2]. Mammæ 1—2=6. Long dorsal piles present. Front of zygoma-root but little projecting. Palatal foramina long.
Celebes.

M. everetti, Günth.[3] Fur long, but the piles not enormously lengthened. Front of zygoma-root convex. Palatal foramina long. Bullæ very large.
Philippines.

M. meyeri, Jent.[4] Fur without lengthened piles. Supraorbital edges much developed. Front of zygoma-root slightly convex. Palatal foramina short. Teeth very large.
Celebes.

M. muelleri, Jent.[5] Mammæ 2—2=8. No dorsal piles. Tail unicolor. Front edge of zygoma convex. Palatal foramina short. Teeth rather small. Bullæ medium.
Sumatra and Borneo.

This last does not properly belong to the present group of species, but is only introduced to complete the list of those of which it is necessary to mention the distinguishing characters when describing *M. macleari* as new. All these species also differ from *M. macleari* in having the general colour grey or yellow instead of rufous. No other described species could possibly be confounded with the present most interesting new form, with which I have much pleasure in connecting the name of Capt. Maclear, of H.M.S. 'Flying-Fish,' to whom the Museum is indebted for the Christmas-Island specimens.

[1] P. Z. S. 1867, p. 598.
[2] *Loc. cit.*
[3] P. Z. S. 1879, p. 75.
[4] Notes Leyd. Mus. i. p. 12 (1878).
[5] *Op. cit.* ii. p. 16 (1879).

II. BIRDS.

By R. Bowdler Sharpe.

The relations of the Avifauna of Christmas Island can hardly be judged by the few specimens in the collection, as there are doubtless some other indigenous species to be found in the island; but the discovery of an isolated species of *Carpophaga*, and of a Thrush whose nearest ally is a West-African species, is of great interest.

1. Turdus erythropleurus, sp. n.

T. *similis* T. pelio, *sed corporis lateribus cervinis et subalaribus cinerascenti-albis nec aurantiaco-fulvis distinguendus.*

Adult female (type of species). General colour above ashy olive-brown, a little clearer brown on the lower back, rump, and upper tail-coverts; wing-coverts like the back, the greater series somewhat fulvous-brown externally, with a yellowish-buff spot at the ends (doubtless the remains of young plumage); bastard-wing, primary-coverts, and quills dusky brown, externally ashy on the primaries, the others externally like the back; tail-feathers dusky brown, washed with olive-brown on both webs; crown of head ashy brown, the feathers at the base of the forehead and above the eye whitish; lores dull ashy; sides of face, ear-coverts, and cheeks light ashy brown; throat white, streaked with brown along the sides of the throat; fore neck, breast, and sides of body light tawny, deeper on the latter, with a shade of ashy on the fore neck and chest, the feathers on the flanks edged with ashy whitish; centre of lower breast, abdomen, and under tail-coverts white, the latter edged with pale tawny; axillaries and under wing-coverts ashy whitish, with a slight tinge of tawny; quills dusky below, ashy along the inner web. Total length 7·8 inches, culmen 0·9, wing 4, tail 3, tarsus 1·2.

Carpophaga whartoni, sp. n. (Plate XLIII.)

This is apparently quite a new species of Fruit-Pigeon. It has uniform chestnut-brown under tail-coverts like *C. ænea*, to which section it belongs; but here resemblance ends, for in its uniform dusky coloration it is difficult to find an immediate ally unless it be *C. ianthina* of Japan. The latter is an equally dark-coloured bird, but the beautiful purple and green lustre on the upper parts of the Japanese species is quite different from the dull-coloured plumage of *C. whartoni*.

I add a detailed description of the type of the latter species:—

Adult male. General colour above dull green, with a very slight gloss of bronze, the latter shade being more evident on the wing-coverts and scapulars; wing-coverts like the back, the greater coverts externally glossy green with a bronzy tinge; bastard-wing, primary-coverts, and quills blackish, externally glossy green with more or less of a bronzy gloss, especially on the inner secondaries; lower back, rump, and upper tail-coverts like the back, the latter rather more green; tail-feathers dark bluish green, glossy bronzy green on the outer aspect; crown of head dingy brown with a very slight bronzy gloss, the forehead, lores, and base of cheeks ashy grey; the ear-coverts, remainder of cheeks, throat, and fore neck dusky ashy, with a slight vinaceous tinge which is a little more pronounced on the breast and abdomen; the sides of the body, flanks, and thighs dark slaty grey with a greenish gloss; under tail-coverts chestnut-brown; under wing-coverts and axillaries dark slaty grey; quills light ashy underneath. Total length 16·5 inches, culmen from frontal plumes 0·85, wing 10·3, tail 6·8, tarsus 1·25.

ARDEA JUGULARIS, Forster; Schlegel, Mus. Pays-Bas, Ardeæ, p. 25.

A female in entirely white plumage. The legs are yellow, more dusky on the tarsus, which has a good deal of black.

SULA PISCATRIX (L.); Schlegel, Mus. Pays-Bas, Pelecani, p. 40.

An adult female in full plumage.

FREGATA AQUILA (L.); Schlegel, *t. c.* p. 2.

An adult bird. An interesting note on the habits of the bird in the neighbourhood of Java is given, from the notes of the Vicomte de Bocarmé, in Schlegel's 'Catalogue' (*l. c.*).

III. REPTILES.

By G. A. BOULENGER.

1. GYMNODACTYLUS MARMORATUS, Kuhl.

2. LYGOSOMA NATIVITATIS, sp. n.

Section *Emoa*. Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and a half in the distance between axilla and groin. Snout long, obtuse. Lower eyelid with an undivided transparent disk. Nostril pierced between a nasal, a postnasal, and a supranasal; frontonasal broader than long, forming a suture with the rostral and with the frontal; latter shield nearly as long as the frontoparietal, in contact with the first and second supraoculars; four supraoculars; eight supraciliaries; frontoparietals united into a single large shield; a small interparietal, behind which the parietals form a suture; a pair of nuchals and a pair of temporals border the parietals; five labials anterior to the large subocular. Ear-opening oval, a little larger than the transparent palpebral disk, with three or four very small lobules on its anterior border. Thirty-four scales round the middle of the body, all smooth, lateral a little smaller than dorsal and ventral. No enlarged præanals. The hind limb reaches the elbow. Digits moderately elongate, a little flattened at the base, compressed at the end; subdigital lamellæ smooth, thirty-two under the fourth toe. Brown above, strongly iridescent, with small golden and blackish spots, most numerous on the sides and limbs; lower surfaces white.

	millim.
Head	15
Width of head	9·5
Body	56
Fore limb	22
Hind limb	31

A single female specimen, without tail.

3. Typhlops exocœti, sp. n.

Body much elongate, of subequal diameter throughout. Snout depressed, rounded. Nasal semidivided, the suture in contact with the second labial; a præocular, of about the same size as the ocular, which rests on the third and fourth labials; eye very distinct, under the ocular; the so-called rostral rounded and narrowing posteriorly, the length of its upper part about equal to its width. Twenty scales round the middle of the body. Tail twice as long as broad at the base, ending in a spine. Pale brownish, each scale with a brown spot; these spots largest and darkest on the dorsal surface, where they form longitudinal lines.

Two specimens, of which the dimensions are as follows:—

a. Total length 350 millim., diameter of body 6, length of tail 8.

b. Total length 230 millim., diameter of body 3·5, length of tail 6.

IV. MOLLUSCA.

By E. A. Smith.

Of the sixteen species of shells obtained at Christmas Island, fourteen belong to well-known forms, but two, a *Succinea* and a *Littorina*, appear to be new. No locality has been previously assigned to *Nerita maxima*, and *Littorina picta* has hitherto been known from the Sandwich Islands only. All or most of the marine forms occur both in the Malay Archipelago and Polynesia. The *Melampi* have an equally wide distribution; and the species of *Succinea*, although considered distinct, like most others of the genus, bears a great resemblance to those from other parts of the world.

The following is a list of the species:—

*1. *Terebra crenulata*, Linn.
2. *Columbella* (*Pusiostoma*) *mendicaria*, Lamarck.
3. *Sistrum ricinus*, Linn. (var. *albolabris*).
4. *Mitra virgata*, Reeve.
5. *Ranella cruentata*, Sowerby.
*6. *Triton chlorostoma*, Lamarck.

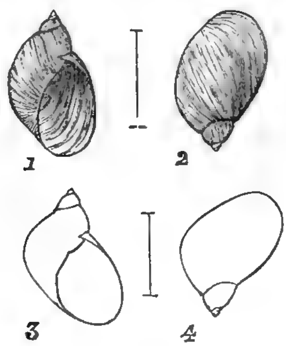
* These species are all inhabited by *Paguri*.

7. *Littorina moluccana*, Philippi.
8. *Littorina picta*, Philippi.
9. *Littorina granicostata*, sp. n.
*10. *Nerita plicata*, Linn.
*11. *Nerita maxima*, Chemnitz.
*12. *Turbo lajonkairei*, Deshayes.
13. *Succinea solidula*, Pfeiffer.
14. *Succinea solitaria*, sp. n.
15. *Melampus luteus*, Quoy and Gaimard.
16. *Melampus fasciatus*, Deshayes.

SUCCINEA SOLIDULA, Pfeiffer[1].

This species has never been figured nor has a locality been previously assigned to it. The two specimens from Christmas Island agree in every respect with the types described by Pfeiffer in Mr. Cuming's collection. There are two principal features which distinguish this form, namely, the thickened peristome and the peculiar sculpture. The latter has the appearance (under a lens) of the texture

Fig. 1.



1, 2. *Succinea solidula.*
3, 4. *Succinea solitaria.*

of very fine linen, or minute crisscross lines, rather than of minute granulations as described by Pfeiffer. Besides this excessively fine ornamentation the surface exhibits rather strong lines of growth or subplications. The thickening of the peristome is slight but evident, and *internal*, hence Pfeiffer's expression "perist. submarginatum."

SUCCINEA SOLITARIA, sp. n.

Shell rather *obliquely* ovate, acuminate above, rather solid, reddish at the apex, paler on the second whorl and wax-white on the last; sculptured with very strong ridges of growth and coarse spiral striæ; volutions 3, very rapidly enlarging, two first very convex, the last sloping above and less rounded, oblique; aperture roundly

[1] Proc. Zool. Soc. 1849, p. 134; Monogr. Hel. vol. iii. p. 22.

ovate and oblique; outer lip the least thickened within; columellar margin arcuate, slightly incrassated.

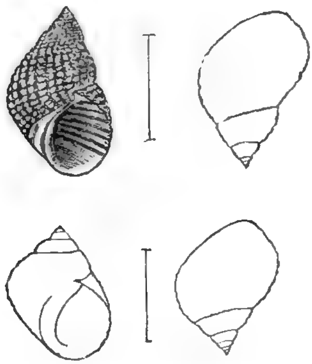
Length $9\frac{1}{2}$ millim., width $5\frac{1}{2}$; aperture 5 long, $4\frac{1}{2}$ broad.

The oblique form, the ridge-like lines of growth, and the coarse spiral striation are the distinguishing features of this shell.

LITTORINA GRANICOSTATA, sp. n.

Shell ovate, acuminate above, white with a minute blackish apex, longitudinally granosely plicate and spirally ridged and sulcated; whorls about 7, moderately convex, penultimate with about five spiral ridges ornamented with small tubercles which fall one under the other, producing longitudinal series and giving the shell a plicate appearance; last whorl with about thirteen ridges alternating with very fine thread-like striæ, and a large broad smooth thickening around the base. Aperture roundish, brown within and

Fig. 2.



Littorina granicostata.

finely lineated with a darker colour, with the usual basal whitish zone; outer lip crenulated at the edge, pale and ornamented with the terminations of the internal brown lineations. Columella more or less arcuate, of a dark brown colour.

Length $11\frac{1}{2}$ millim., diam. 7; aperture 6 long, $3\frac{2}{3}$ broad. A shorter specimen is 10 in length, $6\frac{2}{3}$ in width.

This pretty species is peculiar on account of the nodules on the spiral ridges falling one under the other, thus producing longitudinal series. The single shell from Christmas Island is rather young, but it agrees in every particular with three adult specimens without locality in Cuming's collection, from which the above description is taken.

V. CRUSTACEA.

By R. Innes Pocock.

All the species are Indo-Pacific forms.

Fam. Cancridæ.

Actæa nodulosa (White). A single male specimen.

Eriphia lævimanus (Latr.). A single female specimen.

Fam. Gecarcinidæ.

Gecarcinus, sp.? A single young imperfect male specimen.

Fam. Paguridæ.

Birgus latro (Linn.). Two specimens.

Calcinus tibicen (Herbst). Four specimens.

Cœnobita rugosa (M.-Edwards). Four specimens.

Cœnobita rugosa (M.-Edwards), var. Four specimens.

Cœnobita perlata (M.-Edwards). One specimen.

A single specimen of a Scorpion, *Hormurus australasiæ* (Fabr.), was also in the collection.

VI. COLEOPTERA.

By C. O. Waterhouse.

Several specimens of Coleoptera were collected; but as the majority belong to widely spread genera the species of which are most difficult of discrimination, I must limit myself to the description of the two following new species.

Chrysodema simplex, sp. n.

Viridi-aurata; thorace cyaneo-viridi, linea mediana lævi, fossa laterali rotundata cuprea confertim rugulosa; elytris costatis, costa marginali viridi; femoribus tibiisque cupreis.

Long. $12\frac{1}{2}$ lin.

Resembles *C. auroplagiata*, Deyr. (having the thoracic impressions nearly round and very sharply defined), but at once distinguished by the elytra having no lateral impression. The thorax is of a dark blue-green, with golden-green punctures, and a line of green on each side of the smooth median line. The punctures on the disk are not so numerous as in *C. auroplagiata.* The lateral rugose coppery impressions are round, relatively rather smaller than in *C. auroplagiata*, with the lateral margin distinctly elevated. The elytra appear golden green or slightly coppery according to the position of the light; there is a distinct green tint below the scutellum. The costæ are very slightly raised, the 2nd, 4th, and 6th more distinct posteriorly; the sublateral costa is smooth and bright green, the margin of the elytra (beyond the costa) golden. Prothoracic episterna somewhat golden, tinted with coppery and green in parts; the surface uneven, but not concave as in *C. auroplagiata*; the punctures rather large, but fine near the coxæ. The smooth lateral carina (extending from the posterior angle to near the front angle) straighter than in most of the allied species. Prosternal process chanelled and coarsely punctured. Abdomen densely and finely punctured, except at the posterior margins of the segments. The last segment with a narrow, elongate, triangular notch at the apex. The upper and apical parts of the femora, the posterior edge of the tibiæ, and the tarsi coppery.

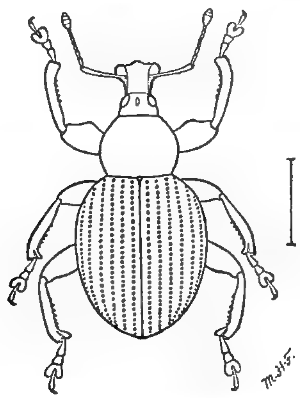
PIEZONOTUS DISCOIDALIS, sp. n.

Niger, depressus, viridi-squamosus; thoracis disco elytrorumque sutura calvis.

Long. 11, lat. 6 millim.

Apex of the rostrum about one quarter broader than the length of the rostrum itself, narrowed at the base, flat above, with a trace of a short ridge in the middle at the apex; forehead with an impressed line between the eyes. Thorax as long as broad, gently convex, a little more narrowed in front than at the base, moderately rounded at the sides. The disk with closely placed, round, shining granules, each granule marked with a puncture. The sides clothed with light green scales. Elytra one-fifth longer than broad, rather flat, gradually declivous at the apex; at the base not broader than the base of the thorax; evenly rounded at the sides, with no distinct

Fig. 3.



Piezonotus discoidalis.

shoulders; punctate-striate; the interstices with numerous (but not very closely placed) round shining granules; all the interspaces (except on the smooth suture) clothed with light green scales, with a few coppery scales interspersed. Underside (except the apex of the abdomen) and the legs clothed with pale green scales, intermixed with pale pubescence, which on the legs is rather long.

The discovery of a fourth species of this genus of *Curculionidæ* is of some interest, the three species previously known having been described from Java, Amboyna, and Punipet.

VII. LEPIDOPTERA.

By A. G. Butler.

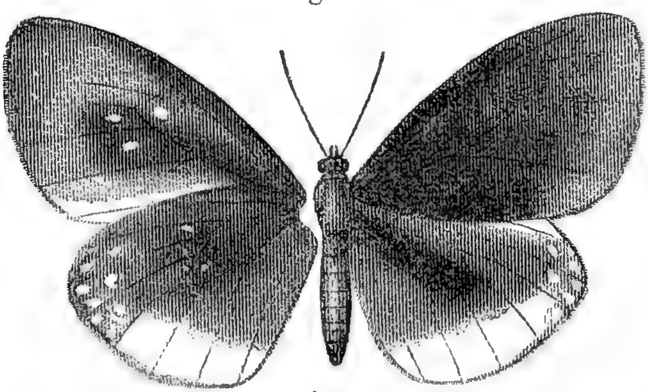
The Lepidoptera obtained in Christmas Island were unfortunately placed in a store-box with a large piece of camphor, which got loose during the transmission of the collection to England, and utterly destroyed all the specimens with the exception of three; the latter are a good deal injured, but two of them are in sufficiently good condition for determination.

Among the fragments of wings I am also able to recognize what was doubtless a female *Hypolimnas*, apparently *H. proserpina*, Cram., a species occurring in Java. The two Butterflies which escaped destruction are well-marked new species.

Vadebra macleari, sp. n.

Allied to *V. sepulchralis* of Java, but of a deep pitchy-brown colour, the wings almost black in the centre; the secondaries with a broad snow-white external band from anal angle to radial vein, whence it becomes suffused with greyish brown to apex; indications

Fig. 4.



Vadebra macleari.

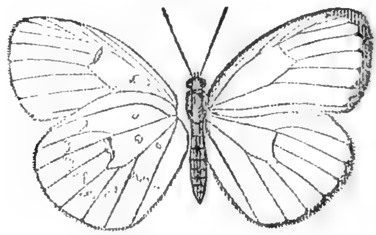
of three white spots in the form of a triangle on the radial and subcostal interspaces towards outer margin; a narrow brown border with black fringe tapering from apex to second median branch, remainder of fringe blackish; costal area greyish white; body quite normal, excepting that the white spots on the thorax are very small. Wings below chocolate-brown, the primaries with the central area blackish and the internal area whitish; a bluish-white spot in the cell and two on the basal half of the median interspaces as in *V. sepulchralis*; secondaries with a small spot in the cell and an angular series of five or six beyond the cell; white external area as above, with three subapical and seven submarginal brown-edged pearly white spots. Expanse of wings 79 millim.

There were originally five specimens of this fine species, but of four of them only fragments of the wings remain.

TERIAS AMPLEXA, sp. n.

Perhaps nearest to *T. desjardinsi* of Madagascar, but very distinct from all described species; wings above bright gamboge or lemon-yellow; primaries with black costal margin and a perfectly regular, rather narrow, external border of almost equal width throughout and regularly sinuated between each pair of nervures; secondaries with a narrower border formed by the union of a series

Fig. 5.



Terias amplexa.

of marginal spots, the inner edges of which are bracket-shaped, ⏜. Body quite normal; under surface bright sulphur-yellow, with marginal black dots and indistinct brown markings, as in *T. hecabeoides*; no subapical brown patch on the primaries as in *T. desjardinsi.* Expanse of wings 42 millim.

One male example.

In colouring this species corresponds better with *T. moorei* from Camorta than with *T. desjardinsi*; but the regularity of the border to the primaries separates it at a glance from all the described forms of this group.

The Moth is much injured; it is a small insect approaching *Pyralis miseralis,* Walk., but is too much broken and rubbed to enable one to say whether or not it is an undescribed species.

VIII. ECHINODERMATA.

By F. J. BELL.

The Echinoderms are common Indo-Pacific species: viz. *Linckia diplax* (M. Tr.), *Ophiocoma æthiops* (Ltk.), *Ophiocoma scolopendrina* (Ag.), *Actinopyga miliaris.* A specimen of *Actinometra* is unfortunately too much injured to allow of description, but undoubtedly belongs to an undescribed species, distinguished by the large number of cirri; cirri, as a rule, being numerous in *Antedon* and scanty in *Actinometra.*

IX. PORIFERA.

By Arthur Dendy.

Only a single Sponge was brought home by H.M.S. 'Flying-Fish,' but this specimen is one of considerable interest. It belongs to a new species of Schmidt's genus *Pachychalina*[1]. It is only very rarely that specimens of Chalinine Sponges come to hand in a sufficiently well-preserved condition to allow of an investigation into the structure of the soft tissues. Such investigation is likely to prove of much importance in determining the true relations of this large and difficult group of Sponges. Hence, as no account has ever yet been given of the minute anatomy of any species of *Pachychalina*, and, as indeed, only one or two Chalinine Sponges have been anatomically described at all, I have thought it desirable to give some description of the minute anatomy of the present species—a proceeding rendered practicable by the excellent state of preservation of the specimen.

Pachychalina spinosissima, n. sp. (Plate XLIV.)

The single specimen in the Collection (Plate XLIV. fig. 1) consists of a long, unbranched, irregularly cylindrical, repent stem, naturally terminating at each end. The specimen has evidently been attached by various parts of the lower surface to the sea-bottom. It is covered all over with very large, stout, sharp-pointed, and often branching spines (whence the specific name), and bears along the upper surface a row of large oscula. Total length of specimen about 350 millim. (=14 inches); average diameter, exclusive of spines, 12 millim.; average length of spines, 10 millim. *Colour* in spirit brownish yellow. *Texture* compressible, elastic, tough, internally cavernous. *Surface* subglabrous over and between the spines. *Dermal membrane* (ectosome) very thin, delicate, and transparent, reduced to a mere network by the very numerous pores (Plate XLIV. fig. 2). *Pores* very numerous rounded openings, thickly scattered through the dermal membrane, averaging about 0·05 millim. in diameter (Plate XLIV. fig. 2). *Oscula* circular, pit-like openings, having their margins flush with the general surface; averaging in diameter about 3 millim.; arranged in a single series along the upper surface of the sponge (Plate XLIV. fig. 1).

Skeleton.—(*a*) Main: a coarse, irregular, wide-meshed reticulation of stout spiculo-fibre, in which there is a strongly developed but rather irregular system of fibres running more or less longitudinally in the direction of the long axis of the sponge. The fibres themselves are, as in other species of the genus, stout and polyspiculous; each consists of a stout spicular axis, composed of very numerous, closely packed spicules lying side by side parallel with one another, and a large proportion of spongin, which unites the spicules together, and, generally at any rate, also forms a distinct sheath around the

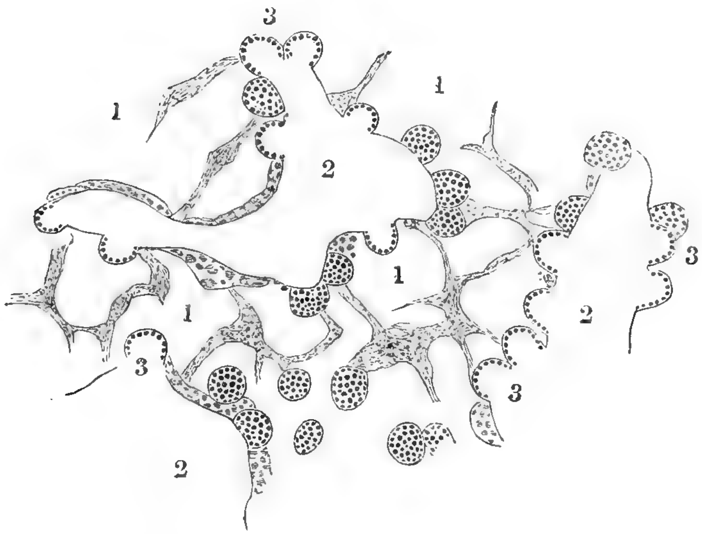
[1] *Vide* Ridley and Dendy, Report on the Monaxonida dredged by H.M.S. 'Challenger,' p. 19, for diagnosis and discussion of the genus.

spicular axis. The diameter of the fibres varies much, averaging, say, about 0·12 millim. There are also numerous spicules outside the fibres, scattered loosely and irregularly through the choanosome. (*b*) Dermal: a very well-developed reticulation of stout spiculo-fibre, branching and anastomosing in such a manner as to give rise to a number of irregularly polygonal meshes. These coarser meshes are further subdivided by a much finer, unispicular, or sub-unispicular reticulation (Plate XLIV. fig. 2), lying at a slightly higher level.

Spicules.—Slightly curved oxea (Plate XLIV. fig. 3), sharply and fairly gradually pointed at each end; size of full-grown spicules about 0·16 by 0·009 millim.

Canal-System.—The canal-system is lacunar, and referable to Dr. Vosmaer's third type[1]. The pores (*vide suprà*) lead into

Fig. 6.



Pachychalina spinosissima; portion of a vertical longitudinal section, showing (1) the inhalant lacunæ incompletely subdivided by strands of mesodermal tissue, (2) the exhalant lacunæ, and (3) the subspherical flagellated chambers opening into the exhalant lacunæ by means of wide mouths.

irregularly shaped subdermal cavities, lying immediately beneath the dermal membrane. Many pores lead into each of the subdermal cavities, which are merely the proximal extremities of a system of ramifying inhalant lacunæ, leading to the flagellated chambers.

The ultimate ramifications of the inhalant lacunæ are very peculiar, consisting of a system of spaces lying amongst and around the exhalant lacunæ, and themselves incompletely subdivided by numerous delicate strands of mesodermal tissue, which, branching and anastomosing, run across and across, from wall to wall (*vide* woodcut, fig. 6).

[1] Bronn's Klass. u. Ordn. d. Thierreichs, Porifera, p. 130.

The exhalant canal-system also consists of a series of more or less lacunar spaces, opening into one another, and finally discharging on to the surface through the oscula; their ultimate ramifications are of comparatively large size, and are readily distinguished from the ultimate inhalant lacunæ by two important characters: (i.) they are not subdivided by strands of mesodermal tissue; (ii.) they are very definitely bounded, and are surrounded by the flagellated chambers.

The flagellated chambers, clustered around the exhalant lacunæ, open directly into the latter by means of wide mouths, as shown in the accompanying woodcut. There are no cameral canaliculi. The proximal portion of each flagellated chamber appears, in the present condition of the sponge, to project freely into the lumen of the inhalant lacuna, in such a manner that it would be completely immersed in the incurrent stream of water; this appearance, however, is probably in part due to the shrinking away of the surrounding tissues owing to the action of the spirit in which the specimen was preserved. In form the chambers are subspherical, and they are very small, measuring only about 0·02 millim. in diameter.

It is important to notice that the canal-system thus described agrees essentially with that of the few other genera of Halichondrina whose canal-system is as yet known to us. Minor differences, which are likely to be of considerable importance for systematic purposes, certainly exist in the arrangement of the canal-systems of these different genera; thus in the species under consideration the structure and arrangement of the ultimate inhalant lacunæ would appear to be decidedly characteristic, possibly even affording a character of generic importance, and that in a genus where such characters are greatly needed; but in all the Halichondrina the *fundamental* type of canal-system appears to be the same—*i. e.*, according to Vosmaer's third type [1].

The fundamental agreement of the canal-system of *Pachychalina spinosissima* with that of *Halichondria panicea*, a species which I have also had the opportunity of studying carefully with well-preserved material, and its close resemblance even in certain minor details, may perhaps be regarded as an argument (though only of a very general character) in favour of the view that the *Chalininæ* are very intimately related to the *Renierinæ*, and of uniting these two groups as two subfamilies of the same family (*Homorrhaphidæ*, Ridley and Dendy [2]).

EXPLANATION OF PLATE XLIV.

Fig. 1. *Pachychalina spinosissima*, seen from the upper surface; natural size.
2. Portion of a surface-section, showing the arrangement of the pores and the dermal skeleton.
3. Oxea.

---

[1] Further details concerning the arrangement of the canal-system in the Halichondrina are given by Mr. Ridley and myself in our Report on the Monaxonida dredged by H.M.S. 'Challenger.'

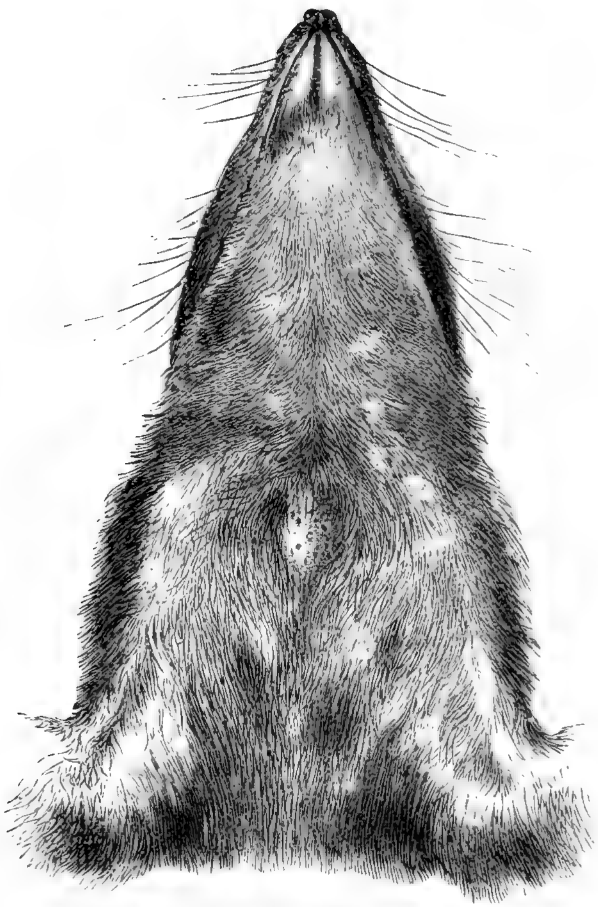
[2] Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. p. 326; and Report on the Monaxonida dredged by H.M.S. 'Challenger,' p. 1, &c.

2. Note on a Point in the Structure of *Myrmecobius*. By Frank E. Beddard, M.A., F.Z.S., Prosector to the Society.

[Received June 23, 1887.]

The accompanying drawing (fig. 1) represents the under surface of the head and anterior region of the thorax of *Myrmecobius fasciatus*. The specimen from which the drawing was made is preserved in spirit in the Natural History Museum, and is an adult female; the drawing is intended to illustrate a remarkable glandular

Fig. 1.



Under surface of head of *Myrmecobius fasciatus*.

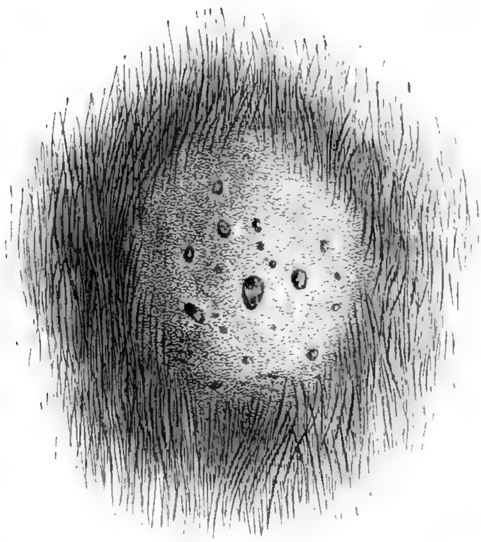
structure situated just anterior to the sternum. Mr. Thomas directed my attention to this modified region of the integument, and asked me to investigate its minute structure.

The drawing referred to is of the natural size, and shows some of the peculiar features of the glandular patch; these are better shown in another drawing (fig. 2), which represents only the glandular patch, magnified about 5 diameters.

It will be seen that in this region the integument is naked or nearly so, and its surface is studded with numerous apertures of various sizes, some being very much larger than others.

An incision through the middle line of the gland shows that the integument is considerably thickened in this region, forming a lens-shaped mass. Large glandular cavities are seen on a naked-eye inspection to be continuous with the external orifices, and to extend as far as the lower surface of the dermis. The material was not in a thoroughly good condition for microscopical research; but I have

Fig. 2.



Glandular patch of *Myrmecobius fasciatus*, more highly magnified than in Fig. 1.

been able to make out some of the principal facts in the structure of the integument.

The glandular apparatus consists of four distinct series of glandular structures.

(1) *Sweat-glands*, which present the ordinary characters of these glands, being contorted tubules, with a lining of cubical epithelium; as a rule three tubules unite to form a single duct, which traverses the dermis and epidermis, and opens very often in the neighbourhood of a hair-follicle. These sweat-glands are isolated, usually in groups of three, and form a compact oval body imbedded in the muscular tissue of the dermis. Very often the duct of these glands opened, as already stated, directly upon the outer surface of the body; and in these cases the duct generally appeared to me to be straight, or at least approximately so; I never detected the corkscrew-like outline

of the excretory duct, which is so generally met with in sweat-glands. The lumen of the duct is extremely fine.

In many cases the duct, formed by the coalescence of the ductules of the several tubules, instead of passing directly on to the exterior of the body, was seen to open at the base of a sudoriparous follicle; in this case the duct appeared to maintain its independence, and to pass through the follicle on to the exterior, not to become continuous with one or more of the glandules in the follicles.

(2) *Sebaceous glands.* In the description of the naked-eye characters of the glandular patch, it has been stated that it is bare without any hairs; a microscopical study shows, however, that there are a few hairs situated chiefly at the periphery; these are generally furnished with a pair of sebaceous glands presenting the ordinary characters.

(3) *Sudoriparous follicles.* The glandular follicles opening on to the exterior by the conspicuous orifices with which the patch is covered appear to be of the nature of sweat-glands; these follicles are filled with a mass of tubules which pass straight from their point of attachment to the external aperture of the follicle; these tubules are club-shaped, the lower extremity being somewhat swollen. This part of the gland is composed of cells which agree exactly in their characters with the cells of sebaceous glands, and, like them, are hardly affected by borax carmine; very frequently the lower extremity of the gland appeared to be bifid. The individual glands are separated from each other by cells which stain deeply with borax carmine, and are in every way similar to the cells of the epidermis; there is a complete layer of these cells lining the follicle, and the extremities of the glands have the appearance of being imbedded in them. The proximal part of each gland consists of a long straight tube surrounded by layers of unstriped muscular fibres and lined with epithelium.

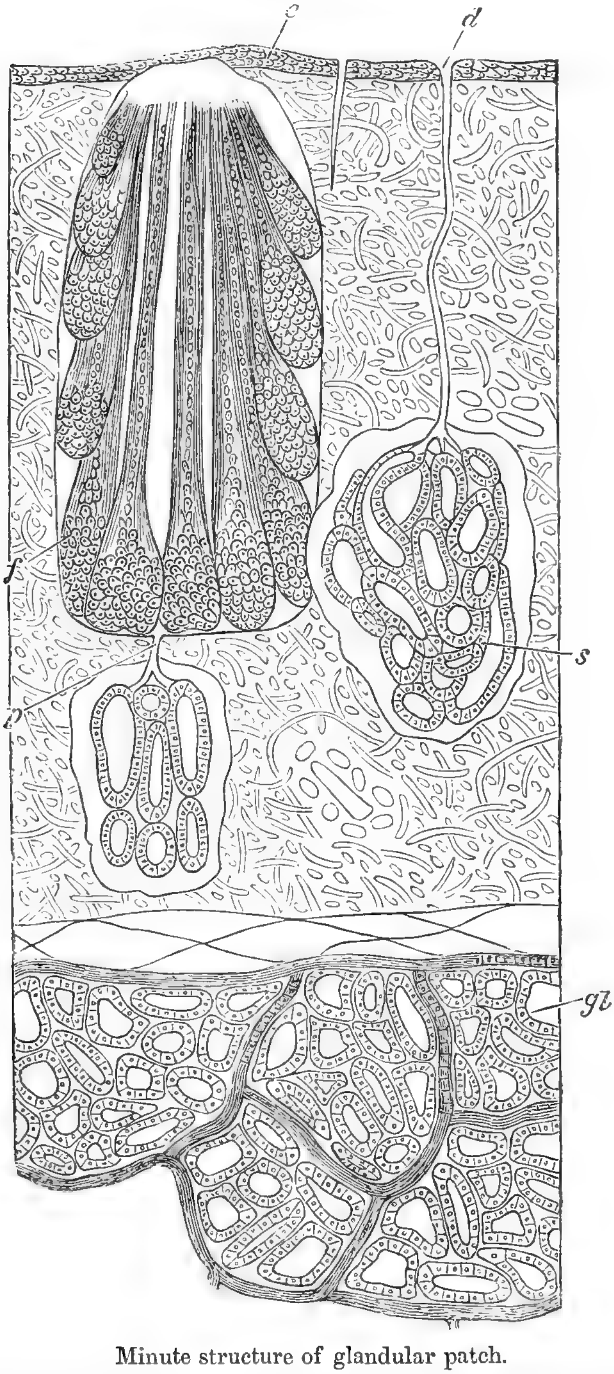
Although in many particulars these glands resemble sebaceous glands, the presence of muscular fibres is, in the present state of our knowledge, decisive in favour of referring them to the sudoriparous series. It is clear, however, from the above description and figures that these glands differ in many points from the typical sweat-glands.

So far the glandular structures are confined to the integument; beneath the layer of loose connective tissue which underlies the dermis is

(4) *A large compound tubular gland*, quite half an inch in diameter; this gland recalls in its general aspect the arm-gland of *Hapalemur*; its structure is like that of the sweat-glands, and it is divided into unequally-sized lobules by partitions of connective tissue. I have been quite unable, however, up to the present to detect the external orifice or orifices of this gland.

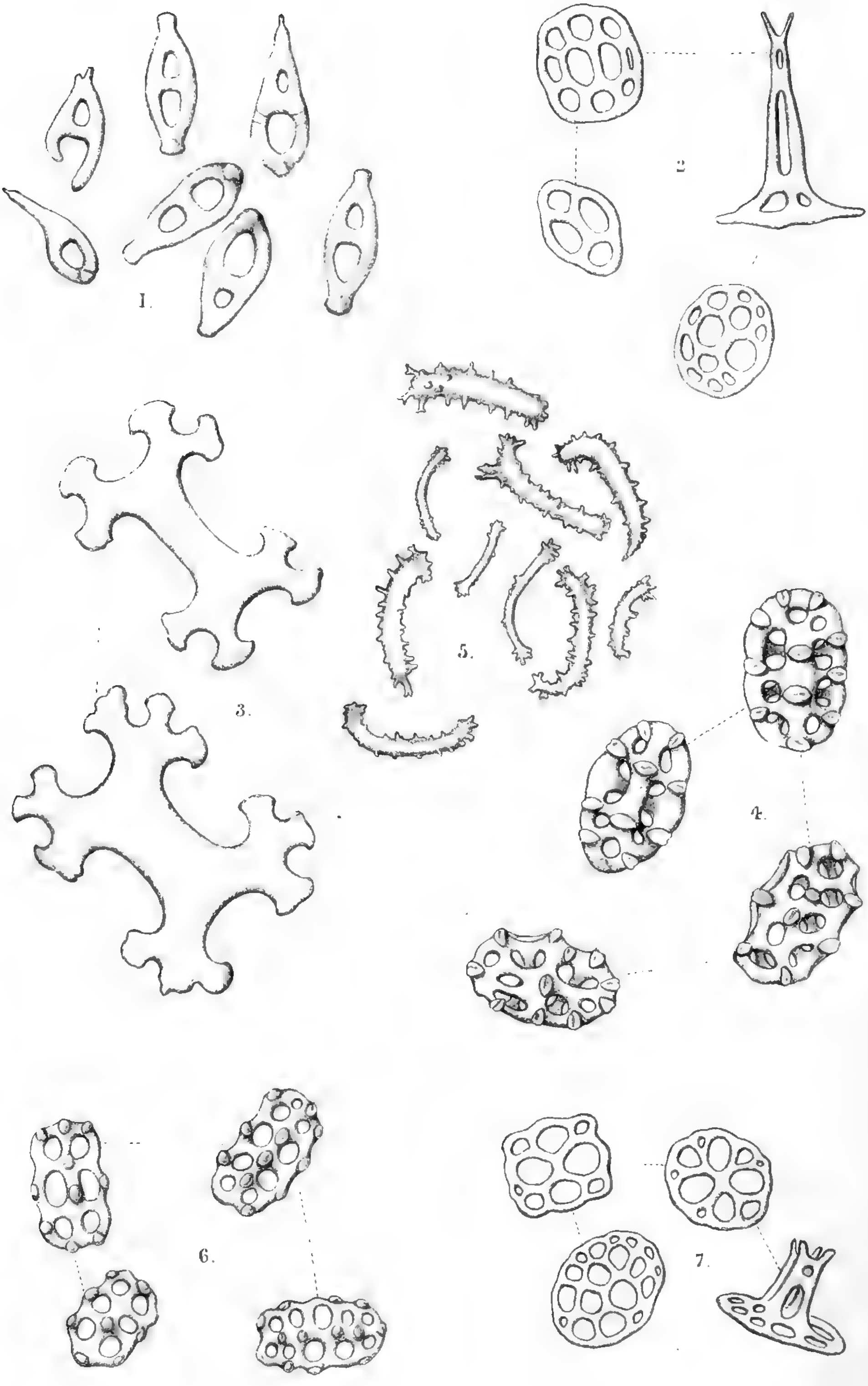
The above-mentioned structures form altogether a complicated glandular mass which is unparallelled among mammals. Special tegumentary glands produced by a local hypertrophy of sebaceous or sweat-glands are extremely widely spread among the Mammalia; but I am not acquainted with any integumental glandular structure which has so complex a character as the sternal gland of *Myrmecobius*. What

Fig. 3.



Minute structure of glandular patch.

e, epidermis; *s*, sweat-gland; *d*, its duct; *p*, duct of sweat-gland opening into sudoriparous follicle; *f*, sudoriparous follicle; *gl*, compound sweat-gland lying below dermal muscles.



Berjeau & Highley del. et lith.

Mintern Bros. imp.

CHARACTERISTIC SPICULES OF NEW HOLOTHURIANS.

its use may be it is impossible to state at present, but that it plays some important part in the economy of the Marsupial can hardly be doubted.

The appearance of the patch of integument is not unlike that figured by Garrod[1] in *Dorcopsis luctuosa*, but its position is very different in the two forms.

With this possible exception I am not able to compare the glandular patch of *Myrmecobius* to any structure in any other Marsupial; the result of the present paper therefore must be the addition of a new character to the diagnosis of *Myrmecobius*.

3. Studies in the Holothuroidea.—VI. Descriptions of new Species. By F. Jeffrey Bell, M.A., Sec. R.M.S., Professor of Comparative Anatomy and Zoology in King's College[2].

[Received June 21, 1887.]

(Plate XLV.)

During the somewhat protracted period in which I have been engaged in determining the large collection of Holothurians in the British Museum, I have noticed a few species of no interest sufficient to justify immediate description, but which, being as yet undescribed, may (on the completion of my work) have their characteristics published. The date on which this paper is read will explain why some of the species are named as they are.

Cucumaria sancti-johannis, sp. nov. (Plate XLV. fig. 1.)

Body considerably elongated; suckers highly retractile, confined to ambulacra and arranged in irregular double rows; no anal teeth.

Calcareous œsophageal ring greatly reduced, the radial piece small, slightly notched posteriorly, completely covered by the insertion of the retractor muscle; the interradial piece a fine filament. The retractors of extraordinary length, extending along two thirds of the whole length of the body, with a broad belly of insertion and long tendon-like band of origin. Stone-canal and several Polian vesicles long. The genital tubes long, simple, and numerous; the Cuvierian organs are apparently wanting.

The spicules (Plate XLV. fig. 1) are numerous and exceedingly simple; at the narrow end there is a tendency to produce a spine; spicules of various stages are shown in the figure.

Two specimens, measuring 50 and 95 millim. respectively, appear each to have a greatest width of about 13 millim.

Ojica, Goto Islands. Collected by Capt. St. John, R.N., H.M.S. 'Sylvia.'

This species is really remarkable; not only for the reduction of the œsophageal ring, which, it may be remembered, is quite aborted in

[1] P. Z. S. 1875, p. 48, pl. viii. [2] P. Z. S. 1884, p. 563.

Amphicyclus japonicus, but for the great length of the retractor muscles; though these prolonged bands have a tendinous appearance, they are of the same histological structure as the more obviously muscular part.

CUCUMARIA BICOLOR, sp. nov. (Plate XLV. fig. 2.)

Body irregularly pentagonal, tapering slightly at its hinder end; no anal teeth; distinctly marked off into ambulacral regions which are quite white, and interambulacral regions which are chocolate or black; the ambulacra very wide, the suckers arranged irregularly, but in more than two rows; the bivial are narrower than the trivial ambulacra; the suckers are strictly confined to the ambulacra.

The state of contraction is such as to make a complete description of the internal anatomy impossible, but it may be noted that the integument is thick, the calcareous œsophageal ring fairly well developed, the interradial piece ending in a dagger-shaped process, and the radial being about twice as wide as the interradial; the genital tubes are numerous.

The spicules are few in number and small in size; the spine of the turriform bodies is bifurcated at its free end.

Length 36; 25 millim.: greatest breadth 20; 12 millim.

King Sound, W. Australia.

This species seems to be most closely allied to *C. versicolor*, from which it differs in the absence of ambulacral papillæ.

CUCUMARIA INCONSPICUA, sp. nov. (Plate XLV. fig. 3.)

Small, stout, a little rough to the touch, with the suckers not quite definitely limited to the ambulacra, though very often nearly so; the trivial suckers are in four and the bivial in two fairly regular rows. No anal teeth. The pharyngeal ring large, the muscles stout and inserted at once into the body-wall; the ring appears to be made up of fine sets of equal pieces, formed probably by the equal radial and interradial calcifications; the Polian vesicle is large.

The genital tubes are long, simple, and not numerous.

The spicules are rare, and are only in the form of large deposits of the shape shown in Plate XLV. fig. 3.

Colour varying shades of dark slate or brown.

Average length 17 millim., average greatest breadth 6 millim.

Port Phillip Heads. Collected by J. B. Wilson, Esq.

The irregularity of the arrangement of the suckers of this species appears to afford a strong argument against the division of the genus *Cucumaria* into *Cucumaria* s. str. and *Semperia*, which has been proposed by Lampert.

HOLOTHURIA (BOHADSCHIA) WHITMÆI, sp. nov. (Plate XLV. fig. 4.)

This is a large *Holothuria* with a stellate anus, and deposits not irregular rosettes, but stout basket-like knobbed bodies.

The body is flattened (in spirit); no dorsal papillæ or suckers; the ventral surface is thickly packed with suckers. Mouth ventral anus distinctly five-rayed, with several hard papillæ along each ray, which look almost like the "teeth" of *Actinopyga*. The body-wall is pretty thick, and, in the specimen dissected, was for 30 millim., at a distance of 40 millim. from the anterior end, particularly thick.

It is impossible, from the condition of the specimen, to describe fully the internal anatomy, but the tentacular ampullæ were seen to be long, the œsophageal ring to be moderately developed, the radial pieces having a deep anterior notch. The Cuvierian organs are small or absent.

The spicules are numerous, very thick, basket-like spheres with small holes and prominent knobs (Plate XLV. fig. 4).

Colour black.

The two specimens measure respectively 240 millim. by 100 millim. and 185 millim. by 95 millim.

Hab. Samoa. Collected and presented by Rev. S. J. Whitmee.

Holothuria (Bohadschia) inermis, sp. nov.

A species distinguished by the absence of spicules and calcareous ring.

Body elongated, tapering somewhat at either end; suckers very thick in trivium, scattered and much rarer in bivium; three indistinctly marked trivial rows; about the middle of the trivium the suckers less closely packed than at either end. Anus five-rayed, the sides of the rays with papillæ.

Twenty black tentacles; pharynx quite devoid of œsophageal ring; no calcareous deposits.

Colour dark brown, the suckers and tentacles still darker.

Hab. West Indies.

In order to retain the general form of the single complete specimen, I have not made a complete dissection; fortunately, however, there is an anterior end of a second specimen, and by it I have been able to assure myself that the absence of the calcareous ring is not an individual peculiarity.

Holothuria kapiolaniæ, sp. nov. (Plate XLV. fig. 5.)

Body elongated, soft to the touch, covered with suckers, more numerous below than above, scattered quite irregularly; obscurely marked papillæ round the anus. Œsophageal ring of ordinary type, the pieces simple and low, with a rather deep notch posteriorly; stone-canal not remarkably long; two Polian vesicles; genital tubes short and not numerous; Cuvierian organs absent or poorly developed. The spicules merely in the form of delicate, slightly curved, very spiny rods.

Colour brownish grey, lighter below; with two rows of eight or nine dark patches on either side of the back.

The single specimen is 60 millim. long, and has an average width of 10 millim.

Sandwich Islands. ?BMNH 1850.

This species appears to be most closely allied to *H. erinaceus*, from which, however, the much smaller stone-canal and the very differently formed spicules are sufficient to distinguish it.

HOLOTHURIA SÆCULARIS, sp. nov. (Plate XLV. fig. 6.)

Body elongated, stout, covered with scattered spicules, which are not numerous and not much more common on the ventral than the dorsal surface. Mouth slightly ventral in position.

The body-wall is very thick (as much as 6 millim.) and is somewhat wrinkled in spirit; the stone-canal is as much as 34 millim. long; there is one Polian vesicle; the pieces of the œsophageal ring are stout and deep; the genital tubes arborescent. Cuvierian organs appear to be absent. The spicules are numerous, small, with well-marked knobs, and ordinarily three pairs of holes; there are no turriform bodies.

Colour light stone speckled with white.

135 millim. long; 45 millim wide.

110 millim. long; 40 millim. wide.

Angola.

The apparently complete absence of turriform bodies from among the deposits of this species is remarkable.

HOLOTHURIA VICTORIÆ. (Plate XLV. fig. 7.)

Body elongated, tapering a little posteriorly, soft to the touch; suckers closely packed in middle ventral line, rarer at sides and above. Mouth ventral.

The radials of the œsophageal ring with a semicircular notch; large Polian vesicle; stone-canal 36 millim. long; body-wall rather thick. The genital tubes, digestive tract, and possibly the Cuvierian organs have been ejected.

Turriform bodies numerous; base with four central large and a varying number of smaller holes; spire with only one transverse bar; no flat plates or supporting spicules.

Colour light brown above, lighter below.

Length of single specimen 137 millim.; greatest breadth 34 millim.

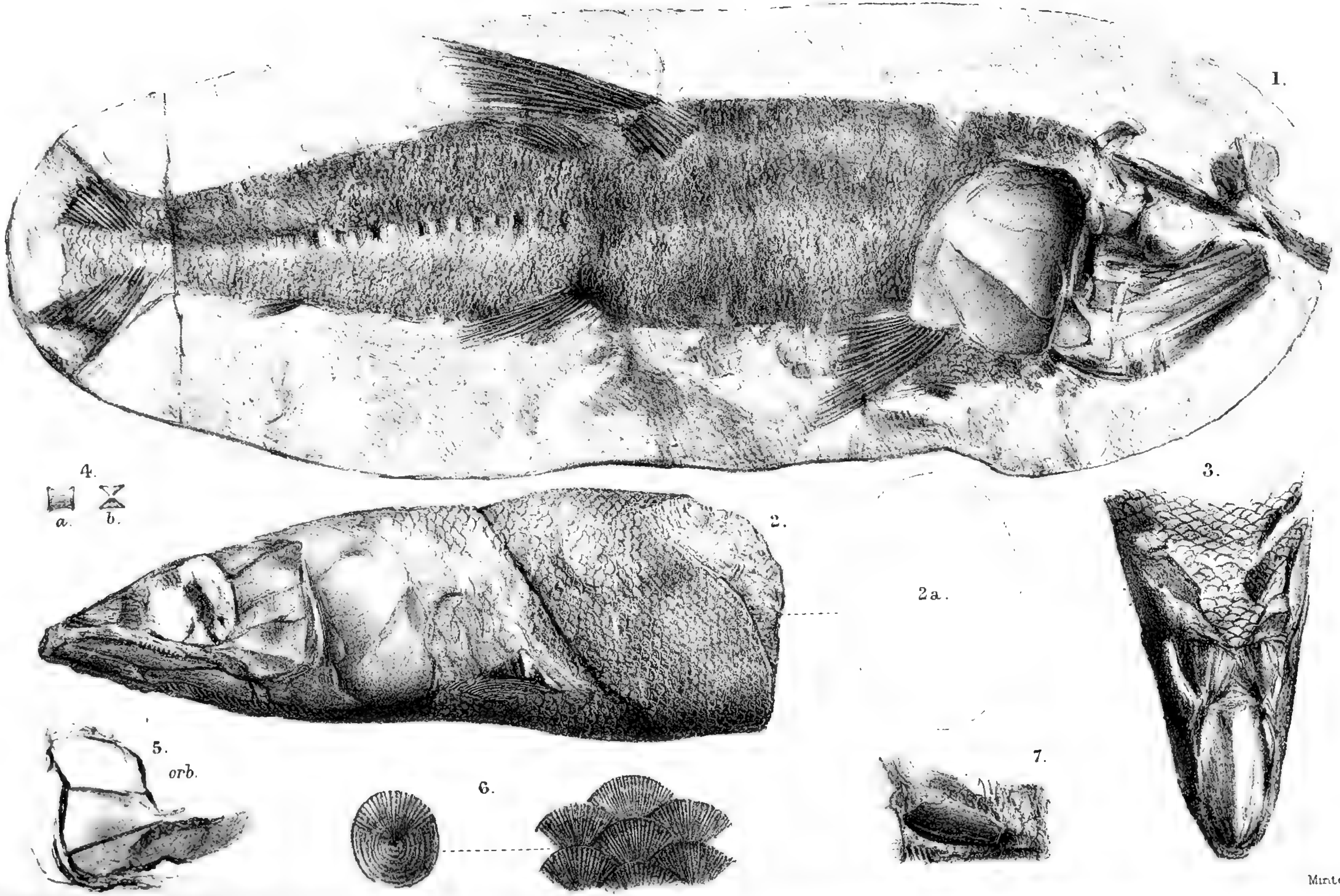
The locality given is "Australian seas"; as the specimen was purchased from Dr. Bowerbank, it is possible that the exact locality was Fremantle, W. Australia, whence Dr. Bowerbank did receive a large number of specimens.

In the key given by Dr. Lampert this new form will stand with *H. intestinalis* and *H. magellani*; from the latter it may at once be distinguished by not having the suckers arranged in rows, and from the former by the form of the spicules.

EXPLANATION OF PLATE XLV.

Fig. 1.	Characteristic spicules of		*Cucumaria sancti-johannis.*
2.	,,	,,	*C. bicolor.*
3.	,,	,,	*C. inconspicua.*
4.	,,	,,	*Holothuria whitmæi.*
5.	,,	,,	*H. kapiolaniæ.*
6.	,,	,,	*H. sæcularis.*
7.	,,	,,	*H. victoriæ.*

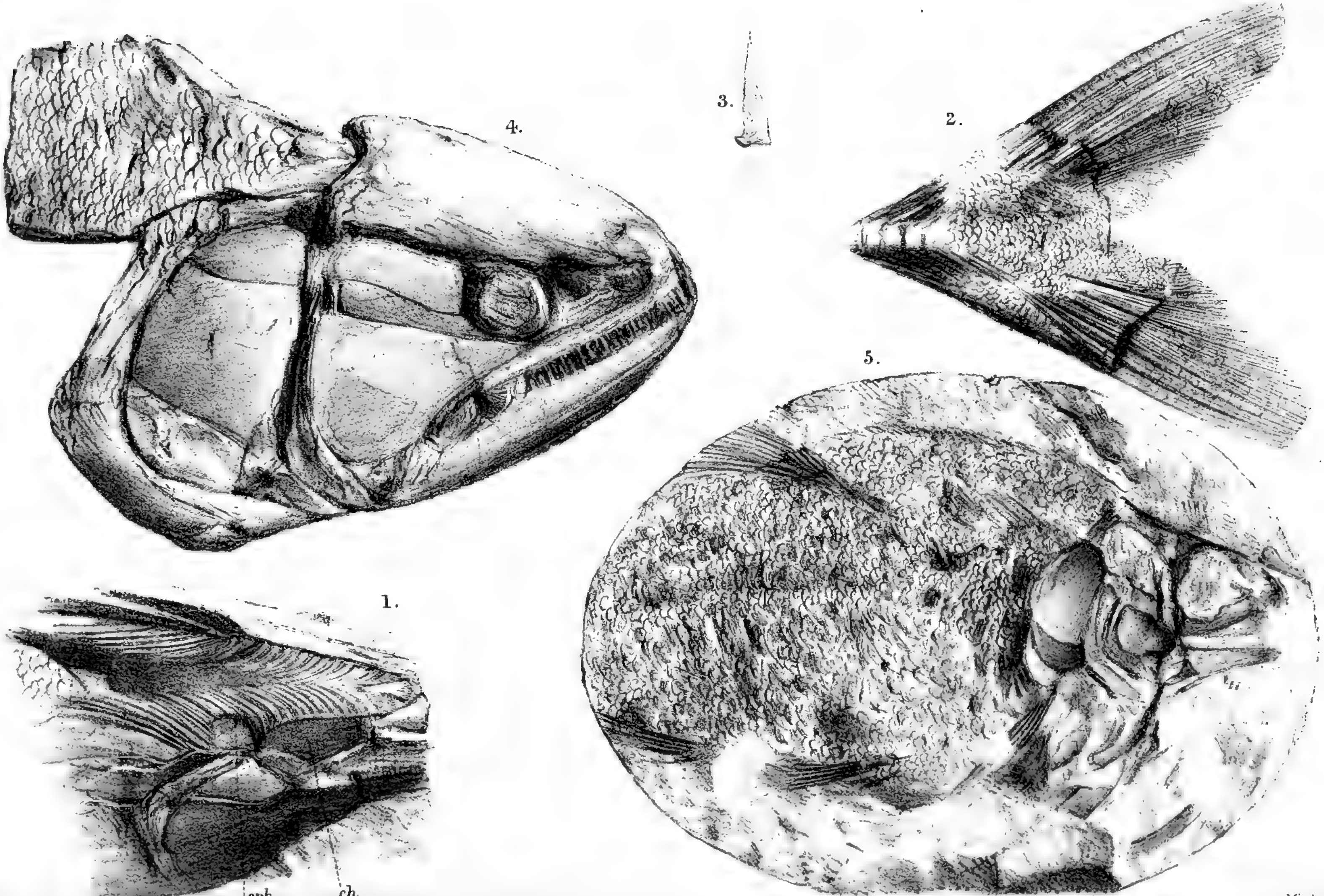
Fig. 4 is magnified 330, fig. 6 440, the others 220 diameters.



F H Michael del et lith.

Mintern Bros. imp.

RHACOLEPIS.



F. H. Michael del. et lith.

Mintern Bros imp.

RHACOLEPIS.

4. On the Fossil Teleostean Genus *Rhacolepis*, Agass. By A. Smith Woodward, F.Z.S., F.G.S., of the British Museum (Natural History).

[Received June 7, 1887.]

(Plates XLVI. & XLVII.)

Among the numerous fossil fishes named and briefly noticed by Agassiz during the preparation of his great work 'Recherches sur les Poissons Fossiles,' but reserved for adequate description in the contemplated supplements which unfortunately never appeared, are some interesting specimens from the north of Brazil, displaying the characters of an extinct generic type, mentioned under the name of *Rhacolepis*. Of these the British Museum now contains an extensive series, enriched especially by the recent acquisition of the Egerton and Enniskillen collections; and as materials are thus provided for a tolerably complete elucidation of the ancient fish they represent, the present seems a favourable opportunity for completing the original diagnoses. The majority of the fossils were actually examined by Agassiz himself, and several bear his MS. labels, so that it is possible to recognize the various species he intended to establish. And a careful study of the whole series has lately revealed some novel facts in regard to the affinities of the genus, which appear to have hitherto escaped observation, and render it of considerable interest to the zoologist.

The fossil fishes in question, together with four or five other genera, are discovered in calcareous nodules, of concretionary origin, scattered upon the hill-sides in the neighbourhood of Barra do Jardim, Serra de Araripe, North Brazil, and the first published allusion to them appears to occur in the record of Spix and Martius's travels at the beginning of the present century [1]. About 1840 many specimens were collected by Mr. George Gardner, of Glasgow, who submitted them to Agassiz, and briefly described the circumstances under which they were met with [2]; and these, probably, form the greater part of the Museum collection at the present time. Still others were brought under Agassiz's notice by MM. F. Chabrillac and Elie de Beaumont, and formed the subject of a lengthy report published in the 'Comptes Rendus' for 1844 [3]. Nearly thirty years later, Professor C. F. Hartt added further remarks upon the geological evidence as to the age of the nodules themselves [4]; and

[1] J. B. von Spix and C. F. von Martius, 'Reise in Brasilien,' 1823–31, Atlas, pl. 22. fig. 5.

[2] G. Gardner, "Geological Notes made during a Journey from the Coast into the Interior of the Province of Ceará in the North of Brazil," Edinb. New Phil. Journ. vol. xxx. 1841, pp. 75–82.—L. Agassiz, "On the Fossil Fishes found by Mr. Gardner," *ibid.* p. 83.

[3] L. Agassiz, "Sur quelques poissons fossiles du Brésil," Comptes Rendus, vol. xviii. (1844), pp. 1007–1015.

[4] C. F. Hartt, 'Geology and Physical Geography of Brazil (Thayer Expedition),' 1870, chaps. xiii., xiv. *passim.*

still more recently Professor Cope[1] has described an interesting physostomous fish from an uncertain locality in South America, which is not improbably derived from the same geological formation. This appears to be the complete literature of the subject, with the exception of brief allusions to the fossils to be noted later on, and none of the accounts are accompanied by figures, if we except the single imperfect drawing given by Spix and Martius.

Though for the most part beautifully preserved, the specimens present the usual imperfections so embarrassing in palæontological research. And while some show very little traces of crushing, or are merely laterally compressed, others were subjected to considerable disturbance before the surrounding mud and sand assumed a hardened state, and several are curiously distorted. There are some in a condition that may be appropriately described as "telescoped"—the fish having been apparently subjected to pressure at right angles to its long axis; and one specimen (B.M. no. 28616) is completely folded up in a most remarkable manner.

Description.

As proved by uncrushed individuals, the body of *Rhacolepis* had a very slightly compressed form, without abdominal "keel," sometimes much elongated (as in *R. buccalis*), and sometimes relatively short (*R. latus*). The roof of the skull exhibits a corresponding flatness, and the snout is remarkably acute. The paired fins are well developed, the pelvic pair being abdominal in situation; there is a single dorsal fin in the middle of the back opposite the pelves; the anal is small, and halfway between the pelvics and the tail; and the caudal fin is deeply forked. The scales are small or of moderate size, and the lateral line is not apparent in unabraded specimens.

Considering these various points in order, there are several features of interest in the *head* that first claim attention.

In the cranium itself, a few of the elements can be more or less distinctly recognized, but the frontals alone are sufficiently perfect and characteristic to merit special note (Plate XLVI. fig. 3). They attain the usual large dimensions and are apparently united together throughout their entire length, the anterior half of the median suture being raised into a prominent longitudinal ridge, and the bone on either side of this for some distance exhibiting a very even surface. Posteriorly, in one specimen (B. M. no. P 1957), a pair of small rectangular bones are to be observed, meeting in the middle line, and these evidently represent the parietals. There is also another prominent element in some examples—as in the original of Plate XLVII. fig. 4—which may probably be interpreted as a membrane bone above the operculum, similar to that observed in certain Characinoids.

The palatine bones are provided with teeth, as disclosed by a fracture in the skull of *R. latus* (no. P 1957); and both premaxillæ,

[1] E. D. Cope, "On two extinct forms of Physostomi of the Neotropical Region," Proc. Amer. Phil. Soc. vol. xii. (1871), p. 53.

maxillæ, and dentaries are likewise armed with a moderately powerful series. These are elongated cones, closely approximated, and varying but little in size, though those on the palatines are apparently the largest. The cleft of the mouth is slightly turned upwards, and the lower jaw scarcely projects beyond the upper; and of the two elements entering into the bony margin above, the maxillæ have much the greater extent.

But the most striking feature in the head is presented by the ring of circumorbital bones, which attain to an extraordinary size (Plate XLVI. figs. 1, 2, 5; Plate XLVII. figs. 4, 5). Two, or perhaps three, of considerable dimensions are situated behind the eye, while the largest occupies a postero-inferior position; and the anteriorly directed process of the latter, which is very narrow in *R. buccalis*, bounds the orbit below, in conjunction with the small foremost element of the ring. Posterior to this series, the long narrow preoperculum is seen; and still beyond are the other elements of the opercular fold. The operculum itself varies in form in the different species (compare Plate XLVI. figs. 1, 2; Plate XLVII. figs. 4, 5); the suboperculum is relatively large; and there is a distinct triangular interoperculum. None of these bones exhibit any definite ornament, sculpturing, or marginal denticulation, and there was no extension of the scales over any part of the cephalic region. The branchiostegal rays attached to the epihyal are about ten in number, and large and much expanded; but in front of these the ceratohyal supports an apparently equal series, which are quite of small size (Plate XLVII. fig. 1), and likewise differ in being considerably "spaced out."

The *vertebral column* is not completely shown in any specimen, and it is thus only possible to determine the number of vertebræ approximately: in *R. buccalis* there appear to be not less than 24 in the abdominal region, and perhaps as many as 20 in the caudal. The centra are well ossified, though perforated in the middle for the passage of a remnant of the notochord; and they exhibit no large lateral excavations, but are marked by delicate longitudinally extended pittings (Plate XLVI. fig. 4 *a*). The ribs are tolerably massive, as shown by B. M. no. 47900, and the same fossil displays a considerable number of crushed intermuscular bones. Both neural and hæmal arches in the caudal region are remarkably strong and elongate; but it is unfortunately impossible to determine with certainty the modifications for the support of the tail-fin.

In the *pectoral arch* the form of the clavicle is well shown, especially by one small fragment (no. P 1958 *c*). It has a gentle longitudinal curve, the concavity being anterior; and there is a comparatively broad, inwardly directed wing, in addition to the exposed part in the plane of the side of the body. The *pectoral fin* is robust (Plate XLVI. fig. 1), and the several stout rays are divided distally; but it is impossible to determine the exact number of these rays, though there cannot have been less than 18 or 20 in *R. buccalis*.

The "*pelvic*" bones are only well shown in one specimen, belonging to the small species just mentioned, and the element of the right side is represented in Plate XLVII. fig. 3. This bone is of an elongated triangular form, the apex directed anteriorly, and the short base supporting the rays of the fin; it exhibits a little rounded process at the posterior extremity of the inner border, for articulation with its fellow of the opposite side. The *pelvic fin* is, as usual, somewhat smaller than the pectoral, though still tolerably robust; and its characters are well seen in the original of Plate XLVI. fig. 1. It is opposed to the hinder part of the dorsal, and consists entirely of soft jointed rays, to the number of about 12 in *R. buccalis*.

The *dorsal fin* is relatively short, and is supported upon a series of strong interspinous bones, of which the most anterior has the widest expansion (*R. brama*, Plate XLVI. fig. 1). In front, there are about three small spinous rays, followed by two others of larger size; but the maximum length is attained by the first succeeding soft ray, and from this there is a gradual shortening backwards. In one species, *R. latus*, the anterior soft ray is extraordinarily powerful, and divided for more than half its length by closely approximated, oblique sutures.

There is no trace of an adipose dorsal fin, notwithstanding the perfection with which some of the soft parts are preserved.

The *anal fin* is very small, and the rays in *R. buccalis* are about 10 in number; these are much divided, as shown in Plate XLVI. fig. 1.

The *caudal fin*, as already mentioned, is deeply forked, and the median rays are very short, only slightly extending beyond the much-elongated posterior termination of the body. In one specimen, indeed, probably referable to *R. buccalis* (no. P 1958 *a*), the median rays do not constitute more than a little delicate fringe, sharply marked off from the two main lobes of the fin (Plate XLVII. fig. 2), though this may quite possibly be an abnormal appearance due to the circumstances of fossilization.

The *scales* are preserved in almost every specimen, but it is only rarely that they are well displayed, owing to abrasion and fractures produced in the removal of the surrounding stony matrix. They are deeply imbricated, but it does not seem possible in any case to determine the number either of the transverse or longitudinal series; nor can anything be stated with certainty as to the variation in size in different regions. The exposed portion of each scale is beautifully ornamented with radiating ridges, which are strongest near the periphery (Plate XLVI. fig. 6); and these sometimes impart to the hinder border of dilapidated examples the appearance of being ctenoid. The superficial layer of the scales, however, is nearly always destroyed. The lateral line is only observed where the ornamented portions of the scales are broken away, and would thus not be visible in the living fish. A small "axillary appendage," of elongated form, is to be noted in one or two specimens above the pectoral fin (Plate XLVI. fig. 7). And, lastly, there is the interesting fact that the dorsal and caudal fins are covered to some extent by smaller scales than those investing the body, these being extremely thin and exhibiting no markings beyond the concentric lines of growth (B. M. no. 28616).

The eye has an ossified sclerotic capsule, and some of the soft parts of the fish are more or less indicated in nearly all the fossils. The gills are well seen when the opercular apparatus is partly removed, the lamellæ being long and slender and reaching the hinder margin of the gill-cavity. The great muscles of the side of the trunk are also fossilized; the successive myotomes, with their transverse muscular fibres, being especially distinct in one specimen in the Enniskillen Collection, which has already been referred to by Agassiz [1].

Specific Types.

In his original notice of *Rhacolepis* (misprinted "*Phacolepis*") Agassiz recognized three distinct specific types, which he very briefly defined as separated by the form of the body and the characters of the posterior elements in the circumorbital ring. These, it appears, are also readily distinguished by the shape of the operculum, and perhaps some other features; and all the examples in the British Museum may be referred to one or other of the three forms. They received the names of *R. buccalis*, *R. brama*, and *R. latus*, and figures of each are given in our Plates.

1. Rhacolepis buccalis. (Plate XLVI. figs. 2–7; Plate XLVII. figs. 1–3.)

This is the smallest species, and comprises the fossil already mentioned as figured by Spix and Martius. It is of a very elongated shape, the greatest depth of the trunk being comprised about five and a half times in the total length. The two posterior circumorbitals are elongated and approximately of equal size, and the length of the postero-inferior plate likewise much exceeds the depth. The vertical measurement of the operculum is much greater than its antero-posterior extent, the relative proportions being about 7 : 4.

2. Rhacolepis brama. (Plate XLVI. fig. 1; Plate XLVII. fig. 4.)

An indeterminable fragment of this species seems to have been originally noticed by Agassiz as *Amblypterus olfersii* [2], and the latter specific name was thus substituted for *brama* in the "Synoptical Table" in the 'Rech. Poiss. Foss.' The body is somewhat less elongate than in *R. buccalis*, the greatest depth of the fossil shown in Plate XLVI. fig. 1 being contained about four and a half times in the total length. The two posterior circumorbitals are likewise much elongated, but the lower is narrower than the upper; and the postero-inferior plate has a deep triangular form. The length and breadth of the operculum are almost equal.

3. Rhacolepis latus. (Plate XLVII. fig. 5.)

This is so called from the considerable depth of the body, as shown in the young individual figured. The two posterior circumorbitals

[1] L. Agassiz, Rech. Poiss. Foss. vol. iv. pt. i. p. 293.
[2] L. Agassiz, ibid. vol. ii. pt. i. p. 40.

are short and of equal size, and the vertical extent of the operculum is about twice its antero-posterior measure. The first soft ray of the dorsal fin is very robust and divided by numerous, closely approximated, transverse sutures.

Systematic Position.

Finally, it remains to determine the systematic position of the genus under consideration. By Agassiz[1], *Rhacolepis* was regarded as a Percoid, probably because the scales had the appearance of being ctenoid, for he had already observed the abdominal situation of the pelvic fins, which would rather point towards a relationship with other types. More recently, Dr. Günther[2] has quoted the genus as one of the Berycidæ; and these are the only two expressions of opinion in regard to the affinities of *Rhacolepis* that I have succeeded in discovering. A glance at the fossils now made known, however, renders it obvious that we are here concerned with a truly physostomous fish; and it is in this primitive division of the Teleostei that we must look for its nearest living representatives.

As kindly pointed out to me by Dr. Günther, some features displayed by these fossils are curiously similar to those of certain Characinoids still inhabiting the fresh waters of Brazil. The scales, for example, have an especially Characinoid aspect, and the large size of the circumorbital bones is also a prominent character of the fishes of this family. But the great number of the branchiostegal rays, the peculiarities of the tail, and the fact that these fossils are accompanied mostly by *marine* forms, are circumstances that seem to point in another direction.

The discovery of an "axillary appendage" in some of the specimens, indeed, suggests affinities with the Elopine and Chanine sections of the Clupeidæ; and it is with the first of these groups that I would venture to associate the genus. *Elops* and its allies are marine types; their bodies exhibit but little lateral compression; their posterior circumorbitals are very large; their branchiostegal rays are generally numerous; and the tail in these forms almost precisely parallels that of the ancient *Rhacolepis*. The correspondence is thus so close that there can be no doubt as to the correctness of the determination.

It is, in fact, difficult to satisfactorily distinguish the Brazilian fossil from some other Elopine genera already recognized; for, in dealing with extinct forms, the imperfection of the palæontological record often prevents any very precise comparisons. Taking first the living genera, *Megalops* may be said to differ especially in possessing a long anal fin, a distinct lateral line, and villiform teeth; while *Elops* seems to be separated by little beyond the conspicuous character of the lateral line, and the absence of small scales on the dorsal and caudal fins. Among fossil allies, *Elopopsis*[3] has a more power-

[1] L. Agassiz, Edinb. New Phil. Journ. vol. xxx. (1841), p. 83; Rech. Poiss. Foss., Synoptical Table, vol. i. p. xliv.
[2] A. Günther, 'Study of Fishes,' 1880, p. 421.
[3] J. J. Heckel, 'Beitr. Kennt. foss. Fische Oesterreichs,' 1856, p. 65.

ful dentition; *Hemielopopsis*[1] seems to be distinguished, among other features, by the absence of teeth on the margin of the mouth; and *Protelops*[2] has relatively shorter and stouter jaws, with rounded crushing-teeth on the palatines. *Thrissopater*[3] differs in having a compressed abdomen, while *Halec*[4] and *Halecopsis*[5] are too imperfectly known for certain reference.

Geological Age.

The foregoing conclusions become of especial interest when the geological antiquity of *Rhacolepis* is taken into consideration, for it almost certainly dates back to the Cretaceous period. As already shown by Agassiz, it is associated with other fossil fishes, *e. g.* the ganoids *Aspidorhynchus* and *Lepidotus*, and the teleostean *Cladocyclus*, the former of which are Jurassic and Cretaceous, and the latter Cretaceous, in European areas; and Gardner has recorded some remains probably of the cephalopod *Turrilites* from the same beds; so that true homotaxis (geological contemporaneity) with the Upper Cretaceous formations of the Old World appears to be well established[6]. *Rhacolepis* is thus one more of the forerunners of the Teleostei, which seem to have become developed during Jurassic times, and to have swarmed in the Chalk seas: it is one which constitutes a decided link between the old bony Ganoids and fishes of a more modern type.

EXPLANATION OF THE PLATES.

Plate XLVI.

Fig. 1. *Rhacolepis brama*, $\frac{2}{3}$ nat. size. [P 3986.]
2. *Rhacolepis buccalis*, anterior portion of fish. 2 *a*. Transverse section of trunk. [P 3983 *a*.]
3. Ditto, upper aspect of head. [P 1958.]
4. Ditto, vertebral centra. *a*. Side view. *b*. Section. [15793, P 1962.]
5. Ditto, posterior circumorbital bones. [P 1958 *a*.]
6. Ditto, scales, twice nat. size. [15485.]
7. Ditto, axillary appendage. [28900 *b*.]

---

[1] F. Bassani, "Descrizione dei Pesci Fossili di Lesina," Denkschr. kais. Akad. Wiss. vol. xlv. (1882), p. 215.

[2] G. C. Laube, "Beitr. Kennt. Fische böhm. Turon's," Denkschr. k. Akad. Wiss. vol. l. (1885), p. 286.

[3] A. Günther, "Figs. & Descr. Brit. Organic Remains," Mem. Geol. Surv. dec. xiii. pl. i.

[4] L. Agassiz, Rech. Poiss. Foss. vol. v. pt. ii. p. 123.

[5] Undescribed specimens in British Museum.

[6] The fossiliferous nodules also contain numerous individuals of a species of entomostracan, but this, unfortunately, does not assist in determining the precise age of the beds. It has been kindly examined by Professor Rupert Jones, F.R.S., and Mr. C. D. Sherborn, F.G.S., who regard the species as probably referable to *Cytheridea*. The former writes: "It differs from any species known to me, but in shape is near to *C. perforata*, Roemer, from the Chalk and Tertiaries."

PLATE XLVII.

Fig. 1. *Rhacolepis buccalis*, under aspect of head, showing ceratohyal (*ch.*), epihyal (*eph.*), and branchiostegal rays. [28900 *a.*]
2. Ditto, tail. [P 1958 *a.*]
3. Ditto, pelvic bone. [P 1962.]
4. *Rhacolepis brama*, head, ½ nat. size. [15490.]
5. *Rhacolepis latus*, young individual. [P 1959.]

All the specimens are preserved in the British Museum, and the numbers refer to the Register of the Geological Department. Unless otherwise stated, the figures are of the natural size.

5. Note on a Fossil Species of *Chlamydoselachus*. By JAMES W. DAVIS, F.G.S. &c. (Communicated by Mr. A. SMITH WOODWARD, F.Z.S.)

[Received June 7, 1887.]

Some years ago a Selachian was obtained by Prof. H. A. Ward, which had been caught off the coast of Japan. It was purchased for the Museum of Comparative Zoology at Harvard College; and in January 1884 Mr. S. Garman, of that Museum, gave a preliminary description of the fish in the 'Bulletin of the Essex Institute,' vol. xvi., in which he recognized it as belonging to a new family and instituted for it the genus *Chlamydoselachus*. A further contribution was made to 'Science' on February 1st following, in which the body is described as long and slender, compressed and thin towards the tail; five feet in length. The head is broad, slightly convex on the crown; six gill-openings are present; the nostrils are nearly vertical, with a fold dividing each orifice into two parts; eyes moderately large, without nictitating membrane. The mouth is anterior and very wide; the teeth are arranged in fifty-one rows of six each across the jaws and are all alike. "Each tooth has three slender, curved, inward-directed cusps, and a broad base, which extends back in a pair of points under the next tooth, thereby securing firmness and preventing reversion." The pectoral fins are described as of moderate size, separated by a distance of twenty-four inches from the ventrals, which, along with the anal and caudal, are large; above the anal there is a small dorsal. Mr. Garman considered that "a certain embryonic appearance in the specimen necessitated a search among the fossils for allied species. Most resemblance was found in the teeth of *Cladodus* of the Devonian; but the cusps were erect instead of reclining, and the enamel was grooved instead of smooth." After the appearance of this notice of the new fish, a considerable amount of correspondence took place in the pages of 'Science,' and diverse opinions were expressed as to the relationship of the genus to extinct forms. Prof. Cope considered that the teeth figured by Mr. Garman "show the animal to be a species of the genus *Didymodus* (=*Diplodus*, Agass.), which has hitherto been supposed to be confined to the Carboniferous and Permian periods;" and in the 'American Naturalist' of April he confirmed his opinion at greater length, and stated that the recent fish should be named *Didymodus anguineus*. Prof. Th. Gill was disposed to consider *Chlamydoselachus* to stand "nearer the true fishes than do the Sharks proper, not because it appears to be in the line of descent between the two, but because it is nearer the primitive line from which both types have diverged." Thus far he agrees with Mr. Garman, but he dissents emphatically from him in regarding the recent acquisition as a Cladodont Shark, and agrees with Prof. Cope that *Chlamydoselachus* had a representative in the Carboniferous genus *Diplodus* or *Didymodus*, although he does not think that the two can be congeneric. He suggests the name *Pternodonta* as preferable to the one given by Mr. Garman. A month later, however, Prof. Gill withdrew his adhesion to the *Diplodus* scheme of affinity; and he says, "I am convinced not only that *Didymodus* has no generic or even family relations with *Chlamydoselachus*, but that it represents even a different order." His objection is founded on the undoubted relationship of *Diplodus* and *Pleuracanthus*, and the possession by the former of a large dorsal fin and nuchal spine, of which there is no evidence in the recent fish; and he concludes that the anatomy of the latter will probably reveal a structure most like that of the Notidanidæ, but of a somewhat more primitive type. In 'Science,' May 30th, 1884, Prof. Cope discusses the relationship of *Diplodus*, Agass., and *Didymodus*, Cope, and regarding the former as the teeth of the fish bearing *Pleuracanthus*-spines, states that it must be separated from the genus *Didymodus*, and that *Chlamydoselachus* is distinct on account of the different structure of the dorsal fin and the absence of a spine; but that hitherto no Pleuracanthoid spines have been found directly associated with *Didymodus* (though they are found in the same strata), and consequently, so far as we know *Chlamydoselachus*, it will not differ from *Didymodus*. These views were published in greater detail in the July 'Proceedings of the American Philosophical Society of Philadelphia.' And so matters remained until the following September, when Mr. Garman read a paper at a meeting of the American Association for the Advancement of Science, in which he strongly reiterated his views as to its relationship with the fossil *Cladodus*, with the result that both Profs. Cope and Gill abandoned their positions and accepted the views of Mr. Garman, Prof. Gill still dissenting "from the opinion that the Cladodontidæ are related to the Chlamydoselachidæ rather than the Hybodontidæ." In July 1885 Mr. Garman published a detailed description of the fish in the 'Bull. of the Museum of Comparative Zoology at Harvard College,' vol. xii. no. 1, pp. 1–35, pls. i.–xx., in which he styles it "a living species of Cladodont Shark."

Leaving this extremely problematical relationship of *Chlamydoselachus* to be substantiated or otherwise by future investigation, it is extremely interesting to find that ten years ago a fossil representative of *Chlamydoselachus* was actually discovered and figured by the late Robert Lawley. The specimen is from the Pliocene beds of Orciano in Tuscany, and is described as very rare; the teeth figured are possessed of three sharp, slender, backwardly-curved denticles, with a base forming a broadly expanded plate divided at its posterior extremity into a pair of prongs, which doubtless extended, as in the existing species, beneath the succeeding tooth, thereby gaining additional firmness and strength. The figures indicate a tooth twice the diameter of the anterior teeth of the existing species. The author knew of no living or fossil representative of the teeth, and gave the figure with a short notice, without description or appending to it any distinctive name. There can be no hesitation therefore in associating the fossil with the existing genus, and it may not be inappropriate to append the name of Mr. Lawley and distinguish it specifically, *Chlamydoselachus lawleyi*.

The figures will be found in 'Nuovi Studi sopra ai Pesci ed altri Vertebrati fossili delle colline Toscane,' di Roberto Lawley, published at Florence in 1876, pl. i. figs. 1–1*c*. I am indebted to Mr. G. A. Boulenger for the opportunity of comparing them with the teeth of the recent *Chlamydoselachus* in the British Museum.

6. Contributions to the Anatomy of Earthworms.—No. IV.[1] By Frank E. Beddard, M.A., F.R.S.E., Prosector to the Society, and Lecturer on Biology at Guy's Hospital.

[Received June 23, 1887.]

IV. *Description of* Cryptodrilus fletcheri, n. sp.

Of this species, which is a native of Queensland[2], I have studied two specimens; one of these was fully mature with a well-developed clitellum, the other specimen was immature without any traces of a clitellum.

In the larger individual the clitellum occupied five segments, commencing with the thirteenth and ending with the seventeenth; the glandular epithelium of the clitellum extends all round the body on these segments with the exception of a ventral area on the seventeenth, corresponding to the part occupied by the ventral setæ and the space lying between them; this space was occupied by an elongated genital papilla, which is rather wider at the two extremities than in the middle. The four succeeding segments are furnished each with a similar papilla of equal size to that on the seventeenth segment and of identical appearance.

These structures closely correspond to the "dumbbell-shaped areas" described by Mr. Fletcher in another species of the same genus, *C. rusticus*; and the evident similarity lead me at first to believe that the species described here was identical with *C. rusticus*. I shall, however, have occasion in the sequel to refer to differences between the two species; and a careful comparison of Fletcher's description of *C. rusticus* with my specimen shows that in the

[1] *Ante* p. 372.
[2] I obtained the specimens through the kindness of Mr. S. Prout Newcombe.

arrangement of these papillæ there is really some little difference between the two species. In the first place, *C. rusticus* has only four of these dumbbell-shaped papillæ, while there are five in my specimen; this is a difference which might easily be explained away on the assumption that Fletcher's specimens were immature, except for the fact that he has examined a large number. Secondly, the papillæ in *C. fletcheri* are restricted each to one segment, the whole of the ventral area of which they occupy; in *C. rusticus*, on the other hand, the papillæ appear to be intersegmental in position.

The *male generative pores* are upon the eighteenth segment and are placed within the area of the ventral papillæ close to the pair of setæ.

The *female generative pore* is situated upon the fourteenth segment; it is a single slit-like orifice with tumid lips.

The apertures of the spermatheca as well as those of the nephridia were invisible in my specimen.

The *setæ* appear to have the same arrangement as in *C. rusticus*, viz. a pair of setæ on either side of the ventral line moderately close together and a laterally placed pair, the individual setæ of which are wide apart [1].

The following notes upon the internal anatomy of the species are of course no more than is necessary for its adequate definition. I hope to be able at some future time to work out more elaborately certain points in the structure of this and other Lumbricidæ.

Alimentary Canal.

The chief feature in the anatomy of the alimentary canal to which I may call attention is the presence of calciferous glands; as these glands appear occasionally to be absent in Earthworms, it is important to record their presence in this species. I noticed two pairs of calciferous glands situated in segments 11 and 12; there may have been others, but an accident prevented an examination of the posterior segments. The position of the glands is somewhat unusual; instead of lying to the side of the intestine as is generally the case (e. g. *Acanthodrilus*, P. Z. S. 1885, pl. lii. fig. 1), they are placed below the intestine, and each gland comes into close relations with its fellow, separated from it, however, by the subintestinal vessel, which is supported by a mesentery.

The gizzard occupies segments 6 and 7.

Nephridia.

Another structural feature of this Earthworm renders it quite impossible to confuse it with *Cryptodrilus rusticus*, or, for the matter of that, with any other of the Australian species of Lumbricidæ.

Mr. Fletcher speaks of the nephridia as consisting of dendriform masses or tufts of glandular cæcal tubes, more developed in the

[1] Since this portion of my paper was written Mr. Fletcher has described (Proc. Linn. Soc. N. S. W., Sept. 1886) a second species of *Cryptodrilus* (*C. saccarius*), which cannot be confounded with the species described above. It agrees with *C. rusticus* in the characters of the nephridia.

anterior segments of the body. In both species of *Notoscolex* the nephridia appear to be much the same, as also in *Didymogaster*: in these genera the description of the nephridia agrees fairly closely with what appears to be the characteristic features of these organs in *Perichæta*, at least in those species in which they have been observed. In my species of *Cryptodrilus* the nephridia are entirely different, and conform to the type that is met with in many species of Earthworms, including *Microchæta* and certain species of *Acanthodrilus*[1]. These organs in *Cryptodrilus fletcheri* consist of a complicated coil of glandular tubules, the details of which I have not worked out, but which appears to bear every resemblance to the corresponding part of the nephridium of *Lumbricus*, opening on to the exterior by a sac-like muscular duct, which is furnished at its extremity with a short diverticulum of identical structure.

Another fact of importance about the nephridia of this species is that their orifices are not fixed; like those of *Acanthodrilus novæ zelandiæ* and *A. dissimilis* and of *Plutellus*, the nephridia of *Cryptodrilus fletcheri* alternate in position from segment to segment. The position of the orifices, however, always corresponds to one of the setæ and may be placed in front of either of the dorsal pair, which have been already stated to be widely separated in this worm. Sometimes the position of the nephridial pore corresponds to the outermost of the two ventral setæ, but I have never observed the nephridial pore to be situated in relation to the ventralmost seta. In one specimen which I studied by means of transverse sections the nephridia appeared to commence in the second segment. In this and the two following segments the nephridiopores were placed in front of the dorsal seta; in the next three segments the nephridiopores have a similar relation to the ventral setæ of the lateral pair; in the ninth segment the pores were asymmetrically disposed, being on one side of the body in front of the outermost seta, on the opposite side in front of ventral seta of dorsal pair. In some of the succeeding segments the asymmetrical disposition of the nephridiopores was also found; in this particular character *Cryptodrilus* agrees with the other species referred to.

The difference in the nephridia of this species and of *C. rusticus* is not, in the present state of our knowledge, sufficient reason for separating the two forms generically; precisely similar differences are to be seen in *Acanthodrilus*.

Reproductive Organs.

The *seminal vesicles* (testes) in the specimen that I dissected have the very anomalous arrangement recorded by Fletcher; that is to say, a pair is placed in segments 9 and 12, the intermediate segments not being occupied by these structures.

The *ciliated rosettes* lie in segments 10 and 11.

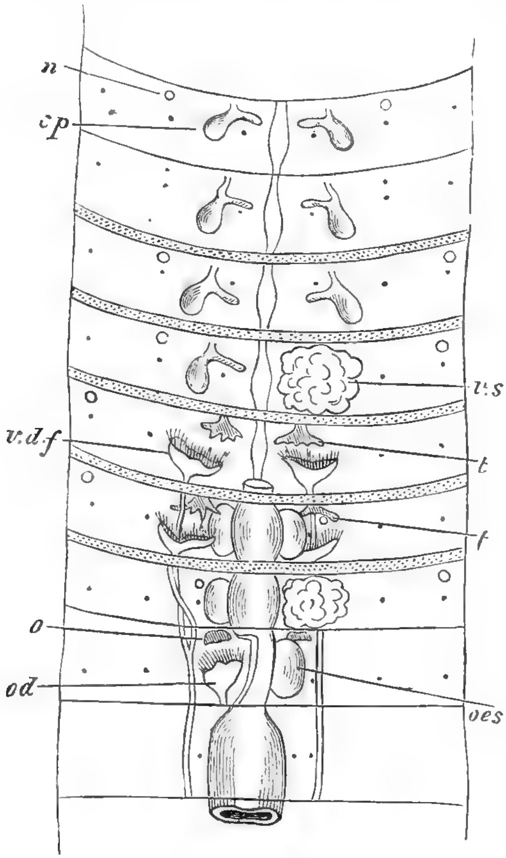
The same segments contain the testes, which are precisely similar in position and in structure to those of other Lumbricidæ. An

[1] P. Z. S. 1885, p. 810.

examination of the genital region by transverse sections failed to show any trace whatever of the supposed missing vesiculæ of segments 10 and 11; those of segments 9 and 12 were well developed and exhibit a racemose structure, as is the case in some other Lumbricidæ.

There are large prostates as in *C. rusticus.*

Spermathecæ.—There are four pairs of these organs situated in segments 6, 7, 8, and 9; they are somewhat pyriform in shape, with a rapidly narrowing external duct; each is furnished with a single diverticulum which lies to the inside; the spermathecæ open on to the



Crytodrilus fletcheri.

n, nephridial pores; *v.d.f*, vas deferens funnel; *v.s*, vesiculæ seminales; *cp*, spermathecæ; *t*, testes; *o*, ovary; *od*, oviduct; *oes*, œsophageal glands.

The œsophagus has been removed for the greater part; in the 13th segment it has been removed from one side together with the œsophageal gland of that side, to display oviduct.

exterior in front of the outermost seta of the ventral pair. In the number and structure of the spermathecæ the present species differs from *C. rusticus,* where there are two pairs of spermathecæ each with two or three short diverticula.

Another curious fact about the present species is the difference of minute structure between the spermatheca and its diverticulum. The spermatheca itself is lined by a tall columnar epithelium; the diverticulum, which joins the duct of the spermatheca just as it perforates the longitudinal muscular layer on its way to the exterior, has delicate muscular walls consisting of circular oblique and longitudinal muscle-fibres well supplied with blood-capillaries; the interior is lined with a delicate epithelium, the cells of which are so excessively thin that hardly anything of them is recognizable but the nuclei; this epithelium contrasts very conspicuously with the tall columnar cells which line the cavity of the spermatheca. The diverticula agree in their minute structure with the spermathecæ of *Urochæta*; it does not appear likely that they are immature considering their large size and the fully mature condition of the Worm.

The *ovaries* and *oviducts* occupy the usual position; the oviducts appear to open separately at either extremity of the slit-like female orifice; I am not, however, absolutely certain about this.

It is interesting to note the great difference in the spermathecal diverticula of this species and of *Acanthodrilus* (see Proc. Zool. Soc. 1885, p. 829) as regards their histological structure.

7. On *Bipalium kewense* at the Cape. By Roland Trimen, F.R.S. &c.

[Received June 7, 1887.]

The characteristic figures of this Planarian given by Prof. Jeffrey Bell (Proc. Zool. Soc. 1886, pl. xviii.), together with Prof. Moseley's diagnosis of the species (Ann. & Mag. Nat. Hist. 5th ser. 1878, i. p. 237), have enabled me to identify it with a worm of which a good many specimens were brought to me in the years 1883–1885. Most of the examples were found by Mr. U. Chalwin, of the Botanic Gardens, Cape Town, from whom, on the 20th of January, 1883, I received the first and largest individual I have seen. I sent five specimens to Prof. Moseley in May 1883, along with some *Peripatus* specimens forwarded to Mr. A. Sedgwick; but it was not till the end of 1885 that I learned from Prof. Moseley the generic position of the worm. Five living specimens have recently been sent to me by Mr. Chalwin, and the comparison of them with the figures and diagnosis referred to leaves no doubt of their being *B. kewense*.

Unfortunately the circumstances of its occurrence here throw no light on the proper habitat of the species, as all the examples (20) brought to me, and others of which I have been informed, were found in gardens. No instance of the discovery of the worm in a wild uncultivated station is known to me. Mr. Chalwin found most of his specimens under flower-pots or plant-cases standing on damp garden-mould, sometimes in ordinary glass frames, but others occurred among damp grass.

I have not found this *Bipalium* exhibit here the extreme sensitiveness to light mentioned by Prof. Bell (*l. c.* p. 168). It is certainly more active at night, but several of my specimens have lived with apparent unconcern in glass jars (provided with water, earth, and plants) fully exposed to bright daylight. The only individual that broke up into short fragments was one which I wished to preserve, and to which I incautiously applied alcohol not sufficiently diluted.

Multiplication by transverse fission is, however, well shown by this animal. The first that I had (about 8 inches long) on the third day of its captivity parted with a short portion (about $\frac{1}{2}$ inch) of its body; and this portion, at first almost motionless, soon began very slowly to move, but remained sluggish and inactive; on the fifth day a second portion was given off, about the same size as the first. On the sixth day the parent worm unfortunately effected its escape, possibly through the perforated zinc covering of the jar, although the perforations were very small. To prevent the escape of the smaller ones I now put the stopper in the mouth of the jar. Two or three days afterwards I was surprised to find a third specimen, very much smaller than the others, but could not ascertain which of its two companions was its parent. The three all remained very sluggish for six days, but on February 4th the two larger ones were moving about; and on my tilting the jar so as to let the water touch them, all three began gliding with some activity towards the top of the jar. Although all three had by this time developed a small fan-shaped expansion at the cephalic extremity (which appeared to be entirely wanting on their original start as separate individuals), it was noticeable that they did not use it as the old worms perpetually do, viz. in exploring the way from side to side with ceaseless undulating motion of its free edge, but moved straight onward with the body simply extended.

A living specimen about 6 inches in length, which was brought to me on the 30th ultimo, parted with about $\frac{3}{4}$ inch of itself on the evening of the second instant. The separated portion was simply thicker and blunter at one end, but soon began to move in a straight line with the thicker end foremost. This separate individual has not up to date (13th May) shown much activity; it usually remains near its parent in a slightly curved posture.

The parent worm, like all the larger living specimens I have seen, assumes quite complicated coils (often about grass stems and leaves) when at rest; but I have specially remarked in this specimen that it also presents at times several *spiral* twists or contortions. On the 5th instant it remained for many hours so twisted, one spiral being at a little distance behind the head, another about an inch further down, and a third about 2 inches from the caudal extremity

Without abundant moisture this *Bipalium* speedily dies. In spite of its copious supply of mucus, it would appear to be extraordinarily sensitive to the effect of contact with an injurious substance; for a good-sized one brought to me on the 3rd instant died with remarkable suddenness on contact with the blacklead used for polishing grates. This specimen, in apparent vigour, was brought in while I was at breakfast, and was placed with the arum-leaf on which it rested on the mantlepiece. Not more than a quarter of an hour afterwards I rose to remove it, but it had left the leaf and could not for some ten minutes be found. It was then discovered, quite dead and shrivelled, adhering by its half-dried mucus to the black-leaded surface of the hearth-stone immediately in front of the grate.

I do not think that this *Bipalium* ever makes use of its mucus as a means of suspension; indeed the nature of its haunts would seem to render any such means unnecessary.

South-African Museum, Cape Town,
13th May, 1887.

8. Descriptions of two new Species of Fishes from Mauritius. By Dr. A. Günther, V.P.Z.S.

[Received June 14, 1887.]

(Plates XLVIII. & XLIX.)

Latilus fronticinctus. (Plate XLVIII.)

This species differs very considerably from the typical forms of *Latilus* in the greater development of the spinous dorsal fin, in the armature of the opercles, narrowness of the infraorbital bone, and great width of the bridge connecting the branchiostegal membranes, so that perhaps it would be better referred to a distinct genus to which the name of *Hoplolatilus* may be given.

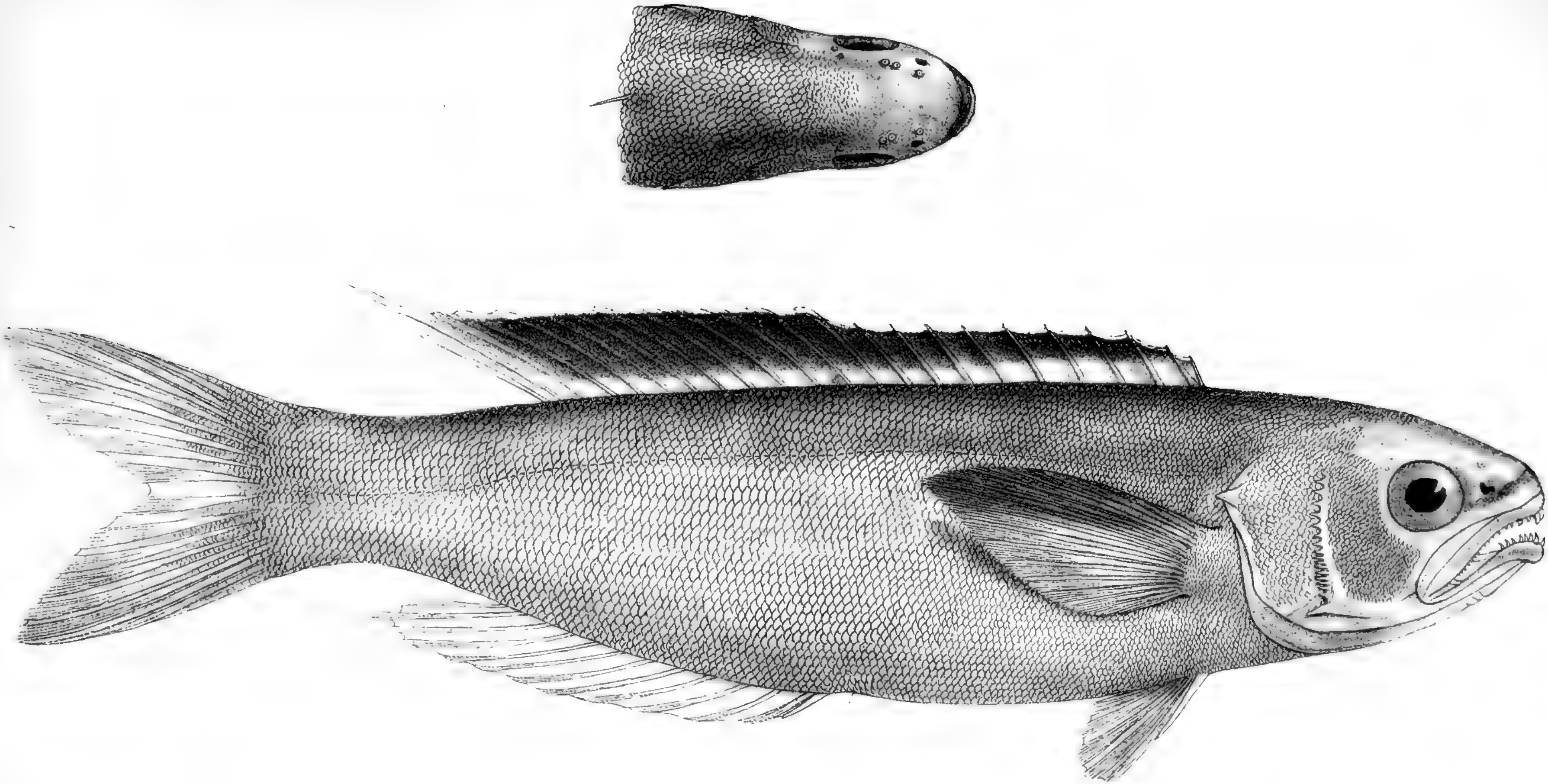
B. 6. D. $\frac{10}{13}$. A. $\frac{2}{12}$. P. 17. V. $\frac{1}{5}$. L. lat. 125.

Head and body compressed, oblong; the greatest depth of the body is nearly equal to the length of the head and one fourth of the total length without caudal. Interorbital space rather convex, somewhat less than one third of the length of the head. Eye equal to the length of the snout and one fourth of the length of the head. Snout short, obtuse, slightly overlapping the lower jaw. Cleft of the mouth oblique, extending a little behind the middle of the eye; the maxillary being separated from the eye by an extremely narrow infraorbital bone. Teeth in both jaws in a band anteriorly, which on the sides tapers off into a single series and terminates behind in the enlarged curved labroid tooth; the upper jaw is armed with two pairs of canines in front, whilst the lower bears a whole series of canine-like teeth outside the villiform band; there are no teeth on the palate.

The præoperculum is strongly armed; it not only bears a strong and coarse serrature along its posterior margin, but it is also armed with a strong triangular spine at its angle. The operculum terminates behind likewise in a flat triangular spine.

Only the snout is naked, the remainder of the head being covered with minute scales.

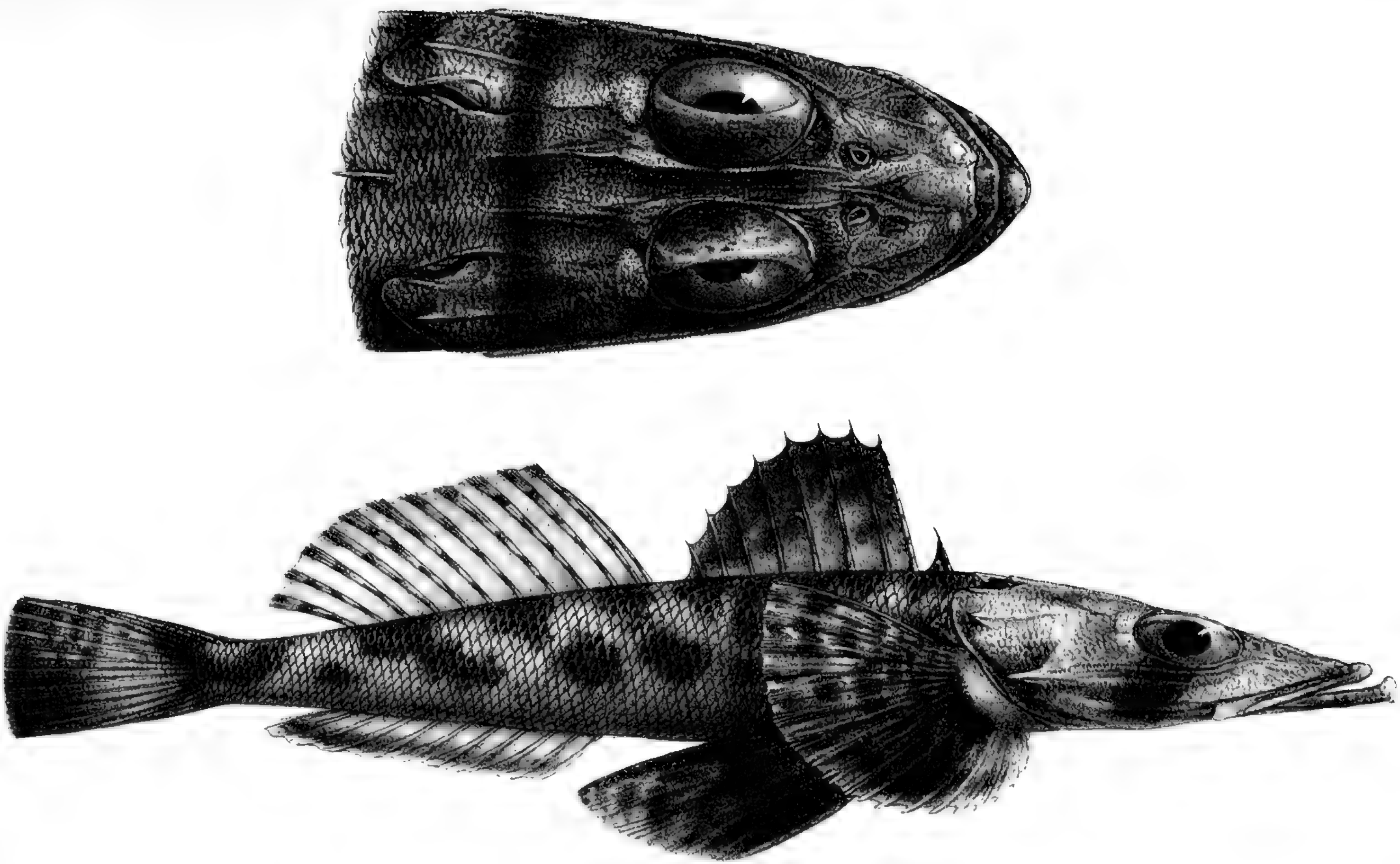
Branchiostegal membrane not joined to the isthmus, forming a broad bridge across it; gill-rakers rather long and lanceolate; there are sixteen along the lower branch of the outer branchial arch. Pseudobranchiæ well developed. A singular skinny nodule of white colour is attached to the inner edge of the clavicle, opposite to the pectoral fin.



R. Mintern del. et lith.

Mintern Bros. imp

LATILUS FRONTICINCTUS



R. Mintern del. et lith.

Mintern Bros. imp.

PLATYCEPHALUS SUBFASCIATUS.

The spines of the dorsal fin are rather strong and pungent; the hindmost a little longer than the eye. The rays are longer than the spines, and especially the penultimate is so far produced as to reach the base of the caudal. The vent is nearly opposite to the first soft ray of the dorsal, the anal commencing immediately behind it. The anal fin resembles much the soft dorsal, but its posterior rays are less produced. Caudal cleft, not quite so long as the head. Of the pectoral rays the sixth and seventh (counted from the upper margin of the fin) are the longest, as long as the head without snout. Ventral inserted below the root of the pectoral, scarcely more than half the length of the head.

The body is of a uniform light olive colour, rather darker on the back. A dark violet band runs from one eye to the other across the front of the snout. Dorsal fin dark violet, yellowish along the base and on the last rays; the upper third of the pectoral fin bluish, the remainder, as also all the other fins, yellowish.

The specimen is nearly 8 inches long.

Platycephalus subfasciatus. (Plate XLIX.)

D. 1/8/12. A. 11. L. lat. 74.

The angle of the præoperculum is armed with three spines, the upper of which is more than twice as long as the middle one and not quite half as long as the eye; it has a minute spine at its base. The middle one is curved downwards, equidistant from the upper and lower. The lowermost is extremely short. The length of the head is one third of the total with the caudal, and contained twice and two thirds in it, without the caudal; its width between the præopercular spines is nearly one half of its length. The interorbital space is a deep and narrow groove, the width of which is scarcely one third of the vertical diameter of the eye; the horizontal diameter of the eye is rather shorter than the snout. The ridges on the head, namely the supraciliary, occipital, and infraorbital, are but slightly prominent, with very fine serrature. The lateral line is very indistinct and smooth. There are six or seven scales in a transverse series between the first dorsal fin and the lateral line. Anterior nostril with a very short tentacle. Light greyish brown, with somewhat irregular, broad, brownish-black cross bands, which are more or less interrupted on the middle of the side; three correspond to the first dorsal fin and three to the second; the hindmost occupies the back of the end of the tail and encloses a whitish spot. Anterior dorsal dark-coloured, with irregular black spots; the rays of the second annulated with black. Anal whitish, with an ill-defined blackish intermarginal band; base of the caudal whitish, the lower part of its posterior half blackish, the upper spotted with black. Pectoral and ventral fins variegated with black and whitish, the tips of most of the rays white. Head with black cross bands, one between the eyes and the other across the occiput; a black band below the eye is most conspicuous.

One specimen from Mauritius, $9\frac{3}{4}$ inches long.

9. Note on the Wild Goats of the Caucasus. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received June 17, 1887.]

In my "Remarks on the various Species of Wild Goats," read before the Society in May last[1], I followed Blasius, Gray, and other authorities in uniting *Ægoceros pallasi*, Rouiller, with *Capra caucasica*, Güld. The recent receipt by the British Museum of Natural History of specimens of what is doubtless the true *C. caucasica* makes it evident that this identification is quite erroneous, as will indeed be at once manifest from the sketches now exhibited of these two very different animals.

Thinking the existence of these two fine species must be well known to our excellent Corresponding Member Dr. Radde, I wrote to him for information on the subject, and received a reply (dated Tiflis, February 9/21), from which the following is an extract:—

"In accordance with your wish, I send you some short notes on *Capra caucasica* and *Ægoceros pallasi.* The former is a good species, and inhabits the western range of the Great Caucasus around the centre of Mount Elbruz. On Kasbeck I have never found this species, but only *C. pallasi*; so also throughout the whole of the eastern Caucasus, east of Kasbeck, and in all Daghestan only *C. pallasi* is found. Blasius has united the two species; and if one only regards the horns, it must be allowed that some very old examples of *C. pallasi* resemble in the form of curve *C. caucasica*, but always have their points more turned inwards. I obtained horns of this form from Suanetia, *i. e.* on the south side of the Great Caucasian range.

"Dinnik published an article on these two species in Russian, about three or four years ago, in the 'Schriften der Naturforscher Gesellschaft' of St. Petersburg, and gave figures of their horns. In *C. pallasi* the horns lie flatter and twist more outwards from the forehead; in *C. caucasica* they go mostly directly backwards and outwards, with the exception of the points, in one plane. I send herewith copies of Dinnik's figures; but should remark that I possess very old horns of *C. pallasi* which also lie almost in one plane, with the points turning in a half-crescent shape towards one another. I send you also a sketch of these horns. This last form perhaps represents a third species, as they fit in well neither with *C. caucasica* nor with *C. pallasi*. On the whole, however, I am of opinion that the form of the horns varies much in individuals.

"Both the species belong to the Great Caucasus, and are not found on the Little Caucasus, or Armenian Highlands. Here, however, *Capra ægagrus*, from the sea-level up to the high alpine heights of 12,000 feet, and upon Mount Ararat to 14,000 feet, takes their

[1] See P. Z. S. 1886, p. 314.

place, together with two species of Wild Sheep. On the Great Caucasus *C. ægagrus* is found locally, but not generally. I have obtained it from the upper Ardon, western Daghestan, and other localities, but it is not found in the eastern ranges."

I have likewise applied for information on the subject of *Capra caucasica* to our Foreign Member, Dr. Strauch, of St Petersburg. Dr. Strauch was so kind as to send me immediately the number of the Russian journal mentioned by Dr. Radde, which contains the original article by Mr. Dinnik. This article Mr. Delmar Morgan, F.R.G.S., has most kindly translated for me, and it will be found published in the last number of the 'Annals and Magazine of Natural History' [1], together with a copy of the plate, which the conductors of that journal have liberally furnished.

Dr. Strauch has also kindly furnished me with a list of the specimens of *Capra caucasica* and *Capra pallasi* in the museum of the Academy of St. Petersburg. It is perhaps not now necessary to read this list; but I may say that it shows that the Academy possesses, as might have been expected, an ample series of specimens of both species. In short, there can be no longer any possibility of not admitting the distinctness of these two animals; and the wonder is that they should have been ever confounded together, the very different shape and curvature of the horns being at once sufficient to distinguish them. I may, however, add a few words upon some of the synonyms attributed to these two Sheep.

In the first place, *Capra caucasica* of Pallas appears to have been little recognized since the time of its describer until recent days. *Capra caucasica* of Keyserling and Blasius, Wirbelth. Europa's, p. 28 (1840), and of Blasius, Säugeth. Deutschlands, p. 479 (1857), as also *Ægoceros caucasica,* Gray, Cat. of Mamm. pt. iii. p. 148 (1852), are all referable to *Capra pallasi.* It is probable also that *Ovis cylindricornis* of Blyth (P. Z. S. 1840, p. 68), based on a description contained in a letter by Col. Hamilton Smith of an animal which died at Toulon, really refers to *C. pallasi*; but as this is not certain, it would not be just to set aside Rouiller's name given a year subsequently in favour of the former appellation.

As regards *Capra pallasi* of Schinz (Neue Denkschr. allgem. Schweiz. Gesellsch. vol. ii. p. 9), which was given by Gray (Cat. of Mamm. pt. iii. p. 148, 1852) as a synonym of *Ægoceros caucasica,* it will be found on reference to that work that this is merely a synonym of *Capra sibirica.*

[1] "On the Caucasian Mountain-Goat (*Capra caucasica*, Güld.)." By H. Dinnik. Ann. & Mag. Nat. Hist. ser. 5, xix. p. 450.

10. On the Systematic Position of the Genus *Miolania*, Owen (*Ceratochelys*, Huxley). By G. A. Boulenger, F.Z.S.

[Received June 16, 1887.]

The remains of the large Australian Quaternary Reptile *Miolania*, recently referred by Prof. Huxley [1] to the order Chelonia, have at the same time been regarded as indicating an animal closely allied to the recent genera *Chelydra*, *Macroclemmys* (*Gypochelys*), and *Platysternum*—a fact which would be of great interest, since the group Cryptodira, to which those genera belong, is, at the present day, unrepresented in the fauna of Australia.

By the kindness of Dr. Woodward I have been able to examine additional material, among which is a nearly perfect skull with the two first cervical vertebræ attached, which was in the hands of Sir R. Owen at the time Prof. Huxley wrote his note. And I have come to the conclusion that, far from bearing any affinity to the *Chelydridæ* or *Platysternidæ*, the extinct Chelonian belongs, like the recent forms of the Australian region, to the group Pleurodira. The structure of the alveolar surface of the skull indicates beyond doubt an herbivorous animal; the ungual phalanges and the curious sheathed tail, I should say, a terrestrial one. The different habits would, therefore, account for some discrepancies on comparison with the recent representatives of the Pleurodira [2]. The structure of the tail, with its opisthocœlous centra, is unique among the Pleurodira and points to a distinct family (*Miolaniidæ*). The pelvis also must have differed from that of existing Pleurodira, the ilium showing a surface for attachment to a sacral rib.

The principal characters which induce me to refer *Miolania* to the group Pleurodira are the following :—

1. The pterygoids are very broad, not narrowed posteriorly ; their outer palatal borders, instead of being emarginate, form wing-like expansions.

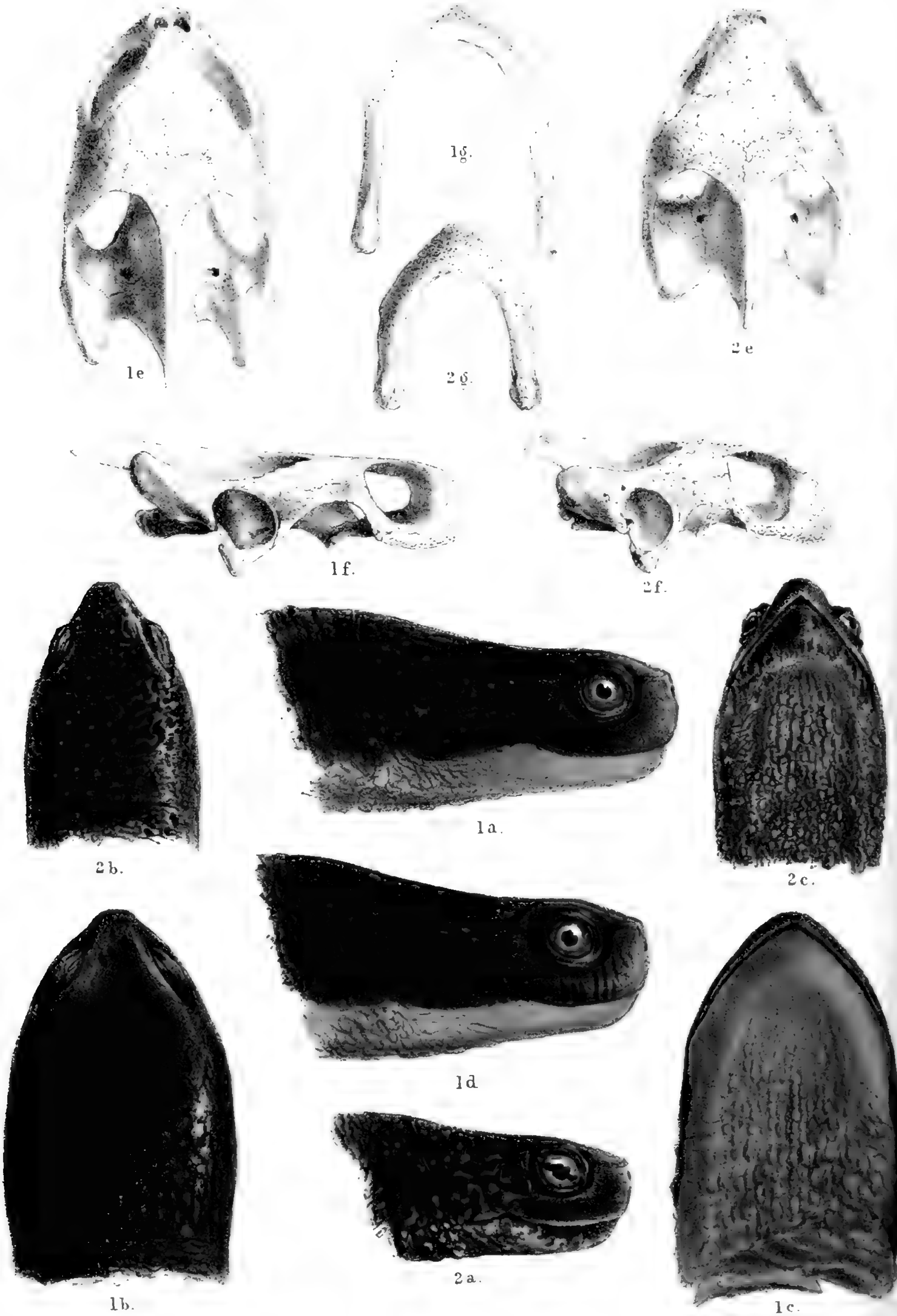
2. The tympanic cavity is completely surrounded by the bony "roof," whilst in all known Cryptodira, however great the development of the roof, the tympanic disk is free behind.

3. The mandible articulates with the skull by a condyle fitting into an articular concavity of the quadrate—a character by which the Pleurodiran Chelonians differ from all other Reptilia, so far as I am aware.

4. The cervical vertebræ are those of a Pleurodiran ; a strong and long transverse process is present, and the posterior borders of the

[1] Proc. Roy. Soc. xlii. p. 232.

[2] All recent Pleurodira are thoroughly aquatic, and, with the exception of *Podocnemis*, carnivorous. The singular canal leading to the orbit, formed by the curved-up anterior wings of the pterygoids, as well as the lateral chambers of the shell, are secondary characters in correlation with the diving powers, and occur also, more or less developed, in some of the most thoroughly aquatic Cryptodira, e.g. *Batagur* and *Ptychemys*. See Rütimeyer's remarks, Verh. nat. Ges. Basel, vi. 1874, p. 58.



Peter Smit del. et lith. Mintern Bros. imp.

1. EMYS BLANDINGII. 2. EMYS ORBICULARIS.

odontoid bone and of the second centrum are deeply emarginate inferiorly, terminating in two diverging tubercular processes exactly as in *Chelys*.

11. Notes on *Emys blandingii*.

By G. A. Boulenger, F.Z.S.

[Received June 20, 1887.]

(Plate L.)

Two specimens, male and female, of the American *Emys* (*E. blandingii*, Holbr.) are now exhibited in the Society's Menagerie, and I have availed myself of the opportunity for examining the question of the validity of this species, which has recently been contested, and for supplementing the only description which has ever been given, viz. that of Holbrook in 1842. Subsequent American authors, Leconte, Agassiz, Cope, &c., have dropped Holbrook's name in favour of Shaw's *meleagris*. But on referring to Shaw's description and figure, and judging by the coloration of the head, I am inclined to identify *Testudo meleagris* with the European *Emys orbicularis*. The reason which, no doubt, led to the identification with *E. blandingii* is Shaw's indication of the habitat "America." However, the fact that Shaw, a few years later, referred *T. meleagris* to the synonymy of *T. europæa* (*orbicularis*), shows that the author himself did not believe in the accuracy of that indication.

Emys blandingii is a rare Tortoise in European collections. It is represented in the British Museum by a skeleton of an adult female (referred by Gray to his *Lutremys europæa*), of unknown origin. A second specimen, a male skeleton, from Lake St. Clair, Canada, has been communicated to me by M. Lataste. The material upon which these notes are based consists therefore of four specimens—two live adults and two adult skeletons.

Emys blandingii is very closely allied to its European congener. The structure of the shell, apart from a somewhat more elongate shape in the adult of the American species, affords no distinctive characters. The colour of the shell is slightly different, owing to the larger size of the yellowish-brown spots on the carapace, and the large blackish blotches on the outer side of each of the plastral shields; Holbrook's figure affords an excellent representation of the adult shells before me. The limbs also are extremely similar to those of the European species, with the exception, perhaps, that the interdigital webs are a trifle shorter. But the head and tail show important differences. The interorbital space is considerably narrower, and the postorbital part of the head much longer; the mandible is longer, and its symphysial part narrower; the width of the symphysis is one sixth of the length of the mandible in *E. blandingii*, and one fourth in *E. orbicularis*. The tail is shorter, its length (from the extremity of the plastron) being contained twice and two thirds in the length of the shell in the adult male, and four times in the adult female; in the quite young, figured by Agassiz, about once and a half. In the adult male of *E. orbicularis* the length of the tail is contained about once and a half in the length of the shell, in the female twice to twice and one fourth; in the quite young, tail and shell are of equal length. I count 27 caudal vertebræ in the skeleton of *E. blandingii* (adult female) in the Museum, and 31 in a skeleton of a female *E. orbicularis*.

Other differences are to be found in the coloration of the head, the lower jaw and throat being of a uniform yellow colour, contrasting with the dark brown of the upper jaw; and in the colour of the iris. This is of a bronzy brown in the female and reddish brown in the male. Similar sexual variations in the colour of the iris are known to occur in *Cistudo carolina*. In the newly-born *Emys orbicularis* the iris is of a uniform dark brown; as the animal advances in age small round yellow spots, similar to those on the sides of the head, appear on the iris, and gradually increase in size until, in the adult, the iris is principally, or even entirely, yellow.

A few words as to the habits, so far as I have been able to observe from the two specimens lent me by the Society, and which I kept for a couple of weeks in company with specimens of the European species. Holbrook says, "It is known to be a land animal, and found about the meadows and prairies of the West." I am not able to confirm the statement that it is terrestrial. The Society's specimens go to the water, though less readily than their European congeners; they dive and feed in the water. When disturbed on land they usually seek shelter by withdrawing into the shell, as do Land-Tortoises; whilst *E. orbicularis*, under similar circumstances, makes for the water. When handled, the timid *E. blandingii* nearly always retires into the shell, whilst even fresh-caught specimens of *E. orbicularis* seldom do so.

To conclude, it may be observed that, though belonging unquestionably to the same group as *E. orbicularis*, *E. blandingii* shows in some of its characters, shorter tail and coloration of the iris, as well as in its less aquatic habits, a certain approach to its American allies of the terrestrial genus *Cistudo*.

EXPLANATION OF PLATE L.

Fig. 1. *Emys blandingii*, Holbr.
- 1 *a*. Head of male, side view.
- 1 *b*. Ditto, upper view.
- 1 *c*. Ditto, lower view.
- 1 *d*. Head of female, side view.
- 1 *e*. Skull of female, upper view.
- 1 *f*. Ditto, side view.
- 1 *g*. Mandible, lower view.

Fig. 2. *Emys orbicularis*.
- 2 *a*. Head of male, side view.
- 2 *b*. Ditto, upper view.
- 2 *c*. Ditto, lower view.
- 2 *e*. Skull of female, upper view.
- 2 *f*. Ditto, side view.
- 2 *g*. Mandible, lower view.

12. Description of a supposed new Species of the Genus *Merula* from South America. By HENRY SEEBOHM, F.Z.S.

[Received June 23, 1887.]

In the years 1845–47 the world was circumnavigated by the Danish ship 'Galathea,' whose adventures are narrated by Capt. Steen Bille in a book bearing the title "Beretning om Corvetten Galathea's Reise omkring Jorden" (Copenhagen, 1849–51). Dr. Behn was the zoologist of the expedition, and amongst other things made a collection of birds, which appears to have been buried for forty years in the museum of the Zoologischer Institut in Kiel.

In the months of July and August 1847, Dr. Behn appears to have travelled in the valley of the Paraná in South America, for on the 10th of August he shot an example of *Turdus albiventris* at Jaragua, having previously shot an example of the same species on the 11th of July in the valley of the Rio Grande in the Province of Sao Paulo. Two days earlier (on the 9th of July) he appears to have been at a place called Jutuba, which is presumably in the same valley of Southern Brazil. Here he obtained a Thrush which appears to belong to an undescribed species.

I am indebted to the kindness of Herr Paul Leverkühn for an opportunity of examining the collection of Thrushes in the Museum at Kiel. Professor Möbius, the Director of the Zoological Institute, has placed the birds in the collection in the hands of this gentleman for examination and determination.

Herr Leverkühn proposes to call this new species of Thrush

MERULA SUBALARIS, sp. nov.

Similis M. nigricipiti, *sed axillaribus et subalaribus albis; gula et subcaudalibus albescentioribus; pileo vix nigrescente.*

The skin is marked a male, and has the throat white streaked with black as in *M. nigriceps* and *M. reevii*. There can be little doubt that, like the two latter species, which are its nearest allies, and like *M. flavipes* and *M. leucops*, which are its next nearest relations, the new species *M. subalaris* has an olive-brown female.

There is a good figure of *M. nigriceps* in P. Z. S. 1874, pl. lxiv., which shows the nearly black crown of that species, but does not display the slate-grey axillaries and under wing-coverts, the two most striking characters which distinguish it from its eastern ally, in which the crown is a scarcely darker slate-grey than the rest of the upper parts, and the axillaries and under wing-coverts are, many of them, pure white.

13. On a new Species of *Calyptomena*. By R. Bowdler Sharpe, F.L.S., F.Z.S., &c.

[Received June 23, 1887.]

The genus *Calyptomena* has, until now, been considered to contain a single species, *C. viridis* (Raffl.), confined to the Indo-Malayan region, and more especially common in Malacca and Borneo than in any other part of its range. The splendid species which I now describe makes the second one of the genus, and was discovered by my friend Mr. John Whitehead on the mountain of Kina Balu. It is at least twice the size of *Calyptomena viridis*, and is easily distinguished by the characters given below. I have named it after Mr. Whitehead, in acknowledgment of the enterprise he has shown during his travels in the East.

Calyptomena whiteheadi, sp. nov.

♂. C. *similis* C. viridi, *sed duplo major, et plaga magna jugulari nigra, plumis dorsi pectorisque nigris, viridi lanceolatim terminatis, cauda velutino-nigra (ad basin viridi) et secundariis cyaneo marginatis distinguenda. Long. tot.* 11·0, *culm.* 0·65, *alæ* 6·35, *caudæ* 3·2, *tarsi* 1·0.

♀. *Mari similis, sed coloribus dilutioribus et crista frontali minore distinguenda. Long. tot.* 9·8, *culm.* 0·75, *alæ* 6·1, *caudæ* 3·3, *tarsi* 1·05.

Hab. In monte 'Kina Balu' dicto, in Borneo septentrionali.

November 15, 1887.

Prof. W. H. Flower, 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, September, and October, 1887:—

The total number of registered additions to the Society's Menagerie during the month of June was 143, of which 31 were by birth, 75 by presentation, 25 by purchase, and 12 were received on deposit. The total number of departures during the same period by death and removals was 94.

The registered additions to the Society's Menagerie during the month of July were 130 in number; of these 53 were acquired by presentation, 32 by purchase, 15 by birth, and 30 were received on deposit. The total number of departures during the same period by death and removals was 83.

The total number of registered additions to the Society's Menagerie during the month of August was 104; of these 48 were acquired by presentation, 37 by purchase, 12 by birth, and 7 were received on deposit. The total number of departures during the same period by death and removals was 199.

The total number of registered additions to the Society's Menagerie during the month of September was 136; of these 72 were acquired by presentation, 25 by purchase, 2 by exchange, 7 were bred in the Gardens, and 30 were received on deposit. The total number of departures during the same period by death and removals was 109.

Amongst these may be specially noticed:—

1. A Red-and-White Flying Squirrel (*Pteromys alborufus*), from the province of Szechuen, in the interior of China, presented by Percy Montgomery, Esq., of Ichang, China, and received September 9th. This fine large Flying Squirrel, which was described and figured by Monsieur Alphonse Milne-Edwards ('Recherches pour servir à l'Hist. Nat. d. Mammifères,' p. 298, pl. xlv.), from specimens obtained by Père David on the Tibetan confines of China, is quite new to us, and is, I believe, also unrepresented in the National Collection.

2. An Urva Ichneumon (*Herpestes urva*), purchased September 17th. This Himalayan Carnivore is also new to us. It is well figured in Hodgson's unpublished drawings in the Society's Library ('Mammals of India,' vol. ii. pls. 128, 129).

The total number of registered additions to the Society's Menagerie during the month of October was 109, of which 4 were by birth, 45 by presentation, 4 by purchase, 53 by exchange, and 3 were received on deposit. The total number of departures during the same period by death and removals was 93.

The following additions are of special interest:—

1. A young male Gorilla (*Anthropopithecus gorilla*), purchased October 10th, of Mr. Cross of Liverpool, being the first Gorilla acquired by the Society.

The animal appears to be about three years old, and its height two feet six inches.

The Gorilla has been placed in the Sloths' House, in an adjoining compartment to that of the female Bald Chimpanzee "Sally," received Oct. 24, 1883, so that there is now a good opportunity for comparing these two forms of Anthropoid Apes.

2. An Aye-Aye (*Chiromys madagascariensis*), purchased Oct. 28th, being the second example of this rare animal which has been acquired by the Society.

The following extract was read from a letter addressed to the Secretary by Herr W. v. Nathusius of Königsborn:—

"I have the pleasure to send you by this, three preparations of

Symbiotes, containing (as labelled):—(1) ♂ (not quite perfect) in copulation with ♀ imperfect; (2) three perfect ♂s; (3) one very young ♀. The last-named object is not easily to be found in the Canada balsam, it is therefore marked by a red circle. The male and female in the act of copulation, the female being yet in the so-called larval state, are perhaps interesting.

"With due respect to Prof. Brown's opinion, I beg leave to observe that since my publication Prof. Pflug, Director of the Veterinary Institution at Giessen, and other veterinaries, have expressed their surprise at the necessity of reminding the public of a fact so well known as of *Symbiotes* being the cause of Fussrande (*i. e.* grease).

"From what I find in Stonehenge, 'British Rural Sports,' 2nd ed. 1856, and Stephens's 'Book of the Farm,' 2nd ed. 1855, I am under the impression that the first stages of the infection (*i. e.* the dry excretion) are frequently overlooked in England; but I own frankly that the peculiar liability of cart-horses to grease may easily foster the idea of the existence of a constitutional disease. Evidently these Acari find a comfortable existence only on horses' feet that are covered by a voluminous cutis and furnished with coarse hair. Experience has shown, in the mange of Man, that in such cases of parasitism opposing convictions are not easily overcome.

"Perhaps artificial infection, by applying the dry excretions, the existence of *Symbiotes* having been ascertained in them by microscopical investigation, to the feet of a sound horse, would be the strongest test. Of the importance of a decision there can be no doubt, I think."

The Secretary read the following extract from a letter addressed to him by Surgeon-General George Bidie, C.I.E., C.M.Z.S., dated Ootacamund, 8th October, 1887:—

"I am sending you by this mail, by book-post, a photograph of a male and female Elephant in sexual congress, an incident very rarely seen by human eyes and one which, so far as I know, has never before been pictured by the camera. Both animals belong to the Commissariat Department, and at the time of contact were at Thayetmyo, a Military Station on the frontier of Lower Burmah. The sexual intercourse of the pair of animals was fruitful; and Capt. L. J. Torrie, who was in charge of the stud, tells me that gestation lasted for about 21 months. The calf when born was of a very pale colour, which led to a rumour getting abroad that a White Elephant had been born. This created a great deal of excitement amongst the Burmese; and as the mother refused at first to have anything to do with her young one, the native 'milky mothers' from the bazaars volunteered to draw and give the calf milk from their breasts!"

Prof. F. Jeffrey Bell, F.Z.S., read the following observations on the "British Marine Area," prepared by Mr. Edgar A. Smith, F.Z.S., and himself.

By the courtesy of Professor Haddon, who acted as its Secretary, we have received advance copies of the Report of the British Association Committee, "appointed for the purpose of considering the question of accurately defining the term 'British,' as applied to the Marine Fauna and Flora of our Islands." To us it is a question of especial interest, feeling as we do that our best efforts ought to be directed to the care and maintenance of one of the most instructive and one of the most popular of the Galleries in the British Museum of Natural History—the one which is ordinarily known as the British Room.

When we ask ourselves what that room should contain, we have to answer—the products of the British Seas; and when we go further and ask, What are the British Seas? there is only one answer that can be given us—the waters that wash the British coasts as far as three miles from land. This is, all the world knows, an arbitrary or conventional arrangement.

If, on the other hand, we seek for the natural boundaries of the British Marine Area, we are met by the facts that it merges on the south into that of the coasts of France, and on the north into those of Norway; the only species that can be considered in any way peculiar to it are little-known forms from great depths, such as *Amphiura bellis*, var. *tritonis*, of Hoyle. Indeed, in the classical work of Edward Forbes[1], the Shetland Islands form part of his Boreal Province, and the rest of the British Isles constitute the northern portion of the Celtic Province, whose southern boundary is the Bay of Biscay.

We are therefore forced to conclude that there is no such thing as a British Marine Area; this is not to be taken as implying that we think that the British Association Committee were engaged on a task which was a mere waste of time, but only to give force to the way in which we should wish to approach the question.

Without seeking for limitations, we ask what may we put in the "British Room," or whence may collectors who confine their collections to British specimens get their examples?

If we are to bind ourselves by the rules of the Committee, we must omit specimens taken from the Channel Islands: this we cannot but think is a regrettable decision; the community of the fauna on either bank of the English Channel is very well marked, but, as a rule, the specimens which come from the southern side are so much finer, and the opportunities for collecting them are generally so much more advantageous that (bearing always in mind that we have to do with an artificially restricted area) we should be reluctant to lose our best hunting-ground. We may, we think, claim that Dr. Gwyn Jeffreys would have been of this opinion[2].

Our view, then, as to the limits of the area are best expressed in the following terms: we would apply the principle of using political divisions *cum grano salis*—including, that is, the Channel Islands, the Shetlands, and St. Kilda, but omitting Heligoland.

It may be pointed out that a strict interpretation of the rules pro-

[1] 'Natural History of the European Seas.'
[2] See his 'British Conchology,' i. p. cxi.

posed by the B. A. Committee would result in the exclusion of St. Kilda.

We recognize the value of the criticism that it is often difficult or inconvenient for a dredger to know whether he is more or less than three miles from shore, and we see clearly that to the north and west of our shores the 100-fathom limit has advantages over the three-miles limit; if it be taken *cum grano salis*, that is so as to include St. Kilda, it will doubtless be found preferable to the political boundary in the Irish and Scotch Seas. If it be retorted on us that in taking a different limit for different parts of the area we reflect on the principles which we ourselves propose to use, we answer, not that we are affected by the present rage for inconsistency, but that, recognizing and insisting on the artificial nature of the area, howsoever defined, we would try so to bound it as to give the greatest satisfaction to the largest number of collectors.

Prof. Newton, V.P. (on behalf of Mr. William Eagle Clarke), exhibited a stuffed specimen of Bulwer's Petrel (*Bulweria columbina*), remarking:—

"Some doubt having, it seems, been expressed as to the occurrence of Bulwer's Petrel in this country, which was announced by Gould in the concluding part of his 'Birds of Europe,' published on the 1st of August, 1837, Mr. William Eagle Clarke, Curator of the Museum of the Philosophical and Literary Society at Leeds, determined to investigate the facts; and as his search for the specimen in question has been successful, I have great pleasure in exhibiting it to you, on his behalf, to-night. I have the greater pleasure in doing this as, but for his perseverance and that of a local naturalist, Mr. James Carter, of Burton House, Masham, the specimen would probably have been for ever lost sight of, whereas we may now hope that it will find a permanently safe abode. Gould's statement was that the specimen having been found dead on the banks of the Ure, near Tanfield in Yorkshire, on the 8th of May, 1837, was brought to Captain Dalton, of Slenningford near Ripon, a gentleman, as I learn, who had succeeded to a collection of stuffed birds begun by his father. The father was Colonel Dalton, who, curiously enough, had sent Bewick the specimen of the Common Stormy Petrel (also found dead in that neighbourhood) from which the figure and description in his well-known work was taken (British Birds, ed. 1, ii. pp. 249–251). At the end of last May, Mr. W. E. Clarke applied to Mr. Carter, and the first result of the latter's inquiry was to find that the Dalton collection had been dispersed by sale just a week before. Fortunately all the cases of stuffed birds had been bought by persons living in Ripon; and, having obtained their names from the auctioneer, Mr. Carter, after many failures and some loss of time, discovered in the possession of Mr. Jacobs, the Head-master of the Choir-School in that city, the case and the specimen before you, labelled '*Procellaria bulwerii*,' which he had bought with others at the Dalton sale. Beyond this fact, however, there was no note or anything to identify the specimen with the object of the search. Mr. Carter thereupon undertook to inquire of the surviving members and connexions of the Dalton family, and, fortunately again, one of the latter, being Mr. George Clarke of Tanfield House, Bedale, a son-in-law of Captain Dalton, was found, who not only remembered the specimen perfectly well, having seen it 'scores of times,' but produced an old manuscript note he had made on the margin of a 'Bewick' (in which he had been accustomed to record ornithological observations), to the effect that this bird was 'found dead on the Bridge at Tanfield,' and had been given to his father-in-law, who had it 'preserved by the late John Stubbs of Ripon, fishing-tackle maker and bird-stuffer.' Mr. George Clarke also remembered the owner having several times refused the offer of twenty guineas for the specimen, and after his death had looked in vain for the specimen, which, it appears, had been put away in a lumber-room and wholly forgotten. I think, therefore, that no doubt can be entertained of our having before us the remains of the very bird which was found dead at Tanfield, as recorded by Gould, and that we are much indebted to the gentlemen concerned in hunting out this specimen, which had so long disappeared."

Mr. H. E. Dresser exhibited on behalf of Lord Lilford some specimens of a Titmouse obtained by Dr. Guillemard in Cyprus, and made the following remarks:—

"I have pleasure in exhibiting three specimens of a Titmouse from Cyprus, allied to *Parus ater*, which appears to me to be worthy of specific distinction, and for which I propose the name *Parus cypriotes*. The specimens in question were collected by Dr. Guillemard near the Kikko Monastery, Cyprus, at an altitude of 4000 feet, and, as will be seen, differ from *Parus ater* in having the upper parts brownish as in *Parus britannicus*, but rather darker, in having the white nuchal patch almost obsolete, and in having the black on the throat extended much further down than in *Parus ater*, thus covering a much larger area. The underparts are tinged with buff, the flanks and under tail-coverts being much darker in tint.

"This form is nearly allied to *Parus æmodius* from the Himalayas, and on comparison with a series will, I think, prove to be also nearly allied to *Parus michalowskii*, from the Caucasus."

Mr. Boulenger exhibited a living specimen of a rare African Batrachian, *Xenopus lævis*, Daud., one of the few representatives of the *Aglossa*, which had been sent to him by Mr. Leslie, F.Z.S., of Port Elizabeth. The specimen, a breeding male, showed closely-set fine black asperities, forming a band along the upper surface of each finger; copulatory asperities had not previously been noticed in *Xenopus*. Another point of interest resides in the curious position of the hand. When the animal is at rest the hand is bent sideways and inwards, with the fingers superposed instead of on the same horizontal plane, so that the inner finger only touches the ground; the outer surface (which corresponds to the lower in other frogs) is coloured, the inner colourless and provided with the nuptial excrescences. This tortion, together with the extreme similarity of the four fingers, renders it difficult to decide, at a first glance, which of the digits are the pre-axial and which the post-axial. The colour of the upper parts is a uniform olive-brown, that of the lower a carneous white. The pupil, in a strong light, is vertically oval; the iris is much obscured by black pigment, except a narrow golden ring round the pupil. The web between the toes is transparent, with the veins forming beautiful arborescent purplish lines.

Mr. Boulenger intended to hand over the specimen to Prof. Howes, who, he hoped, would investigate the circulatory, muciferous, and urogenital systems. It was most desirable that such an examination should be made, as nothing was known of the soft anatomy of the *Dactylethridæ*.

Prof. Flower exhibited and made remarks on a photograph of a specimen of Rudolphi's Whale (*Balænoptera borealis*), taken in the Thames near Tilbury, on the 18th October last. The sex had been ascertained to be male.

A letter was read addressed to the Secretary by Dr. Emin Pasha, C.M.Z.S., dated Wadelai, April 15, 1887, referring to some collections sent to the British Museum, and offering some account of his observations on Natural History to the Society.

The following papers were read:—

1. A List of the Reptiles and Batrachians collected by Mr. H. H. Johnston on the Rio del Rey, Cameroons District, W. Africa. By G. A. Boulenger.

[Received June 30, 1887.]

1. Rhampholeon spectrum, Buchh.

2. Urobelus gabonicus, A. Dum.

3. Dipsadoboa unicolor, Gthr.

4. Cornufer johnstoni, sp. n.

Tongue with a conical papilla in the anterior part of the median line. Vomerine teeth in two slightly oblique series behind the line of the choanæ. Snout rounded, shorter than the diameter of the orbit; canthus rostralis obtuse; loreal region concave; nostril nearer the tip of the snout than the eye; interorbital space nearly as broad as the upper eyelid; tympanum half the diameter of the orbit. Digits terminating in triangular expansions, the diameter of which is a little more than half that of the tympanum ; first finger shorter than second ; toes with a slight rudiment of web ; subarticular tubercles rather feeble, oval ; a single, oval, flat, inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout. Skin granulate above and on the sides, smooth inferiorly ; scattered larger warts on the body. Grey-brown above, with dark brown spots on the head and body and cross bands on the limbs ; a broad, dark cross band between the eyes ; a dark brown streak from the nostril to the eye ; lower surfaces flesh-coloured.

From snout to vent 31 millim.

A single female specimen.

The discovery of a species of *Cornufer* in Africa is particularly interesting. Peters has, it is true, previously referred a West-African frog to this genus (*Petropedetes cameronensis*, Reich.) ; but on examination of the type specimens in the Berlin Museum I find that that species may best be referred to *Rana*, so far as I can judge without examining the pectoral arch. The toes are half-webbed and the web widely separates the outer metatarsals.

5. Bufo tuberosus, Gthr.

6. Bufo superciliaris, sp. n.

Crown without bony ridges ; sides of head nearly vertical ; snout very short ; upper eyelid with projecting angular edge, with a tendency towards developing a horn as in *B. ceratophrys*, Blgr. ; interorbital space flat, a little narrower than the upper eyelid ; tympanum small and very indistinct. First finger longer than second ; toes short, with a very short basal web ; subarticular tubercles simple ; two moderate metatarsal tubercles ; a tarsal fold. The tibio-tarsal articulation reaches the angle of the mouth. Upper parts smooth or with very small warts ; parotoids narrow and prominent, about as long as their distance from the nostril, tapering posteriorly to a point continuous with a dorso-lateral glandular ridge which is lost halfway down the side. Back and upper surface of head pale brownish, yellowish, or pink ; a dark, usually deep black, chevron-shaped marking between the eyes, pointing backwards ; sometimes one or two pairs of black spots on the back ; sometimes a very fine lighter vertebral line ; sides of head and body dark, grey or brown, forming a sharp contrast with the light colour of the upper parts ; the boundary between the two colours runs along the canthus rostralis, the edge of the upper eyelid, the parotoid, and the lateral fold ; limbs above grey or brown, with well-defined darker cross bands, which, on the foot, tarsus, inner side of tibia and front side of thigh, alternate with a whitish ground-colour ; hinder side of thighs, and sometimes also the flanks, bright crimson. Lower parts greyish, speckled with whitish ; lower jaw white-edged.

Many young specimens ; the largest measures 39 millim. from snout to vent.

2. Notes on three Species of Shells from the Rio del Rey, Cameroons. By Edgar A. Smith.

[Received June 30, 1887.]

The shells here remarked upon form part of zoological collections recently sent to this country by Mr. H. H. Johnston, H.B.M. Vice-Consul for the Cameroons.

Ennea (Ptychotrema) cyathostoma, Pfr.

This species has only been previously recorded from Old Calabar, somewhat to the north-west of the Rio del Rey. Specimens from the two localities offer no differences.

Melania frethii, Gray.

The series of specimens in the British Museum and those from the Rio del Rey show that this species varies considerably in form, colour, and sculpture. The typical form (Griffith's Anim. Kingd. vol. xii. pl. 14. fig. 2), from Fernando Po, appears to be identical with *M. nigritina*, Morelet, found at Gaboon and Calabar. *M. guineensis* of Reeve I also believe to be a smoother form of this species; for although stated by Reeve to be "destitute of any striated or shagreened sculpture," the surface is in fact minutely granosely striated, but much more finely than in the type of *M. frethii*. The *M. fœnaria* of Reeve is, as suggested by Brot, merely a light-coloured variety, the paleness in a great measure being due to the fact that the outer earthy deposit has been removed from the figured shell (Reeve, Conch. Icon. f. 134). The "zone of reddish rust" described by the author encircles the upper part of the whorls and is frequently visible within the aperture. None of the specimens sent by Mr. Johnston are full-grown, and some are very slender, but they all ageee in having three dark bands, clearly seen within the mouth, which would probably become less conspicuous when the shells arrived at maturity.

Neritina oweniana, Wood.

Nerita oweniana, Wood, Index Test. Suppl. p. 25, pl. 8. fig. 8.
Neritina oweniana, Martens, Conch.-Cab. ed. 2, pp. 75, 276, 278, pl. 9. figs. 14–17.

The only locality previously recorded for this species is the island of Fernando Po, which is situated practically in the same region as the Rio del Rey, being only some twenty or thirty miles from the mouth of that river.

This shell is usually described as reticulated with black; but among the specimens received from Mr. Johnston are a few which, although reticulated throughout, show distinct transverse dark and lighter zones. The colour of the enamel which overspreads the columellar region varies from an almost uniform reddish tint to slaty black. The operculum also is, in some instances, almost entirely of a fleshy red colour, which in other specimens is considerably replaced, especially on the columellar side, by bluish-black streaks. The form of the young shells is very different from that of the adult, the wing-like expansions at both ends being entirely wanting, so that they have a much rounder appearance.

3. On two small Collections of African Lepidoptera recently received from Mr. H. H. Johnston. By A. G. Butler, F.L.S., F.Z.S., &c.

[Received August 15, 1887.]

Dr. Sclater has recently submitted to me three boxes of Lepidoptera, chiefly Butterflies, forwarded by Mr. H. H. Johnston, F.Z.S., from the Cameroons and from the Rio del Rey to the west of these mountains. The first of these collections (consisting of thirteen Butterflies and three Moths) contains nothing of great interest, the best specimen being a Moth, possibly unnamed, of the genus *Soloe*, represented in the Museum collection by one specimen from Ashanti. The other species are:—*Mycalesis martius* and *mirium*, Fabr.; *Junonia terea*, Drury; *Aterica cupavia*, Cram.; *Romaleosoma ceres*, Fabr.; *Euralia anthedon*, Doubl., and *E. mima*, var., Trimen; *Terias senegalensis*, Boisd.; *Nepheronia argia*, Fabr.; *Aletis fascelis*, Linn., and its variety *A. macularia*, Fabr.: all well-known species.

The second collection, which was unset, is far better, and may be dealt with in detail.

Lepidoptera from Rio del Rey.

RHOPALOCERA.

1. Amauris hecate.

Danais hecate, Butler, P. Z. S. 1866, p. 44. n. 5.
Euplœa niavius, Hewitson, Gen. Diurn. Lep. pl. 11. fig. 3.

One good specimen.

2. Mycalesis asochis.

Mycalesis asochis, Hewitson, Ex. Butt. iii. *Myc.* pl. 7. figs. 46, 47 (1886).

A perfectly typical male.

3. Mycalesis martius.

Papilio martius, Fabricius, Ent. Syst. iii. 1, p. 219. n. 686 (1793).

One beautiful male.

4. Cymothoë uselda [1].

Harma uselda, Hewitson, Ex. Butt. iv. *Har.* pl. 4. figs. 13, 14 (1869).

5. Cymothoë theodota.

Harma theodota, Hewitson, Ex. Butt. iii. *Har.* pl. 1. figs. 3, 4 (1864).

6. Cymothoë fumana.

Harma fumana, Westwood, Gen. Diurn. Lep. p. 288. n. 3, note (1850).

One of each of the three above-named species was obtained, all more or less injured; the species of *Cymothoë* are probably strong-flying Butterflies, for they rarely come to hand in really good condition.

7. Aterica tadema.

Aterica tadema, Hewitson, Ex. Butt. iii. *Aterica* and *Harma*, figs. 10–12 (1866).

One pair obtained.

8. Aterica lysandra.

Papilio lysandra, Stoll, Suppl. Cram. pl. 29. figs. 3, 3 *c* (1790).

A good female was taken: the species rarely comes to hand.

9. Aterica gambiæ.

Euryphene gambiæ, Feisthamel, Ann. Soc. Ent. France, 1850, p. 251, pl. 9. fig. 2.

A male.

10. Aterica atossa.

♀. *Aterica atossa*, Hewitson, Ex. Butt. iii. *Eur.* pl. 3. figs. 1, 2 (1865).

♂. *Aterica amaxia*, Hewitson, *l. c. At.* and *Eur.* pl. 6. figs. 8, 9 (1866).

A single dwarfed female. In the Hewitson collection his *A. atossa* and *A. amaxia* stand near together in the same drawer; how he failed to see that they are sexes of one species, I cannot understand.

11. Euryphene phantasia, var.?

Euryphene phantasia, Hewitson, Ex. Butt. iii. *Eur.* pl. 2. figs. 9–11 (1865).

I am not quite sure that the single male obtained is not specifically distinct from Hewitson's insect; it has a white apical spot on the primaries, which is wholly wanting in the figure of the male from Old Calabar; moreover a specimen which we have from the Congo

[1] Males of this species stand in Hewitson's collection as a variety of *C. coccinata* and a female as that sex of *C. sanguris*, a second female from the same locality following it as type of *C. uselda*.

and one from Old Calabar, in addition to the absence of this spot, have the subapical ochreous band narrower than in the specimen before me; the only difficulty is that a female in the Museum from Old Calabar corresponds far better with the Cameroons type than with Hewitson's males, none of which differ strikingly from the Congo male. As it is hardly likely that the differences between the Old Calabar and Cameroons males can be constant, though well marked in the specimens in the Museum, I have regarded them as the result of individual variation.

12. EURYPHENE MARDANIA.

Papilio mardania, Fabricius, Ent. Syst. iii. 1, p. 249. n. 776 (1793).

A female of this common species.

13. EUPHÆDRA RUSPINA.

Romaleosoma ruspina, Hewitson, Ex. Butt. iii. *Rom.* pl. 2. figs. 6, 7 (1865).

One male in good condition.

14. EUPHÆDRA XYPETE.

Romaleosoma xypete, Hewitson, Ex. Butt. iii. *Rom.* pl. 2. figs. 8–10 (1865).

15. EUPHÆDRA JOHNSTONI, sp. n.

♂. Allied to *E. losinga* and *luperca*; nearest to the former, from which it differs as follows: primaries above with the costa, two large spots in the cell, and the apical half black, external angle suffused with purple; oblique ochreous subapical belt longer and broader; secondaries with a broad external belt of purple, from subcostal vein almost to anal angle, enclosing four large oval dark copper-brown spots: all the wings below with subapical white band, that of primaries representing the ochreous band of the upper surface, that of secondaries more transverse and tapering to below the third median branch; three black spots placed in the form of a triangle, and a terminal transverse black dash in all the discoidal cells. Expanse of wings 90 millim.

One male.

I have been unable to find a description of this very handsome species, which I have therefore been obliged to name.

16. EUPHÆDRA CERES.

Papilio ceres, Fabricius, Syst. Ent. p. 504. n. 257 (1775).

This abundant species is rarely absent from any West-African collection.

17. CRENIS OCCIDENTALIUM.

Crenis occidentalium, Mabille, Bull. Soc. Zool. de France, vol. i. p. 275 (1876).

Crenis vadimonis, Druce, Ent. Month. Mag. xiv. p. 226 (1878).
Crenis ribbei, Dewitz, Nova Acta Acad. Leop.-Carol. 1879, pl. xxvi. fig. 3.

The above is the correct synonymy of this species; and it is a singular thing that this Butterfly, which had long stood in collections as a variety of the Natal insect, should have suddenly been taken up and described in three consecutive years.

18. Catuna crithea.

Papilio crithea, Drury, Ill. Exot. Ent. ii. pl. 16. figs. 5, 6 (1773).

19. Neptis agatha.

Papilio agatha, Cramer, Pap. Exot. iv. pl. 327. A, B (1782).

20. Atella columbina.

Papilio columbina, Fabricius, Ent. Syst. iii. 1, p. 148. n. 453 (1793).

21. Ergolis enotrea.

Papilio enotrea, Cramer, Pap. Exot. iv. pl. 236. A, B (1782).

22. Junonia sophia, var.

Papilio sophia, Fabricius, Ent. Syst. iii. 1. p. 248. n. 771 (1793).

A rather pale and large speeimen.

23. Junonia ethyra.

Salamis ethyra, Feisthamel, Ann. Soc. Ent. France, 1850, p. 250.

24. Kallima rumia.

Kallima rumia, Westwood and Hewitson, Gen. Diurn. Lep. p. 325. n. 5, pl. 52. fig. 2 (1850).

25. Charaxes cynthia.

Charaxes cynthia, Butler, P. Z. S. 1865, p. 626. n. 12, pl. 36. fig. 3.

A fine male of this handsome species was obtained. It appears still to be a rare insect, at any rate I never see it in African collections sent to the Museum to be selected from.

26. Charaxes imperialis.

♂. *Charaxes imperialis*, Butler, Trans. Ent. Soc. 1874, p. 531, pl. xi. fig. 3.

The female of this splendid Butterfly, unfortunately a little damaged, is in the collection. It differs from the male in its greatly superior size; the blue band of primaries reduced to a short externally excavated bar, terminating above in a white spot, above this are two parallel bent series of four and six white spots respectively, and the white spot in the cell is enlarged; in the secondaries the blue band differs chiefly in being greener, excavated or arched in front and ending in two white spots; the white spot of the male is much enlarged and quadrate, and the submarginal and marginal markings are larger and buff-coloured instead of blue.

27. TELCHINIA SERENA.

Papilio serena, Fabricius, Syst. Ent. p. 461. n. 76 (1775).

One male of this common species.

28. ABISARA TANTALUS.

Sospita tantalus, Hewitson, Ex. Butt. ii. *Sosp.* pl. 1. fig. 1 (1861).

29. LYCÆNESTHES LARYDAS.

Papilio larydas, Cramer, Pap. Exot. iii. pl. 282. H (1782).

This and the other species of *Lycænesthes* in the collection were all represented by males only; females of this genus seem to be rare.

30. LYCÆNESTHES LIGURES.

Lycænesthes ligures, Hewitson, Trans. Ent. Soc. 1874, p. 349.

31. LYCÆNESTHES DOCILIS, sp. n.

♂. Above dark slaty blue, brownish towards the outer margins of the wings; fringes grey-brown, with darker subbasal line and white tips; costal and abdominal borders of secondaries brown: body blackish: under surface dove-grey, with the markings indicated only by their white edges, very similar in their general arrangement to those of *L. ligures*, excepting that an additional irregular macular band runs from the costa across the middle of the discoidal cell in all the wings; the ocelli of the secondaries are also reduced to small distinct black spots, without any orange iris or metallic blue sealing; venter white. Expanse of wings 32 millim.

One male only of this very distinct species was obtained.

32. AZANUS OCCIDENTALIS, sp. n.

♂. Nearest to *A. gamra*, chiefly differing on the upper surface in the absence of the black anal spots of the secondaries; below, the primaries differ in the darker colouring of all the markings, in having a round white-bordered blackish spot in the cell and an oblique grey dash nearer to the base below the cell, the subapical oblique band more oblique, and the submarginal white line beyond it widened to a band; secondaries chalky white, all the markings sharply defined, but without white borders, the markings beyond and below the cell black and composed of distinct spots like the others; anal ocelli small. Expanse of wings 26 millim.

One male only. We have it also from Sierra Leone, and in the Hewitson cabinet it stands as the *A. moriqua* of Wallengren, which is a totally distinct species, found commonly at Natal. *A. gamra* is the common species of Beirût.

33. Allotinus zymna, var.?

Pentila zymna, Hewitson, Gen. Diurn. Lep. pl. 76. fig. 7 (1852).

One example with very narrow border to the secondaries and slightly browner under surface. As it is possible that these may only be individual differences, I have not ventured to consider the specimen distinct.

34. Neopithecops elorea.

Papilio elorea, Fabricius, Ent. Syst. iii. 1, p. 194. n. 603 (1793).

35. Iolaus faunus.

Papilio faunus, Drury, Ill. Exot. Ent. ii. pl. 1. figs. 4, 5 (1773).

36. Tatura lebena.

Thecla lebena, Hewitson, Descr. Lyc. p. 9. n. 21 (1868); Ill. Diurn. Lep. p. 127. n. 202, pl. 51. figs. 266–7 (1869).

37. Mylothris chloris.

Papilio chloris, Fabricius, Syst. Ent. p. 473. n. 129 (1775).

One pair.

38. Mylothris asphodelus, sp. n.

♂. White; primaries above with the basal fourth gamboge-yellow; base of costa greyish, a broad apical black border, tapering on costal margin, interrupted so as to form a separate spot at the end of second median branch and followed by a black dot at the end of first median branch; secondaries with six marginal black spots: body greyish, quite normal. Under surface white, slightly pearly: all the wings with rather large black spots on the outer margin; primaries with the basal yellow patch more restricted and rather more golden than above, the apical area tinted with sulphur-yellow; base of secondaries bright yellow towards costa: body below white, legs with a black longitudinal stripe; a black spot on each side of the anal valves. Expanse of wings 57 millim.

One male only; it mimics *Phrissura sylvia*.

39. Terias senegalensis.

Eurema senegalensis, Hübner, Zutr. exot. Schmett. figs. 969, 970 (1837).

A female specimen.

40. Terias boisduvaliana.

Terias boisduvaliana, Mabille, in Grandid. Hist. Madag. ii. Atlas, i. pl. 32. figs. 4, 5 (1885).

A dwarfed male.

41. Catopsilia hyblæa.

Callidryas hyblæa, Boisduval, Sp. Gén. Lép. i. p. 612. n. 7 (1836).

A female.

42. PHRISSURA SYLVIA [1].

Papilio sylvia, Fabricius, Syst. Ent. p. 470. n. 115 (1775).

One male specimen was obtained.

43. PAPILIO SIMILIS.

Papilio similis, Cramer, Pap. Exot. i. pl. 9. B, C (1779).

44. PAPILIO UCALEGON.

Papilio ucalegon, Hewitson, Exot. Butt. iii. *Pap.* pl. 7. fig. 19 (1865).

45. PAPILIO POLICENES.

Papilio policenes, Cramer, Pap. Exot. i. pl. 37. A, B (1779).

46. PAPILIO ERINUS.

Papilio erinus, Gray, Cat. Lep. Ins. Brit. Mus. i. p. 35, n. 127 (1865).

47. PAPILIO HESPERUS.

Papilio hesperus, Westwood, Arc. Ent. i. pl. 48 (1843).

Two fine male specimens of this magnificent species.

48. PAPILIO CYPRÆAFILA.

Papilio cypræafila, Butler, Ent. Month. Mag. v. p. 60 (1868).

49. HESPERIA FORESTAN.

Papilio forestan, Cramer, Pap. Exot. iv. pl. 391. E, F (1782).

50. HESPERIA BIXÆ.

Papilio bixæ, Linneus, Mus. Lud. Ulr. p. 335 (1764).

51. ASTICTOPTERUS JOHNSTONII, sp. n.

Dark chocolate-brown; primaries crossed obliquely near apex by a semitransparent amber-yellow belt from costa to just below second median branch near outer margin, the inner edge of the band almost straight, the outer edge arched, so that it forms almost a half-moon shape; costa of secondaries pale; sides of palpi, front edge of collar, and under surface of tarsi orange; primaries below with pale brown internal border. Expanse of wings 57 millim.

Not nearly allied to any known species.

52. THANAOS WESTERMANNI.

Hesperia westermanni, Latreille, Enc. Méth. ix. p. 791. n. 167 (1823).

53. TAGIADES FLESUS.

Papilio flesus, Fabricius, Spec. Ins. ii. p. 135. n. 621 (1781).

[1] I find that the species of this group belong to *Phrissura*, which will now contain *P. phaola*, *P. sylvia*, *P. eudoxia*, *P. coniata*, *P. polisma*, and *P. illana*.

54. Tagiades brigida, var.

Antigonus brigida, Plötz, Stett. ent. Zeit. 1879, p. 361. n. 32.

But for the fact that the type of this species was from the Cameroons, coupled with the remark "Diese Art sieht *Trichoneura*, Feld., ähnlich," I should certainly have failed to identify it; the description, "Hind wings above with broad straw- or orange-yellow borders," hardly represents an insect in which more than half the hind wing is bright orange; nor does the statement that there are "six hyaline white points" in the front wings answer to a specimen with ten. However, I am unwilling to risk describing as new a species which may be subject to variation and therefore already described as above, or which may have been incorrectly described.

55. Ceratrichia argyrosticta?

Apaustus argyrosticta, Plötz, Stett. ent. Zeit. 1879, p. 358. n. 22.

One example so nearly approaching the description of the above that I think it can hardly be distinct.

HETEROCERA.

56. Pseudopontia paradoxa.

Globiceps paradoxa, Felder, Pet. Nouv. Ent. n. 8 (1869).

Gonophlebia paradoxa, Felder, *l. c.* n. 24, p. 95, fig. (1870).

Pseudopontia calabarica, Plötz, Stett. ent. Zeit. 1870, p. 348, pl. 2. figs. 1 *a–f*.

I cannot understand why this insect has been referred to the Butterflies; the structure of the antennæ and the neuration are altogether peculiar. In my opinion the genus is more nearly related to the Chalcosiid moths.

57. Otroeda occidentis.

Otroeda occidentis, Walker, Cat. Lep. Het. ii. p. 403. n. 2 (1854).

One male example.

58. Chrysopoloma rudis.

Lasiocampa rudis, Walker, Cat. Lep. Het. Suppl. ii. p. 561 (1865).

59. Pitthea continua.

Pitthea continua, Walker, Cat. Lep. Het. ii. p. 463. n. 1 (1854).

60. Cyligramma latona.

Phalæna-Noctua latona, Cramer, Pap. Exot. i. p. 20, pl. 13. B (1779).

61. Azazia rubricans.

Ophiusa rubricans, Boisduval, Faune, Lép. Madag. p. 106. n. 11, pl. 16. fig. 1.

4. On the Genus *Myosorex*, with Description of a new Species from the Rio del Rey (Cameroons) District. By G. E. Dobson, M.A., F.R.S.

[Received November 8, 1887.]

The genus *Myosorex*[1] was founded in 1837 by Dr. J. E. Gray for the reception of a small species of white-toothed Shrew, *Sorex varius*, Smuts, from the Cape Colony; which was then at once distinguished from all other known species of white-toothed Shrews by the short, subequal, and rather coarse hairs covering the tail. Trivial as this character may appear, and as such it has evidently been hitherto regarded by systematic zoologists, it is, however, the only one out of the many enumerated in the original definition of this genus (see footnote below) which is really characteristic of it taken in connection with the white colour of the teeth.

Myosorex.

Myosorex, Gray, Proc. Zool. Soc. 1837, p. 124.

General characters those of *Crocidura*, but distinguished by the absence of long hairs on the tail, which is clothed with short fur of equal or subequal length, by the shortness of the third upper incisor, and by the absence of a distinct cloaca, the generative organs and the alimentary canal opening on the surface close together by distinct orifices.

Dentition : $\frac{\text{Inc. } 3-3,\ \text{pm. } 3-3,\ \text{m. } 3-3}{\text{Mand. } 6-6 \text{ or } 7-7}=30$ or 32 teeth.

Range. Africa south of the Sahara Desert.

1. Myosorex varius.

Sorex varius, Smuts, Mamm. Capens. 1832, p. 8.

Myosorex varius, Gray, Proc. Zool. Soc. 1837, p. 124.

This, the largest species of the genus, is somewhat larger than *Crocidura aranea*. The body is clothed with dense fur, pale reddish grey on the surface, passing gradually into ashy beneath, the basal four-fifths of the hairs bluish; tail clothed thinly with equal-sized reddish-grey hairs forming a small pencil at the tip. The lateral gland is well developed in males, rudimentary or absent in females, and situated close behind the arm.

The teeth are very peculiar and characteristic. The upper incisors and premolars are provided with prominent basal processes, the third

[1] "Myosorex, Gray. Head elongate, ears hid under the soft fur; tail elongate, slender, covered with short, rigid, close-pressed hairs, when old quadrangular; feet and toes not ciliated; teeth white; cutting-teeth $\frac{8}{6}$, two upper central unequally bifid, the second lateral moderate, the third very small, rudimentary, the fourth small but larger than the third; front lower cutting-teeth elongate, with an entire sharp upper edge; second and third lateral teeth small, simple, crowded on the base of the front ones."—Gray, P. Z. S. 1837, p. 124.

incisor is much smaller than the anterior maxillary tooth, and the penultimate premolar is minute, quite invisible from without, and placed in the small angle between the adjoining teeth. The most remarkable peculiarity, however, is found in the mandible, where (as first pointed out by me in the Journ. Anat. Phys. xx. p. 359, 1886) a minute tooth exists on each side between the second and third teeth, so that the number of mandibular teeth is fourteen instead of twelve, as we find in all other known species of *Soricidæ*.

(For measurements see table p. 578.)

Hab. South Africa (Namaqua-Land, Cape Colony, Natal).

2. Myosorex morio.

Crocidura morio, Gray, Proc. Zool. Soc. 1862, p. 180[1].

Smaller than *Myosorex varius* and about the size of a large specimen of *Crocidura aranea*, but distinguished at once, not only from all species of the genus, but also from all known species of *Soricidæ*, by the comparatively enormous size of the lateral gland[2], which, in the male, occupies a circular space having a diameter of 9 millimetres, larger than the space occupied by the same gland in the Great Indian Musk-Shrew (*Crocidura cærulescens*), and by the nakedness of the sides and abdomen below and behind these glands. Ears moderate, clothed with very short hairs; manus and pes covered with short hairs. Fur dark reddish brown above, and slightly paler beneath.

The first upper incisor is long, the anterior cusp much longer than the posterior, which, however, is well developed; the third incisor is shorter than the anterior maxillary tooth; but the greatest peculiarity exists in the comparatively large size of the penultimate premolar, which, viewed externally, though not half the size of the anterior maxillary tooth, stands quite in the tooth-row, and its cusp equals or slightly exceeds (in specimens in which it is not worn) the anterior basal cusp of the last premolar. The last upper molar is like that of *Myosorex varius*, larger than in the species of the genus *Crocidura*, its posterior part being as well developed as the corresponding tooth in that species. The first mandibular tooth has two very distinct notches as in *Myosorex varius*; the second tooth is unicuspidate and has this peculiarity that, instead of being placed almost altogether on the first tooth, its base very slightly overlies it;

[1] "Uniform rather brownish black, rather paler and browner beneath. Teeth white. Feet very slender, weak. Tail nearly as long as the body and head, very slender, annulated, covered with very short closely adpressed hair.

"Length of body and head, dry, $2\frac{3}{4}$ inches; tail, dry, 2 inches."—Gray, *l. c.*

It may be seen that it would be impossible from this description alone to identify not merely the species but even the genus, nevertheless, as the type, a skin, corresponds in all respects to the well-preserved specimen in alcohol from which I have taken my description of this species, I retain Dr. Gray's specific title.

[2] Having shown the glands in this species to Mr. G. A. Boulenger, he remarked that an integumentary gland occupies a corresponding position on each side of the body in several species of the genus *Paludicola* (Batrachia); of very large size in some species (*P. bufonium*, Bell, e. g.), in others of the same genus it is so small as to render it very difficult to say whether a gland exists or not.

the third tooth has not the prominent anterior and posterior cusps so well developed in *M. varius*. There is no minute tooth between the second and third mandibular teeth.

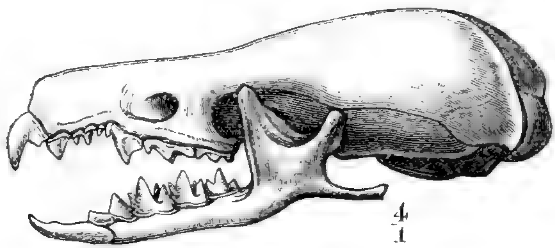
(For measurements see table p. 578.)

Hab. Cameroon District, West Africa.

The type, a skin with skull, was collected by Captain R. Burton, and is preserved in the British Museum (Natural History); a second specimen, a well-preserved example of an adult male, in alcohol, has formed the basis of the above description, and has furnished the measurements given in the table at p. 578.

3. Myosorex johnstoni, n. sp.

Very slightly larger than *Crocidura etrusca*, and therefore almost the smallest mammal known. The tail is even shorter than in that species, shorter than the body without the head, and clothed characteristically with short, even-sized hairs. The ears are moderate and clothed with very short hairs. Both the manus and pes are moderate in size, with short claws, and covered with thinly-spread short fur. As in *M. morio* there is a very large lateral gland in the male, but as no female specimen has yet been obtained, its condition in that sex is unknown. So far as can be ascertained from the inspection of a single male specimen preserved in alcohol the colour of the fur is dark brown above, slightly paler beneath.



Skull of *Myosorex johnstoni.*

Although the animal is but slightly larger than *C. etrusca* in general measurements, yet its skull is considerably larger in all dimensions. The teeth agree with those of the other two species in the reduced size of the third upper incisor (see woodcut above), but correspond most closely with those of *M. morio* from the same part of Africa in their general form and in the position of the penultimate premolar, which stands in the tooth-row and is not minute as in *M. varius*. The anterior mandibular tooth has two notches, as in the other species, for the posterior basal cusp of the first upper incisor and for the cusp of the second incisor. There is no rudimentary tooth (such as I have described in *M. varius*) between the second and third mandibular teeth.

(For measurements see table p. 578.)

The type, a full-grown male specimen, well preserved in alcohol, was obtained by H. H. Johnston, Esq., H.M. Vice-Consul for the

Cameroons, and I have much pleasure in connecting with its specific title the name of that distinguished traveller.

Hab. Cameroon District, West Africa (Rio del Rey).

The following table exhibits the measurements, in millimetres, of adult male specimens (preserved in alcohol) of the three above described species; in the first column are those of *Myosorex varius*, in the second *M. morio*, and in the third *M. johnstoni*.

	1.	2.	3.
Tip of nose to vent	76	64	39
Vent to tip of tail	41	55	25
Eye to tip of nostril	12½	12	9
Elbow to end of middle digit (without claw)	21	18½	11½
Manus (without claw)	9	8	5
Pes (without claw)	13½	13½	9
Skull, occipital crest to front edge of premaxilla	19	16½	13
Skull, foramen magnum to front edge of premaxilla	19	16½	12
Greatest width of the skull	11	9½	7
Length of upper tooth-row	9½	8	6½
Distance between tips of principal cusps of first upper incisor and last premolar	4½	4½	3½
Length of mandible from condyle to tip of first tooth	14½	13	9½

A synopsis of the species may be given as follows, from the descriptions above:—

A. Mandibular teeth 7—7.
- *a.* Penultimate upper premolar minute, internal; elbow to end of middle digit 21 mm. .... 1. *M. varius.*

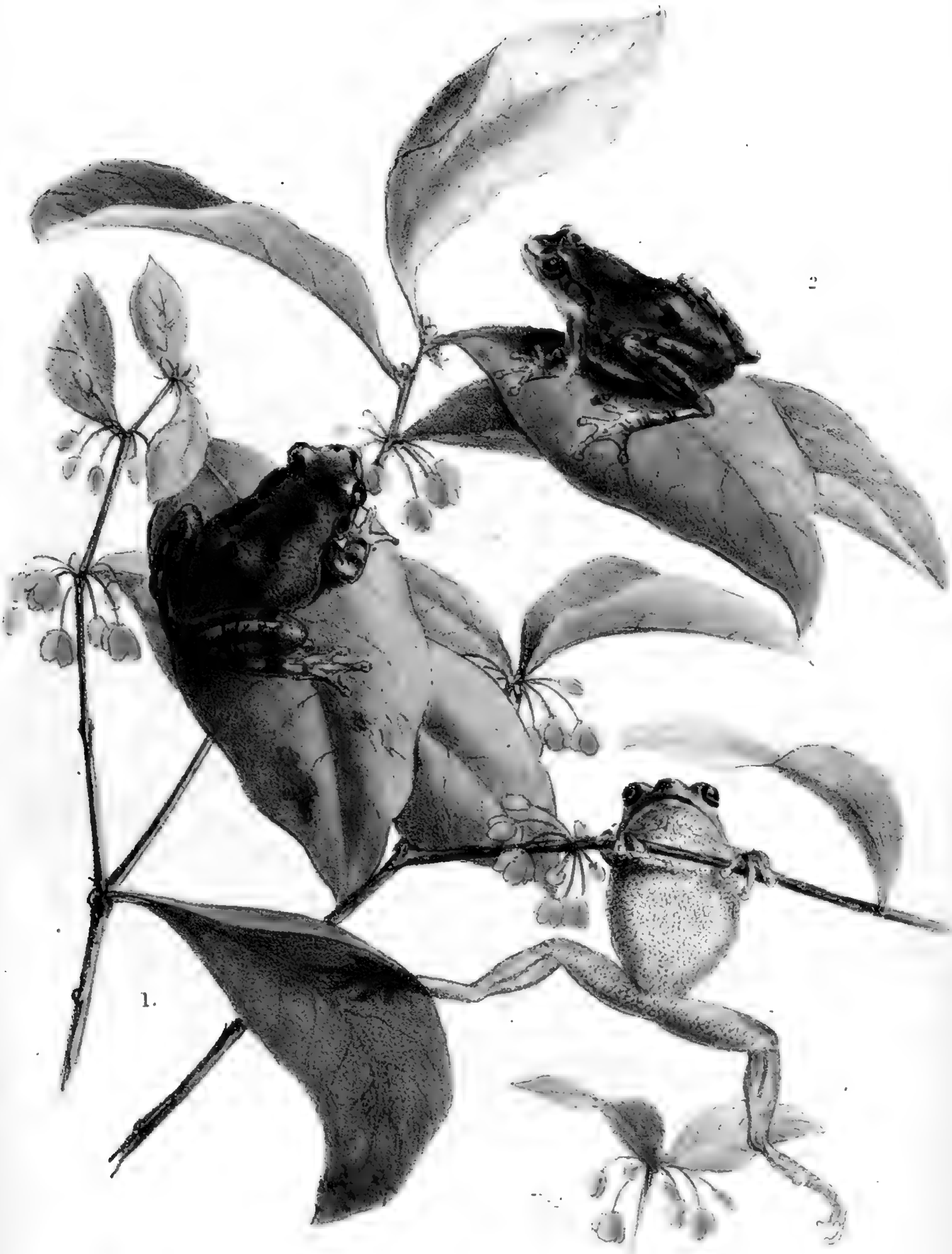
B. Mandibular teeth 6—6.
- *b.* Penultimate upper premolar not minute, standing in the tooth-row.
  - *b'.* Elbow to end of middle digit 18½ mm. .... 2. *M. morio.*
  - *c'.* Elbow to end of middle digit 11½ mm. .... 3 *M. johnstoni.*

5. On a new Species of *Hyla* from Port Hamilton, Corea, based on an example living in the Society's Gardens. By G. A. Boulenger, F.Z.S.

[Received July 2, 1887.]

(Plate LI.)

Two Tree-Frogs of the genus *Hyla*, obtained by Mr. George Stephen, of H.M.S. 'Champion,' at Port Hamilton, a small island between the Corean Peninsula and Japan, have been presented by him to the Society. They prove of great interest, as one belongs to a little-known race of *Hyla arborea*, viz. the var. *japonica* (Plate LI. fig. 2); and the other to a new species, which I propose to call, in honour of its discoverer.



Peter Smit del. et lith.

Mintern Bros.

1. HYLA STEPHENI.
2. HYLA ARBOREA, VAR. JAPONICA.

HYLA STEPHENI. (Plate LI. fig. 1.)

Near *H. arborea.* Tongue subcircular, slightly nicked, and free behind. Vomerine teeth in two slightly oblique series between the choanæ. Head a little larger than that of *H. arborea,* broader than long; snout rounded, shorter than the diameter of the orbit; canthus rostralis distinct; loreal region slightly concave; interorbital space as broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers with a short web at the base; no projecting rudiment of pollex; toes hardly two-thirds webbed; disks a little smaller than the tympanum; subarticular tubercles moderate; inner metatarsal tubercle large and very prominent, oval, about two-thirds the length of the inner toe; a fold along the inner edge of the tarsus. The tibio-tarsal articulation reaches the tympanum. Tibia not half the length of the head and body. Skin smooth above; lower surfaces, throat of male included, granular. Colour varying from greyish or brownish to green, with darker, blackish-edged permanent symmetrical insuliform spots on the body and cross bands on the limbs; a dark brown streak from nostril to eye; lower parts whitish, lower belly and limbs carneous; sides of thighs carneous. Iris dark bronzy brown. Male with an external subgular vocal sac.

From snout to vent 35 millim.

EXPLANATION OF PLATE LI.

Fig. 1. *Hyla stepheni.* Upper and lower view.
2. *Hyla arborea,* var. *japonica.*

December 6, 1887.

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

Mr. Howard Saunders, F.Z.S., exhibited, on behalf of the Rev. H. A. Macpherson, a specimen of *Saxicola isabellina,* shot on Nov. 11 near Allonby, in Cumberland, being the first recorded occurrence of this species in Great Britain or Western Europe.

Prof. Bell exhibited the integumentary glands of a Rocky-Mountain Goat (*Haplocerus montanus*), which had been taken from either side of the middle line just behind the horns. The glands having, unfortunately, been dried, no information could be given as to their structure, but it was thought advisable to put their presence and position on record.

The following papers were read:—

1. Brief Notes on the Fauna of Corea and the adjoining coast of Manchuria. By Henry H. Giglioli, C.M.Z.S., and Thomas Salvadori, C.M.Z.S.

[Received August 16, 1887.]

(Plate LII.)

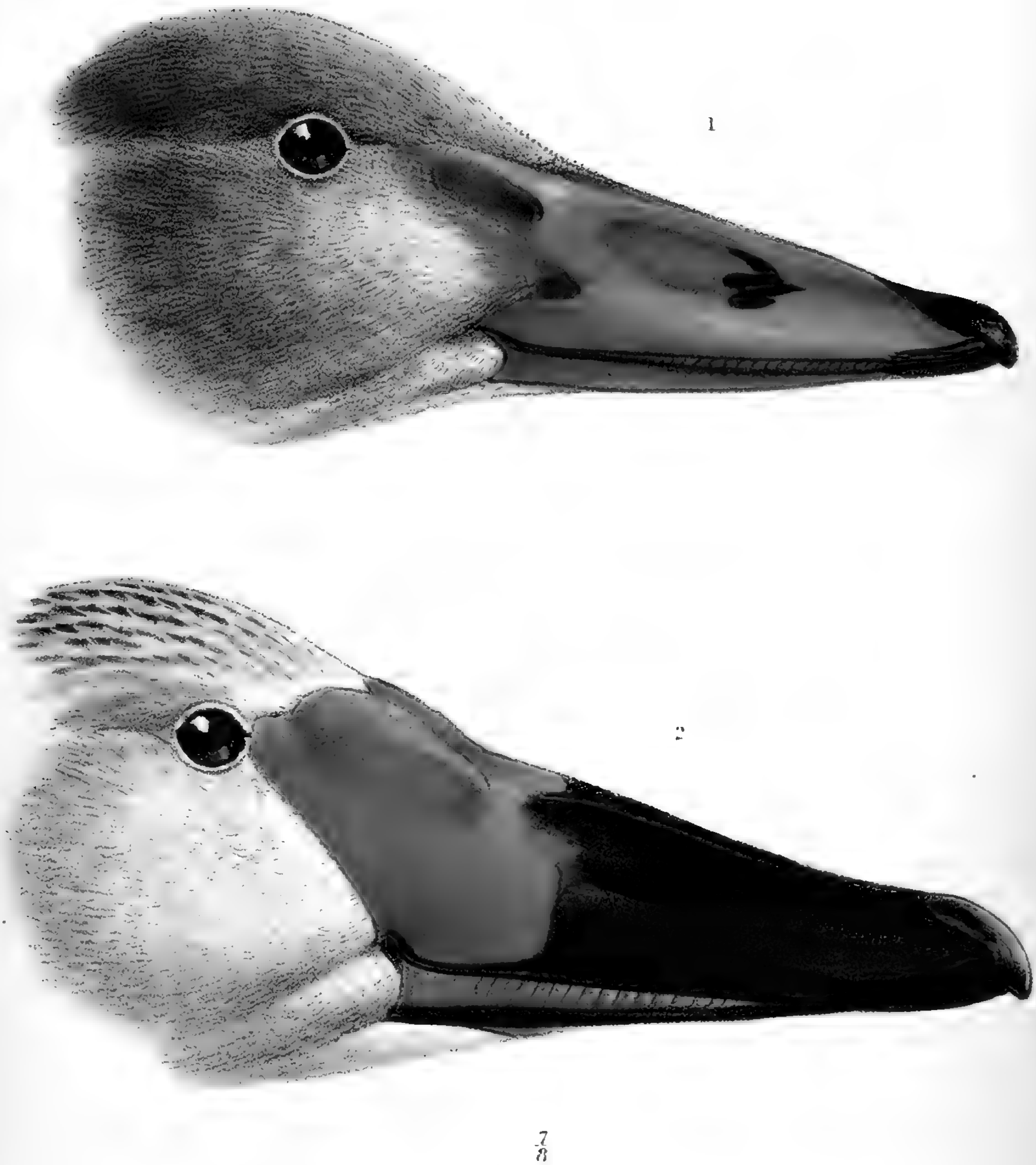
The specimens which are the subject of the following "Notes" form part of a large collection, principally of Vertebrates, made by order of H.R.H. Prince Thomas of Savoy, Duke of Genoa, whilst he was in command of the 'Vettor Pisani,' on a voyage round the World, 1878–81; the entire collection is now deposited in the Royal Zoological Museum at Florence.

Corea, or Chō-sen as the Japanese have it, is yet very much a "terra incognita," and more especially so as regards its fauna. The Italian corvette 'Vettor Pisani' visited only three localities on the eastern sea-board of Corea—Fusan to the south, from the 1st to the 7th of August, 1880; Port Lazareff in Broughton's Bay, on August the 9th, staying three days; and Gensan, between the 15th and the 18th of the same month. Fusan was again visited in February 1881.

Three very interesting localities on the adjoining coast of Manchuria were also visited and collections made; these localities were:—Possiette Bay, called also Port Bruce, on the border between Corea and Manchuria; Vladivostok, slightly further to the north, near the Albert peninsula; and Olga Bay, still more northwards. At Olga Bay the 'Vettor Pisani' remained from the 24th of August to the 22nd of September, 1879; at Vladivostok from the 23rd of September to the 11th of October following; and at Possiette Bay between the 12th and the 25th of October the same year. It was in this locality that the most important zoological capture was made, viz. that of two specimens of the scarcely known *Cygnus davidi*. The collections made at the above-named localities consist of:—1 Mammal; 96 Birds, belonging to 47 species; 7 Reptiles, representing 3 species; 2 Amphibia, 1 species; and 7 Fishes, belonging to 4 species.

A glance at the species in the five classes of Vertebrata shows with undeniable evidence the very close affinity existing between the Corean and the Japanese faunas, a coincidence which was fully to be expected. Two years ago, Canon Tristram described a small collection of birds made in Corea by Lieut. G. Gunn, R.N.[1]; there were eight specimens of eight well-known species, but, as our learned friend observes, "as absolutely nothing is known of the avifauna of Korea, I have thought it might not be without interest to give a list of what Lieut. Gunn has procured." It is worth remarking that only one of the eight species in that list is represented in the collection made by the 'Vettor Pisani,' and that is *Larus*

[1] H. B. Tristram, "On a small Collection of Birds from Korea," in 'Ibis' 1885, p. 194.



J. G. Keulemans del. et lith.

Mintern Bros. imp.

1. CYGNUS DAVIDI.
2. CYGNUS BEWICKII.

crassirostris! The seven remaining are:—*Asio otus, Scops stictonotus, Caprimulgus jotaka, Cecropis japonica, Nemoricola indica, Hæmatopus osculans,* and *Totanus glottis.*

It may be well to note that David and Oustalet, in their well-known 'Oiseaux de la Chine,' mention a few species as also from Corea; and Dr. O. Finsch, in a paper which bears the title 'Ueber eine Vogelsammlung aus den Küstenländern der chinesisch-japanischen Meere" (Verh. k.-k. zool.-bot. Gesell. Wien, xxii. pp. 253–272), mentions the three following species from Corea:—*Scops japonicus, Anthus pratensis,* and *Phalaropus cinereus.*

We have therefore good reason to believe that the following "Notes" will not prove devoid of interest.

MAMMALIA.

1. CROCIDURA LASIURA, Dobson.

a. ♀. Fusan, August 5th, 1880.

A young specimen with teeth partially descended. It was kindly determined for us by Mr. Dobson, to whom it was sent.

The type of this species, also from Corea, is in the Imperial Zoological Museum at St. Petersburg.

AVES.

1. ACCIPITER NISOIDES, Blyth.

Accipiter nisoides, Blyth, J. A. S. B. xvi. p. 727 (1847), Malacca.

Astur (Nisus) gularis, Temm. et Schl. Faun. Jap., Aves, p. 5, tab. 2 (1850).

Accipiter stevensoni, Gurn. Ibis, 1863, p. 447, pl. 11 (China).

Accipiter virgatus, partim, Sharpe, Cat. Birds B. M. i. p. 151 (1873); David et Oust. Ois. Chine, p. 26 (1877).

a. Olga Bay, September 1879.

Mr. Gurney, who has kindly examined this specimen for us, thinks it is a young female of the above-named species.

2. ASIO ACCIPITRINUS (Pall.).

Asio accipitrinus, Sharpe, Cat. Birds B. M. ii. p. 234 (1875).

Otus brachyotus, David et Oust. Ois. Chine, p. 41 (1877).

a. Vladivostok, October 1879.

b. Possiette Bay, October 1879.

Both specimens are rather dark in the ground-colour of the underparts.

3. ALCEDO BENGALENSIS, Gm.

Alcedo bengalensis, Sharpe, Monogr. Alced. pl. 2 (1868); David et Oust. Ois. Chine, p. 74 (1877).

a, b. Olga Bay, September 1879.

c, d, e, f. Gensan, 16th August, 1880.

The Corean specimens are young birds with exceedingly short bills.

4. Lanius bucephalus, Temm. & Schleg.

Lanius bucephalus, Temm. et Schleg. Faun. Japon., Aves, tab. 14 (1850); David et Oust. Ois. Chine, p. 98 (1877); Gadow, Cat. Birds B. M. viii. p. 270 (1883).

a. Olga Bay, September 1879.

This unique specimen is apparently referable to this species, although it differs from six Japanese specimens, with which it has been compared, in the more reddish colour of the pileum and cervix, and in having the flanks decidedly of a deeper chestnut, and the back also tinged with reddish chestnut. The lores and periotic region are black; the breast is marked with narrow dark crescentic bands.

5. Ianthia cyanura (Pall.).

Ianthia cyanura, David et Oust. Ois. Chine, p. 231 (1877).

Tarsiger cyanurus, Sharpe, Cat. Birds B. M. iv. p. 255 (1879).

a. ♂ ? Olga Bay, September 1879.

A single specimen in the garb of the adult male, viz. with all the upper parts of a deep blue.

6. Monticola solitarius (P. L. S. Müll.).

Monticola solitaria, David et Oust. Ois. Chine, p. 166 (1877); Seebohm, Cat. Birds B. M. v. p. 319 (1881).

a. ♂. Olga Bay, September 1879.

A perfectly adult bird.

7. Calobates melanope (Pall.).

Calobates melanope, David et Oust. Ois. Chine, p. 302 (1877).

Motacilla melanope, part., Sharpe, Cat. Birds B. M. x. p. 497 (1885).

a, *b*, *c*. Olga Bay, September 1879.

Underparts very yellow, hardly any trace of fulvous on the breast. The specimens appear to be fully adult and, of course, belong to the eastern race, which only differs from western specimens in being slightly smaller and in having a rather shorter tail. Such differences are, however, said not to be constant; and we must further remark that our specimens are moulting.

8. Emberiza castaneiceps, Moore.

Emberiza castaneiceps, Moore, P. Z. S. 1855, p. 215 (Kintang, China); Horsf. & Moore, Cat. B. Mus. E. I. Comp. ii. p. 484 (1856); ? Swinh. P. Z. S. 1871, p. 389 (Peking).

Emberiza rustica, Swinh. (nec Pall.), Ibis, 1861, p. 255 (Talien Bay, N. China); id. ibid. 1863, p. 87 (= *cioides*, Swinh. nec Brandt).

Emberiza cioides, Swinh. (nec Brandt neque Temm. et Schleg.), Ibis, 1861, pp. 409, 410 (Amoy); ? id. Ibis, 1863, p. 378 (Formosa); id. P. Z. S. 1870, p. 436; David et Oust. Ois. Chine, p. 328 (partim, 1872).

Emberiza ciopsis, Swinh. (nec Bp.) P. Z. S. 1863, p. 300 (South China); id. ibid. 1871, p. 388.

Emberiza gigliolii, Swinh. Ibis, 1867, p. 393 (Amoy in winter).

Emberiza cioides, subsp. *gigliolii*, Seebohm, Ibis, 1879, p. 38 (China).

Two specimens.

a. ♂ ? Fusan (Corea), 5th August, 1880.

b. ♀ ? Fusan, 3rd August, 1880.

The second specimen is a young bird, the first an adult with feathers much worn; the latter compared with two fine specimens of *E. cioides*, Brandt, from Krasnoyarsk (Central Siberia), differs in its notably smaller dimensions and also in having the chestnut band across the chest less distinct. Mr. Seebohm, who has (*l. c.*) clearly indicated the difference in size of the two forms, writes to us that the type of *Emberiza castaneiceps*, Moore, in the British Museum, is identical with the type of *E. gigliolii*, Swinh., in his own collection.

9. Emberiza fuscata, Pall.

Emberiza fuscata, Pall. Itin. iii. App. 698. no. 22 (1776); id. Zoogr. Rosso-As. tab. xlvi. (1811).

Emberiza fucata (sic), Pall. Zoogr. Rosso-As. ii. p. 41 (1811); Temm. et Schleg. Faun. Jap., Aves, p. 96, tab. 57 (1850); David et Oust. Ois. Chine, p. 325 (1877).

a. ♂ ? Fusan, August 2nd, 1880.

b. ♂ ? Fusan, August 4th, 1880.

Both are perfectly adult birds. Evidently the specific name must be spelt *fuscata*, as it was originally written by Pallas; and not *fucata*, which is a misprint and a word devoid of sense.

10. Corvus japonensis, Bp.

Corvus macrorhynchus, Schleg. (nec Wagl.), Faun. Jap., Aves, p. 79, tab. 39 B (1850).

Corone japonensis, Sharpe, Cat. Birds B. M. iii. p. 41 (1877).

a. Olga Bay, September 1879.

Our specimen is moulting, with feathers incompletely developed, perhaps a young bird. It is similar to a specimen shot at Ajiro (Japan) in July 1866, by one of us during the voyage of the 'Magenta,' and now in the Turin Museum, but has a rather shorter bill; this may, however, be owing to difference in age or sex. It happens to be intermediate between the last-mentioned specimen and one of *C. sinensis*, Gould, from Pekin, also in the Turin Museum.

It is not improbable that the Olga Bay specimen may belong to a distinct species, for, if in our specimen the rectrices are fully developed, the tail of the Olga Bay bird is much more rounded than that of *C. sinensis*. Both *C. japonensis* and *C. sinensis* have the basal portion of the feathers grey, whilst they are white in *C. macrorhynchus*, *C. validus*, and *C. enca*.

11. PICA RUSTICA (Scop.).

Pica caudata, David et Oust. Ois. Chine, p. 373 (1877).
Pica pica, Sharpe, Cat. Birds B. M. iii. p. 62 (1877).
a. Olga Bay, September 1879.
An adult specimen, in no respects differing from European birds.

12. PHASIANUS TORQUATUS, Gm.

*Phasiann*s *torquatus*, Elliot, Mon. Phas. ii. pl. v.; David et Oust. Ois. Chine, p. 409 (1877, Corea).

a. ♂ (adult). Possiette Bay, October 1879.
b. ♂ (juv.). Fusan, August 4th, 1880.
c. ♀. Fusan, August 4th, 1880.

The first specimen is in the perfect plumage of the fully adult bird; the forehead is dark bottle-green, the summit of the head light olive without dark markings; the whitish eyebrows are well marked, and the white collar is complete and very wide (about an inch in front), its feathers being slightly margined with greenish black, especially at the back. The flanks are of a richer ochraceous than in the usual North China specimens, from which it otherwise does not differ.

Specimen *b* is a young bird in the ordinary garb of young Pheasants moulting. It shows the following peculiarities:—1st. *Not a few feathers of the neck and breast are of a reddish chestnut*, some of them show violet reflections on their edges. 2nd. Two feathers on the rump are black, with a green apical border and irregular whitish ochraceous stripes, exactly as can be seen in *P. torquatus* from China. 3rd. Some of the feathers on the inferior part of the cervix show:—an apical triangular mark, a narrow black edging on each side, next a reddish-brown band interrupted by the apical mark already mentioned, a horseshoe-shaped band, a narrower one of ochraceous colour, and finally the median black is divided by the light-coloured stem. 4th. Two of the scapular feathers have chestnut-coloured margins with a black band followed by a light ochraceous one and a third narrow one black, the central portion being grey variegated with black. The tail is very short, formed of narrow rectrices barred with black, reddish chestnut and grey, and spotted with black.

Specimen *c* is in the ordinary garb of the female, in which we find noticeable:—1st. The feathers at the base of the neck in front and behind of a reddish chestnut colour with lighter edges, and a V-like black mark on the posterior feathers, and a crescentic black mark on the anterior ones. 2nd. The reddish tail-feathers with black stripes variegated with grey in the middle.

From an attentive examination of the last two specimens, it appears to us very probable that they belong to the well-known *P. torquatus*, for the young male shows feathers on the rump, scapulars, and inferior cervix similar to those of the last-mentioned species. Also Père David gives Corea as possessing the common Ring-necked Pheasant, and we can now fully confirm his assertion.

13. SQUATAROLA HELVETICA (Linn.).

Squatarola helvetica, David et Oust. Ois. Chine, p. 424 (1877); Salvad. Orn. Pap. e Mol. iii. p. 293 (1882).

a, b. Olga Bay, September 1879.

c. Gensan, 15th August, 1880.

The first two look like young birds, the underparts being much spotted and both being of small size. Specimen *c* is a large specimen with a very big bill, perfectly adult; the middle region of the underparts is nearly covered with the black feathers of the summer garb.

14. CHARADRIUS FULVUS, J. F. Gm.

Charadrius fulvus, David et Oust. Ois. Chine, p. 424 (1877); Salvad. Orn. Pap. e Mol. iii. p. 294 (1882).

a, b. Olga Bay, September 1879.

Both young birds, fulvous on flanks and underparts. Their dimensions are:—Bill (culmen) 0·020 m., wing 0·164 m., tarsus 0·040 m.

15. CHARADRIUS DOMINICUS, Müll.

Charadrius dominicus, Müll. S. N. Suppl. p. 116 (1776).

Charadrius virginicus, Harting, P. Z. S. 1871, p. 115; Dress. B. of Eur. vii. p. 447 (1871).

a. Olga Bay, September 1879.

We were rather surprised to recognize a specimen of this species amongst the Plovers collected on the Manchurian coast; still it must be remembered that *C. dominicus* and *C. fulvus* have both been found in Heligoland (cf. Blasius, Ibis, 1862, p. 71), and that both species occur at Alaska (cf. Stejneger, Bull. U.S. Nat. Mus. no. 29, p. 105). It is evidently a young bird, with the underparts greyish, more or less spotted with white. Its dimensions are:—Bill (culmen) 0·022 m.; wing 7·2 inches=0·180 m.; tarsus 0·040 m. It agrees with all the characters of the North-American Golden Plover, and differs from specimens of *C. fulvus* in being larger, less golden above, and more greyish on the nape.

16. ÆGIALITIS MONGOLICA (Pall.).

Ægialitis mongolicus, David et Oust. Ois. Chine, p. 427 (Corea).

Ægialitis mongolica, Salvad. Orn. Pap. e Mol. iii. p. 299 (1882).

a, b, c, d. Olga Bay, September 1879.

The first specimen is an adult in perfect plumage, the three following are immature birds, similar, and agreeing also in being smaller than the first.

17. STREPSILAS INTERPRES (Linn.).

Strepsilas interpres, David et Oust. Ois. Chine, p. 433 (1877); Salvad. Orn. Pap. e Mol. iii. p. 289 (1882).

a, b. Olga Bay, September 1879.

Two young birds in their first plumage, the feathers of the upper parts being margined with ochraceous.

18. Lobipes hyperboreus (Linn.).

Lobipes hyperboreus, David et Oust. Ois. Chine, p. 482 (1887); Salvad. Orn. Pap. e Mol. iii. p. 311 (1882).

a. Olga Bay, September 1879.

A fine specimen in autumnal garb, the feathers of the back being edged with fulvous.

19. Tringa crassirostris, Temm. et Schleg.

Tringa crassirostris, Temm. et Schleg. Faun. Japon., Aves, tab. 64 (1850); David et Oust. Ois. Chine, p. 468 (1877); Salvad. Orn. Pap. e Mol. iii. p. 312 (1882).

a. Olga Bay, September 1879.

A single specimen either in winter garb or immature.

20. Limicola platyrhyncha (Temm.).

Tringa platyrhyncha, David et Oust. Ois. Chine, p. 470 (1877).

a. Olga Bay, September 1879.

A perfectly adult bird, with the dorsal feathers margined with ferruginous brown.

21. Pelidna alpina (Linn.).

Tringa cinclus, David et Oust. Ois. Chine, p. 471 (1877).

a. Olga Bay, September 1879.

In winter plumage.

22. Actodromas albescens (Temm.).

Tringa ruficollis (partim), David et Oust. Ois. Chine, p. 472 (1877).

Tringa albescens, Salvad. Orn. Pap. e Mol. iii. p. 315 (1882).

a. Olga Bay, September 1879.

A single specimen in winter plumage.

23. Tringoides hypoleucus (Linn.).

Tringoides hypoleucus, David et Oust. Ois. Chine, p. 467 (1877).

Tringoides hypoleucos, Salvad. Orn. Pap. e Mol. iii. p. 318 (1882).

a, b, c. Olga Bay, September 1879.

These specimens are rather smaller than usual, but otherwise do not differ from Italian ones with which they have been compared.

24. Heteractitis brevipes (Vieill.).

Totanus brevipes, Vieill. Nouv. Dict. Hist. Nat. vi. p. 410 (1816).

Totanus pulverulentus, Temm. et Schleg. Faun. Jap., Aves, p. 109, tab. lxv. (1850).

Totanus incanus, Swinh. (nec Gm.), P. Z. S. 1871, p. 406; David et Oust. Ois. Chine, p. 466 (1877); Salvad. Orn. Pap. e Mol. iii. p. 320 (1882, partim).

Heteractitis brevipes, Stejn. Res. Ornith. Explor. Kamtsch. p. 137 (1885).

a. Olga Bay, September 1879.

b. Port Lazareff, August 11th, 1880.

c. Gensan, August 17th, 1880.

The first is an immature bird showing numerous whitish spots on the upper parts. Specimens *b* and *c* are both adult, with feathers rather abraded and immaculate upper parts.

Mr. Stejneger (*l. c.*) finds that in Eastern Asia and neighbouring islands, in the Malay Archipelago, in the Moluccas, in New Guinea, and in Australia the true *H. incanus* of Eastern Polynesia is represented by an allied species (*H. brevipes*). The former differs from the latter in having slightly larger dimensions, the underparts, including the middle abdomen and under tail-coverts, covered with dark grey undulated lines and back of a purer grey in the breeding-plumage; besides the nasal groove of the bill reaches to two thirds the length of the culmen.

In *H. brevipes* the nasal groove only reaches half down the culmen; in the breeding-plumage the middle abdomen and under tail-coverts are white, the undulated lines are finer, and the grey of the back is tinged with brown; besides it is a smaller bird. We have been able to confirm these differences, comparing the Corean birds with an adult specimen in full breeding-plumage from the Viti Islands; in it the grey extends to the fore neck and breast, these parts being varied with white. Thus it appears that the Polynesian species extends to the Melanesian islands.

25. Totanus fuscus (Linn.).

Totanus fuscus, David et Oust. Ois. Chine, p. 463 (1877).

a, b, c, d. Olga Bay, September 1879.

These all look like young birds, the plumage being much mottled and spotted above and below, in fact perfectly similar to that of a young male of the same species shot near Florence, in September 1874, and which forms part of the Italian Collection in the Florence Museum.

26. Totanus calidris (Linn.).

Totanus calidris, David et Oust. Ois. Chine, p. 464 (1877).

a. Olga Bay, September 1879.

A perfectly adult bird.

27. Terekia cinerea (Güldst.).

Terekia cinerea, David et Oust. Ois. Chine, p. 460 (1877); Salvad. Orn. Pap. e Mol. iii. p. 326 (1882).

a, b. Olga Bay, September 1879.

c. Port Lazareff, August 11th, 1880.

The last-mentioned specimen has black apical blotches on the scapulars.

28. Limosa brevipes, G. R. Gray.

Limosa brevipes, David et Oust. Ois. Chine, p. 460 (1877); Salvad. Orn. Pap. e Mol. iii. p. 328 (1882).

a, b, c. Olga Bay, September 1879.

All three look like young birds, and have the feathers of the upper parts margined with ochraceous grey.

This species differs from *L. melanura* of Europe in its smaller size.

29. Limosa baueri, Naum.

Limosa baueri, David et Oust. Ois. Chine, p. 459 (1877); Salvad. Orn. Pap. e Moll. iii. p. 329 (1882).

a, b. Olga Bay, September 1879.

The first specimen is in winter plumage, but the second still shows large traces of rufous on the underparts.

30. Numenius cyanopus, Vieill.

Numenius tahitiensis, David et Oust. Ois. Chine, p. 458 (1877, nec Gmel.).

Numenius cyanopus, Salvad. Orn. Pap. e Mol. iii. p. 330 (1882).

a. ♂?; *b.* ♀? Vladivostok, October 1879.

c. Gensan, August 17th, 1880.

The first two are fully adult birds; the supposed male differs from the supposed female, as is the case with *N. arquatus,* in having a very considerably shorter bill. Specimen *c* appears to be immature, and shows no trace of the reddish tinge which the full-grown birds present, especially when in breeding-plumage.

31. Gallinago megala, Swinh.

Gallinago megala, David et Oust. Ois. Chine, p. 477 (1877); Salvad. Orn. Pap. e Mol. iii. p. 337 (1882).

Scolopax megala, Seebohm, Ibis, 1886, p. 133.

a. Gensan, 15th August, 1880.

A single specimen of this Eastern Asiatic species, having only 20 rectrices, of which the outer four on each side are much attenuated, but less so than in *G. stenura* (Kuhl).

32. Fulica atra, Linn.

Fulica atra, David et Oust. Ois. Chine, p. 489 (1877).

a. Possiette Bay, October 1879.

Evidently a young bird, with frontal shield slightly developed, and feathers on the underparts slightly margined with whitish.

33. Ardea cinerea, Linn.

Ardea cinerea, David et Oust. Ois. Chine, p. 437 (1877).

a. Gensan, August 16th, 1880.

b. Olga Bay, September 1879.

The first is an adult bird, the second is much younger, we should say in the second year; neither differ from European specimens.

34. Herodias torra (Buch.-Ham.).

Herodias alba, David et Oust. (nec Linn.) Ois. Chine, p. 439 (1877).

Herodias torra, Salvad. Orn. Pap. e Mol. iii. p. 350 (1882).

a. Gensan, August 17th, 1880.

Some ornithologists will not separate this smaller race of the Great White Egret, which appears to be peculiar to Eastern and Southern Asia, extending to the northern parts of the Australian region. Our specimen is perfectly adult; the following are its measurements compared with those of an adult ♀ *H. alba* from Italy:—

	Bill (culmen).	Wing.	Tarsus.	Middle toe (with claw).
	m.	m.	m.	m.
H. torra	0·100	0·385	0·160	0·105
H. alba, ♀ ..	0·120	0·415	0·174	0·104

35. Anser albifrons (Scop.).

Anser albifrons, David et Oust. Ois. Chine, p. 492 (1877).

a. ♂?; *b*. ♀? Fusan, February 1881.

Both perfectly adult, of large size, with the rather big characteristic yellow bill of this species.

The measurements of both are:—

a. ♂? Total 0·780 m.; wing 0·420 m.; bill 0·050 m.; tarsus 0·068 m.; middle toe with claw 0·069 m.

b. ♀? Total 0·760 m.; wing 0·410 m.; bill 0·045 m.; tarsus 0·066 m.; middle toe with claw 0·067 m.

We believe the differences are owing to sex.

36. Cygnus bewicki, Yarrell.

Cygnus minor, David et Oust. Ois. Chine, p. 494 (1877).

Cygnus bewicki, Sclat. P. Z. S. 1880, p. 507.

a. ♂? Fusan, February 1881.

An adult specimen, which from its size appears to be a male; it agrees perfectly with two specimens of the same species captured in Italy, and has the same bill with a basal yellow patch not reaching the nares. The following are its dimensions:—

Wing 0·526 m.; tail 0·143 m.; bill (culmen) 0·102 m.; bill (from the gape) 0·104 m.; tarsus 0·100 m.; middle toe (with claw) 0·142 m.

37. Cygnus davidi, Swinh. (Plate LII.)

Cygnus (Coscoroba) davidi, Swinh. P. Z. S. 1870, p. 430 (Tientsin); G. R. Gray, Hand-l. iii. p. 29, no. 10607 (1871).

Cygnus davidi, Swinh. P. Z. S. 1871, p. 416; David et Oust. Ois. Chine, p. 494 (1877); Sclater, P. Z. S. 1880, p. 507.

Cygnus (Koskoroba) davidi, David, N. Archiv. Mus. Bull. vii. Cat. n. 438.

Coscoroba davidi, Stejn. Pr. U. S. National Mus. v. p. 180, note (1882).

Two specimens from Possiette Bay, shot between the 12th and 25th of October, 1879.

a. ♂? Immature specimen of a greyish-white colour; it has the following dimensions:—Wing 0·520 m.; tail 0·160 m.; bill (culmen) 0·070 m.; bill (from gape) 0·080 m.; tarsus 0·100 m.

b. ♀? Whiter than the male, and therefore older, but shows also the greyish tinge of youth. Dimensions:—Wing 0·500 m.; tail 0·155 m.; bill (culmen) 0·068 m.; bill (from gape) 0·077 m.; tarsus 0·090 m.

These specimens are evidently young birds, as is shown by the greyish tinge in both; in each of them *the lores are covered with very small feathers, those of the forehead descend on the culmen of the bill down to the two curved angles which run along the sides of the culmen*; again, in both the bill is mostly of a yellowish colour, and only the tip for less than one third of the total length is black; also the nares appear to open in a small black area.

On comparing our two specimens with an adult example of *C. bewicki*, one of us noted a very great similarity. The size and dimensions of the wing and feet are nearly the same; the greatest difference appears in the bill, which is smaller (narrower and shorter), but thi difference looks greater than it really is on account of the feathers which cover the lores and the base of the bill; should these feathers eventually disappear, supposing (as one of us does) that they may be a juvenile character, then the difference in the size of the bill between our two Corean specimens and the adult *C. bewicki* with which they have been compared might be accounted for by age. The difference in the distance between the tip of the bill and the external corner of the eye is hardly half a centimetre, being 0·112 m. in the adult *C. bewicki*, and 0·107 m. in the female from Possiette Bay.

The dried feet in both our specimens seem to have a greenish colour with some traces of reddish brown.

It appears no easy matter to recognize in the two birds before us specimens of David's Swan, a species as yet so very incompletely described, from the unique specimen, a mutilated one, said to be still in the Museum formed years ago in the Lazzarist Mission-House at Peking by the worthy Père David, unless moths and dust have destroyed it. It is strange how deficient both the descriptions of Swinhoe and David of that type specimen are! It is said to be smaller than *C. bewicki*, with the neck a third shorter, bill vermilion red with the dertrum (alone?) black, and feet orange-yellow. Now no clear traces of any such characters can be seen on our two specimens from Possiette Bay. Swinhoe added that *C. davidi* was akin to *C. coscoroba* from South America, with which our two Swans have no likeness at all, being much more like *C. bewicki* (even adult), from which species they mainly differ in having the lores covered with small feathers and the bill much less black. However, as Père David, who saw our two specimens shortly after their arrival in Florence (April 1880), recognized them at once as belonging to *C.*

davidi, we have thought it advisable to refer them to that bird, especially as they come from a region where the *C. davidi* is likely to be found. We believe, however, that as matters stand we should have been perfectly justified in describing them as belonging to a new and undescribed species, considering the incomplete and, what is worse, erroneous description which appears to have been given of *C. davidi*, for we repeat the two specimens from Possiette Bay have nothing whatever to do with *C. coscoroba*.

The opinion expressed by Taczanowski (Bull. Soc. Zool. de France, 1882, p. 44), that *C. davidi* may be identical with *C. sibilus*, Pall. (Zoogr. Rosso-As. ii. p. 215), appears to be erroneous, for the latter species was described with a frontal knob and with black lores, and has been, with good reason, identified with *C. olor*.

The Plate we give shows well the difference in the shape of the bill between our two Swans and an adult *C. bewicki*.

38. Eunetta falcata (Pall.).

Eunetta falcata, David et Oust. Ois. Chine, p. 504 (1877).

Querquedula falcata, Sclat. P. Z. S. 1880, p. 521.

a. ♂. Possiette Bay, October 1879.

A young bird, just beginning to assume the beautiful plumage of the adult male.

39. Aix galericulata (Linn.).

Aix galericulata, David et Oust. Ois. Chine, p. 501 (1877); Sclat. P. Z. S. 1880, p. 513.

a. ♀. Olga Bay, September 1879.

An adult bird, interesting for the locality and the time of year.

40. Cosmonetta histrionica (Linn.).

a. ♀. Olga Bay, September 1879.

An adult bird, with a whitish patch below the eye extending to the base of the bill. This species is not mentioned by David and Oustalet in their work on the Birds of China.

41. Œdemia deglandi, Bp.

Oidemia deglandi, Bp. Rev. crit. Orn. Eur. Degl. p. 108 (1850); Stejn. Bull. U.S. Nat. Mus. no. 29, p. 174 (1885).

Oidemia velvetina, Cassin, Pr. Acad. Nat. Sc. Philad. v. p. 126 (Oct. 1850).

Melanetta velvetina, Baird, Birds N. Amer. p. 805 (1858).

Œdemia americana, Swinh. (nec Sw.), Ibis, 1863, p. 435; P. Z. S. 1871, p. 419 (Yangtsze).

Œdemia velvetina, Swinh. Ibis, 1875, p. 457 (Yangtsze); Sclat. P. Z. S. 1880, p. 520.

Oidemia fusca, David et Oust. Ois. Chine, p. 504 (1877, nec Linn.).

a. ♂ adult. Possiette Bay, October 1879.

b, c. ♂ juv. Possiette Bay, October 1879.

Bonaparte, and nearly contemporaneously Cassin, were perfectly justified in separating this bird from the European Velvet Scoter (*Œ. fusca*), and we can hardly imagine how, when compared, the distinction between the two could have been overlooked. The difference lies principally in the bill, which in *Œ. deglandi* is not only relatively shorter, because more covered by feathers at the base, but has a basal knob of a rounded shape which projects in fully adult males 0·014 m. above the nostrils and bulges out in front like that of *C. olor*. Beside, the black colour *surrounds* the base of the bill, the rest of which, with the exception of the unguis, is *red* not orange. In colour the adult males of both species are alike, but in *Œ. deglandi* the white below the eye and on the wing is more extended.

We are happy to be able to confirm that the American Velvet Scoter inhabits also the Pacific coast of Eastern Asia, as well as Japan, whence H.R.H. Prince Thomas of Savoy sent specimens captured at Yamada in November 1880.

The three specimens from Possiette Bay, are very interesting: *a* is fully adult, but has a frontal knob not quite so prominent as it is in two males from Yamada; *b* and *c* are young males in the act of assuming the black garb of the adult, both are in very dilapidated plumage, the old feathers being of a nearly uniform drab brownish grey. In *b* the lower back, wings, and tail are moulted; in *c* the head is better clothed, but the body is in a miserable condition as to feathers, the remiges are quite undeveloped, so that it could certainly not fly.

The case of this species is an interesting one and requires some further investigation; it would be desirable to clearly establish whether the Velvet Scoter found on the Atlantic coasts of North America is really identical with the Pacific bird[1].

42. Phalacrocorax carbo (Linn.).

Phalacrocorax carbo, David et Oust. Ois. Chine, p. 532 (1877).

a. Olga Bay, September 1879.
b. Possiette Bay, October 1879.
c. Gensan, August 16th, 1880.

All are young birds in imperfect plumage; specimen *a* shows the underparts very white.

43. Larus ridibundus, Linn.

Chroicocephalus ridibundus, David et Oust. Ois. Chine, p. 520 (1877).

Larus ridibundus, Saund. P. Z. S. 1878, p. 200.

a. Possiette Bay, October 1879.

A fully adult bird in winter plumage.

44. Larus cachinnans, Pall.

Larus cachinnans, David et Oust. Ois. Chine, p. 519 (1879).

a. Vladivostok, October 1879.

[1] Since this paper was sent to the Zoological Society of London, we have received Mr. Ridgway's 'Manual of North-American Birds,' in which work the North-eastern Asiatic Scoter has been named *Œdemia stejnegeri*.

An immature specimen which in no way differs from specimens captured off the coasts of Italy.

45. LARUS CRASSIROSTRIS, Vieill.

Larus melanurus, Temm. Pl. Col. 459 (1838).

Larus crassirostris, David et Oust. Ois. Chine, p. 519 (1877).

a, b, c. Olga Bay, September 1879.

d. Port Lazaref, August 14th, 1880.

e. Gensan, August 17th, 1880.

The first three specimens are fully adult; *a* and *b* have the nape and occiput tinged with grey, while in *c* the vertex and also the sides of the neck are greyish brown. Specimen *d* is evidently a young bird of the year, dusky above and beneath, with the feathers of the upper parts margined with ochraceous. Specimen *e* is fully adult in summer plumage, with head and neck pure white.

46. CEPPHUS CARBO, Pall.

Cepphus carbo, Pall. Zoogr. Ross.-As. ii. p. 350 (1811); Stejn. Pr. U.S. Nat. Mus. vii. p. 224 (1884); id. Bull. U.S. Nat. Mus. no. 29, p. 22 (1885).

Uria carbo, Gould, B. of Asia, vii. pl. 71.

a, b, c, d. Olga Bay, 15th September, 1879.

Not feeling quite sure of the determination of these birds, we sent specimens *a* and *b* to Prof. Alfred Newton, who kindly compared them with the specimens preserved in the British Museum; he wrote to say that they agreed in every essential with a specimen from Hakodate (Japan), slightly more adult, rightly labelled as *C. carbo*. Thus Prof. Newton does not hesitate in referring the Olga Bay specimens to that species.

All our birds appear to be immature and show their upper parts of a shiny black, whilst the underparts are white more or less varied with blackish, the tips of the feathers being blackish: this character is more marked in specimen *a*, which being also slightly larger may be considered to have been more adult; it is more blackish on the flanks and in the median region of the breast and abdomen. Specimen *b* has the middle of the breast and abdomen pure white, only the feathers on the flanks having blackish tips; it is also smaller; the feet are also smaller and dark, not showing traces of red.

We were very doubtful as to the determination of these birds, considering how they differ from *C. carbo* in their white underparts, their smaller dimensions, their lacking the white space on the sides of the head, and in the grey colour of the under wing-coverts.

We add a brief description of our birds, for it does not appear that the immature garb of *C. carbo* has ever been described

Supra fusco-niger, paullum nitens; gula alba, collo antico fusco-nigro, pectore et abdomine albis, plus minusve nigro-variis; alis, cauda et tibiis fusco-nigris; subalaribus griseis; rostro nigro, pedibus in exuvie rubescentibus.

Long. tot. circa 0·340 m.; *al.* 0·160 m.; *caud.* 0·050 m.; *rostri culm.* 0·032 m.; *tarsi* 0·034 m.

47. PODICEPS HOLBOELLI, Reinh.

Podiceps rubricollis major, Temm. et Schl. Faun. Jap., Aves, tab. 78 B (1850).

Colymbus holboelli, Baird, Brewer, & Ridgway, Water-Birds N. Amer. ii. p. 428 (Eastern Siberia and south to Japan).

a. Vladivostok, October 1879.

b, c. Olga Bay, September 1879.

Specimen *a* is not in perfect plumage, the feathers on the neck being partly red and partly grey; *b* has hardly any traces of rufous, and indeed looks like a young bird, its underparts are white. Specimen *c* is fully adult, and bears the nearly perfect nuptial plumage: grey cheeks, red neck, and darkish underparts.

This species differs from *P. griseigena* in being notably a larger bird. It also inhabits North America, including Greenland, whence came the types described by Reinhardt. It has escaped the notice of Père David.

REPTILIA.

1. TRIGONOCEPHALUS BLOMHOFFII, Boie.

? *Coluber halys*, Pall. Voy. iii. App. 703 (1771); Lichts. Voy. Eversmann, Cat. p. 106 (Tartary).

Trigonocephalus blomhoffi, Boie in Isis, 1826, p. 414 (Japan); Schleg. Faun. Jap., Rept. p. 88, pl. 6 (1834–38); id. Phys. des Serpens, p. 552, pl. 20. figs. 8, 9 (1837); Dum. et Bibr. Hérp. vii. part 2, p. 1496 (1854).

a, b. Avahuna river, Olga Bay, September 1879.

c, d. Fusan, August 7th, 1880.

The first two are larger and much finer specimens, the two from Corea are not only smaller but less well preserved; all are in spirit. The dark markings on the upper parts of the two Olga Bay specimens are most conspicuous and have a greenish tinge. From the note on the label attached to the bottle which contained them, it would appear that they were caught in the river.

I cannot divest myself of the idea that this species and *T. halys* are one and the same; in that case the latter name has the priority; but I have no western, or rather Caspian, specimens to compare with my eastern ones. These agree perfectly with Schegel's description and plate of Japanese specimens.

2. TROPIDONOTUS TIGRINUS, Boie.

Tropidonotus tigrinus, Boie in Isis, 1826, p. 206 (Japan); Schleg. Faun. Jap., Rept. p. 85, pl. 4 (1838); Günth. Cat. Colubr. Snakes B.M. p. 71 (1858).

Amphiesma tigrinum, Dum. et Bibr. Erpétologie, vii. part 1, p. 732 (1854).

a. Avahuna river, Olga Bay, September 1879.

b. Gensan, August 16th, 1880.

The first is a fine specimen preserved in spirit; the second is larger, but is unfortunately merely a dried skin. Mr. Cuming collected this species at Ningpo; it is therefore not surprising that it should be found in Corea and in Manchuria.

3. Callopeltis conspicillatus (Boie).

Coluber conspicillatus, Boie, Isis, 1826, p. 210 (Japan); Schleg. Faun. Jap., Rept. p. 85, pl. 3 (1838); Günth. Cat. Colub. Snakes B.M. p. 91 (1858).

Elaphis conspicillatus, Dum. et Bibr. Erpétologie, vii. part 1, p. 285 (1854).

? *Coluber mandarinus,* Cantor, Ann. & Mag. Nat. Hist. 1842, p. 483 (Chusan).

a. Juv. Avahuna river, Olga Bay, September 1879.

Fine specimen, evidently young, preserved in spirit. It agrees perfectly with Schlegel's description, so does *C. mandarinus,* Cantor, from Chusan, which I strongly suspect to be the same species. The resemblance of *C. conspicillatus* to *C. leopardinus* is very evident.

AMPHIBIA.

1. Rana esculenta, Linn., var. japonica, Boulg.

Rana esculenta, Schleg. Faun. Jap., Rept. p. 109, pl. 3. fig. 1 (1838).

Rana esculenta, var. *japonica,* Boulenger, Cat. Batrachia Salientia B.M., 2nd edit. p. 40 (1882).

a, b. ♀. Fusan, August 7th, 1880.

Both are full-grown, but one is larger; in both the large shovel-shaped inner metatarsal tubercle is quite distinct, but is especially conspicuous in the smaller specimen. The interrupted narrow glandular folds along the back are also very distinct. As batrachian matters go at present, I do not see why this Eastern Asiatic form should not be considered specifically different from our common Frog.

PISCES.

1. Sebastes inermis, Cuv. & Val.

Sebastes inermis, Schleg. Faun. Jap., Poissons, p. 47, pl. 21. figs. 3, 4 (1880).

a, b. Gensan, August 18th, 1880.

Two young specimens in alcohol, but badly preserved.

2. Clupea zunasi (Bleeker).

Clupea kowal, Schleg. Faun. Jap., Poiss. p. 235, pl. 107. fig. 1 (1850, nec Rüpp.).

Harengula zunasi, Bleek. Verh. Bat. Genootsch. xxvi. p. 117 (Japan).

a. Gensan, August 18th, 1880.

A small specimen in spirit in a bad condition.

3. TETRODON PORPHYREUS, Schleg.

Tetraodon porphyreus, Schleg. Faun. Jap., Poiss. p. 282, pl. 121. fig. 1 (1850).

Liosaccus porphyreus, Günth. Cat. Fishes, viii. p. 287 (1870).

a, b, c. Gensan, August 18th, 1880.

One fairly adult, two very young specimens; in spirit but in bad condition.

4. OSTRACION CUBICUS, Linn.

Ostracion cubicus, Linn. S. N. i. p. 410 (1766).

Ostracion immaculatus, Schleg. Faun. Jap., Poiss. p. 296 (1850).

a. Gensan, August 16th, 1880.

A single dried specimen.

2. Liste des Oiseaux recueillis en Corée par M. Jean Kalinowski. Par M. L. TACZANOWSKI, C.M.Z.S.

[Received October 4, 1887.]

La collection est recueillie depuis le mois de septembre 1885 jusqu'à la moitié de mars de 1887, principalement dans les environs de la capitale du pays, jusqu'à Gouran vers le nord.

Selon la relation du collecteur le pays est très pauvre en oiseaux, dépourvu en général de forêts, pauvre en végétation herbacée et très pauvre en eaux continentales. Les moyens de locomotion sont très difficiles; la population partout brutale, inhospitalière, paresseuse et très pauvre, incapable à aider en rien au voyageur. En outre de ces inconvénients le voyageur a eu un obstacle grave dans ses travaux en été de l'année passée lorsque l'épidémie de choléra faisait des grands ravages pendant plus de trois mois dans la population de la capitale et des environs. Quelques centaines d'indigènes succombaient par jour, on n'enterrait que la moitié, tandis qu'on rejettait l'autre moitié de cadavres dans les champs autour de la ville, tous les environs étaient donc empestés à tel point qu'il était impossible de sortir dehors.

Il n'y a donc rien d'étonnant que cette collection est aussi pauvre en espèces. Selon la relation de M. Kalinowski le quart des espèces fournies reste pour nicher dans le pays, tandis que les autres trois quarts n'y sont que de passage.

Le grande pluralité de ces espèces est composée d'oiseaux sibériens, les autres appartiennent à la faune japonaise, dont les trois espèces suivantes, *Parus varius, Mecistura trivirgata* et *Microscelis amaurotis,* sont trouvées pour la première fois sur le continent asiatique; les autres espèces sont chinoises ou indiennes, et qui n'ont pas été retrouvées en Sibérie ni dans le pays Oussourien.

Dans une lettre que je viens de recevoir le voyageur communique une liste d'espèces recueillies après l'expédition de cet envoi, dans laquelle il indique plusieurs qui manquaient dans sa première collection; nous pouvons donc espérer qu'il trouvera encore un bon nombre jusqu'à son départ, qui ne va pas tarder.

L'exploration de M. Kalinowski ne donnera qu'une faible représentation de l'ornis du pays. Elle est très courte et les contrées boisées ne sont pas touchées.

1. Milvus melanotis, Temm. et Schl.

Un mâle et deux femelles tués à Séoul en novembre et décembre. Dimensions :—

♂ ad.	Long. totale 665,	vol. 1620,	aile 525,	queue 343,	bec 48 mm.
♀ ad.	„ „ 650,	„ 1630,	„ 520,	„ 320,	„ 45 mm
♀ ad.	„ „ 640,	„ 1556,	„ 510,	„ 313,	„ 45 mm.

2. Buteo plumipes, Hodgs.

Un mâle tué en mars.

3. Astur cuculoides (Temm.).

Deux mâles et une femelle tués en mai et en juin.

Un de ces mâles est d'un blanc presque pur sur tout le dessous du corps, à plumes de la poitrine d'un vineux pale couvert par le blanc terminal ; les côtés colorés par une légère teinte vineuse, les plumes des côtés du bas ventre grises maculées de blanc ; le haut des pantalons moucheté de gris ; les plumes du milieu de l'abdomen rayées en travers de gris couvert presque complétement par le blanc terminal ; le cendré des parties supérieures du corps est fort bleuâtre et pur. Rectrices, outre les deux médianes, traversées de 5 raies noires, sur la barbe interne des externes il y en a 7, plus fines et moins complètes que sur les autres. Iris brun foncé, cire et pieds d'un jaune orangé.

Un autre mâle, probablement moins adulte, a le roussâtre plus répandu sur la poitrine, et qui s'étend aussi sur le haut de l'abdomen ; la couleur des parties supérieures du corps moins claire. Iris brun foncé.

La femelle adulte est plus foncée en dessus que le mâle précédent ; gorge largement d'un blanc coloré de gris roussâtre et varié de baguettes noires dans toutes les plumes ; tout le dessous du corps est d'un roussâtre sâle, presque uniforme sur les côtés et varié de raies transversales sur le milieu de l'abdomen ; souscaudales blanches colorées d'une nuance de crème dans la partie terminale des plumes ; toute la surface des pantalons fort colorée et mouchetée de gris et de roussâtre ; sousalaires plus fortement roussâtres que celles du mâle, et variées de quelques petites macules noirâtres. Les bandes caudales plus larges que celles du mâle. Iris jaune tirant en orangé ; pieds et cire jaune.

	Long. totale.	Vol.	Aile.	Queue.	Bec.	Tarse.	Queue dépassant l'aile de
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
♂ ..	305	650	200	140	20	40	40
♂ ..	304	635	194	133	19	42	50
♀ ..	315	660	200	140	21	40	45

4. Accipiter nisus (L.).

Deux mâles et deux femelles tuées en décembre, janvier, février et mars.

5. Falco hendersoni, Hume.

Un mâle très adulte tué le 6 janvier 1887.

Cet oiseau a le sommet de la tête et la nuque roux varié de stries noires centrales dans les plumes; dos et les scapulaires rayés en travers d'une manière assez régulière de brun plus ou moins nuancé de cendré et de roux assez intense, les raies brunes étant plus larges que ces dernières ; sur le dos inférieur, le croupion et les tectrices supérieures de la queue le brun est fort nuancé de cendré, les raies rousses remplacées par le cendré clair, à plumes bordées de roussâtre à l'extrémité et la baguette noire, les raies claires des souscaudales externes blanches. Tout le dessous est blanc à l'exception du milieu du ventre et des souscaudales, qui sont d'un blanc de crème ; les moustaches fines mais bien prononcées, des petites macules brunes sur les côtés de la tête et du cou, distinctement plus grosses et peu nombreuses sur la poitrine ; assez grosses et subarrondies sur l'abdomen ; les plus grosses et prolongées en travers sur les côtés du ventre ; pantalons fort tachetés. Rectrices rayées en travers de brun et de fauve roussâtre, ces raies complètes dans toutes les pennes au nombre de 14 de chaque couleur. Iris presque noir.

Longueur totale 510, vol 1160, aile 375, queue 210, queue dépassant l'aile de 40 mm.

6. Dendrofalco æsalon (L.).

Un jeune mâle et une femelle, tués en décembre et en février.

7. Cerchneis tinnunculus japonicus (Temm. et Schl.).

Trois mâles adultes et un jeune mâle, tués en janvier, mars, juin et juillet.

Tous ces exemplaires présentent les caractères de cette race bien prononcés.

	Long. totale.	Vol.	Aile.	Queue.	Tarse.	Queue dépassant l'aile de
	mm.	mm.	mm.	mm.	mm.	mm.
♂	360	740	245	170	38	46
♂	343	746	240	157	38	38
♂	334	735	240	154	38	38
♂ jun. .	360	745	243	153	37	42

8. Circus cyaneus (L.).

Un mâle adulte tué en décembre.

9. Ninox japonicus (Temm. et Schl.).

Trois mâles recueillis en mai.

Tous ces exemplaires présentent des dimensions aussi fortes que celles des oiseaux de la côte du pays Oussourien.

Long. totale.	Vol.	Aile.	Queue.	Tarse.	Queue dépassant l'aile de
mm.	mm.	mm.	mm.	mm.	mm.
290	783	235	124	27	3
290	775	227	126	27	7
293	750	224	125	27	15

10. Scops semitorques, Temm. et Schl.

Une femelle de Séoul, tuée en février. Iris jaune avec une légère nuance rougeâtre.

11. Bubo ignavus, Forst.

Une femelle adulte, tuée à Séoul en janvier. Iris orangé.

Long. totale 660, vol 1710, aile 474, queue 270 mm.

Ce Duc est en général plus obscur que le mâle de Sidemi, il a les flammules et les taches noires en général plus grosses, les ondulations foncées en général plus larges. Il est aussi en général plus obscur que la grande pluralité des grands Ducs de l'Europe centrale.

12. Syrnium nivicolum, Blyth.

Une paire de Siongnio, recueillie en mars. Phase grise, sans rien de roussâtre et de fauve.

♂. Long. totale 420, vol 940, aile 276, queue 180, tarse 40, queue dépassant l'aile 40 mm.

♀. Long. totale 445, vol 1015, aile 305, queue 185, tarse 40, queue dépassant l'aile 45 mm.

La différence principale du *S. aluco* est dans les deux rectrices médianes, qui sont distinctement rayées de blanchâtre en travers, il y a 3 raies chez le ♂ sur la partie terminale de la queue, 6 sur les rectrices de la femelle; sur les autres rectrices les raies sont plus blanches; les rémiges primaires terminées par une large bordure blanche; le dessin des scapulaires un peu plus compliqué, mais ce qui ne produit pas une grande différence; les taches sur la barbe externe des rémiges primaires sont plus blanches; le plumage des pieds plus fortement rayé ou maculé, mais on trouve cependant entre les oiseaux européens des individus à pieds presque aussi fortement tachetés.

13. Caprimulgus jotaka, Temm. et Schl.

Une femelle de Séoul, prise en mai. Iris brun foncé.

14. Cecropis daurica (Pall.).

Trois exemplaires de Séoul, recueillis le 10 juin. Identiques en tout aux oiseaux da la Daourie, à bande rousse uropygiale, large de 24–26 mm.

	Long. totale.	Vol.	Aile.	Queue.	Rectrice ext. dépassant la 2me de
	mm.	mm.	mm.	mm.	mm.
♂	200	324	116	105	34
♂	210	347	122	106	34
♀	196	325	114	95	25

15. Hirundo gutturalis, Scop.

Six exemplaires des environs de Seoul, à blanc du dessous du corps presque pur ou coloré d'une très légère nuance roussâtre, comme dans les oiseaux qui nichent dans l'Europe centrale, considérablement moins roux que dans les hirondelles des environs de Wladiwostok et des autres localités du pays Oussourien. Entre les nombreux exemplaires que j'ai vus de ce pays, il n'y a eu qu'un fourni par M. Jankowski, de Sidemi, qui a tout l'abdomen aussi blanc. Dans ces six exemplaires il n'y a que trois dont le roux du devant du cou pénètre profondement dans le noir du collier, ne laissant qu'une fine bordure noire; les trois autres ont la bande noire complète comme celle de l'hirondelle de cheminée européenne. Il ne reste donc dans ces exemplaires d'autres caractères différentiels constants de ceux de l'hirondelle européenne qu'une taille distinctement moins forte, les rectrices externes moins prolongées et la tache blanche aux rectrices plus étroite. Deux de ces mâles ont une strie noire sur les tectrices souscaudales postérieures.

	Long. totale.	Vol.	Aile.	Queue.	Rectrice ext. dépassant la 2me de
	mm.	mm.	mm.	mm.	mm.
♂	176	310	110	86	32
♂	177	305	108	82	28
♂	190	310	112	99	42
♂	173	310	111	84	36
♂	..	..	110	86	30
♀	176	318	114	79	22

16. Eurystomus orientalis (L.).

Une paire de Séoul, recueillée en juin et juillet.

17. Halcyon pileatus (Bodd.).

Deux mâles et un jeune de Séoul, pris en juin et juillet. Iris brun foncé, bec et pieds rouges.

18. Ispida bengalensis, Briss.

Deux mâles et une femelle, recueillis à Séoul en avril, mai et juillet. Iris brun foncé.

19. Ceryle lugubris, Temm.

Un mâle d'Ara-Sambo, pris le 1 décembre 1886. Iris brun foncé.

20. Certhia familiaris, L.

Un exemplaire de Séoul. Cet oiseau ressemble en tout par sa coloration aux oiseaux du Baical méridional, de la Daourie et du pays Oussourien, avec lesquels je l'ai comparé, il a le blanc du dessous également pur, le bec aussi court que la pluralité de ces oiseaux; il est cependant d'une taille un peu plus petite, l'aile pliée n'a que 59 mm., tandis qu'un oiseau de l'embouchure de l'Oussouri l'a de 63 mm., un de Koultouk 62 mm., une paire de la Daourie 66 mm.

21. Sitta amurensis, Swinh.

Une paire d'Ara-Sambo et de Séoul, pris en janvier, parfaitement identiques aux oiseaux de l'Amour et du pays Oussourien.

22. Troglodytes fumigatus dauricus (Tacz.).

Trois mâles et deux femelles recueillis à Séoul en décembre et janvier.

Ces oiseaux de la Corée ressemblent beaucoup à ceux de Sidemi, quoique ils présentent une légère différence dans la rayure moins forte sur le devant du cou, qui, surtout dans un mâle et les deux femelles, ne dépasse pas la poitrine. Ils diffèrent encore plus sous ce rapport des oiseaux de la Daourie, dont le devant des parties inférieures du corps est fortement rayé en travers jusqu'à la gorge inclusivement. Il me paraît cependant que ce troglodyte continental diffère constamment du troglodyte japonais, dont je ne connais que deux exemplaires, un du Musée de St. Pétersbourg, provenant de Yokohama, l'autre du Musée de Varsovie, de l'îlôt Ascold. Ces deux troglodytes sont beaucoup plus roux en général que ceux du continent, à rayure très faible au dos, et n'ont point de raies foncées sur la gorge et sur toute la poitrine.

23. Cinclus pallasi, Temm.

Deux mâles et une femelle recueillis à Sambo Pielijan en mars et en décembre. Iris brun foncé.

24. Accentor montanellus (Pall.).

Un mâle et trois femelles de Séoul et d'Ara-Sambo, recueillis en décembre, janvier et février.

25. Turdus fuscatus, Pall.

Une paire de Séoul, recueillie en avril.

26. Turdus naumanni, Temm.

Deux mâles et deux femelles recueillis à Seoul en janvier et février.

Ces quatre exemplaires sont semblables à ceux qu'on trouve constamment dans le pays Oussourien, et que le Dr. Dybowski distingue sous le nom de *T. abrekianus*, tandis que M. Radde les considère comme métis entre le *T. naumanni* et le *T. ruficollis*. Ces Grives présentent une telle variabilité dans les différents détails de la coloration qu'il m'est impossible de comprendre la question. Les individus semblables à ceux de l'Oussouri et de la Corée se trouvent aussi dans les environs du Baical méridional, mais ils y sont rares, tandis que les deux espèces typiques citées y sont en grande majorité. Au contraire, dans une quarantaine d'individus que j'ai eu des différentes contrées du pays Oussourien et de la côte méridionale de ce pays, il n'y a en aucun individu typique du *T. ruficollis* ni du

T. naumanni; le Dr. Dybowski assure aussi qu'il n'y a jamais vus de Grive typique de ces deux espèces, mais toujours des individus de cette variété ou race, et c'est la raison principale de son opinion que c'est une forme distincte, particulière à la contrée.

Ces oiseaux ont vraiment les caractères de la coloration intermédiaires entre ceux des deux espèces, mais les détails de la communauté sont très variables. Il y a des individus complètement unicolores sur les parties inférieures du corps comme chez le *T. ruficollis* typique, mais il y a des individus avec un mélange aussi fort de roux et le croupion uniformément roux comme chez le *T. naumanni*, le plus typique; entre ces deux modes de la coloration il y a des transitions en différents degrés.

Dans les uns de ces oiseaux le dessous depuis le menton jusqu'à la poitrine est comme dans les différentes variétés du *T. ruficollis* vrai, mais les côtés de l'abdomen sont aussi fort tachetés ou même plus comme dans le *T. naumanni* vrai.

Les uns ont la bande sourcilière aussi rousse comme celle du *T. ruficollis*, dans les autres elle est presque aussi blanche que celle du *T. naumanni*, dans les autres des transitions sans fin.

Tous les oiseaux de cette variété ont le sommet de la tête strié de foncé également comme dans les *T. ruficollis* typiques, et jamais je n'ai pas vus d'exemplaires à sommet de la tête aussi foncé comme dans le *T. naumanni* vrai.

Je n'ose pas de m'hasarder à trancher la question, et je la laisse à ceux qui pourront l'étudier en nature; mais je ne pus m'accorder avec l'opinion de M. Radde, car je ne comprends pas quelle serait la raison pour que les métis de ces deux espèces se rassemblent dans cette contrée de l'extrême orient, évitée par les individus typiques des deux espèces. Tous le 7 exemplaires de Séoul ont le dessus du corps unicolore, avec un très petit mélange de roux au croupion; un a le sourcil comme celui du *T. ruficollis*, et aucun ne l'a pas blanc pur.

27. Oreocincla varia (Pall.).

Une paire recueillie en avril et mai à Séoul.

28. Monticola solitarius (Müll.).

Deux mâles pris à la fin de mai. Iris brun foncé.

29. Ruticilla aurorea (Pall.).

Trois mâles et une femelle recueillis à Séoul et à Soukamakoro en novembre, janvier, février et en juin.

30. Phyllopneuste borealis, Blas.

Une mâle tué à Séoul, en mai.

31. Phyllopneuste coronata (Temm.).

Une paire tuée à Séoul, en avril.

32. Phyllopneuste supciciliosa (Gm.).

Une mâle de Séoul.

33. Microscelis amaurotis (Less.).

Dix exemplaires des deux sexes, recueillis aux environs de Séoul en décembre, janvier et février. Comparés au Musée de Varsovie avec les oiseaux de Yokohama.

34. Motacilla leucopsis, Gould.

Un mâle adulte en noces, tué à Séoul en avril.

35. Motacilla ocularis, Swinh.

Une paire en habit d'hiver complet de Séoul, recueillie en décembre.

36. Calobates melanope (Pall.).

Un mâle adulte tué en juin à Séoul.

37. Limonidromus indicus (Gm.).

Trois mâles de Séoul, recueillis en juin. Iris brun foncé.

38. Alauda arvensis, L.

Deux mâles, recueillis à Séoul en mars et en avril.

39. Galerita cristata coreensis.

Une paire recueillie à Séoul en janvier 1886. Comparés avec une grande série de races de Cochevis de différentes contrées de l'Europe, du nord de l'Afrique et de l'Asie centrale et occidentale.

Par la longueur du bec et par la coloration elle resemble le plus à la *G. magna*, Hume, du Turkestan (recueillis par Severtzoff), et en Mongolie occidentale aux environs du lac Lob-noor (recueillis par le général Prjewalski), mais s'en distingue par une taille moins forte, par le fond des parties supérieures du corps un peu plus foncé et plus roussâtre, sur lequel les taches brunes, centrales dans les plumes, sont en général plus grosses et plus fortement déssinées; le roux plus fort sur les tectrices supérieures de la queue; le brun noirâtre plus largement répandu le long du milieu des plumes de la huppe; en dessous la couleur jaunâtre distinctement plus forte; le roux du dessous de l'aile plus foncé et plus intense tirant sur le ton de cannelle; la nuance des rectrices externes beaucoup plus foncée. La taille est moins forte.

La coloration est aussi semblable à celle de la *G. macrorhyncha*, Tristr., des plateaux sahariens de l'Algérie, mais elle s'en distingue aussi par les détails indiqués plus haut; la couleur de la rectrice externe est cependant plus rapprochée.

Elle ressemble aussi et plus encore par la grosseur et l'intensité des taches foncés dorsales à la *G. abyssinica*, Bp., de l'Egypte supérieur, ainsi que par la taille, mais elle est moins foncée en dessus à taches claires plus distinctes, les rectrices externes plus rousses, le cannelle du dessous de l'aile distinctement plus intense. La couleur générale des parties supérieures du corps, la grandeur et la force des taches foncés, ainsi que la nuance des rectrices externes la rapprochent le plus à la *G. arenicola*, Tristr., des plateaux élevés de l'Algérie (Constantine, Batna, &c.), mais elle en diffère par le bec beaucoup plus long, les tectrices rousses de la queue à strie brune centrale foncée et grosse, tandis qu'elle est presque nulle chez l'oiseau cité ; le fond des parties inférieures et des côtés de la tête est beaucoup plus jaunâtre, au lieu de blanchâtre dans notre oiseau de la Corée. La deuxième rectrice présente la plus grande différence, elle n'a qu'une bordure roussâtre externe très fine, tandis que dans l'oiseau Algérien la plus grande moitié de la barbe externe est occupée par cette couleur et largement sur l'extrémité de toute la penne ; sur les autres rectrices, sauf les médianes, il y a aussi des bordures terminales pareilles. La taille est presque la même.

Toutes les autres races qui me sont connues présentent des différences beaucoup plus grandes, la couleur des parties supérieures du corps est tout-à-fait autre.

♂. Longueur totale 197, vol 362, aile 105, queue 68, bec 25, tarse 14, doigt médian 14, ongle 4, ongle du pouce 12.

♀. Longueur totale 185, vol 330, aile 94, queue 62, bec 23, tarse 23, doigt médian 17, ongle 4, ongle du pouce 11.

♂. Queue dépassant le bout des ailes de 25 mm.

♀. Queue dépassant le bout des ailes de 25 mm.

40. Parus varius, Temm. et Schl.

Deux mâles et une femelle tués à Séoul le 8 février 1886. Iris brun foncé.

41. Parus minor, Temm. et Schl.

Deux mâles recueillis à Séoul en novembre et en décembre. Semblables en tout aux oiseaux du pays Oussourien, moins verts et plus cendrés en dessus que les oiseaux du Japon.

42. Pœcilia palustris crassirostris, Tacz.

Une femelle tuée à Séoul le 17 décembre. Parfaitement identique aux oiseaux du pays Oussourien.

43. Mecistura trivirgata (Temm. et Schl.).

Un exemplatre de Séoul.

44. Suthora webbiana, Gr.

Deux mâles et une femelle, recueillis à Séoul le 2 décembre. Comparés avec un exemplaire du Shensi méridional, provenant de la collection de l'Abbé David, et ne s'en distinguant que par la couleur du dos moins foncée et pas aussi nettement tranchée de la couleur rousse du cou postérieur. Ces oiseaux diffèrent plus des oiseaux de la race de la Mantchourie russe, à la quelles ils présentent une certaine transition.

♂.	Long. totale	141,	vol	168,	aile	52,	queue	67	millim.
♂.	„	140,	„	165,	„	57,	„	67	„
♀.	„	132,	„	157,	„	49,	„	63	„

45. Oriolus diffusus, Sharpe.

Quatre mâles et une femelle de Séoul, recueillis en mai et en juillet.

46. LANIUS SPHENOCERCUS, Cab.

Deux mâles et une femelle adultes pris à Séoul et à Siongno en décembre et en février.

47. PHONEUS BUCEPHALUS (Temm. et Schl.).

Un mâle pris à Séoul en mars.

48. OTOMELA LUCIONENSIS (L.).

Quatre mâles recueillis à Séoul en mai et en juin.

49. BUTALIS LATIROSTRIS, Raffl.

Un mâle tué à Séoul en mai.

50. ERYTHROSTERNA LUTEOLA (Pall.).

Un mâle tué à Séoul en mai.

51. XANTHOPYGIA TRICOLOR, Hartl.

Quatre mâles recueillis à Séoul, à la fin d'avril et en mai.

Egalement comme les oiseaux de la côte de la mer du Japan les uns ont le sourcil tout blanc, les autres en partie coloré légèrement de jaune.

52. CYANOPTILA CYANOMELÆNA (Temm. et Schl.).

Une femelle de Séoul.

53. PERICROCOTUS CINEREUS, Lafr.

Deux mâles de Séoul, tués en mai.

54. CYANOPOLIUS CYANUS (Pall.).

Deux mâles et trois femelles de Tiumbudon, Siongno, Pedziu-umne, recueillis en janvier et mars.

55. GARRULUS BRANDTI, Eversm.

Une paire de Séoul et de Tempunkudzi, tués en janvier et mars.

Semblables en tout aux oiseaux Oussouriens.

56. PICA CAUDATA JAPONICA (Temm. et Schl.).

Deux mâles, deux femelles et un jeune, tués en décembre et en janvier.

Semblables en tout aux oiseaux du pays Oussourien.

57. MONEDULA DAURICA (Pall.).

Une paire de Siongno, recueillie en mars.

58. CORVUS MACRORHYNCHUS JAPONENSIS (Bp.).

Deux femelles tuées à Séoul en janvier.

59. FRUGILEGUS PASTINATOR (Gould).

Un exemplaire de Pedziu-umne pris en mars.

60. Nucifraga caryocatactes, L.

Un exemplaire pris à Séoul en novembre.

61. Sturnus cineraceus, Temm. et Schl.

Une mâle pris à Séoul en avril. Iris brun foncé.

62. Emberiza fucata, Pall.

Un mâle pris en mai à Séoul.

63. Emberiza cioides, Brandt.

Un mâle et deux femelles pris en décembre à Séoul.

64. Emberiza spodocephala, Pall.

Un mâle pris en mai à Séoul.

65. Emberiza elegans, Temm.

Trois mâles de Séoul et d'Ara-Sambo, pris en décembre, en janvier et en mars.

66. Schœnicola polaris (Midd.).

Trois mâles et une femelle pris à Siongno en mars.

67. Passer montanus (L.).

Une paire, prise à Séoul en novembre et décembre.

68. Fringilla montifringilla, L.

Deux mâles et une femelle, pris à Séoul, à Ara-Sambo et à Tempunkudzi, en décembre.

69. Chlorospiza sinica (L.).

Un mâle pris à Séoul en mars.

70. Chrysomitris spinus (L.).

Quatre mâles et cinq femelles, pris à Séoul en décembre et en avril.

Sur ces quatre mâles il y a trois dont le devant du cou est fort coloré d'une nuance orangé roussâtre, cette couleur est répandue dans un de ces exemplaires sur toute la poitrine, sur les côtés de la tête et sur toute la bande sourcilière, dans l'autre elle ne dépasse pas la région jugulaire et est peu répandue sur les côtés de la tête, dans le troisième elle est moins forte et moins disposée.

71. Coccothraustes vulgaris japonicus, Temm. et Schl.

Une femelle, prise à Séoul en avril. Iris et bec d'un bleu pâle.

72. Propasser roseus (Pall.).

Un mâle adulte, pris en février à Séoul.

73. Uragus sanguinolentus (Temm. et Schl.).

Trois femelles de Usambo et de Kuksude-i, prises en décembre.

74. Loxia curvirostra albiventris (Swinh.).

Cinq mâles et deux femelles pris à Séoul en février.

Ces oiseaux de la Corée se distinguent des oiseaux de la Sibérie et de l'Europe centrale par une taille un peu moins forte et par la couleur rouge du mâle, qui est carminée dans ces oiseaux de la Corée, au lieu de ponce sanguiné des Becs-croisés communs. Quant à la couleur blanche du milieu du ventre, elle n'est pas plus répandue dans ces oiseaux coréens que dans les Becs-croisés sibériens et européens. Tous les Becs-croisés que j'ai eu des différents localités de la Sibérie orientale sont identiques aux oiseaux européens.

Dimensions des oiseaux de la Corée :—

	Long. totale.	Vol.	Aile.	Queue.	Culmen.	Queue dépassant l'aile de
	mm.	mm.	mm.	mm.	mm.	mm.
♂ ..	175	295	91	60	18	29
♂ ..	173	294	93	58	19	23
♂ ..	168	289	90	58	18	27
♂ ..	171	289	90	59	18	26
♂ ..	171	292	93	62	18	24
♀ ..	165	278	86	55	16	24
♀ ..	166	282	89	57	18	24

75. Pyrrhula orientalis, Temm. et Schl.

Une paire de Séoul, prise en février et mars.

76. Cuculus canorus telephonus (Heine).

Un mâle tué en novembre à Séoul au commencement d'avril.

77. Gecinus canus (Gm.).

Une femelle tuée en novembre à Séoul. Cet oiseau est beaucoup plus vert au dos que la plus grande pluralité de ces Pics du pays Oussourien.

78. Thriponax kalinowskii, sp. n.

Th. *nigerrimus ; dorso infero cum uropygio abdominequo flavido-albis, regione anali nigra, albido undulata ; tibiis albo nigroque variis, remigibus primariis albo terminatis ; subalaribus abdomini concoloribus ; collo antico supero tenuissime albo vario.*

Mas *pileo toto fasciaque malari vivide cinnabarino-rubris.*

Fem. *capite toto nigro.*

♂ ad. Plumage général noir intense, à dos inférieur et le croupion d'un blanc légèrement jaunâtre ; abdomen fort coloré de roussâtre, assez clair sur une grande majorité de plumes, d'un ocreux sale sur les autres [1], tout le sommet de la tête jusqu'à la nuque inclusivement est d'un beau rouge vermillon trés vif, bande malaire étroite d'un rouge plus obscur ne dépassant pas le niveau du bord postérieur de l'œil ;

[1] Cette couleur rousse paraît être superficielle, ce qui a souvent lieu dans le plumage avant la mue chez beaucoup d'autres Pics.

plumes de la gorge noirâtres bordées de blanchâtre, quelques petites macules ou bordures blanches sur le noir du haut du devant du cou, une raie composée de petites taches blanches située le long des côtés du cou commençant au niveau du milieu de l'œil, une tache composée de macules ou de petites stries blanches derrière l'orcille; région anale noirâtre rayée de blanchâtre par les bordures des plumes; plumage des jambes varié de noirâtre et de blanchâtre. Cinq rémiges primaires terminées de blanc, sur la première abortive il n'y a qu'une petite macule terminale, tandis que sur la troisième la barbe externe blanche dans la longueur de 2·5 centimètres, l'interne dans plus d'un centimètre; le blanc terminal de la quatrième n'atteint pas la largeur de 2 centimètres; les sousalaires sont d'un blanc plus jaunâtre que celui du croupion avec une grosse tache noire sur les grandes tectrices primaires; pli de l'aile noir; rémiges blanc jaunâtres à la base dans la longueur de 4·5–5 centimètres. Bec noir; pieds noirâtres; iris jaune pâle. (Oiseau de Séoul du 23 juin, 1886).

♀. Distincte du mâle par le manque complet du rouge sur la tête, le blanc abdominale légèrement jaunâtre et non roussâtre, le haut du devant varié plus fortement de bordures blanches, la gorge immaculée; huit rémiges primaires terminées de blanc, un peu plus largement que celles du mâle. Iris blanc jaunâtre. (Oiseau de Siongno tué le 28 février, en plumage frais.)

La couleur blanche est fort répandue sur la barbe interne des rémiges primaires, dans la 1re et 2^{e} rémiges le blanc dépasse le tiers basal de ces rémiges, dans la 4^{e} il dépasse le quart basal; dans les rémiges secondaires le blanc est aussi largement disposé; la baguette de toutes ces rémiges est aussi blanche dans sa partie basale.

♂. Longueur totale 495, vol 775, aile 246, queue 173, bec de la commissure 66, tarse 31, doigt antérieur externe 28, ongle en diamètre 18, doigt postérieur externe 18, ongle en diamètre 16, queue dépassant le bout des ailes de 90 mm.

♀. Longueur totale 453, vol 786, aile 252, queue?, bec 69, tarse 32, doigt antérieur ext. 28, ongle 19, doigt postérieur externe 19, ongle 17 mm.

79. Picus major, L.

Une paire de Séoul, prise en février. Sous le rapport de la forme du bec et la coloration semblables à ceux de l'Europe centrale, de la Daourie et du Baical méridional, ils ont cependant le blanc moins prolongé sur le devant des scapulaires, les bandes blanches un peu moins larges sur les rémiges. Le blanc et le noir également disposé sur les rectrices, mais à bandes noires distinctement plus larges. Le mâle a le blanc du dessous sali de grisâtre, le front également sale, la tache auriculaire et le devant du cou colorés légèrement de roussâtre sale. Le plumage du dessous de la femelle plus pur, mais coloré fortement de la nuance de cuire tannée sur la tache auriculaire et sur tout l'abdomen.

♂. Longueur totale 247, vol 430, aile 130, queue 85, bec 33, tarse 22, doigt ext. ant. 15, ongle 10 mm.

♀. Longueur totale 250, vol 423, aile 133, queue 90, bec 30, tarse 22, doigt ext. ant. 14, ongle 10.

Queue dépassant le bout des ailes de 38 millim. chez le ♂, de 45 chez la ♀.

80. Picus leuconotus, Bechst.

Deux mâles de Séoul, pris en décembre et en février. Ces oiseaux ne présentent aucune différence de ceux de l'Europe centrale, ils ont les bandes blanches transalaires également larges, les stries du dessous de la même grosseur, la couleur rouge également répandue, le blanc du dos inférieur également varié de noir, le blanc également disposé sur les rectrices latérales; la même forme du bec. Un de ces mâles a le milieu de la région jugulaire et de la poitrine coloré légèrement de rosé.

♂.	Longueur totale 290,	vol 485,	aile 150,	queue 100,	bec 45 mm.
♂.	„ 294,	„ 490,	„ 150,	„ 102,	„ 47 mm.

81. Jungipicus dörriesi, Hargitt.

Deux mâles et une femelle, recueillis à Séoul et à Tempunkudzi, en décembre et février. Identiques aux oiseaux de l'ilôt Ascold et de la côte de la Manchourie Russe.

82. Jungipicus seebohmi, Hargitt.

Une mâle de Séoul.

Semblable en tout aux oiseaux typiques de Yokohama de la collection de M. Hargitt, et aux oiseaux de la Manchourie Russe, mais cet exemplaire est d'une taille un peu moins forte. Longueur de l'aile 83 mm., queue 50 mm.

83. Columba rupestris (Pall.).

Une femelle tuée à Séoul en avril.

84. Turtur rupicola (Pall.).

Une jeune femelle tuée à Séoul en décembre.

85. Turtur torquatus, Briss.

Un mâle et trois femelles recueillis à Séoul en novembre, décembre et mai.

86. Bonasia betulina, Dresser.

Deux mâles et une femelle recueillis à Sambo Pielijan en novembre et décembre.

Les mâles ne présentent aucune différence de la grande pluralité des gélinottes de l'Europe centrale et du pays Oussourien; la femelle présente une anomalie dans sa gorge noire comme celle du mâle, mais mélangée légèrement de fauve et le menton blanchâtre.

87. Coturnix communis, Bonnat.

Trois mâles et deux femelles de Sesulma, Siongno, Ara-Sambo et C.-chonmal, recueillis en novembre, janvier et mars.

	Long. totale.	Vol.	Aile.	Queue.	Bec.	Tarse.	Doigt médian avec l'ongle.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
♂..	210	337	96	37	16	25	27·5
♂..	213	355	105	36	16	28	28
♂..	205	340	100	39	15	27	25
♀..	208	338	103	38	15	28	25
♀..	205	328	95	36	15	25	24

88. Phasianus torquatus, Temm.

Une paire prise aux environs de Séoul en janvier. Coloration en général considérablement plus obscure que celle des Faisans du pays Oussourien. Le mâle a toutes les couleurs plus foncées, ce qui est le plus frappant au bas du cou (*auchenium*), où elle est d'un roux doré au lieu de straminé ; le noir du milieu des parties inférieures du corps prolongé jusque sur la poitrine, le vert au cou passant moins au bleu ; la couleur de la poitrine, de la région jugulaire et des flancs beaucoup plus foncée, etc. ; il lui manque de macule blanche au dessous des oreilles, mais la plus grande différence est dans la forme du collier blanc, qui est presque d'égale largeur partout, tandis que celui du Faisan Oussourien est fort attenué en arrière et élargi sur les côtés ; le blanc de la bande sourcilière n'atteint pas la base des huppes latérales, tandis qu'il la dépasse chez l'oiseau cité. Jugeant de la description dans l'ouvrage sur 'Les Oiseaux de la Chine' de l'Abbé David et M. Oustalet, ce Faisan Coréen est différent dans les différents détails de toutes les trois variétés locales mentionnées dans ce travail. La femelle est aussi en général considérablement plus foncée.

89. Ægialitis minor (Mey. et Wolf).

Deux mâles et deux femelles recueillis à Séoul en avril.

90. Ægialitis placidus (Gr.).

Un mâle de Séoul, tué en janvier.

91. Vanellus cristatus, Mey. et Wolf.

Une femelle tuée en mars à Dultoni.

92. Tringa cinclus, L.

Un mâle tué à Séoul en novembre.

93. Tringa minuta, Leisl.

Deux paires d'oiseaux jeunes tués en novembre.

94. Gallinago scolopacina, Bp.

Un exemplaire de Séoul tué en novembre.

95. Gallinago stenura, Kuhl.

Un exemplaire de Séoul tué en novembre.

96. Grus viridirostris, Vieill.

Une paire de Sesulma et de Piengga ; yeux presque noirs.

97. Grus leucauchen, Temm.

Deux femelles de Séoul et de Dultoni recueillis en mars. Iris jaune rougeâtre.

98. Ibis nippon, Temm.

Trois mâles et une femelle de Séoul et de Gouran, tués en décembre et janvier.

99. Ibis nippon sinensis, Oust.

Une femelle tuée à Tongdje en mai.

100. Ciconia boyciana, Swinh.

Mâle adulte tué en mars. Bec noirâtre ; pieds d'un rouge obscur ; tour dénué de l'œil et peau gulaire rouge, iris jaune pâle.

Longueur totale 1330, vol 2470, aile 705, queue 256, bec 288, tarse 265, partie dénuée des tibiæ 186, doigt médian 98, aile dépassant la quéue de 10 mm.

101. Ardea cinerea, L.

Un mâle tué à Séoul en avril.

102. Ardea alba modesta (J. E. Gr.).

Un mâle tué à Séoul en juillet. Iris jaune pâle ; bec et pieds noirs. Longueur totale 993, vol 1460, aile 370, queue 135, bec 140, tarse 190, partie dénuée des tibiæ 105, doigt médian 97, ongle 10, scapulaire dépassant le bout de l'aile 144 mm.

103. Gallicrex cinerea (Gm.).

Femelle tuée à Séoul en juillet.

104. Sternula sinensis (Gm.).

Six mâles et deux femelles, tués à Séoul en mai et juin.

105. Cairina rutila (Pall.).

Un mâle tué à Seoul en janvier.

106. Clangula glaucion (L.).

Une paire recueillie à Gouran en décembre.

107. Oidemia americana, Sw. et Rich.

Une femelle de Gouran (port Lazarew), tué en décembre. Iris presque noir.

3. On the Pygmy Hippopotamus of Liberia, *Hippopotamus liberiensis* (Morton)[1], and its claims to distinct Generic Rank. By W. H. Flower, C.B., LL.D., F.R.S.

[Received November 15, 1887.]

The Zoological Department of the British Museum has lately acquired a complete skeleton and skin of a fully adult Pygmy Hippopotamus. This animal has been separated generically from *Hippopotamus* by Leidy[2], under the name of *Chœropsis*; and Leidy's view has been adopted by Alphonse Milne-Edwards[3] (who has given a very careful description of the whole skeleton), by Gratiolet[4], and by others[5]. The two points of generic distinction insisted on are:—I. The absence of the outer pair of lower incisors which are found in *Hippopotamus amphibius*. II. The very different proportions and relations of the parts of the cranium.

It is admitted that in all other structural characters the two forms are closely allied.

I. With reference to the dentition, we may recall the division which was made long ago by Dr. Falconer[6] of all the then known species of Hippopotamus living and extinct into two subgenera, *Hexaprotodon* and *Tetraprotodon*, according as they had three or two incisors on each side of the jaw. The former term was afterwards raised to generic rank by Owen[7], the old generic name *Hippopotamus* being retained for *Tetraprotodon*. Accepting this distinction as a valid one, it was logical on the part of Leidy, on the discovery of a form with only one incisor in the lower jaw, to separate it also generically.

In his revision of the group, Mr. Lydekker does not accept these divisions as generic, remarking that "the case of *H. palæindicus*, which in its lower jaw is really a *Hexaprotodon* in process of conversion into a *Tetraprotodon*, coupled with the instance of unilateral hexaprotodontism in *H. amphibius*, indicates that Dr. Falconer's two subgenera should be abolished. This point being admitted, there are but slight grounds for retaining the subgenus or genus *Chœropsis*,

[1] *Hippopotamus minor*, Morton, Proc. Acad. Nat. Sciences Philadelphia, 1844, p. 14. Name withdrawn, as preoccupied, in favour of *H. liberiensis*, Morton, Journ. Acad. Nat. Sc. Philad. 2nd ser. vol i. p. 232 (1849).

[2] *Chœrodes* (Proc. Acad. Nat. Sc. Phil. vi. p. 52), withdrawn, as preoccupied, in favour of *Chœropsis* (Journal Acad. Nat. Sc. Philad. 2nd ser. ii. p. 213, 1853).

[3] Recherches pour servir à l'histoire naturelle des Mammifères: Paris, 1868, p. 77.

[4] Recherches sur l'Anatomie de l'Hippopotame: Paris 1867. Apparently unaware of Leidy's generic name, Gratiolet proposed that of *Ditomeodon* (p. 202).

[5] Macalister, "The Anatomy of *Chœropsis liberiensis*," Proc. R. Irish Academy, 2nd ser. i. p. 494 (1873). The existing literature of this interesting species is completed by reference to a description and figure of the sternum (which was absent in the skeleton described by Milne-Edwards) by Peters, Monatsbericht Ak. Berlin, 1873, p. 445.

[6] Falconer and Cautley, Asiatic Researches, xix. pt. i. p. 51 (1836).

[7] Odontography, p. 566 (1840–45).

and accordingly all the species of Hippopotamus may be referred to a single genus"[1].

The new specimen affords an interesting corroboration of this opinion. In the front of the lower jaw are the two usual incisors; but on the right side is an additional smaller tooth placed between the normal incisor (*i.* 1) and the canine, and which evidently corresponds with the smaller outer incisor of *H. amphibius* (*i.* 3, according to Lydekker's determination). This tooth is procumbent (though rather less so than the contiguous incisor). It has a cylindrical root, and (as in the opposing outer incisor of the upper jaw) a portion of the enamel-covered crown remains, the greater part being worn obliquely away. Its diameter is 7 millimetres, that of the first incisor being 12. There is no corresponding tooth on the left side.

The remaining dentition of the Pygmy species is essentially that of *Hippopotamus*, although undoubtedly differences in detail can be pointed out. The most striking of these are the larger development and greater persistence of the first premolar, the smaller relative size of the fourth upper premolar, and the greater simplicity of the form of the crowns of the true molars. Whether these characters are of sufficient importance for generic distinction is a point to be decided according to the view taken of the advisability or otherwise of multiplying such distinctions.

With regard to the cranial differences, so strongly insisted upon by Leidy, Milne-Edwards, and Gratiolet, striking as they are on superficial observation, they all depend upon one circumstance, the greater relative size of the brain-cavity and capsules of the sense-organs (orbits and auditory bullæ) in *H. liberiensis*, contrasted with the huge development of the masticating organs, and ridges for the attachment of muscles to move the jaws, in *H. amphibius*. Apart from this the crania are essentially similar, even the remarkable thin-walled capsule formed by the lachrymal bone in the floor of the orbit, well known in the common species, is present, though on a smaller scale, in the Liberian animal. Now it is rather remarkable that these differential characters have been pointed out with great emphasis by the three eminent anatomists mentioned above, without any indication of the circumstances that they are just those characters by which, in any natural group, the small members differ from the large, and just those in which in any species the young differ from the adult. The universal law of the arrest of growth of the nervous system and sense-organs in the large members of homogeneous groups fully accounts for all the differences of the two skulls which have been pointed out with such minuteness. Exactly similar differences are found between the Tiger and the smaller species of *Felis*, the Gorilla and Baboons and the smaller allied Apes, the large and small members of the genus *Otaria*, and in fact wherever there is great diversity in size in closely related forms and even in individuals of the same species. A pygmy Hippopotamus which should present all the exact proportions of the large form as regards these parts of its organization, would be as great an anomaly as a dwarf

[1] Palæontologia Indica, ser. 10, vol. iii. p. 47.

or a child with the proportions of a full-sized adult. All these distinctions therefore, instead of indicating diversity, are rather conclusive evidence of affinity, unless size itself is to be considered as a worthy ground of generic distinction.

After all a generic name is purely a matter of convenience, and for my part I think it more desirable and instructive to call the Liberian species *Hippopotamus*, and thereby to indicate its close relationship with the well-known large animal of that name, than to give it a designation in which this affinity is lost sight of. It may be sometimes expedient to divide up genera in which the number of species are excessive upon comparatively trivial characters; but in the case of *Hippopotamus*, with only two living and but few extinct species, no such reason can be alleged.

4. On a new Genus and Species of Australian Mugilidæ. By J. Douglas-Ogilby, Department of Fishes, Austr. Mus. Sydney. (Communicated by F. Day, C.I.E., F.Z.S.)

[Received November 1, 1887.]

Trachystoma, gen. nov.

Branchiostegals six; pseudobranchiæ present. No adipose eyelids. Vomer and palate furnished with distinct bands of villiform teeth; jaws toothless. Scales rather small, finely ctenoid.

Trachystoma multidens, sp. nov.

B. vi. D. $4\frac{1}{8}$. A. 3/9. V. 1/5. P. 15. C. 14.
L. lat. 48–51. L. tr. 16.

Length of head $5\frac{1}{3}$ to $5\frac{1}{2}$, of caudal fin $4\frac{3}{4}$ to $5\frac{1}{3}$, height of body $4\frac{8}{9}$ to 5 in the total length. *Eye* without adipose lids, the diameter of each $4\frac{1}{7}$ to $4\frac{1}{3}$ in the length of the head, $1\frac{1}{5}$ to $1\frac{1}{3}$ diameters from the end of the snout, and $1\frac{4}{5}$ diameters apart. Interorbital space convex; snout broad and depressed; upper lip not thickened. Angle made by the anterior edges of the mandibles moderately obtuse; the length of one of the mandibular rami is $\frac{2}{3}$, or slightly more, of the width of the gape of the mouth. The maxilla reaches backwards to the vertical from the hinder margin of the posterior nostril. Preorbital serrated along its outer edge. Nostrils nearer to the eye than to the end of the snout; the anterior nearly circular, small; the posterior oval, large, about five times the size of the anterior. The free space on the chin is of moderate size and lanceolate. *Teeth*: a patch of villiform teeth on the vomer, sometimes crescentic, sometimes biclavate; palate with an elongate band, broadest anteriorly. *Fins*: Spinous dorsal commences rather nearer to the base of the caudal than to the tip of the snout; its spines are strong, the first the longest, about two thirds of the length of the head; the interspace between the two dorsal fins is rather less than the base of the spinous dorsal, while the distance between the origins of the two dorsals exactly equals the length of the head, anterior rays of second dorsal equal to the first spine. Anal commences considerably in advance of the second dorsal, and its rays are somewhat longer than those of that fin. Ventral fin about three fourths of the length of the head; pectoral rather more. Caudal forked, its lobes much longer than the head; the least depth of the free portion of the tail is half the length of the head. *Scales* 29 or 30 between the snout and the origin of the spinous dorsal; 6 to 8 in the interspace between the two dorsals. No pointed axillary scale. The pectoral fin reaches to the 13th or 14th scale of the lateral line. The first dorsal commences above the 19th scale of the lateral line, the second above the 32nd to 34th scale. Anterior rays of the soft dorsal and anal covered with small scales for fully half their height. An angular scale at the bases of the soft dorsal and ventral. *Colours*: silvery, the back greenish; cheeks tinged with gold; fins grey; irides yellow.

In the preparation of the above description I have examined three specimens of this fish picked out from a number of other Mullets exposed for sale in the Sydney fish-market; all three came from Port Stephens, where they were taken in the brackish water at the mouth of the Keruah River, and are said to be distinguished from the two common Grey Mullets (*Mugil dobula* and *M. peronii*) under the name of "River Mullet." These examples were obtained during the month of February, but though I have carefully overlooked all the consignments which have been sent to the market from that neighbourhood since, I have failed to meet with this species again: one of these, a female, had the roe almost ready for extrusion; in the two others, both males, the milt was about half developed; it is evident therefore that the autumn spawning takes place about the month of March with the main body of fish, and as all our other Mullets spawn twice in the year, it is probable that this species also has a spring spawning-season. The specimens examined measured respectively 14, 15½, and 16¾ inches.

I may here mention that after an exhaustive examination of numerous examples of the two reputed species, *Mugil dobula*, Günth., and *M. grandis*, Casteln., I can find no differences sufficient to justify their separation. Castlenau's fish is the adult, which comes in from the open sea twice in the year, in spring and autumn, for the purpose of depositing its spawn about the mouths of our creeks and rivers, and is known to fishermen by the name of "Sea-Mullet." On their arrival from the sea they are in fine condition and very fat; and being very plentiful and of excellent flavour they command a ready sale in the market, and are eagerly sought for by the professional fishermen, to whom the mullet harvest here is analogous to the herring harvest in Scotland, or the pilchard harvest to a Cornish man. The shoals of mullets are usually followed by several large Sharks, among which *Carcharodon rondeletii*[1] and *Galeocerdo*

[1] The *Carcharias leucas* of Bennett (Proc. Zool. Soc. 1859, p. 223), doubtfully given by Dr. Günther as a synonym of his *C. brachyurus*, is *Carcharodon rondeletii*; the specimen is still preserved in the collection of the Australian Museum, and has been verified by the man who caught it.

rayneri are the most common species, which frequently make havoc of the nets, thereby causing serious loss to the fishermen, not only by the damage to the nets but also by the loss of all the enclosed fish, which quickly find the rents made by the Sharks and escape through them. I am of course speaking of seine-nets, which are the only kind in general use here. Günther's species is the half-grown fish, which does not go to the sea but remains in our bays and estuaries, and is therefore about a month earlier on the spawning-grounds, and consequently in the market, where it is called "Hard-gut Mullet." These fishes after spawning accompany the remnant of the older fishes to the sea, and return during the following equinox as "Sea-Mullet."

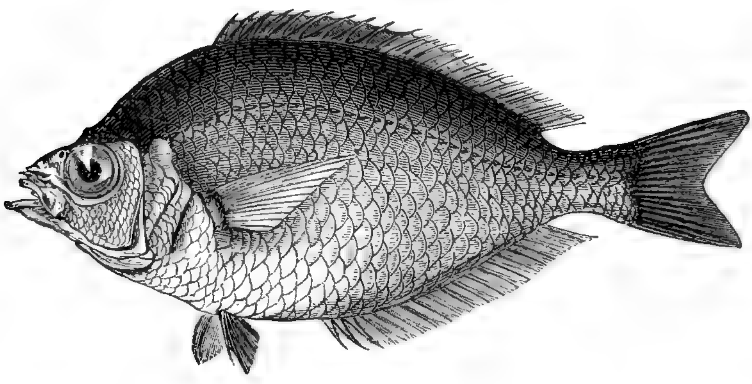
5. On a new Genus of Percidæ. By J. Douglas-Ogilby. (Communicated by F. Day, C.I.E., F.Z.S.)

[Received November 7, 1887.]

Chthamalopteryx, gen. nov.

Branchiostegals six; pseudobranchiæ present. Body oblong-ovate, compressed. Mouth protractile. Preorbitals with a blunt bony protuberance in front; preopercles entire. A band of small teeth in the jaws. One dorsal fin very slightly notched, the length of the soft portion greater than that of the spinous, having the formula $\frac{9}{17}$; anal $\frac{3}{17}$; caudal forked. Scales of moderate size, cycloid, deciduous.

From the above diagnosis it is plain that this proposed genus is closely allied to *Gerres*; and it is in fact founded on a species which was described some years ago by Count Castelnau under the name of *Gerres melbournensis*, from specimens obtained probably in the



Chthamalopteryx melbournensis.

Melbourne fish-market. No other examples seem to have been noticed, at least none have been recorded that I am aware of, since his time, but during the last eighteen months the Australian Museum has received from different sources two perfect specimens agreeing in every respect with Castelnau's description, both of them having been caught in the Gulf of St. Vincent. These two examples, from which the description is taken, measure respectively $4\frac{1}{2}$ and $5\frac{1}{6}$ inches, and the type specimen is about the same length, which seems to be the full size to which it grows. It is worthy of mention that Count Castelnau's original type, a dried half skin, was presented by him to this Museum, where it is still preserved. Appended is a full description of the species.

CHTHAMALOPTERYX MELBOURNENSIS.

Gerres melbournensis, Casteln. Proc. Zool. Soc. Vict. i. 1872, p. 158; Macleay, Descr. Catal. Austr. Fish. i. p. 80.

B. vi. D. 9/17. A. 3/17. V. 1/5. P. 14–15. C. 17.
L. l. 37. L. tr. 4/10?

Length of head 4 to $4\frac{1}{4}$, of caudal fin $4\frac{3}{5}$ to $4\frac{4}{5}$, height of body $2\frac{5}{6}$ in the total length. *Eye*: diameter $\frac{3}{8}$ of the length of the head, $\frac{5}{6}$ of a diameter from the end of the snout, and $\frac{6}{7}$ of a diameter apart. The groove for the process of the intermaxillary bones is ovate and short, extending but little beyond the anterior margin of the orbit. The interorbital space is slightly convex; the upper profile of the head is concave, the snout, however, being obliquely flat, while there is a slight protuberance above the middle of the eye. The maxilla reaches to the vertical from the anterior margin of the orbit; its posterior edge is concave. Preorbitals with a bony point directed forwards. *Teeth*: a broad band of minute curved teeth in the jaws, the outer row somewhat enlarged. *Fins*: Dorsal fin scarcely notched; the length of the base of the spinous portion is three fourths of that of the soft, and the space between the dorsal and caudal is one third of that between the dorsal and snout, its origin is above the last quarter of the opercle, and its termination a little in front of that of the anal fin. The spines are of moderate strength and gradually increase in height to the last two or three, which are equal, and about half the length of the head; the rays are subequal in height to the posterior spines. The anal fin commences beneath the anterior dorsal ray, and the length of its base is one fourth more than the length of the head; the spines are much stronger than those of the dorsal, the third the longest, rather more than a third of the length of the head. The origin of the ventral is beneath the posterior angle of the base of the pectoral; it does not quite extend to the vent, and is four sevenths of the length of the head, while its spine is five sixths of the length of the adjacent ray. The pectoral fin is elongate, the fourth and fifth rays being the longest, extending to the vertical from the third anal spine, and slightly shorter than the head. Caudal forked. *Scales*: interorbital space, snout, and preorbital absolutely scaleless, punctured by numerous small round pores; posterior nostril twice the size of anterior, placed very close to the eye. Scales of the cheek rather smaller than those of the body, extending on to the mandible. *Colours*:

silvery, the upper parts with a blue, the sides with a bronze, tinge; the spinous portion of the dorsal is pale purple, the soft portion, the anal, and the caudal yellowish; pectorals and ventrals pinkish, the cheeks and opercles being also washed with the same colour. Irides golden.

6. On a new Caucasian Goat (*Capra severtzowi*, sp. n.). By Dr. M. Menzbier, C.M.Z.S., Professor in the University of Moscow.

[Received November 15, 1887.]

In the lately published memoir of Mr. Eug. Büchner, "Zur Geschichte der kaukasischen Ture"[1] we have a carefully prepared treatise upon the present state of our knowledge of *Capra caucasica* and *Capra cylindricornis* (*Ægoceros pallasii*), as well as of their distribution and synonymy. But it seems that I am more fortunate than Mr. Büchner in the solution of the question what is the *Capra caucasica* of Güldenstaedt, who very positively speaks on the "cornua" of this Goat as "retrorsum et extrorsum arcuata, apice denuo introrsum vergentia." During the last two years I have had an opportunity of receiving many skins, horns, and skulls of the Mountain-Goat from the northern Caucasus, and amongst them I have found at last the true *Capra caucasica* of Güldenstaedt. It is a Mountain-Goat inhabiting the region between Elbruz and Dykhtau, and only mentioned by Mr. Dinnik in his pamphlet on the Caucasian Mountain-Goat. I do not understand either how such an excellent naturalist could maintain that the Mountain-Goat from the central part of the northern Caucasus is the same as the Mountain-Goat from the western half of this region, nor his conclusion that the western Mountain-Goat is the true *Capra caucasica* of Güldenstaedt. In the western and eastern or central Mountain-Goat of the northern Caucasus we have two quite different animals—the central being the true *Capra caucasica* of Güldenstaedt, in many respects assimilating to *Æg. pallasii*; the western, I think, being a species new to science, but erroneously described by Mr. Dinnik and Mr. Büchner as *Capra caucasica*. For this western Caucasian Goat I propose the name *Capra severtzowi*, in honour of my friend Mr. Severtzow, to whom we are under great obligations for our knowledge of the different Wild Goats and Sheep.

The subjoined descriptions of the Caucasian Mountain-Goats may serve to distinguish these two very different animals.

Capra caucasica, Güld.

This Goat is a very graceful, handsome, and powerful animal, a little smaller than *Capra severtzowi*, but with enormous black horns.

[1] Published in the Mém. Acad. Sc. St. Pétersbourg, sér. vii. t. xxxv. No. 8 (1887).

The curve of the horns is as follows (I speak of the horns of the full-grown male): from the head the horns rise upwards and outwards, then backwards and outwards, and finally downwards, with the tips curved inwards (cornua . . . . maxima, ... retrorsum et extrorsum arcuata, apice denuo introrsum vergentia), so that the tips approach one another very sensibly. The section of the horns taken near the base is quadrangular with rounded posterior corners. On the front surface of the basal half there are 8 or 9 small ribs, on the apical half about 10 more conspicuous nodules. The length along the anterior surface is from 30″ to 32″ 2‴; the circumference at the base is from 11″ to 12″. The distance between the tips of the horns is only about 20″. By all these characters of the horns *Capra caucasica* differs from *Capra severtzowi* and approaches to *C. cylindricornis* sive *Æg. pallasii.*

The incisors of the lower jaw are fine and slight in comparison with those of *Capra severtzowi.* The skull has a higher forehead, more broadly developed occipital and frontal regions, and is more solid. The beard, reddish-brown in colour, is short and broad, like that of *Capra cylindricornis,* and not like the beard of *Capra severtzowi.* The head is covered with a reddish-brown fur, darker in the front than at the sides. The general colour of the fur is yellowish-brown-grey, the colour of *Cervus elaphus*; but on the nape of the neck is a lighter spot; along the edge of the spine there is a dark stripe; the groins are light; the tail is covered with very long dark brown hairs. The extremities are dark, with a slightly developed light stripe on the posterior side of the fore feet, more visible on the posterior side of the hind feet. The fur on the belly is very dark, black-brown.

The distribution of *Capra caucasica* is very limited; it inhabits only the mountains between Elbruz and Dykh-tau, *i. e.* it is met with only at the sources of the Chegem, Baksan, and Malka. This region is central in its position, between the region of *C. cylindricornis* on the east and the region of *C. severtzowi* on the west.

CAPRA SEVERTZOWI, sp. n.

The *Capra caucasica* of Mr. Dinnik differs in such a great number of characters from the true *Capra caucasica* of Güld., that it undoubtedly must be distinguished as a separate species. It is a very powerful animal, with enormous black horns, as in *C. caucasica,* but their curve is regular and inclined in one plane. From the head the horns rise upwards and outwards, then backwards and outwards, and finally downwards. I have seen many beautiful horns of this species with the tips curved outwards, but this is not the rule, though the distance between their tips is always enormous compared with the horns of *Capra caucasica*: on the authority of Mr. Dinnik, this distance is nearly 3 feet in one skull of his collection, and I know a skull with the distance between the tips of the horns about 32″. The section of the horns taken near the base is triangular, with rounded corners. On the front surface there are more or less conspicuous nodules.

The incisors of the lower jaw are thick and round. The skull, in comparison with the skull of *Capra caucasica*, has neither such a developed forehead nor such a broad occipital region.

The fur has the following peculiarities: the general colour is a brownish grey, with more expressed yellowish tinge than in *Capra caucasica*; the head is darker, a light spot on the nape of the neck is but a little developed; along the ridge of the spine a dark stripe. The anterior and posterior extremities are dark with a very observable light stripe on their posterior side. The fur on the belly is light brownish. The beard, brown in colour, is longer and narrower than in *Capra caucasica*; the tail, on the contrary, is shorter.

It seems to me that all the figures of horns on the plate accompanying Mr. Büchner's pamphlet (taf. 1) should be referred to *Capra severtzowi*.

The distribution of Severtzow's Goat is more extensive than that of *Capra caucasica*; this animal is met with throughout the whole of the alpine region of the western Caucasus, and, according to the observations of Mr. Dinnik, presents some marked distinctions in the specimens inhabiting its westernmost parts. "Their horns are comparatively short, thick, with a more decided outward turn at the base, and with large nodules on the anterior side. Their section taken near the base proved them to be quadrangular with rounded corners, rather than triangular. The circumference at the base of the horn as compared with the length measured along the anterior surface is equal to half or a little more. The colour of the fur of this Goat is also perceptibly lighter."

It is possible that this western Caucasian Mountain-Goat may form a third distinct species, or at least a variety of *Capra severtzowi*.

Both the described typical specimens of Goats (*Capra caucasica* and *Capra severtzowi*) are now preserved in the Zoological Museum of the University of Moscow.

7. Critical Notes on the Nomenclature of Indian Mammals. By W. T. Blanford, F.R.S., F.Z.S.

[Received November 9, 1887.]

I. *On the* Simia silenus *and* S. veter *of Linnæus, and on the proper name of the Malabar Bearded Monkey.*

Ever since the time of Schreber the specific name *silenus* has been applied to a bearded species of *Macacus* peculiar to the Malabar coast. This Monkey is commonly known amongst European zoologists as the Wanderoo, and in many European works on natural history is said to inhabit Ceylon; but it was long since shown by various writers that the species is not Ceylonese, and that the Wanderoo of Ceylon is a *Semnopithecus*. The question I have endeavoured to solve is whether the bearded *Macacus* of Malabar is the *Simia silenus* of Linnæus.

In the twelfth edition of the 'Systema Naturæ,' vol. i. p. 36, *Simia silenus* is described thus:—"*S. caudata barbata nigra, barba nigra prolixa. Habitat in Egypto. Species obscurior, ignotis. Pedum unguibus, aliisque plurimis attributis.*" Neither the colour of the beard nor the locality agrees with the Malabar Monkey.

Two references are given by Linnæus thus:—

"Simia Callitriches magnitudine Cynocephalorum. Alp. ægypt. 242?

"Cercopithecus barbatus niger, cæsarie prolixa faciem cingente. Briss. Quad. 209."

Brisson's account was, however, taken from Prosper Alpinus's work, to which the first reference in Linnæus applied. It is thus manifest that the *S. silenus* of Linnæus is founded solely on P. Alpinus's description. His work is entitled "Prosp. Alpini Hist. Ægypti naturalis pars prima. Lugduni Batavorum, MDCCXXXV." At p. 242 are several descriptions of Monkeys, but bearded species are only described towards the bottom of the page. The work is rare (the only copy I have seen is in the British Museum), so I append a somewhat lengthy extract.

"*** Tertius est ex iis qui vulgo Monichi vocantur caudati, & barbati: ex Ethiopiæ locis conterminis in Ægyptum deducuntur, suntque admodum cicures, & mundi, non tamen eo ingenii acumine, ut alii Cynocephali donati sunt. At ut feles naturam ingenii habent, atque hæc de Simiis Cynocephalis à facie canina vocatis sufficiant. Sequuntur has Simiæ caudatæ & barbatæ, quas Callitriches Aristoteles vocavit, quæ prioribus admodum dissimiles cernuntur. Quædam maximorum Canum magnitudinem habent, & quædam mediocris sunt magnitudinis. Rarò hæ Simiæ bipedes incedunt, sed quadripedes brutorum modo. Habent alias differentias quibus interstinguuntur; etenim aliquæ ex iis toto corpore figura ad leones accedentes, crinitasque jubas veluti leones habere videntur, sed pilis nigris pendulas. ¶ Hic simius in pectore crassior apparet, & circa ilia subtilior, ut leones. Caudam latam pilis longis, prolixisque cubitalem, & ampliorem habet: facies vero ad leoninam quadantenus inclinat, ore & dentibus itidem proximis. Barba ex mento pendet longa, lata, nigris pilis obsita. Aures humanis longiores cernuntur, totaque facies nigerrimo splendet colore. Hic Simius haud injuria a nobis Callitriches leonino corpore dictus est."

*** *Vide* tab. xx. num. 3.

¶ *Vide* tab. xx. num. 2.

With regard to the figures, tab. xx. fig. 3 represents an animal with a thin beard, below the chin alone, and with a rather long tail; tab. xx. fig. 2 shows a Monkey drawn so as to resemble a Lion as much as possible. Neither figure has any resemblance to the Malabar Monkey.

It should, however, be observed that a note of interrogation occurs after the number of the page in Linnæus's reference, and I have no doubt that the animal to which it was intended to refer was one described by Prosper Alpinus on p. 244 in the following terms:—

"Quædam Simiæ ex Callitrichis visuntur magnitudine magnorum

Cynocephalorum nigro colore, totius corporis, & faciei præsertim, quæ undequaque est cæsarie magna pilorum nigrorum circumdata. Hilari & eleganti faciei sunt, admodumque cicures, mansuetæ, ‡ *Vide* tab. xxi. benevolæ, atque fideles hæ Simiæ observantur. ‡ Imaginem pictam quam hic damus, misit ad me Nicolaus Contrarenus Patritius Venetus maxime illustris, ad Simiam ex Ægypto Venetias deductam affabre pictura delinatam."

Tab. xxi. represents an animal with a short tail, hairy body, and long hair all round the head. This figure has some resemblance to the Malabar Monkey, but quite as much to *Cynocephalus hamadryas* or *Macacus* (*Theropithecus*) *gelada* or *M. obscurus*. Indeed, taking the description into consideration, the last may not improbably have been the species intended. The resemblance of this figure to that of Buffon's "Ouanderou" not improbably led to the two being confounded.

It will be noticed that the quotation from Prosper Alpinus in Linnæus, "Simia Callitriches magnitudine Cynocephalorum," was evidently taken from the last quoted description.

I conclude therefore that the *Simia silenus* of Linnæus was distinguished by three characters, not one of which can possibly apply to the Malabar Monkey. These three characters were: (1) the size was equal to that of the largest Baboons; (2) the beard was black; and (3) the animal was an inhabitant of Egypt or Ethiopia.

It should, however, be noticed that in the tenth edition of Linnæus, p. 26, *Simia silenus* was described as "*S. caudata barbata, corpore nigro, barba nivea prolixa.*" The only reference is again to Prosper Alpinus, but the locality is given as Asia; Ceylon, Java, &c. It is highly improbable that the Malabar Bearded Ape was the animal indicated [1].

So far as I can ascertain, there is nothing to show that the Malabar animal was known to Linnæus or to any earlier naturalist. But even if the *S. silenus* of the 10th edition of the 'Systema' were founded wholly or partly on the Malabar Monkey, I fail to see how the name could be used for that animal, since the same specific term is applied to a totally different species in the 12th edition.

A second Linnæan name that has been applied to the Malabar Monkey is *Simia veter*, Syst. Nat. ed. xii. p. 36. This was thus described:—"S. caudata barbata alba, barba nigra, Brisson, Quad. 207. Simia alba s. incanis pilis, barba nigra promissa, Raj. Quad. 89. Habitat in Zeylona." Brisson's account (like Klein's, which is quoted by Brisson) is taken from Ray, but the page in Ray's 'Synopsis Animalium Quadrupedum' is 158, not 89 (the latter is the page in Klein's work, which Linnæus does not quote). Ray's description runs thus:—"Simia alba seu incanis pilis, barba nigra promissa. Ex Zeylona: Elawandum Zeylanensibus. D. Robinson e Museo Leydensi." It is impossible to determine this animal. It may perhaps have been a *Semnopithecus*; but no Ceylon species

[1] It is very possible that the animal which Linnæus intended to name was the Wanderu of Ray, Synopsis Animal. Quad. p. 158. "Cercopithecus niger barba incana promissa." This was doubtless *Semnopithecus cephalopterus*.

is known to have a black beard. Elawandum is perhaps the same as Eli Wanderu, a Ceylonese name, according to Kelaart, of *S. thersites*, which I believe to be a variety of *S. cephalopterus*. It, however, has not a black beard. Elawandum is the same as Buffon's Lowando. The name *Simia veter* cannot possibly refer to the Malabar Monkey.

I now turn to the authentic history of the Malabar Monkey in the works of European naturalists.

Buffon, Hist. Nat. xiv. pp. 169, 174, pl. xviii., described and figured a Monkey which was clearly the Malabar form. He called the animal "Ouanderou;" and identified it with the "Wanderow" of Captain Robert Knox, and with the Wanderu and Elawandum of Ray. The name of *Wanderu* has clung to the Malabar Monkey ever since; but really applies, as Templeton, Kelaart, Tennent, and others have shown, to the Ceylonese *Semnopitheci*, and was rightly employed for those animals by Knox and Ray. The word *Wanderu*, however, as Sterndale has pointed out, is merely a Cingalese form of the Hindi word *bandar*, and means Monkey in a wide sense.

Schreber, in 1775 (Säugth. i. p. 87), united the "Ouanderou" of Buffon with the *Simia silenus* of Linnæus, and has been followed by naturalists generally [1].

There can be very little doubt but that the animal under consideration is the "Lion-tailed Monkey" of Pennant[2]. The first Latin name that I can find applied to this species is *Simia ferox*, given by Shaw in the 'Museum Leverianum' (p. 69), published in 1792. The description is accompanied by a fair figure. I think that the specific name *ferox* ought, by the rules, to be employed for this species, and I see no reason why Pennant's English name should not be adopted, instead of the misleading term "Wanderoo Monkey."

II. *On the* Simia cynomolgos of *Linnæus.*

In the twelfth edition of Linnæus's 'Systema Naturæ,' p. 38, a species of *Simia* is thus described:—

"S. cynomolgos caudata imberbis, naribus bifidis elatis, cauda arcuata, natibus calvis. Habitat in Africa, vigilis noctu instituit in arboribus."

Two references are given:—Brisson, Quad. p. 213, and Cercopithecus angolensis major, Marcgrav. Bras. 227. To the quotation from Marcgrav is added a reference to Ray, Quad. 155. Both Ray and Brisson, however, merely copied Marcgrav's account with a few unimportant emendations. It is clear, therefore, that the *Simia cynomolgos* of Linnæus is the animal described by Marcgrav.

George Marcgrav, who appears to have been a trustworthy writer,

[1] The only important exception is Frédéric Cuvier, who, in the folio 'Histoire Naturelle des Mammifères,' gave two capital figures of the "Ouanderou," and pointed out that it differed from the animal described by Prosper Alpinus. In the 'Table Générale et Méthodique,' however, the specific name *silenus* was used.

[2] Syn. Mamm. p. 109; Hist. Quad. ed. 3, i. p. 198, pl. xliv. f. 1.

published in 1648 a work entitled 'Historia Naturalis Brasiliæ.' This work contains descriptions not only of Brazilian animals, but also of several from the Portuguese possessions in Western Africa. Thus there is an unmistakable figure of the Red River-hog, on which the *Sus porcus* of Linnæus was founded [1]. At the page 227 quoted in the 'Systema Naturæ' is the following description :—

"Cercopithecus Angolensis major; in Congo vocant Macaquo. Color pilorum totius corporis ut Lupi, nares habet bifidas, elatas; caput ursino simile, nates calvos quibus insidet: caudam semper portet arcuatam. Longitudo corporis a capite ad caudam unius pedis et supra: capitis longitudo sex digitorum; caudæ pedalis; crura quatuor æqualis longitudinis decem digitorum in prioribus cruribus; manus tres & semis digit. longas, quinque digitis præd itas, in posterioribus longas manus quinque digitos. Crassities corporis ubi maxima unius pedis & novem digitorum: clamat hah, hah. Dentes habet albissimos. Mire gesticulatur, penem habet humano similem instar pueri."

It is perfectly clear from this that *Simia cynomolgos*, L., was an animal inhabiting the country around the mouth of the Congo, and, judging from the size, the bear-like head, and tail shorter than the body, a Baboon [2]. Certainly the Linnæan name has not the slightest application to the Malay Monkey, commonly known (improperly) as the Macaque Monkey, for which this name is generally used.

The Malay Monkey is, however, Buffon's "Macaque"; this name and also the generic term *Macaca* of Lacépède (1801) (subsequently modified into *Macacus* by F. Cuvier and Desmarest) being derived evidently from the same West-African or Portuguese word as Marcgrav's Macaquo. Schreber in this case, as in that of *Simia silenus*, is the author of the confusion that has arisen. He applied the Linnæan term *Simia cynomolgos* to Buffon's *Macaque*, of which he copied the figure.

The first author, so far as I can ascertain, who noticed the difference between Buffon's Macaque and the *Simia cynomolgos* of Linnæus was Frederick Cuvier, who, in 1818 [3], proposed for the former the name *Macacus irus*, a name that I think should, in accordance with the rules of nomenclature, be retained for the Malay Monkey.

There are, however, two other early names, *S. aygula*, Linn. (Syst. Nat. ed. 12, i. p. 39), and *S. atys*, Audebert (Hist. Nat. Singes et Makis), that have been applied to the present species; and it is as well to inquire whether either can be identified as pertaining to it. *Simia aygula* was thus described by Linnæus :—" S. caudata subimberbis grisea, eminentia pilosa verticis reversa longitudinali," with the quotation "Osb. Iter. 99." Osbeck's 'Voyage to China

[1] The much later specific title *penicillatus*, given by Schinz in 1847, is commonly used for this animal.

[2] The term *naribus bifidis* is puzzling, and I cannot suggest any satisfactory explanation of it.

[3] 'Mémoires du Muséum,' iv. p. 120.

and the East Indies' was published in 1757 at Stockholm; but there are German and English translations. It appears to me extremely doubtful whether the tufted animal described by Osbeck was not a young *Semnopithecus*, possibly *S. mitratus*. The description certainly suits that animal rather than any *Macacus*. The habits mentioned by Osbeck are indeed those of a *Macacus*, not of a *Semnopithecus*; but they are evidently derived from hearsay, and not from observation.

There is a second reference under *S. aygula* in the original Linnæan description to "*Simia nigra magnitudinis mediæ*, Edw. Av. 221, t. 311." The figure and description of Edwards's "Middle-sized Black Monkey" were probably taken from a *Cercopithecus*.

I do not think the term *aygula* can with any reasonable probability be applied to the Malay Monkey.

The name *Simia atys* is of equally questionable origin. It was given to a young albino monkey that may have been either a *Cercopithecus* or a *Macacus*.

Unless some good reason can be found for retaining one of the earlier appellations, it appears probable that Cuvier's name has the best claim to stand for the species.

III. *On* Macacus rhesus.

The above name has been very generally adopted for the common *Macacus* of Northern India, and I believe correctly. Every now and then, however, this animal is called *M. erythræus* (Schreber). The name *Simia rhesus*, as is well known, was given by Audebert in the 'Histoire Naturelle des Singes et Makis,' published in 1797. A good figure of the animal was given, and the species was identified with the "Macaque à queue courte" of Buffon, Hist. Nat. Supp. vii. p. 56, pl. xiii.

Now this same figure of Buffon's was copied by Schreber, and the name *Simia erythræa* applied to it. But this plate does not appear amongst the Monkeys in Schreber's 'Säugthiere,' in vol. i. (1775), nor in the additional plates referred to as belonging to vol. i. in vol. iii. p. 590 (1778), and vol. iv. p. 636 (1792). The plate was published undoubtedly as plate viii. c in Wagner's Supplement (1840), and a description was given in the letterpress. The only question is whether any earlier publication took place. The reference to Schreber runs thus, "Schreb. tab. 8. fig. Buff." Schreber's original plate 8, however, represented *Simia mormon*, the Mandrill. There is, in Wagner's Supplement, no reference to any page as in the case of other species described in Schreber's original work.

But the name *Simia erythræa* was used long previously on Schreber's authority. The earliest use of it that I have been able to find is in Shaw's 'General Zoology' (vol. i. p. 33), published in 1880. The only reference is "Schreb. Supp.," no number of the plate nor of letterpress being quoted. Another reference is by Geoffroy (Ann. Mus. xix. p. 101), and many might be quoted. From none, however, can I gather that the plate on which the name appeared was ever published; it was probably distributed to a few naturalists, but not issued in such a way as to give validity to the title.

IV. *On* Presbytis *or* Semnopithecus thersites.

A Hanuman Monkey from Ceylon was named *Presbytis thersites* in MS. by Walter Elliot, and was thus described by Blyth in 1847[1]:—

"Adult male inferior in size to *P. entellus* . . . . of a uniform dusky grey colour (devoid of fulvous tinge) on the upper parts, darker on the crown and fore limbs and passing to dull slaty-brown on the wrists and hands; the hair upon the toes whitish or dull white; no crest upon the vertex (as in *P. priamus*), nor does the hair there form a sort of transverse ridge (as in the living *P. entellus*); face surrounded with white, narrow over the brows; the whiskers and beard more developed than in the other Entelloid species, and very conspicuously white, contrasting much with the crown and body, which are darker than in *P. priamus*."

Subsequently, in 1851[2], Blyth observed that *P. thersites* did not exhibit "the radiating centres of hair a little behind the brow seen in various other Entelloid Monkeys." Kelaart (Prodr. Faun. Zeyl. p. 5) admitted *P. thersites* as distinct, and was followed by Sir E. Tennent and others. But in his 'Catalogue of the Mammalia in the Museum Asiatic Society,'[3] published in 1863, Blyth classed the original type of *P. thersites* under his *P. priamus*. This view was adopted by Dr. J. Anderson both in his 'Anatomical and Zoological Researches,' p. 19, and in his 'Catalogue of Mammalia in the Indian Museum, Calcutta,' p. 38. Dr. Anderson's conclusions, like Blyth's, were founded on the original types. I confess to being much puzzled. Dr. Anderson was doubtless under the impression that the longitudinal crest in *P. priamus* was artificial and due to the stuffer. But the common S. Indian and Ceylonese *Semnopithecus* is unquestionably crested. We have the testimony of several observers who have seen it alive, amongst them Jerdon and Kelaart, and recently Mr. W. Davison has been good enough carefully to observe living individuals and to communicate the result to me. I have also seen dried skins both from S. India and Ceylon, several of which had not been subjected to any manipulation, and in all the crest was as distinct as possible. Moreover, so far as I have been able to observe, the peculiar radiation of the hairs on the anterior part of the crown, so conspicuous in *S. entellus* and *S. schistaceus*, is always distinctly, if somewhat less, conspicuous in *S. priamus*. Blyth, however, especially described the type of his *Presbytis thersites* as wanting both crest and radiation.

Now there is nothing in the description of *P. thersites*, so far as I can see, to distinguish it from *Semnopithecus cephalopterus*, which has neither crest nor radiation, and which has "the whiskers and beard more developed than in the other Entelloid species, and very

[1] J. A. S. B. xvi. p. 1271.
[2] J. A. S. B. xx. p. 154. [3] P. 12.

conspicuously white." The crown and body too are darker than in *P. priamus*. I cannot help suggesting that the so-called *Presbytes thersites* was really a variety of *S. cephalopterus*, perhaps approaching the variety called *S. kelaarti* by Schlegel [1].

V. *On* Semnopithecus pileatus *and* S. chrysogaster.

Dr. J. Anderson, in his 'Anatomical and Zoological Researches' (p. 13), and again in his 'Catalogue of Mammalia in the Indian Museum,' has classed these terms as synonymous, I think from having misunderstood some remarks of Blyth's in the posthumous 'Catalogue of the Mammals and Birds of Burma,' p. 11 [2]. The two species are really very different, not only in coloration, but in structure, for *S. pileatus* has a peculiar cap of long harsh hair confined to the crown of the head, of which there is no trace in *S. chrysogaster*. The latter however appears, judging by the only known adult specimen, to have a compressed crest extending from the vertex to the nape.

Although an excellent figure of *S. chrysogaster* was published by Professor Peters (MB. Akad. Berlin, 1879, p. 830, pl. iv. *b*), no description except Blyth's (Cat. Mamm. Birds Burma, *l. c.*), taken from the drawing, has ever appeared, so far as I am aware. The animal might, however, easily be recognized from Blyth's account, which is good.

It is marvellous that so beautiful a species as *S. chrysogaster* should never have been detected again, if this animal is really from Tenasserim. It is true that the interior of Tenasserim, even to this day, is almost uninhabited, and very rarely visited by Europeans, the difficulties of travelling being excessive. But still it is remarkable that amongst the collections made since the days of Helfer by Major Berdmore, Captain Beavan, Mr. Davison, Mr. Limborg, Captain Bingham, and others, no specimen of so conspicuous a form should have been detected. Had not Peters (P. Z. S. 1866, p. 429, footnote) distinctly stated that the types were from Tenasserim, and had not Blyth (*l. c.*) confirmed the statement and added that they were collected by Helfer, I should be disposed to regard the locality as very doubtful. I examined the specimens when I was in Berlin two years since, and found them to be labelled "Tenasserim—Prof. Strempel," but I could learn nothing of their history.

VI. *Notes on some of the Varieties of* Felis bengalensis, *Kerr, and especially on* Felis jerdoni, *Blyth.*

The wild Spotted Cat of the Indian and Malay forests, appropriately named the "Leopard-cat" by Jerdon, has been very differently regarded by various naturalists. By some the differences in the size, form, and distribution of the spots, in the tint of the

[1] Mon. Singes, Mus. Pays-Bas, vii. p. 52.
[2] J. A. S. B. xliv. 1875, extra number.

ground-colour, in the size of the animal, and in the length of the tail, together with modifications in the form of the skull, have been regarded as specific, and a great number of specific names have consequently been proposed for the forms found in those parts of the Oriental region throughout which this type of Cats ranges. By others these differences have been treated as insufficient to justify specific distinction, and it has been urged that such differences as exist are not constant. As typical of the first class, Dr. Gray and Dr. Fitzinger may be quoted, of the latter Mr. Blyth.

Dr. Gray, in his latest work on the subject, the Catalogue of Carnivorous, Pachydermatous, and Edentate Mammalia in the British Museum (1869)[1], enumerates as distinct *F. minuta* (syn. *F. sumatrana*) from Sumatra, *F. javanensis* from Java, *F. nepalensis* from "India," "perhaps a hybrid or domesticated," *F. chinensis* from China, *F. pardinoides* from "India," *F. pardochroa* from Nepal, and a variety from Tenasserim, *F. tenasserimensis* from "India, Tenasserim," *F. jerdoni* from "Indian peninsula, Madras," *F. herschelii* from India, "Zanzibar?" (*sic*), and *F. wagati* from "India." Of these the form termed *F. pardinoides* has, I believe, since been ascertained to have been derived, not from India, but from South America. *Viverriceps ellioti* from "Madras," however, appears to belong to the same type as *F. bengalensis*, and to have no relation to either of the three very diverse forms, *F. viverrina*, *F. planiceps*, and *F. rubiginosa*, that are, on what principle it is difficult to conceive, associated together to form the genus *Viverriceps*. Two other names formerly given by Dr. Gray, *Leopardus horsfieldii*[2] from the Himalayas, and *L. reevesii*[3] from China, are omitted from the Catalogue; both were probably given to forms of the "Leopard-cat."

Mr. Blyth, whose latest publication[4] on the subject was considerably earlier in date than either Dr. Gray's or Dr. Fitzinger's, classed all the various Asiatic Spotted Cats to which the names above enumerated had been given by Horsfield, Temminck, Hodgson, Gray, and others, as forms of *F. bengalensis*, Desmoulins. He, however, named a supposed distinct species, *F. jerdoni*, separating it on account of its smaller size, although it was very similar in its markings.

In the same writer's 'Catalogue of the Mammals and Birds of Burma,' published[5] after his death in 1875, the name of *F. undata*, Desmarest, was adopted for the Leopard-cat.

[1] A considerable proportion of this work, as is well known, was reprinted from papers published in the Society's Proceedings for 1864, 1865, 1867 and 1868.

[2] Ann. & Mag. Nat. Hist. x. p. 260 (1842).

[3] Cat. Mamm. B. M. 1843, p. 44.

[4] P. Z. S. 1863, p. 184. The only apparent difference between the views there expressed and those published in the same author's Catalogue of the Mammalia in the Museum Asiatic Society, p. 60, published in the same year, 1863, but written a year or two previously, is that *F. jerdoni* is proposed as a distinct species in the first-mentioned paper only.

[5] J. A. S. B. xliv. pt. 2, extra number, p. 27.

Jerdon [1] in this, as in other points, has followed Blyth closely, but he remarked (p. 107) of the supposed *F. jerdoni* that it might prove only a small variety of *F. bengalensis*. In treating of *F. rubiginosa*, however (p. 109), he suggested that the Ceylon species referred to that Cat by Kelaart might perhaps be *F. jerdoni* of Blyth, which, he went on to say, "that gentleman recently writes me is perhaps the representative of *F. rubiginosa* on the Malabar coast. In the British Museum there is a specimen stated to be from Malacca, but Mr. Blyth is inclined to think that a mistake."

Mr. D. G. Elliot, in his illustrated 'Monograph of the Felidæ' (1883), separated these Spotted Cats into two species, which he called *F. bengalensis* and *F. javanensis*; but he gave no reasons for so doing, and omitted to point out wherein these two supposed species differ from each other. He included several of the forms enumerated by Gray and Fitzinger under each of the two types.

Both in the monograph and in a paper published in the Society's Proceedings [2], Mr. Elliot classes *F. jerdoni* as a variety of *F. rubiginosa*, and says that both Blyth and Jerdon agreed in this identification after examining the specimens [3]. In this view, as will be seen presently, I am unable to concur.

The only other writer on the subject whom I shall quote is Dr. Mivart, who in his work on the Cat distinguishes as separate kinds *F. bengalensis*, *F. wagati*, *F. chinensis*, *F. minuta*, *F. jerdoni*, and *F. javanensis*.

F. rubiginosa is classed by all as distinct, and of its distinctness there can be no question. The anterior upper premolar $\underline{p.\ 2}$ is always wanting, in adults at all events, as in the Lynxes, and the bony orbit in the skull is complete behind. In *F. bengalensis* and its varieties, out of more than 40 specimens examined I have only seen two in which the anterior upper premolar is absent on both sides, and the bony orbit is never complete behind. There is also a character in the external coloration by which every specimen I have examined of both forms can be at once distinguished. In all these Cats a variable number of interrupted dark lines pass from the forehead over the head and hind neck to the interscapulary tract. Usually there are four well-marked bands on the head; of these the two inner are continued between the shoulders in *F. rubiginosa* by two long, straight, slightly diverging dark lines, without any lines or spots between them. In *F. bengalensis* and its allies there are never these two lines alone; either the markings are all broken and interrupted, or other lines and spots intervene between the continuations of the two inner frontal bands. The tail, too, in *F. rubiginosa* is unspotted above; in all forms of the Leopard-cat distinctly spotted.

There is in the Natural History Department of the British Museum at present a very fine series of these Indian and Malayan

[1] 'Mammals of India,' pp. 105–107 (1867).
[2] P. Z. S. 1871, p. 760.
[3] This is confirmed by Mr. Holdsworth, so far as regards Mr. Blyth, P. Z. S. 1871, p. 758.

Spotted Cats; no less than 6 specimens of *F. rubiginosa*, all but one of which are from Ceylon, and the remaining specimen from Nellore in Southern India; and 42 skins of *F. bengalensis* and its allies. In going through the latter, whilst I have been struck by the great variety exhibited, I have been unable to trace a single character, external or cranial, by which the various races can be distinguished. There are doubtless several races, and except that I cannot see how *F. jerdoni* is to be separated, even as a variety, from *F. javanensis* of Horsfield, those accepted as kinds by Prof. Mivart are fairly recognizable. There is perhaps one to be added, the true *wagati* of Sir W. Elliot, not the form that was (I believe erroneously) described under that name by Dr. Gray. The variation in dimensions is not nearly so great as in the Leopard, and that in the markings is less than in the Ocelot.

Accepting, then, the view that all the forms of Leopard-cat are varieties of one species, which, for reasons to be assigned presently, must be called *F. bengalensis*, the next question for determination is whether the Cat called *F. jerdoni* by Blyth is a distinct form, as it has been considered by Blyth and Mivart, whether, as Jerdon suggested, it is a small race of *F. bengalensis*, or whether, as stated by Mr. D. G. Elliot, it is identical with a form of *F. rubiginosa*. *F. jerdoni* was founded by Blyth upon three specimens, as he writes (P. Z. S. 1863, p. 185):—"I first detected an adult male and a kitten of this species in the Museum at Madras, and find that there is an adult specimen also in the British Museum." There is now a second specimen in the British Museum, obtained from the East India Museum and labelled *F. jerdoni* in Mr. Blyth's handwriting. On the stand of the original specimen the name *F. jerdoni* has also been written by Mr. Blyth. The two specimens are precisely similar and that first in the Museum may be taken as the type of the species.

The markings of this specimen, as already mentioned, are scarcely distinguishable from those of Horsfield's type of *F. javanensis*. In both the characteristic points mentioned—the marks in the interscapulary region, and the spots on the tail—the two skins agree with *F. bengalensis* and not with *F. rubiginosa*. To complete the evidence, Mr. Thomas has had the skull of one of the skins of *F. jerdoni* extracted, and it proves to possess the anterior upper premolar and imperfect orbit of *F. bengalensis*. I have, therefore, not the least hesitation in assigning *F. jerdoni* as a variety to that species, and I believe it to be identical with the form commonly known as *F. javanensis*. The locality of neither specimen of *F. jerdoni* in the National Collection is known; but, considering that so closely similar a form has been described from Java, whilst there is no evidence as to the derivation of the Madras Museum specimens, it is far from improbable that Mr. Blyth was mistaken in his supposition, and that these skins were really brought originally from Malacca or the neighbourhood.

The next point for consideration is the oldest scientific name of the Leopard-cat. Blyth, as already remarked, used in 1863[1] the

[1] Cat. Mam. A. S. p. 60; in P. Z. S. 1863, p. 184, he calls this cat *F. bengalensis*, Desmoulins, probably a slip for Desmarest.

term "*Felis bengalensis*, Desmarest," and in his 'Catalogue of the Mammals and Birds of Burma,' *F. undata*, Desmarest.

The *Felis undata* of Desmarest was described first and very briefly in the Nouv. Dict. d'Hist. Nat. (1816), vi. p. 115, no. 27, as *Le petit chat sauvage de l'Inde.* It was said to be smaller than *F. javanensis*, its fur to exhibit waves rather than spots ("son pelage présente des ondes plutôt que des taches"), and it was compared to the Wild Indian Cat of Vosmaer, except that the latter was figured of a more bluish tinge.

In Desmarest's 'Mammalogie,' published in 1820, further details were given, the essential character being, "Pelage d'un gris sale, avec des nombreuses petites taches noirâtres, un peu alongées." This might perhaps refer to *F. viverrina*, but the description is palpably at secondhand, being founded on a specimen of a kitten brought by Péron from Java, and noticed by Cuvier in the 'Ossemens Fossiles.' It is clear that this animal was not *F. bengalensis*. The Wild Cat of Vosmaer is called by him "Japansche Bosch-Kat," and the figure has not the least resemblance to any Indian wild cat. Indeed the coloration is unlike that of any wild animal, and the specimen was doubtless a domestic cat or the offspring of one run wild.

But even if the term *F. undata* were applicable, it must give way to the much older *F. bengalensis* if, as appears to me to be the case, the latter can be shown to be really applicable to the same species; for this name dates, not from Desmarest's article published in 1816, as Blyth appears to have supposed, but from Kerr's 'Animal Kingdom' (p. 151), published in 1792. The name was founded on the Bengal Cat of Pennant (Hist. Quadr. p. 272), described from an animal brought alive to England, and which was said to have swum on board a ship at anchor off the coast of Bengal. This circumstance led Jerdon (Mamm. Ind. p. 106) to suggest that Pennant's Cat was a specimen of *F. viverrina*; but Pennant's description shows that the species was really the Leopard-cat, and it is more likely that the story of its capture was incorrect. The animal was described as of a beautiful pale yellowish-brown colour above, white below, and as rather less than a common cat in size, none of which characters agree with those of *F. viverrina*, whilst all apply to the Leopard-cat.

VII. *On the Scientific Name of the Common Indian Mungoose* (Herpestes griseus, *auct.*, *nec* Ichneumon griseus, *Geoff.*).

Although there has been by no means a general agreement as to the name to be applied to the common Mungoose of the Indian Peninsula, the Grey Ichneumon of some, a considerable majority of English naturalists have identified the animal with the *Ichneumon griseus* of Geoffroy St.-Hilaire, or, which comes to the same, with the *Herpestes griseus* of Desmarest. This specific name *griseus* had been adopted by zoologists in British India until recently, when Dr. Anderson (An. Zool. Res. p. 181) rejected it in favour of Wagner's later name *pallidus*, because Geoffroy's *Ichneumeon griseus* "originally included an African species." I agree with Dr.

Anderson in rejecting the name *griseus*, not, however, merely because it included an African species, which might not under all circumstances have been a sufficient reason, but because it was, I think, proposed for an African species, and not for the Indian Mungoose at all.

In a note to his paper on the Mammals of Mr. Hume's collection (P. Z. S. 1886, p. 56, note), Mr. Oldfield Thomas gives reasons for coming to conclusions opposed to my own. He identifies the Indian Mungoose with *Ichneumon griseus* of Geoffroy, and rejects Gmelin's specific name, which, as I will show presently, appears to me applicable. To explain these views some details are necessary.

The original description of *Ichneumon griseus* by Geoffroy St.-Hilaire occurs in the Natural History of the 'Description Générale de l'Egypte,' vol. ii. pp. 138, 139, and runs thus [1] :—

"Une autre espèce, également des Indes Orientales, est la mangouste nems de Buffon, Supp. iii. pl. 27. Elle est d'un cinquième plus grande que l'espèce à bandes [2], sa queue se termine de même en pointe, son pelage est plus claire, d'une couleur uniforme, tant sur le dos que sur les pattes, ses petits traits d'un brun roussâtre disséminés également, et dont il y a autant que de poils, font voir en gris-roux la teinte totale qui est, au fond, jaune couleur de paille. Daubenton a connu cette mangouste et l'a décrite dans la première partie de son article H. N. G. tome xiii."

This description will apply equally well to several distinct kinds of *Herpestes*. It will be seen that the species is founded on the *Mangouste nems* of Buffon. Now this is distinctly said by Buffon to be from Africa. As the term East Indies (Indes Orientales) was until recently very vaguely used and included all countries east of the Cape of Good Hope, East Africa may have been the locality meant by Geoffroy. There is nothing, so far as I can see, in the description to distinguish either the *nems* or Geoffroy's *Ichneumon griseus* from a young *Herpestes galera* or possibly *H. pulverulentus*. Mr. O. Thomas, in his paper on the African Mungooses (P. Z. S. 1882, p. 72), refers *Viverra nems*, Kerr (An. Kingdom, p. 160), to *H. galera*. Now Kerr's name was clearly founded upon Buffon's description, the characters assigned being abridged from Buffon's account; and if *Viverra nems*, Kerr, be the same as *Herpestes galera*, so is *Ichneumon griseus*, Geoffroy. Moreover, as the two names were founded on the same description, the oldest name has under any circumstances priority over *griseus*, which must therefore be relegated to the list of synonyms, whatever be the species to which it ought to belong.

But there is another and more important fact to be considered. The paper by Geoffroy on the Egyptian Ichneumon, from which the description of *I. griseus* has just been quoted, contains a list with notes of the species known to the author. The first of these is the "*mangouste de l'Inde* ou la *mangouste à bandes*," of which it is remarked, "Elle porte aux Indes le nom de *Mungo* ou de *Mungutia*,

[1] I give the extract in full, as the work is rare.

[2] The head and body of which are said to be 25 centimetres long.

d'où Buffon a dérivé celui de mangouste, que nous conservons comme nom générique." This is said, moreover, to be the animal noticed by Kaempfer and others, and recorded by Linnæus. In the note on p. 139, where Latin names are given, this species is called *Ichneumon mungo.* I believe that Geoffroy understood by this name, and not by *I. griseus,* the Common Indian Mungoose; and I shall show that this was the view of Frederic Cuvier, Geoffroy's collaborator in the 'Histoire Naturelle des Mammifères.' The mixing up of the "*Mangouste de l'Inde*" and the "*Mangouste à bandes*" is due to Buffon and Schreber.

Some years ago I expressed the opinion[1] that the oldest name for the Common Indian Mungoose was *Viverra mungo* of Gmelin. This name, which was evidently the origin of Geoffroy's *Ichneumon mungo*, has been by recent writers either ignored or applied to an African species, *Crossarchus fasciatus.* That several species were referred to in the descriptions quoted by Gmelin is unquestionable; and there is good reason for believing that one of these was *C. fasciatus*; but I am inclined to look upon the name as really given to the Indian Mungoose, for it is applied to the *Viverra ichneumon β* of Linnæus and Schreber. Now the *V. ichneumon β* of Linnæus's twelfth edition, the *Mustela glauca* of the fifth, and the *Mungos* of his 'Amœnitates Academicæ,' are all founded on the *Viverra mungo* of Kaempfer, said to be called "Mungutia" by the Indians and Mungo by the Portuguese. Kaempfer visited India amongst other places, and gave in his work[2] a general account of the Indian Mungoose. It is probable that his remarks refer partly also to *H. javanicus.* The question, however, is to determine which is the species of *Herpestes* known in the country it inhabits by the name *Mungutia,* or by some term of which *Mungo* or *Mungos* is a corruption, for this must clearly be the species to which the names of Kaempfer, Linnæus, and Gmelin were intended to apply. And as the Anglo-Indian term Mungoose is evidently of similar origin, its derivation if ascertained must elucidate the question.

In Colonel Yule's recently published 'Hobson Jobson' the term Mungoose is traced to a Telugu word *mangisu.* Sykes[3], Elliot[4], and Jerdon[5] state that the word *mangús* itself is Mahratti, and, according to Jerdon, Hindi also in Southern India. I do not attach much importance to this, as it is just possible the name may not have existed originally in either language, being probably Dravidian, whilst both languages are of Sanscrit derivation. The Hindi name in Northern India in *Nyul,* but I know that *mangús* is pretty generally understood by those natives who come much in contact with Europeans. But to return to the dialects of Southern India. Elliot[6] gives *Mungli* as Canarese; and Kelaart[7] *Moogatea* as Cingalese. In all probability, as so frequently happens in Indian languages, a nasal *n* before the *g* in Cingalese has escaped Kelaart's

[1] Eastern Persia, ii. p. 42.
[2] Amœn. Exot. p. 574.
[3] P. Z. S. 1831, p. 102.
[4] Madr. Journ. Lit. Sci. x. p. 102.
[5] Mammals of India, p. 132.
[6] *Loc. cit.*
[7] Prodromus Faun. Zeyl. p. 41.

notice, for it is scarcely likely that the first syllable in Cingalese wants the *n* that occurs in Telugu, Canarese, &c. In this case the Cingalese name furnishes the original Mungutia of Kaempfer.

I cannot find any similar word in Malay. Horsfield[1] gives *Garangan* for *H. javanicus*, and Cantor[2] *Musang turon* for *H. brachyurus*. *Musang* is the term used for *Paradoxurus*, whence the specific name *musanga* was derived.

I conclude that the name *mungo* or *mungos* was derived from the Common Mungoose of India, *H. griseus* of many modern writers, and that this was the animal indicated by Gmelin and others as *Viverra mungo*, by Geoffroy as *Ichneumon mungo*, and, as I shall show, by F. Cuvier as *Herpestes mungos*.

If, however, the specific name *mungo* be rejected, what is the next in priority? This, I think, must be *Herpestes frederici*, Desmarest[3], which, like *H. malaccensis*, Fischer[4], was applied to the animal figured and described by F. Cuvier as *La Mangouste* in the well-known 'Histoire Naturelle des Mammifères.' Desmarest's name was given in honour of Frederic Cuvier. The specimen figured was believed (probably erroneously[5]) to have come originally from Malacca, and was referred to in an article on another species as the "Mangouste de Malacca." It is true that Blyth, Jerdon, and some other writers have classed this under Fischer's name as distinct from their *H. griseus*, the Common Indian Mungoose, the latter being less rufous than the former; but I quite agree with Dr. Anderson in classing the rufous and grey forms together[6]. Now comes the important point already referred to. F. Cuvier in his article distinguised the animal which, following Buffon, he called "*La Mangouste*" from the *Ichneumon griseus* of Geoffroy, the *nems* of Buffon, and in the "Table générale et méthodique" to the whole work he assigned to *La Mangouste* the Latin name of *Herpestes mungos*.

It appears to me that from Gmelin to Frederic Cuvier or even later[7] the specific name *mungo* or *mungos* was understood to apply to the Common Indian Mungoose, and that this specific name should be restored instead of the term *griseus*, which was never intended for the animal and was not, so far as I can ascertain, applied to it before 1830, one of the first authors who used the name being Sykes in 1831. I quite admit the justice of Mr. Thomas's argument that Gmelin's name was applied to the *Viverra*

[1] Res. Java.

[2] J. A. S. B. xv. p. 243.

[3] Dict. Sc. Nat. xxix. p. 60 (1823).

[4] Synopsis Mamm. p. 164 (1829).

[5] In this case, and also in that of the specimen obtained by Cantor in the Malay Peninsula (J. A. S. B. xv. p. 242), it is, I think, most likely that the animals had originally been taken from India.

[6] I also unite the Sind form described by myself as *H. ferrugineus* (P. Z. S. 1874, p. 661, pl. lxxxi.) and Mr. Murray's *H. atkinsoni* (Vert. Zool. Sind, p. 34). In the same manner I regard *H. smithi* and *H. jerdoni* (*H. monticolus*, Jerdon) as rufous and grey varieties of the same specific form.

[7] In the late Sir W. Elliot's excellent list of Southern Mahratta mammals published in 1839 (Madr. Journ. Lit. Sci. x. p. 102).

ichneumon β of Schreber, at least that was the first reference, that Schreber's figures were taken from Buffon, and that one of them may have been the species known as *H. fasciatus*, whilst the other, though probably meant for the Indian Mungoose, is not good enough for recognition. No doubt, too, under Schreber's name and references several distinct species were confounded, one of these, as I have shown elsewhere, being the small *H. auropunctatus* v. *persicus*. But Schreber's *Viverra ichneumon* β was founded on that of Linnæus, and I have shown that the latter rests much on Kaempfer, though other references are given, all relating more or less clearly to forms of Mungoose.

The conclusions to which I have come may therefore be briefly stated thus. The *Viverra mungo* of Gmelin comprised several species, of which the most important were *Crossarchus fasciatus* and the Indian Mungoose. Probably *Herpestes javanicus* was also included. Now in Geoffroy's paper *C. fasciatus* and *H. javanicus* were distinguished, leaving the Indian Mungoose in *H. mungo*, which is, I think, the proper name for the animal. If, however, the specific term be rejected as being barbarous, or as having been applied originally to a confused admixture of different species, the name next in priority is *H. frederici*.

VIII. *On the Scientific Name of the Common Fox, and on the Classification of Allied Forms.*

The common European Fox is usually designated either *Canis vulpes* or *Vulpes vulgaris*. The first name is the true Linnæan title, but if, in accordance with the views expressed by Prof. Huxley[1], the Foxes are separated generically from the Dogs, the question arises as to whether the specific name *vulgaris* is rightly applicable. This term is derived from Brisson, whose specific names are not admissible, though by the British Association rules his generic terms for birds are, when they are additions to those employed by Linnæus. The generic name *Vulpes*, which was employed by Brisson, is therefore available, if the same rule be applied to mammals as to birds, but the specific term *vulgaris* has no authority.

All later writers, however, refer two Linnæan species, *Canis vulpes* and *Canis alopex*, to the Common Fox. The two are distinguished, according to Linnæus, by the former having the tip of the tail white, the latter black. *C. alopex* is said to inhabit Europe and Asia, and appears to be merely an accidental or even an individual variety, the Fox with the characteristically black-tipped tail, *C. corsac*, having been known to Linnæus and named by him. The term *alopex* is derived from Aristotle's name for the Fox. It appears therefore that the correct name for the Common Fox, if the genus *Vulpes* be admitted, is *Vulpes alopex* (L.).

There is a curious gradation in size amongst the Foxes allied to *V. alopex*, the European form exceeding all the others in stature. *V. flavescens* from Central Asia comes next, and then the Himalayan

[1] P. Z. S. 1880, p. 286.

race commonly called *V. montana*[1]. The North-African *V. nilotica* and the Persian *V. persica* are considerably smaller; and *V. griffithi* of Afghanistan, *V. pusilla* of the Punjab, and *V. leucopus* of Western India are of still inferior dimensions, the last-named being the smallest of the series. But except in size I can find no constant distinction between these races. I do not think in any case that *V. griffithi* and *V. pusilla* can be distinguished from *V. leucopus*, and I have equally little hesitation in uniting *V. flavescens* and the so-called *V. montana* with *V. alopex*; but I do not feel so sure about *V. persica* and *V. nilotica*. So far as India is concerned, it appears most convenient to recognize as distinct species the large *V. alopex* (including *V. flavescens* and *V. montana* v. *himalayica*) and the small *V. leucopus* (comprising *V. pusilla* and *V. griffithi*), especially as the two are said to occur together in Afghanistan; and it is possible that *V. nilotica*, originally described as being the size of the European Red Fox (*V. alopex*), may be a variety of that species, and *V. persica* of *V. leucopus*. The North-American Cross Fox, *Canis fulvus* v. *pennsylvanicus*, appears also to be a variety of *V. alopex*.

IX. *On the Generic Terms* Mustela, Martes, *and* Putorius.

By most English naturalists the Martens have been referred to a genus *Martes*, and the Polecats and Weasels to *Mustela*, under the supposition that the old Linnæan genus *Mustela* was thus divided by Cuvier in 1797 in his 'Tableau Elémentaire.' This was not the case; he merely called the Martens in French "*Les Martes.*" But he did divide the genus in the 'Règne Animal,' 1st ed., published in 1817, and proposed four subgenera, keeping the Martens alone in *Mustela*, and using *Putorius* for the Weasels and Polecats[2]. Alston urges, P. Z. S. 1879, p. 468, that the names then proposed by Cuvier cannot be employed as they are only of subgeneric value; but not only have they been generally used by continental naturalists, but several of the best known genera of birds, amongst others *Ploceus*, *Vidua*, and *Budytes*, stand on precisely the same foundation, having been similarly proposed in the same work. There is nothing to show that the Weasels were considered the typical forms of *Mustela* by Linnæus; indeed his description of the genus points rather to the Martens, and the word *Mustela* in Latin appears to have been employed for a Marten.

X. *On* Xantharpyia, Eleutherura, *and* Cynonycteris.

My friend Mr. Dobson, in his valuable works on Chiroptera, has adopted Peters's term *Cynonycteris*, first proposed in 1852, for the genus of Fruit-eating Bats comprising *Pteropus amplexicaudatus*,

[1] *Canis vulpes montana*, Pearson, J. A. S. B. v. p. 313. According to the views of many of the best naturalists, a trinomial appellation like this has no claim to priority, and Ogilby's *Canis himalayicus*, P. Z. S. 1836, p. 103, given the same year, would be preferred.

[2] My attention was called to this by Mr. Oldfield Thomas.

P. ægyptiacus, and *P. stramineus* of Geoffroy St.-Hilaire, *P. collaris*, Illiger, and some other species. In the British Museum Catalogue of the Chiroptera, p. 70, Mr. Dobson gives his reason for rejecting the earlier title *Eleutherura* of Gray, proposed in 1844 for *Pteropus hottentota = collaris*.

I think another term of Gray's, *Xantharpyia*, has priority over *Eleutherura*. Both appear together, it is true, in the Mammalia of the Voyage of the 'Sulphur,' p. 29, where *Eleutherura* was first proposed; but *Xantharpyia* had been published in the previous year, 1843, in the 'List of the Specimens of Mammalia in the Collection of the British Museum,' pp. 37, 38, and applied to the three species *Pteropus amplexicaudatus*, *P. ægyptiacus*, and *P. stramineus*. It is true that no description of the genus was given, but this is not essential.

XI. *On* Hipposiderus *and* Phyllorhina.

It is, I fear, impossible to admit that the name *Phyllorhina* can be used for the group of Leaf-nosed Bats to which the term has been applied by Bonaparte, Peters, Dobson, and others. The reference given by both Peters and Dobson for the original description of the genus is to Bonaparte's 'Saggio di una Distribuzione metodica degli Animali vertebrati,' Rome, 1831, p. 16. In this work, which contains no descriptions, and is a mere list of generic names, the genus *Rhinolophus* is divided into two subgenera thus,—

Rhinolophus, Leach.
Phyllorhina, Leach.

For a long time I was unable to discover where these genera of Leach were published; but Mr. Waterhouse, the Society's librarian, has succeeded in finding the names in that author's 'Systematic Catalogue of the Specimens of the Indigenous Mammalia and Birds in the British Museum,' a small pamphlet issued in 1816 and reprinted by the Willughby Society. In this, immediately following *Rhinolophus ferrum-equinum*, is "*Phyllorhina minuta*, small Leaf-nose; Torquay, Devon." It is manifest that the genus *Phyllorhina* was proposed by Leach for *Rhinolophus hipposiderus*, and consequently cannot be applied to the genus for which it has been used by Peters, Dobson, and others.

Bonaparte, it is true, in his 'Iconografia della Fauna Italica,' a work published at intervals between 1832 and 1841, proposed to transfer Leach's generic name from the smaller Horseshoe Bat to the first section of the genus *Rhinolophus* in Temminck's 'Monographie de Mammalogie,' [1] vol. ii. pp. 10 *et seq.*, and this section corresponds to the genus *Phyllorhina* of later writers. Bonaparte's remarks occur in the article describing *Rhinolophus ferrum-equinum*. But to admit a change of this kind would lead to endless confusion.

[1] As the date of this volume ranges from 1835 to 1841, Bonaparte's application of the generic term *Phyllorhina* to the section defined by Temminck can scarcely have been published before 1836.

Moreover, independently of the question whether such a change could be admitted, Gray's generic name *Hipposideros* has priority over Bonaparte's *Phyllorhina* as distinguished from Leach's. Peters and Dobson quote *Hipposiderus* as dating from 1834. In the 'Proceedings' of this Society for that year, p. 53, the name was mentioned without description and without any species being quoted as type, and would consequently have no validity; but the generic term *Hipposiderus* was, in fact, first proposed three years earlier, in 1831, in Gray's 'Zoological Miscellany,' p. 37, with a description which, although clumsily worded, pointed out the characteristic distinctions of the nose-leaf, and with the following list of the species referred to the new genus:—*H. speoris*, *H. elongatus*, *H. diadema*, *H. larvatus*, *H. vulgaris* (= larvatus), *H. deformis* (= larvatus), and *H. tridens*. With the exception of *H. elongatus*, which I cannot trace, all these are species of the genus *Phyllorhina* of Peters and other writers. It is quite contrary to the rules of nomenclature generally adopted to set aside a generic name *a*, properly defined in 1831, in favour of another name *b*, that in 1816 had been proposed for a species belonging to a different genus and that was only applied some years later to the same genus as *a* had already been proposed for.

I can see no escape from the conclusion that the name *Hipposiderus* must be adopted for the genus—a conclusion which I greatly regret, as *Phyllorhina* is preferable on the score both of euphony and of signification.

December 20, 1887.

Prof. W. H. 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 November 1887:—

The total number of registered additions to the Society's Menagerie during the month of November was 132, of which 100 were by presentation, 7 by birth, 8 were received in exchange, and 17 on deposit. The total number of departures during the same period, by death and removals, was 110.

Mr. Sclater read the following description of a supposed new Humming-bird of the genus *Chætocercus*, contained in a letter received from Dr. H. Burmeister, F.M.Z.S.:—

"The species is nearly allied in size, figure, and colour to *Chætocercus bombus* (Gould, Mon. Troch. Suppl. pl. 32), but differs entirely in its tail, which is of singular construction.

"The bill is straight, entirely black, and as long as the head (1 cm.). The whole upper part of the body is of a dark green metallic colour, except the wings, which are black, 1 inch ($2\frac{1}{3}$ cm.) long, and somewhat curved. The small feathers of the throat on the under jaw are whitish, with a darker spot in the middle; there begins on the throat the crimson-red bilateral beard, which is composed on both sides of three rows of very small feathers, these becoming somewhat larger in the middle of the beard and terminating with two ranges of feathers in the exterior half. Many of these feathers are shining metallic green in certain positions. A white spot behind the eyes descends from there to the breast, which is also whitish, but with a dark spot on every feather, causing a greyish appearance in the middle of the breast. The hinder half of the breast and the belly are black, but the anal portion is white, and also the sides of the body except the thighs, which are black. The inferior feathers behind the anal region are clear yellow-brown, but those in the middle have a green metallic spot. The tail is composed of eight feathers; the two exterior on each side are more than an inch long, very small but of equal size in the whole extent, and rounded at the tip, not pointed. The exterior rectrix is entirely black; the second has a clear brown stripe on the inner border. The third rectrix of each side is very short, only half an inch long, and more than eight lines shorter than the exterior; its colour is entirely black. The two middle tail-feathers are shorter than the third pair, and partly covered by the coverts; they are of a metallic green colour like the coverts.

"*Hab.* A single specimen obtained in the mountains of Tucuman (Valle de Tafi) is in the National Museum of Buenos Aires."

Mr. Sclater exhibited a drawing of this bird sent by Dr. Burmeister, and stated that, after consulting Mr. Salvin and Graf v. Berlepsch, he had come to the conclusion that it must belong to a new species, for which he proposed the name *Chætocercus burmeisteri*.

The Secretary exhibited, on behalf of Major Yerbury, F.Z.S., a pair of horns of the Oorial (*Ovis cycloceros*) which formerly belonged to the Royal Artillery Mess at Fort Attock, and were stated to have been originally obtained in the Chitta Pahar Range a few miles south of Attock.

These horns were of unusual size, and, although they came from the mountains on the left bank of the Indus, appeared to belong to the form described by Mr. A. O. Hume as *Ovis blanfordi* (J. A. S. B. vol. xlvi. part 2, p. 327, 1877).

The Secretary read an extract from a letter received from H. M. Phipson, Esq., C.M.Z.S., of the Bombay Natural History Society, relating to living specimens of two Snakes lately received at Madras.

1. A *Trimeresurus erythurus*, which had been caught on board a timber-ship from Moulmein in Bombay Harbour.

2. An *Ophiophagus bungarus*, from the Canarese Jungles, which

was stated to be 12 feet in length, of a jet-black, with a cream-coloured throat and bars across its back.

The Secretary remarked that the latter specimen would be particularly acceptable to this Society, as their large specimen of *Ophiophagus bungarus* received on the 5th March, 1875, had died on the 25th of October last, after living twelve years and seven months in the Society's Gardens, during which period it had been fed nearly entirely upon English snakes.

A paper was read by Mr. Frank E. Beddard, F.Z.S., Prosector to the Society, entitled "Observations on the Structure of Hooker's Sea-Lion (*Arctocephalus hookeri*)."

This paper will be published entire in the Society's 'Transactions.'

The following papers were read:—

1. Description of a new Genus of Lizards of the Family *Teiidæ*. By G. A. Boulenger, F.Z.S.

[Received November 24, 1887.]

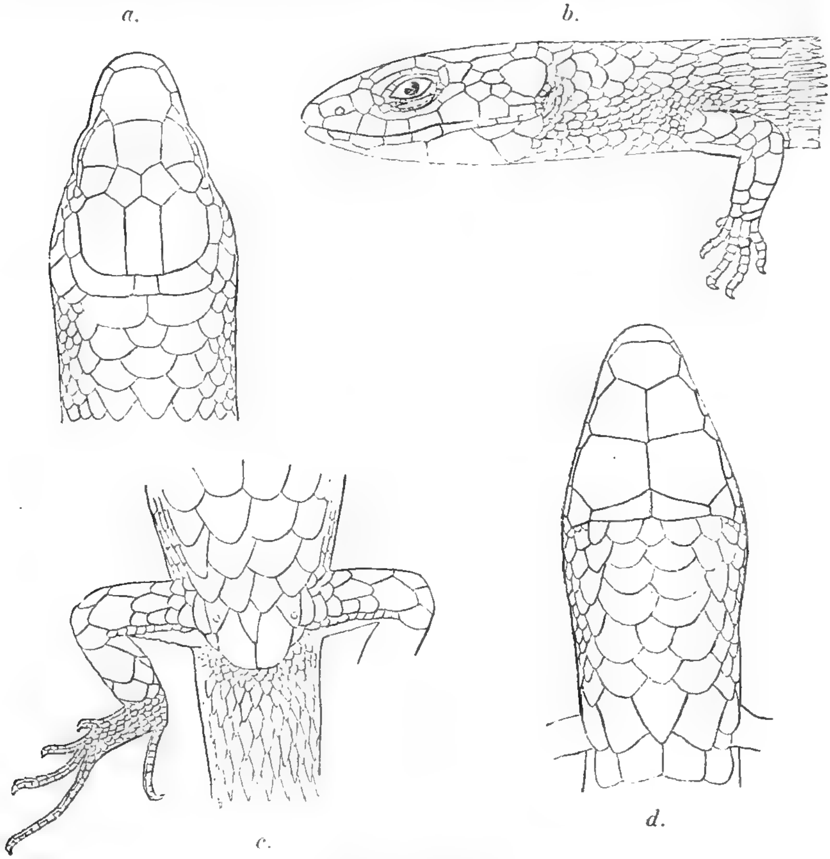
Stenolepis.

Tongue moderately elongate, arrow-headed. Head with large shields; frontonasal separating the nasals; no præfrontals; frontoparietals present; nostril pierced in the lower part of the nasal, touching the first labial. Lower eyelid with an undivided, semitransparent disk. Ear exposed. Limbs well developed, pentadactyle. Dorsal and lateral scales equal, hexagonal-lanceolate, keeled, imbricate, arranged in regular transverse series; ventral plates large, subquadrangular, rounded and overlapping posteriorly, smooth, arranged in regular longitudinal and transverse series. No collar-fold. Tail cylindrical. A præanal pore on each side in the female.

Nearly equally related to *Arthrosaura*, Blgr., and *Heterodactylus*, Spix. Agreeing with the former in the presence of frontoparietal shields, the distinct ear, and the well-developed pentadactyle limbs; with the latter in the absence of præfrontal shields, the position of the nostril, the undivided palpebral disk, and the absence of a collar-fold; with both in the scaling of the body.

Stenolepis ridleyi.

Habit lacertiform. Snout short, obtuse. Two large supraoculars, with a small one in front; frontal pentagonal, a little longer than broad; frontoparietals small; a pair of large parietals, separated by an equally long, but narrow interparietal; a square occipital; a loreal and a freno-orbital; a row of very small suborbitals; a large subcircular temporal, with two smaller ones above it; six upper and five lower labials; five chin-shields, an anterior azygous and two pairs forming a suture, very large; large transverse, rounded gulars, in two rows anteriorly, in three posteriorly ; a row of five elongate pectoral shields, median triangular and pointing backwards. Dorsal scales very narrow, strongly keeled, ending in a sharp point. 32 scales round the middle of the body, ventrals included ; 29 scales from occiput to base of tail ; nuchal scales large, broad, smooth. Ventral scales in 6 longitudinal and 16 transverse series. Five præanal shields, of which one pair are large and form a median suture. The adpressed limbs just meet. Tail nearly twice as long as head and body, covered with annuli of hexagonal-lanceolate keeled scales. Brown above, with four longitudinal series of lighter dots ; vertebral



Stenolepis ridleyi.

a. Upper view. *b.* Side view. *c, d.* Lower view.

line and sides blackish ; two series of light dots along the tail ; lower parts white, throat with black dots.

	millim.
Total length	128
Head	9
Width of head	6·5
From end of snout to fore limb	15
From end of snout to vent	45

	millim.
Fore limb	10
Hind limb	17
Tail	83

A single female specimen was obtained by Mr. H. N. Ridley in the forest of Iguarasse, Pernambuco, and presented by him to the British Museum.

2. Revision of the Japanese Species of the Coleopterous Family *Endomychidæ*. By the Rev. H. S. Gorham, F.Z.S., F.E.S.

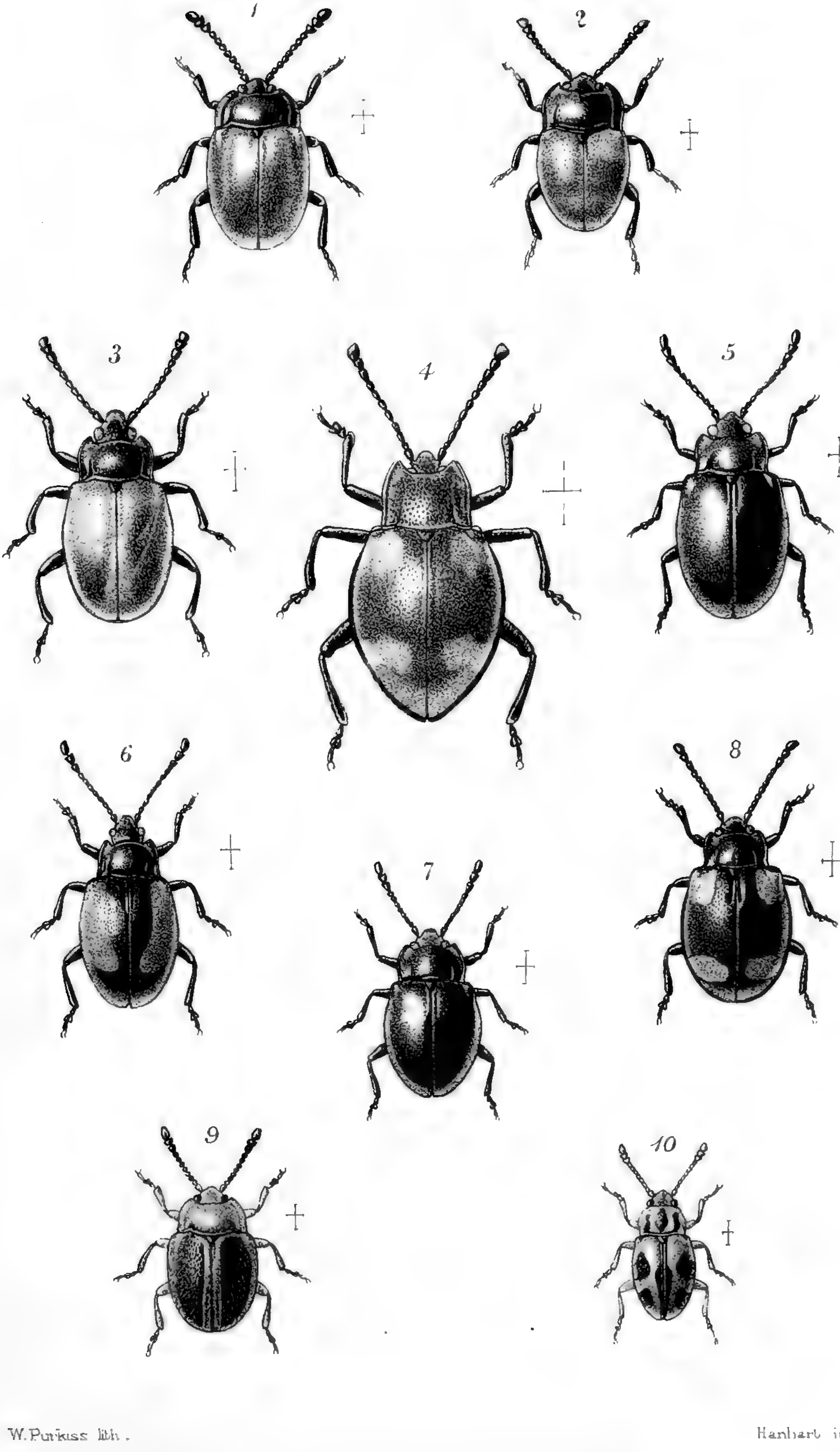
[Received November 29, 1887.]

(Plate LIII.)

The expedition made by Mr. G. Lewis to Japan in 1880 and 1881 was the cause of a large number of additions to the Coleopterous fauna of those islands. The Endomychidæ are a small but very interesting family, and the new species now described show how very incomplete our knowledge of some of these minor groups are, and what interesting forms we may expect to see when other islands on the limits of the great continents have been equally well explored. Mr. Lewis's stay was, from circumstances, necessarily brief in many of the localities visited; hence it is but reasonable to believe that a longer stay would have brought to light many new species, especially in such genera as *Cyanauges*, *Stenotarsus*, *Chondria*, and allied forms, which live a more or less obscure life, and only remain in the imago state for a few weeks.

Compared with the number of species that are new, the number of new genera is large. This is sure to be the case in a fauna as yet only partially known, and lying so isolated from the centres whence most of the material which has been the basis of the systems proposed has hitherto come. *Ectomychus* and *Chondria* are not only new as genera, but hardly find a place in the subfamilies as yet proposed. The following is a complete list of Japanese Endomychidæ:—

Ancylopus melanocephalus, *Ol.*
Danaë orientalis, *Gorh.*
Lycoperdina dux, *Gorh.*
—— sp.
—— castaneipennis, *Gorh.*
—— mandarinea, *Gerst.*
Saula japonica, *Gorh.*
Rhabduchus denticornis, *Gorh.*
Mycetina amabilis, *Gorh.*
—— ancoriger, *Gorh.*
—— laticollis, n. sp.
Stenotarsus chrysomelinus, n. sp.
—— internexus, n. sp.
—— musculus, n. sp.
—— nigriclavis, *Gorh.*
Ectomychus, n. gen.
Ectomychus basalis, n. sp.
Bolbomorphus, n. gen.
—— gibbosus, n. sp.
Panamomus lewisi, *Gorh.*
—— decoratus, n. sp.
—— brevicornis, n. sp.
Phæomychus, n. gen.
—— rufipennis, *Mots.*
Cyanauges gorhami, *Lewis.*
—— plagiatus, n. sp.
—— quadra, n. sp.
—— nigropiceus, n. sp.
Chondria, n. gen.
—— lutea, n. sp.
Symbiotes niponensis, *Gorh.*
—— ? orbicularis, n. sp.



W. Purkiss lith.

Hanhart imp.

NEW JAPANESE SPECIES OF ENDOMYCHIDÆ.

Ancylopus, Costa.

1. Ancylopus melanocephalus, Oliv.

Mr. Lewis says this insect was very abundant in the middle of March in Mississippi Bay, Yokohama, under stones and also under planks which had been washed up by the sea. At Nagasaki it was abundant in garden-refuse early in the spring.

Danaë, Reiche.

(*Oediarthrus*, Gerstaecker. *Coniopoda*, Gorham.)

1. Danaë orientalis.

Coniopoda orientalis, Gorham, Ent. Mo. Mag. vol. ix. p. 205.

Hab. Kiushiu : Nagasaki, Ichiuchi, Kobe.

None of the specimens captured exhibit the peculiarity of a swollen ninth joint of the antennæ, yet as many have been met with, it is hardly likely but that we have received both sexes. If this is so, perhaps the generic name *Coniopoda* will have still to be retained for this insect. All the species are rare in collections, and I have not enough specimens to examine them in detail. *D. orientalis* occurs in haystack-refuse in early spring.

Lycoperdina, Latreille.

1. Lycoperdina dux, Gorh. Ent. Mo. Mag. vol. ix. p. 205.

Very few specimens of this species have at present been obtained—at Hiogo in puffballs on the ground in fir-woods, three examples, and one at Yokohama.

2. Lycoperdina, sp. inc.

A few specimens of a *Lycoperdina*, apparently distinct from *L. dux*, were obtained by Mr. Lewis at Sapporo; these specimens are of a light chestnut-yellow colour, with the exception of the legs and antennæ, which are brownish yellow. The thorax is transverse instead of being nearly quadrate, as in *L. dux*. Three of the specimens are female and one a male, but I do not feel disposed to describe the species upon the specimens before me, as they may not be fully matured.

3. Lycoperdina castaneipennis, Gorham, Ent. Mo. Mag. vol. xi. p. 151.

Apparently commoner than *L. dux*; Mr. Lewis met with specimens at Nikko, in the Main Island, and Sado, in October, from a kind of puffballs which grew in quantities on standing but rotten beeches; also one example at Nagasaki in March 1881.

4. Lycoperdina mandarinea, Gerst. Mon. Endom. p. 212 [1].

Hab. China : Hongkong [1]. Japan : Kiushiu : Nagasaki, Hiogo.

Met with again by Mr. Lewis in Yezo, at Tomakomai, two specimens.

SAULA, Gerstaecker.

1. SAULA JAPONICA, Gorham, Ent. Mo. Mag. vol. x. p. 224.

Hab. KIUSHIU: Nagasaki and in Higo. MAIN ISLAND: on Manjasan near Hiogo.

Beaten commonly off foliage, chiefly in the wet season, July and August.

RHABDUCHUS, Gorham.

1. RHABDUCHUS DENTICORNIS, Gorham, Ent. Mo. Mag. vol. ix. p. 257; End. Rec. plate, fig. 1.

Hab. KIUSHIU: Nagasaki.

This insect remains unique in Mr. Lewis's collection.

MYCETINA, Mulsant.

1. MYECTINA AMABILIS, Gorh. Ent. Mo. Mag. vol. ix. p. 205.

Hab. KIUSHIU: Nagasaki, Oyayama, Yuyama, Konose, in the province of Higo.

MAIN ISLAND: Kashiwagi, Yunoshiku, Oyama; YEZO: Sapporo.

Several specimens were obtained in May and June 1881, a few of which are of the variety without spots on the posterior part of the elytra. Some years ago I saw specimens which were said to have been found at Hakodate.

2. MYCETINA ANCORIGER, Gorh. Ent. Mo. Mag. ix. p. 206.

Hab. KIUSHIU: Nagasaki, Miyanoshita, Higo.

MAIN ISLAND: Wadatogè, Awomori, Shimonosurva lake.

Met with rarely, and apparently in single specimens.

3. MYCETINA LATICOLLIS, n. sp. (Plate LIII. fig. 2.)

Nigro-picea, nitida; elytris castaneis, disco indistincte infuscato, valde convexis; antennarum articulo apicali, geniculis tarsisque rufis. Long. $3\frac{1}{2}$–4 millim.

Hab. MAIN ISLAND: Kashiwagi, Nara, Maiyasan at Kobè.

A good deal larger than *M. ancoriger*, broader and with the elytra more convex. Antennæ longer in proportion, and with their joints all less transverse. Eyes rather large and more coarsely granulate than in *M. amabilis*; mouth and palpi rufous. Thorax twice as wide as long, very similar in form to that of *M. ancoriger*, impunctate, basal sulci deep, and curving inwards at their apices. Scutellum of the same rufous colour as the elytra, the latter very much swollen, rather strongly rounded at the sides; viewed laterally they are slightly gibbous, distinctly punctured, but not very deeply so. The underside is pitchy, the abdomen pitchy red. I have only seen seven examples of this *Mycetina*, two from each of the localities first named and two or three from the neighbourhood of Kobè.

STENOTARSUS, Perty.

1. STENOTARSUS CHRYSOMELINUS, n. sp. (Plate LIII. fig. 1.)

Niger, nitidus; elytris castaneo-brunneis, fulvo-pubescentibus, *punctato-striatis, striis postice abbreviatis ; prothoracis margine lato, deplanato ; tarsis rufis.* Long. 4–5 millim.

Hab. MAIN ISLAND: Ichiuchi, Nara.

Antennæ black, the terminal joint pitchy, the third to the seventh joints a little longer than wide, eighth bead-shaped, the club laxly jointed, the ninth and tenth joints transverse, apical joint about as long as wide. Head and thorax black, the latter transverse, the flat margin wide and rather elevated, a decided fovea in the hind angle of the disk. Base margined, sulci hardly apparent. Elytra closely punctured at the base, each with eight punctured striæ, little impressed, irregular, and not extending below the middle, the seventh and eighth united at the base. Four specimens off old trees at Nara. Unlike any described Eastern species in colour; the black head and thorax will easily distinguish it in the section to which it belongs.

2. STENOTARSUS INTERNEXUS, n. sp. (Plate LIII. fig. 9.)

Rufo-ferrugineus, parum oblongus; antennis (basi excepta) elytrisque (sutura margineque prætermissis) nigris, his crebre punctulatis, punctis majoribus in seriebus confuse congestis. Long. $3\frac{1}{2}$–$3\frac{3}{4}$ millim.

Hab. KIUSHIU: Nagasaki. MAIN ISLAND: Kashiwagi.

Antennæ rather thin and with joints 4–8 bead-shaped; the club laxly jointed, the ninth and tenth joints as long as wide, a little produced on the inner side, the apical joint oblong. Thorax transverse, with broad flattened margins, which narrow very considerably behind, where their surface is also concave. The basal sulci represented by a round punctiform fossa on each side. Elytra oblong, faintly sulcate and strongly punctured; the larger punctures form irregular series which terminate about the middle. Their surface is black, excepting the suture and margins, which are evenly but broadly red. Although this species must be placed in the section with punctured striæ, and in the division in which the striæ are irregular and shortened, it is really intermediate between the Eastern and the New-World forms which have the punctuation quite confused. It is therefore very interesting, especially as some other Japanese species have no serial punctuation, bringing them still closer to the American type. Six examples.

3. STENOTARSUS MUSCULUS, n. sp.

Breviter oblongus, niger; abdomine elytrisque rufis, his macula magna communi haud bene discreta nigra; antennis tenuibus, piceis, articulo basali extus clavaque nigris; thorace brevi, antice declivo margine deplanato, sulcis basalibus distinctis. Long. $2\frac{1}{2}$–3 millim.

Hab. KIUSHIU: Nagasaki. MAIN ISLAND: Kashiwagi.

This little species is well distinguished by its short broad shape. The head and thorax and underside excepting the abdomen are black, the antennæ thin and short, as in *S. nigriclavis*, the third to the eighth joints very slender and longer than wide, the three club-joints lax and subequal, the apical being the largest. The thorax is particularly short and broad, and with the front and head more declivous than usual in this genus. Its margin is flattened and broad, but with the edges raised, so that its own surface is concave as in *S. internexus*. The sides narrow strongly from the base without being much rounded; the basal sulci are quite distinct, reaching nearly half across the disk. The elytra are very convex and rather pointed behind, finely punctured, but wholly without serial punctuation, rufous, with a black patch, not coming nearer the base than one third of the elytral length, and not reaching the margins nor apex. The underside is black, with the abdomen very faintly rufous, and the legs are black. A considerable number of this species were met with in the island of Kiushiu and it was also found by Mr. Lewis on the Main Island at Kashiwagi.

4. STENOTARSUS NIGRICLAVIS, Gorh. Ent. Mo. Mag. ix. p. 206.

Hab. KIUSHIU: Nagasaki.

Mr. Lewis met with three or four more specimens of this species at the beginning of June 1881. With *S. musculus* it will form a separate section of the genus, differing from other unstriate *Stenotarsi* in the feeble structure of the antennæ.

ECTOMYCHUS, n. gen.

Corpus oblongum, subparallelum, supra pubescens, subtus vix vestitum. Antennæ breves, tenues, clava triarticulata, articulis duobus primis intus paulo productis. Oculi haud granulati. Pronotum lateribus marginatis et deplanatis, sulcis basalibus distinctis leviter impressis. Elytra prothoracis latitudine, oblonga, ad apicem conjunctim rotundata. Prosternum breve, processu coxas anticas vix superante, apice truncato, subruguloso. Pedes breves, femora compressa; tarsi breviusculi, articulo secundo bilobato.

I propose this genus for the reception of a small Beetle having very much the appearance of a *Mycetophagus*, but from the structure of its tarsi and from the margination of the sides of its thorax and the basal impressions evidently allied to *Stenotarsus*.

1. ECTOMYCHUS BASALIS, n. sp.

Oblongus, niger, parce pubescens, obsolete subtiliter punctatus, elytris basi rufis, antennis tarsisque rufo-piceis, illis clava nigra. Long. 3 millim.

Hab. MAIN ISLAND: Kawatchi, Miyanoshita, Kurigahara. YEZO: Sapporo.

Head small, received into the prothorax; eyes small and very little prominent; antennæ short, but longer than the head and thorax, basal joint very stout, second short, but equally stout, third to eighth thin and short, the third about twice as long as the others, ninth and tenth acuminate internally, very much larger, and apical joint ovate, forming a lax but distinct club. Thorax nearly twice as wide as long, the disk convex, finely and sparsely punctured, rather pubescent, the lateral margin raised and flattened, sides rounded into the front angles. In the sulcate part of the disk, before the raised margin, are many large punctures, and the margin itself is somewhat sulcate and punctured. The elytra are thickly and finely punctured, without any trace of striæ, and are densely pubescent, with rather long ragged grey hairs; they are blackish, with an ill-defined basal red spot, which covers the humeral angles, but does not quite reach the suture. The legs are pitchy-black, with pitchy-red tibiæ and tarsi. The underside is wholly black. The prosternum is coarsely punctured, including the posterior process, the breast smooth, the abdomen slightly pubescent, with its basal segment obsoletely punctured.

Mr. Lewis informs me that this species was not rare in the localities where he met with it. In its general appearance it reminds one of *Dacne*, but it is pubescent and more parallel.

BOLBOMORPHUS, n. gen.

Corpus oblongo-ovatum. Elytra convexa, valde gibbosa, apicibus acuminatis. Antennæ modice elongatæ, clava parum dilatata. Oculi fortiter granulati. Palpi maxillares articulo ultimo truncato, subsubulato. Prothorax subquadratus, nitidus, angulis anticis acutis, sulcis basalibus brevibus distinctis; prosternum latum, fortiter punctatum, processu lato quadrato, apice leviter rotundato. Mesosternum transversum, utrinque antice sulcatum. Scutellum transverso-ovatum. Abdomen segmentis quinque tantum distinctis, segmento basali tribus sequentibus longiore, inter coxas valde latum, punctatum. Pedes validi, sat longi, femoribus haud clavatis, tarsis breviusculis.

Sexus differentia latet.

This new genus, the most interesting of Mr. Lewis's fresh discoveries in this family, has very much the general appearance of *Eumorphus*, but is in fact allied to *Eucteanus*, Gerst., by the wide prosternum, and, apparently, by the absence of secondary sexual characters, which are not usual in Gerstaecker's third division of the family, the Endomychini.

It differs from it in the structure of the club of the antennæ, which is largely developed in both *E. hardwicki* and *E. marseuli*, while in the Japan insect it is very little evident at all. Even more does it diverge in the coarsely granulated eyes and the wider prothorax, which is shining, though punctured, instead of being opaque as in both species of *Eucteanus*.

1. BOLBOMORPHUS GIBBOSUS, n. sp. (Plate LIII. fig. 4.)

Niger, subænescens; prothorace transverso subquadrato, antice angustato, nitido, angulis anticis acutis productis, margine laterali incrassato reflexo, disco distincte parcius punctato; elytris ovatis, convexis, gibbosis, crebre obsolete punctatis, singulis maculis duabus transversis, dentatis, flavis. Long. 8–9 millim.

Hab. MAIN ISLAND: Kashiwagi.

Head deeply sunk in the prothorax, so that the eyes are half hidden, crown punctured and uneven; epistoma transverse and punctured; labrum membranous, twice as wide as long; eyes oblique coarsely granulate. Antennæ more than half as long as the body, their third joint a little longer than the fourth, and this to the eighth gradually diminishing in length, ninth and tenth obconic, terminal joint triangular, obliquely truncate, as wide as long. Thorax shining, disk even, moderately thickly and distinctly punctured, front angles very acute, projecting as far as the base of the antennæ when the head is not exserted. Elytra very convex, and much rounded on the sides; viewed laterally the greatest convexity is at one third from the base, so that they are gibbous, their margins are reflexed but not expanded; each has a yellow spot at the base, which has a deep notch behind, and the small humeral callus which invades it in front is of the pitchy-black colour of the elytra, also a somewhat arcuate transverse spot behind, notched on its front edge.

The punctuation is thick and obsolete above, rather coarse and deep on the body beneath.

Mr. Lewis secured a considerable number of examples of this insect. They were first met with on June 14, on fungoid growth on trees which had been broadly ringed; they were then immature, but a week later mature examples were abundant, and obtained by beating the brushwood.

PANAMOMUS, Gorham.

1. PANAMOMUS LEWISI, Gorh. Ent. Mo. Mag. ix. p. 207.

Many examples were found by Mr. Lewis at Nagasaki in March 1881, also in April at Kumamoto, under dead leaves in sunny places in spring, the original example in fungoid growth.

The species was described from a unique example captured by Mr. Lewis in the same locality, Nagasaki, in 1866.

2. PANAMOMUS DECORATUS, n. sp. (Plate LIII. fig. 10.)

Flavus, ferrugineo variegatus, fere impunctatus, prothorace maculis tribus, duabus lateralibus angulatis brunneis, una mediana fusiformi nigra; elytris perobsolete punctatis, sutura pone medium, maculisque duabus in singulis, magnis subquadratis nigris; callo humerali interdum nigrescente. Long. $2\frac{3}{4}$ millim.

Hab. KIUSHIU: Oyayama. MAIN ISLAND: Kashiwagi.

The size and form of this new species are the same as those of *P. lewisi*, the punctuation especially of the thorax more obsolete, in fact only very faint and sparse punctures can be seen on the elytra under a strong lens. The antennæ, some marks on the head, the margins of the thorax and of the elytra, with the suture, and callus of the shoulder are all darker than the ground of the elytra. In some specimens the club of the antennæ is infuscate, and in one the anterior spot on each elytron is fused with the sutural plagia, and the whole insect is darker, and the punctures of the elytra are distinct and are seen to form in places irregular series.

3. Panamomus brevicornis, n. sp.

Ferrugineus, prothorace parce sat fortiter punctato, disco nigro-piceo ; elytris punctato-striatis, disco subfasciato, nigro-piceo ; antennis breviusculis. Long. $2\frac{1}{4}$ millim.

Hab. Main Island : Miyanoshita.

Allied to *P. lewisi*, the thorax is rather less bulky, with the sides more sinuate; the basal sulci are obsolete, not produced in finely impressed lines upon the disk, as in *P. lewisi*, the punctuation much more sparse and more deep and distinct. The antennæ shorter, with the joints succeeding the basal one shorter and more bead-like.

The elytra are more pointed behind, and the punctures of the striæ larger and deeper, especially near the suture. One specimen only was obtained, in spring, at Miyanoshita.

Phæomychus, n. gen.

I propose this new genus for *Endomychus rufipennis* of Motschulsky. This species differs from typical species of *Endomychus*, not only in general form, being more parallel, and having the thorax more quadrate, not narrowed in front, in the peculiar way of *E. coccineus*, &c., but also by having secondary sexual characters in the front tibiæ, and by the presence of a stridulating-organ between the front margin of the pronotum and the head, which bears a file.

I do not know any other species of the allied genera thus characterized at present.

1. Phæomychus rufipennis, n. sp. (Plate LIII. fig. 3.)

Endomychus rufipennis, Motsch. Etudes Ent. 1860, p. 18.

Hab. Main Island : Nikko. Yezo : Hakodate.

The tibiæ of the front legs in this species are widened and compressed from below the middle, so as to give the idea of an obsolete tooth at that part. The prosternum is somewhat narrower at the tip of its intercoxal process, and passes the coxæ further than in *Cyanauges*, to which genus it is otherwise more allied in form than to *Endomychus*. I think it possible that the insect described by me as *Endomychus bicolor* is congeneric with this species ; as, however, I have not the type for comparison, and had not seen a male, I can only associate it doubtfully with it. I think it not improbable that some other Indian species will prove specifically distinct from the Japanese species which are closely related to them, and this appears to be so in this instance. The metasternum as well as the abdomen is red in *P. rufipennis*, whereas the metasternum was black in *E. bicolor*.

Mr. Lewis met with many specimens of this insect at Nikko in June 1880, and at Hakodate in August, where it occurs on old logs and under planks.

On the front margin of the pronotum of both sexes of this species is a depressed, prominent, and semitransparent point, which acts on a corresponding file on the base of the head as a stridulating-organ. At present I have not met with this character in any *Cyanauges* or

Endomychus. It is not, however, of itself a generic character. Somewhat similar organs exist in one species of *Encymon* (see Notes from Genoa Mus. vol. ii. 1885, p. 519) and in certain genera of Languriides.

CYANAUGES, Gorham.

To this genus the North-American *Endomychus biguttatus* of Say and *Mycetina limbata*, Horn, belong. The latter is the insect alluded to by me (End. Rec. p. 64) as *Endomychus quadripunctatus*, Illiger, and is the *E. quadrinotatus* of Dejean's Catalogue, p. 464. It is wrongly given in Gemm. and Harold's Cat. as a synonym of *E. biguttatus*, from which it is specifically distinct. It occurs, according to Horn, in the State of California; I have seen it from Nevada (*Morrison*). I am not inclined to lay much stress upon the generic difference between these species and *Endomychus*. If we except the two North-American species mentioned, the other Asiatic species are very differently coloured, and are narrower and more convex. Perhaps after all some one may discover better points of distinction than those I have given for *Cyanauges*.

1. CYANAUGES GORHAMI, Lewis, Ent. Mo. Mag. xi. 1874, p. 55. (Plate LIII. fig. 5.)

Hab. MAIN ISLAND: Kashiwagi, Nikko, and Fukui. YEZO: Junsai and Sapporo.

Described from a unique example from Kawatchi.

Mr. Lewis informs me this insect was found commonly in 1881, in the mountains, on a species of *Agaricus* allied to *A. atrocæruleus*, in Kiushiu and on the Main Island, in June. In April only the remains of former generations were to be found.

2. CYANAUGES PLAGIATUS, n. sp. (Plate LIII. fig. 6.)

Niger, nitidus; elytris singulis plagia lata nec marginem nec suturam attingente, abdomineque (segmento basali excepto) castaneis. Long. 5 millim.

Hab. KIUSHIU: Yuyama and Hitoyoshi.

Var. *Plagia interrupta, maculas duas aurantiacas formante.*

Hab. KIUSHIU: Higo.

The average specimens are a little larger than *C. gorhami*, but the general form and punctuation is similar. Head and thorax shining black, the latter a good deal narrower than the elytra at its base, the sides narrow to the front angles, which are prominent and subacute. The elytra are oblong-ovate, distinctly punctured. Most of the examples have the margin narrowly, the suture widely for half its length, more narrowly behind, and the apex widely black, thus leaving a wide discoidal plagia yellow. Occasionally, as in examples from Higo, this is divided by the ground-colour of the elytra leaving only two yellow spots, one humeral occupying the callus, the other a little past the middle, ill-defined, yellow. The breast and whole of the basal segment of the abdomen black, the remainder of the abdomen chestnut-yellow. Many examples were found, some showing more or less tendency to becoming four-spotted, but only two or three definitely four-spotted varieties. Sexual distinction not apparent.

3. Cyanauges quadra, n. sp. (Plate LIII. fig. 8.)

Niger, nitidus, elytris latius ovatis, singulis maculis duabus ornatis, una humerali, una subapicali, flavis. Long. 5 millim.

Hab. Main Island: Kashiwagi.

Black, elytra each with two orange-yellow spots, one on the shoulder, and one larger and transverse near the apex. Head and thorax impunctate, the latter narrow, basal sulci distinct and deep, a little arcuate and simple (*i. e.* not bisulcate at the base), the sides narrowing from the base and sinuous, front margin between the angles nearly straight. Elytra thickly but quite distinctly punctulate; their widest part is below the middle; apex broadly rounded. The antennæ have their fourth and subsequent joints short, but not transverse, the third nearly equal to the fourth and fifth taken together.

A single specimen.

4. Cyanauges nigropiceus, n. sp. (Plate LIII. fig. 7.)

Niger; ore, elytris, pedibus et corpore subtus saturate nigro-piceis, abdominis apice dilutius piceo. Long. 4 millim.

Hab. Main Island: Kashiwagi.

Very like *C. gorhami*; compared with which it is a rather shorter and broader insect, and without any of the blue tinge which characterizes that species. The thorax is twice as wide as long, very smooth, the disk rather convex, the basal sulci distinct and half the length of the disk, quite as in *C. gorhami*, except that it is wider and altogether rather larger. Elytra punctured, but rather faintly so, black, but with a pitchy tinge, less ovate and more broadly rounded behind than in *C. gorhami*. Antennæ with joint 4 very little shorter than 3; 5–8 longer than wide but gradually shorter. Abdomen becoming gradually lighter in colour from the base to the apex.

Three specimens.

Chondria, n. gen.

Tarsi quadriarticulati, haud lobati. Prosternum processu intercoxali angusto, lanceolato, marginato. Pronotum late marginatum ut in genere Stenotarso, *margine deplanato concavo, limbo crenulato. Antennis articulo nono et decimo subquadratis æqualiter latis, ultimo oblongo, apice acuminato.*

This new name is proposed for a genus of the family Endomychidæ, allied on one hand to *Stenotarsus* by the broad flat margin of the thorax, but more closely, in general structure, especially by that of the tarsi, to *Symbiotes*. The tarsi are quite simple, *i. e.* without a long bilobed second joint as in *Stenotarsus*. The prosternum entirely agrees with that of *Symbiotes*. Of the trophi I cannot speak particularly, there being only two specimens of the single species; but, so far as can be seen without dissection, the palpi, especially the maxillary pair, have their apical joint wider and more triangular than in *Symbiotes*, in which they are oblong and truncate; but not at all securiform.

1. Chondria lutea, n. sp.

Breviter oblonga, latiuscula, pallide ferruginea unicolor, pubescens; prothorace transverso, lateribus fortiter rotundatis, late marginatis, limbo crenulato, disco lævi, basi profunde bisulcata, elytris leviter punctato-striatis. Long. $2\frac{1}{4}$ millim.

Hab. Kiushiu: Nagasaki.

The head is quite sunk in the thorax, of which the prominent front angles, formed by the broad margin, completely surround it, except in front; the eyes are coarsely granulate. The antennæ are entirely red, their second to eighth joints short, the ninth and tenth as broad as long and of the same form, the apical joint nearly twice as long, compressed at the tip. Thorax twice as broad as long (if the anterior angles are excluded), sides rounded and contracted into the anterior prominent angles, the flattened margin broad and slightly concave, the outer edge being a little reflexed and faintly crenulate, basal sulci impressed as small fossæ on the basal margin, and thence continued as lines about halfway across the disk. Elytra punctate-striate, the striæ continued to the apex, but the internal ones united before the apex. Pubescence rather thick and pilose, of the same luteous colour as the whole insect.

Two examples, found in haystack-refuse.

Symbiotes, Redtenbacher.

1. Symbiotes niponensis, Gorh. Ent. Mo. Mag. vol. x. p. 225.

Hab. Kiushiu: Nagasaki.

China: Kiu-kiang on the Yangtse-kiang river (*Lewis*).

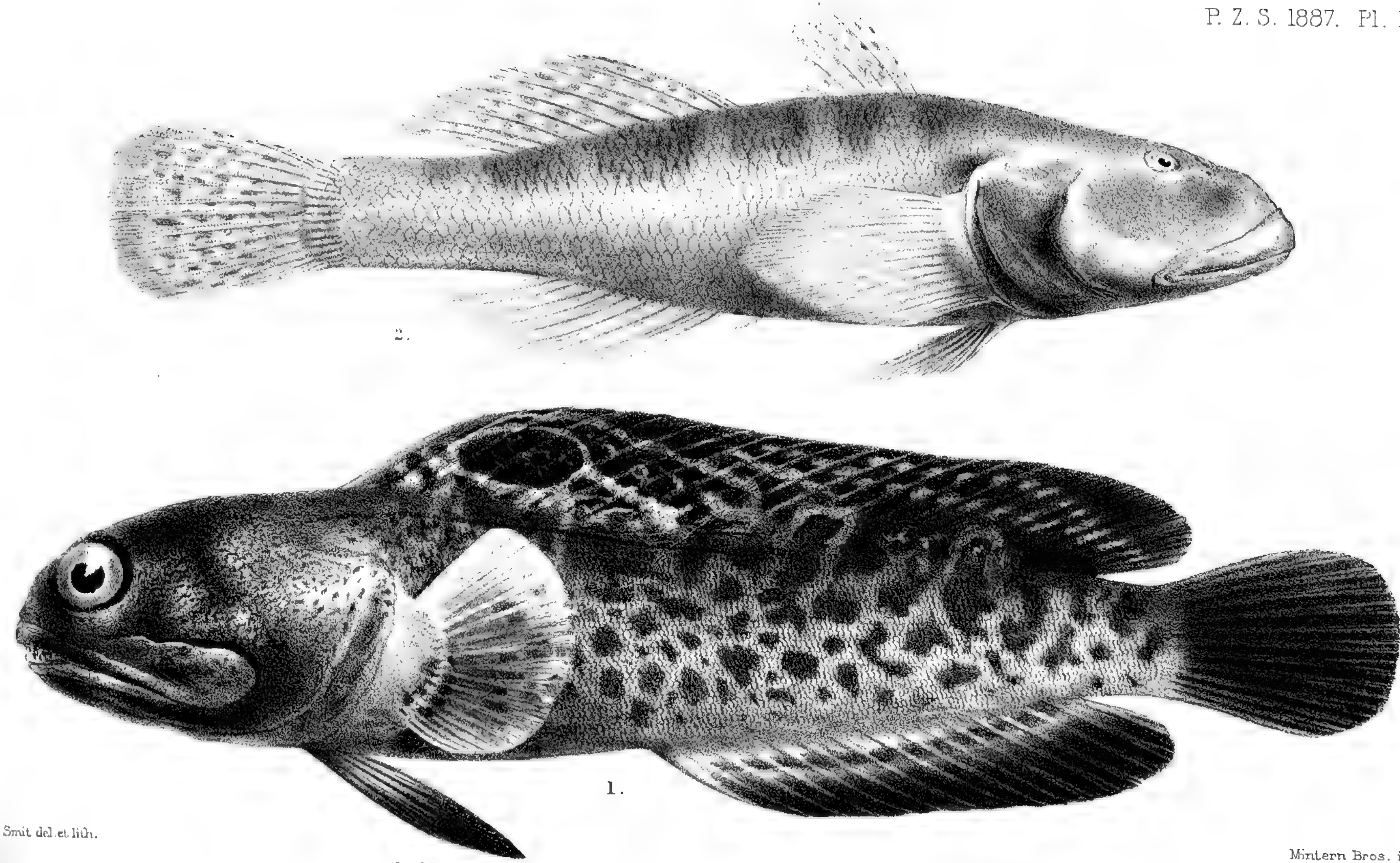
This curious little insect was met with commonly by Mr. Lewis in the neighbourhood of Nagasaki, in haystack and other refuse: it was also originally found by him in China; but the latter locality was omitted by oversight.

2. Symbiotes? orbicularis, n. sp.

Orbicularis, convexus, fere hemisphæricus, cinereo-pilosus, brunneus; thorace brevi, basi profunde bisulcata; elytris sat crebre fortius punctatis, haud striatis. Long. $1\frac{3}{4}$ millim.

Hab. Main Island: Kashiwagi, Kurigahara.

Larger and more orbiculate than *S. niponensis* and, moreover, at once to be distinguished from it by the punctuation of the elytra, which is not in striæ, but dispersed. The whole insect is rusty red; the antennæ are formed as in *S. niponensis*, the two basal (especially the first) joints being stout, the intermediate ones very small and linear, gradually shortening from the third (the longest) to the seventh, which is quadrate. The three apical joints are subequal, nearly quadrate, forming an elongate, stout club. The head and



P. Smit del. et lith.

Mintern Bros. imp.

1. OPISTHOGNATHUS MUSCATENSIS. 2. GOBIUS JAYAKARI.

thorax do not appear at all punctured, even under the microscope; the eyes are moderate in size and in their granulation. The thorax is quite twice as wide as long, the margin thick and reflexed, the outer edge of the basal suture forms a ridge, so that the space between this and the margin appears hollowed out. The basal margin is sinuate, with a broad median lobe, and with a fine marginal line. The elytra are uniformly punctured, their margin somewhat expanded, with a row of larger punctures, or small foveæ, evanescent towards the apex. The clothing is formed of rather sparse, ragged hairs, without any pubescence between them. The tarsi are simple, long and thin. The humeral callus rather strongly raised.

Two specimens, both taken in mountain-districts at over two thousand feet elevation.

EXPLANATION OF PLATE LIII.

Fig. 1. *Stenotarsus chrysomelinus*, p. 644.
2. *Mycetina laticollis*, p. 644.
3. *Phæomychus rufipennis*, p. 649.
4. *Bolbomorphus gibbosus*, p. 647.
5. *Cyanauges gorhami*, p. 650.
6. —— *plagiatus*, p. 650.
7. —— *nigropiceus*, p. 651.
8. —— *quadra*, p. 651.
9. *Stenotarsus internexus*, p. 615.
10. *Panamomus decoratus*, p. 648.

3. An Account of the Fishes obtained by Surgeon-Major A. S. G. Jayakar at Muscat, East Coast of Arabia. By G. A. Boulenger.

[Received December 6, 1887.]

(Plate LIV.)

The Natural History Museum has received a large and most valuable collection of Fishes, obtained at Muscat and presented by Mr. Jayakar, which I have been directed by Dr. Günther to examine. This collection, containing specimens of 172 species, many of which were unrepresented in the National Collection and 14 of which are apparently new to science, fills a gap in our knowledge of the distribution of the fishes of the Indian Ocean. Scarcely anything is known of the fauna of the Persian Gulf and the neighbouring coasts, a district intermediate between two others the fishes of which have been tolerably well investigated, viz. the North-eastern coast of Africa and the West coast of India. It therefore seems to me that, in addition to the description of the new species, the publication of a full list of the fishes obtained will be useful. With the exception of three (the names of which are preceded by an asterisk) all the species enumerated are marine.

TELEOSTEI.

Acanthopterygii.

Percidæ.

1. Serranus angularis, C. & V.

S. celebicus, Blkr.

2. Serranus geoffroyi, Klunz.

S. areolatus, C. & V., nec Forsk.

3. Serranus morrhua, C. & V.

4. Serranus præopercularis, sp. n.

D. $\frac{11}{14\text{–}15}$. A. $\frac{3}{8}$. P. 17–18. L. lat. 100–110. L. tr.[1] $\frac{13\text{–}14}{45\text{–}50}$.

Canines large; two rows of teeth in the lower jaw, those of the inner row largest. Length of the head twice and three fourths or three times in the total; upper profile rather convex; diameter of the eye five times in the length of the head; maxillary reaching the vertical of the posterior border of the eye; præoperculum finely serrated posteriorly, produced at the angle and armed with several strong teeth; posterior border of præoperculum forming nearly a straight angle with the lower; upper border of opercle sinuous; median opercular spine nearer the lower than the upper; lower spine extending much further back than the upper. Depth of the body about one fourth of the total length. Spinous part of the dorsal as deep as the soft; third spine longest. Pectoral reaching to below the ninth dorsal spine. Caudalis rounded. Brown; sides with black dots, irregularly disposed; dorsal, anal, and caudal blackish at the end, the soft dorsal with a narrow whitish margin; in the half-grown specimen an oblique dark line extends from below the centre of the eye to above the angle of the præoperculum.

Total length 2 feet 2 inches.

Two specimens: adult dry, half-grown in spirit.

Closely allied to *S. morrhua*.

5. Serranus hemistictus, Rüpp.

6. Serranus gigas, Brünn.

7. Serranus stoliczkæ, Day.

8. Serranus gibbosus, sp. n.

D. $\frac{11}{19}$. A. $\frac{3}{10}$. P. 18. L. lat. 110. L. tr. $\frac{22}{65}$.

No true canine teeth; teeth in the lower jaw small and in three or four rows. Length of the head thrice and a half in the total; upper profile of head slightly concave, nape much elevated; diameter of the eye seven times in the length of the head; maxillary extending beyond the vertical of the posterior border of the eye; præopercular border curved, upper limb very feebly denticulated; upper border

[1] Counted below the sixth dorsal spine.

of operculum strongly sinuous; a single, feeble opercular spine. Greatest depth of the body (at the origin of the dorsal) one third of the total length. Spinous part of the dorsal not quite so deep as the soft; third and fourth spines equal and longest. Pectoral reaching to below the tenth dorsal spine. Caudalis rounded. Brown all over, with round blackish spots, some of which are surrounded by a light ring; on the sides of the body these spots have a tendency to unite into longitudinal lines; about 16 spots in a vertical series on the middle of the body; pectorals and ventrals with a blackish border.

Total length 1 foot 3 inches.

A single specimen, in spirit.

Closely allied to *S. striolatus*, Playf.

9. Mesoprion bohar, Forsk.

10. Mesoprion rangus, C. & V.

11. Mesoprion fulviflamma, Forsk.

12. Mesoprion ehrenbergii, Ptrs.

13. Mesoprion chirtah, C. & V.
M. annularis, C. & V.

14. Mesoprion quinquelineatus, Bl.

15. Mesoprion lineolatus, Rüpp.

16. Genyoroge quinquelinearis, Bl.

17. Genyoroge bengalensis, Bl.

18. Genyoroge rivulata, C. & V.

19. Priacanthus boops, Forst.

20. Apogon annularis, Rüpp.

21. Apogon maximus, sp. n.

$$D.\ 7\,\frac{1}{9}.\quad A.\ \frac{2}{7}.\quad L.\ lat.\ 26\text{–}27.\quad L.\ tr.\ \frac{2}{6}.$$

Teeth on the sides of the lower jaw in two series. Head large, its length nearly three times in the total; diameter of the eye one fourth the length of the head; maxillary extending to below the centre of the eye, its width posteriorly a little more than half the diameter of the eye; only the præopercular edge denticulated. Depth of the body thrice and a half in the total length. The longest dorsal spine half, the longest branched ray two thirds, the depth of the body. Lateral line continuous. Caudalis notched, with rounded lobes. Pale reddish brown, head darker; each scale with one to three ink-black spots; the membrane between the dorsal, anal, and ventral fins dark grey; base of pectoral blackish.

Total length 10 inches.

Three specimens, in spirit.

22. Chilodipterus lineatus, Forsk.

23. Chilodipterus octovittatus, C. & V.

24. Odontonectes erythrogaster, C. & V.

A dry specimen, measuring 2 feet 2 inches.

25. Therapon jarbua, Forsk.

26. Pristipoma hasta, Bl.

27. Pristipoma dussumieri, C. & V.

28. Pristipoma stridens, Forsk.

29. Pristipoma operculare, Playf.

30. Diagramma griseum, C. & V.

31. Diagramma gaterina, Forsk.

32. Diagramma punctatum, C. & V.

33. Diagramma jayakari, sp. n.

D. $\frac{13}{22}$. A. $\frac{3}{8}$. P. 17. L. r.[1] 100. L. tr. $\frac{13}{20}$.

Length of the head one fourth of the total; diameter of the eye once and two fifths in the length of the snout, and thrice and two thirds in that of the head; lips thick, swollen; the maxillary reaches to the vertical of the posterior nostril; the depth of the præorbital a little less than the diameter of the eye; præoperculum with the vertical limb finely and evenly serrated, and the angle rounded. Depth of the body thrice and two fifths in the total length. Dorsal fin scarcely notched; spines strong, fourth longest and not quite one third the length of the head; the greatest depth of the soft dorsal equals the length of the longest spine, or seven eighths the depth of the body; second anal spine longest and strongest. Pectoral reaching to below the tenth dorsal spine. The distance between the anal and the caudal about twice the depth of the free portion of the tail. Caudalis concave. Greyish; upper part of head and upper two thirds of body with a blackish network enclosing numerous roundish yellow spots; suborbital part of head with longitudinal blackish streaks (five or six on the præoperculum); spinose dorsal grey, with large round, bright yellow spots; upper half of pectoral, and extremity of ventrals, anal, and caudal, blackish.

Total length 11 inches.

A single specimen, in spirit.

34. Scolopsis auratus, Mungo Park.

S. torquatus, C. & V.

35. Scolopsis ghanam, Forsk.

[1] Counted above the lateral line.

36. Scolopsis bimaculatus, Rüpp.

37. Scolopsis inermis, Schleg.

38. Synagris tolu, C. & V.

39. Synagris bleekeri, Day.

40. Cæsio chrysozona, C. & V.

41. Aphareus rutilans, C. & V.

$$\text{D. } \tfrac{11}{11}. \quad \text{A. } \tfrac{3}{11}. \quad \text{L. lat. } 63. \quad \text{L. tr. } \tfrac{6}{16}.$$

Fourth, fifth, and sixth dorsal spines longest; the last ray of the dorsal and anal fins much longer than the preceding. First pectoral ray not produced. The depth of the body exceeds the length of the head, and equals one third the total length; head thrice and three fourths in the total. Uniform cherry-red, paler inferiorly.

42. Gerres acinaces, Blkr.

Squamipinnes.

43. Chætodon collaris, Bl.

44. Chætodon selene, Blkr.

45. Chætodon melanopterus, Guichen.

Through the kindness of Prof. Vaillant I have been able to compare these specimens with one of Guichenot's types from Réunion.

46. Chætodon obscurus, sp. n.

$$\text{D. } \tfrac{13}{22}. \quad \text{A. } \tfrac{3}{18}. \quad \text{L. r. } 38. \quad \text{L. tr. } \tfrac{5}{17\text{–}18}.$$

Snout produced, longer than the diameter of the eye; upper profile of head concave, descending abruptly from the nape; præoperculum not denticulated. Lateral line extending nearly to the caudal peduncle. Scales nearly twice as deep as long, the longitudinal series directed upwards and backwards. Soft dorsal and anal angulated, not produced. Caudalis truncate. Dark brown, the centre of each scale black; snout, forehead, nape, chin, and chest yellowish; dorsal and anal spines, edge of soft dorsal and anal, and ventrals black; caudalis black, with a broad yellow edge.

Total length $5\frac{1}{2}$ inches.

Two specimens, one in spirit.

47. Heniochus macrolepidotus, L.

48. Holacanthus maculosus, Forsk.

49. Holacanthus imperator, Bl.

50. Drepane punctata, L.

MULLIDÆ.

51. MULLOIDES FLAVOLINEATUS, Lacép.

52. MULLOIDES ZEYLONICUS, C. & V.

D. 7 $\frac{1}{8}$. A. $\frac{1}{6}$. L. lat. 38. L. tr. $\frac{2\frac{1}{2}}{6}$.

Depth of the body five and a half times in the total length, length of the head four and a half times. Interorbital space once and a half the diameter of the eye, which measures nearly half the length of the snout. Red, with a rather indistinct yellow lateral band; fins orange.

Distinguished from *M. flavolineatus* by the more elongate shape, the broader vertex, and the red coloration.

53. UPENEUS MACRONEMUS, Lacép.

54. UPENEUS CYCLOSTOMA, Lacép.

55. UPENEUS DISPILURUS, Playf.

SPARIDÆ.

56. SARGUS RONDELETII, var. CAPENSIS, Smith.

Like the specimen from Maculla, south coast of Arabia, noticed by Playfair and Günther (Fishes of Zanzibar, p. 43); differing from the Mediterranean and Atlantic *S. rondeletii* in the indistinctness of the four or five blackish cross bands, and in the series of incisors forming a rather stronger curve.

The same form has been well described by Steindachner (SB. Ak. Wien, lxxiv. 1877, p. 203), from specimens obtained in the Persian Gulf and at Madagascar, and named *S. kotschyi*.

57. LETHRINUS LONGIROSTRIS, Playf.

58. LETHRINUS MAHSENA, Forsk.

59. LETHRINUS RAMAK, Forsk.

60. PAGRUS RUBER, sp. n.

D. $\frac{12}{11}$. A. $\frac{3}{8}$. L. lat. 52–53. L. tr. $\frac{7\text{–}8}{18\text{–}19}$.

Length of the head one fourth of the total; the diameter of the eye equals the width of the interorbital space, and is contained about once and two thirds in the distance from the mouth; a protuberance between and in front of the eyes; the maxillary does not extend to below the anterior border of the eye; præorbital once and one fourth as long as deep; six or seven series of scales on the præoperculum, the edge of which is not crenulated. Depth of the body twice and a half in the total length. First and second dorsal spines extremely small, scarcely projecting; third longest, compressed and curved, its length one third to one fourth the depth of the body; the membrane between the longer spines very short. Second anal spine slightly longer, but not stronger than the third, Pectoral reaching to below the second soft dorsal ray, and one third in the total length. Red.

Total length 1 foot $8\frac{1}{2}$ inches.

Two specimens: adult dry, half-grown in spirit.

61. PAGELLUS AFFINIS, sp. n.

D. $\frac{12}{10}$. A. $\frac{3}{10}$. L. lat. 60. L. tr. $\frac{7}{16}$.

Molar teeth smaller than in *P. erythrinus*, in two series in both jaws. Length of the head one fourth of the total; eye nearer the end of the snout than the extremity of the gill-cover; the diameter of the eye equals the width of the interorbital space, and one fourth the length of the head, and is contained once and a half in that of the snout; maxillary not reaching to the vertical of the eye; præorbital two thirds as deep as long, the maxillary edge slightly notched; six series of scales between the præorbital and the angle of the præoperculum; posterior nostril ovate. Depth of the body one third of the total length. The length of the third dorsal spine equals its distance from the lateral line. The pectoral fin reaches to below the origin of the soft dorsal. Red; each scale on the upper half of the body with a dark central spot; these spots forming ten longitudinal series.

Total length 1 foot 2 inches.

A single specimen, stuffed. A second specimen, a skin from the Cape of Good Hope, is in the British Museum, and has been noticed under *P. erythrinus* by Günther (Cat. Fishes, i. pp. 474, 475), as belonging probably to a new species.

62. CHRYSOPHRYS SARBA, Forsk.

63. CHRYSOPHRYS BIFASCIATA, Forsk.

64. CHRYSOPHRYS HASTA, Bl. Schn.

SCORPÆNIDÆ.

65. PTEROIS VOLITANS, Gm.

66. PTEROIS LUNULATA, Schleg.

67. PTEROIS MILES, Benn.

TEUTHIDIDÆ.

68. TEUTHIS JAVUS, L.

69. TEUTHIS ORAMIN, Bl. Schn.

T. albopunctata, Schleg.

BERYCIDÆ.

70. MYRIPRISTIS MURDJAN, Forsk.

71. HOLOCENTRUM RUBRUM, Forsk.

POLYNEMIDÆ.

72. POLYNEMUS PLEBEJUS, Brouss.

SCIÆNIDÆ.

73. UMBRINA STRIATA, sp. n.

$$\text{D. } 10\,\tfrac{1}{28}.\quad \text{A. } \tfrac{2}{7}.\quad \text{L. lat. } 50.\quad \text{L. tr. } \tfrac{8}{13}.$$

Teeth uniformly villiform in both jaws. Length of the head twice and three fifths in the total; diameter of the eye one fourth the length of the head, and equal to the length of the snout; maxillary reaching to below the anterior third of the eye; præoperculum denticulated, more coarsely at the angle; barbel extremely short. Depth of body one third of the total length. The length of the third dorsal spine twice and one half in the length of the head; second anal spine very strong, one third the length of the head. Pectoral as long as the postorbital part of the head. Caudalis truncate. Greyish, with oblique blackish streaks directed upwards and backwards, and corresponding to the longitudinal series of scales.

Total length 1 foot 4 inches.

A single specimen, dry.

XIPHIIDÆ.

74. HISTIOPHORUS GLADIUS, Brouss.

Two specimens, 9½ and 8½ feet long.

75. HISTIOPHORUS BREVIROSTRIS, Playf.

Two specimens, 10 and 8½ feet long.

ACRONURIDÆ.

76. ACANTHURUS SOHAL, Forsk.

77. ACANTHURUS NIGROFUSCUS, Forsk.

78. ACANTHURUS XANTHURUS, Blyth.

CARANGIDÆ.

79. CARANX RUSSELLII, Rüpp.

C. kurra, C. & V.

80. CARANX CRUMENOPHTHALMUS, Bl.

81. CARANX DJEDDABA, Forsk.

82. CARANX FERDAU, Forsk.

83. CARANX FULVOGUTTATUS, Forsk.

84. CARANX AUROGUTTATUS, C. & V.

C. fulvoguttatus, Rüpp. nec Forsk.

85. Caranx helvolus, Forst.

86. Caranx speciosus, Forsk.

87. Caranx hippos, L.

88. Caranx chrysophrys, C. & V.

C. chrysophryoides, Blkr.

89. Caranx jayakari, sp. n.

$$D.\ 8\ \frac{1}{21}.\quad A.\ 2\ \frac{1}{16}.\quad Sc.\ lat.\ 30.$$

Teeth in both jaws forming villiform bands; teeth on the vomer, the palatines, and on the tongue. Length of the head nearly one fourth of the total; diameter of the eye four and a half times in the length of the head, once and two thirds in the length of the snout; no adipose eyelids; the maxillary reaches to the vertical of the anterior border of the eye; lower jaw projecting beyond upper. Depth of the body thrice and one third in the total length (twice and two thirds without caudal). Length of the spinose dorsal one third the depth of the body; soft dorsal and anal much produced anteriorly, about once and a half in the depth of the body. The length of the pectoral equals the depth of the body. Breast naked up to the pectorals; the lateral line is parallel to the upper profile, and becomes straight below the middle of the soft dorsal; lateral keeled plates little developed, not much larger than the neighbouring scales. Axilla and an opercular spot black.

Total length 13 inches.

A single specimen, in spirit.

90. Caranx gallus, L.

Adult specimens 3 feet long.

91. Seriolichthys bipinnulatus, Q. & G.

The largest specimen measures 3 feet 3 inches.

92. Chorinemus lysan, Forsk.

93. Chorinemus moadetta, C. & V.

94. Trachynotus baillonii, Lacép.

95. Trachynotus oblongus, C. & V.

96. Psettus argenteus, L.

97. Platax vespertilio, L.

P. orbicularis, Forsk.

98. Platax teira, Forsk.

99. Equula fasciata, Lacép.

100. Equula edentula, Bl.

Coryphænidæ.

101. Coryphæna hippurus, L.

Scombridæ.

102. Scomber kanagurta, Cuv.

103. Scomber janesaba, Blkr.

104. Thynnus thynnus, L.

One specimen, which is 4 feet long, has 10 finlets.

105. Thynnus thunnina, C. & V.

106. Thynnus pelamys, L.

107. Cybium commersonii, Lacép.

5 feet long.

108. Elacate nigra, Bl.

Trachinidæ.

109. Percis nebulosa, Q. & G.

110. Percis alboguttata, Gthr.

111. Sillago sihama, Forsk.

112. Opisthognathus muscatensis, sp. n. (Plate LIV. fig. 1.)

D. 25–27. A. 15–17.

Teeth in a broad villiform band near the symphysis, with an outer series of enlarged and somewhat curved teeth continued along the rami. Length of head not quite one fourth of total; diameter of orbit one fourth the length of the head; interorbital space three fifths the diameter of orbit; maxillary extending to about halfway between the orbit and the base of the pectoral, widening posteriorly. Body much compressed, its depth more than twice its diameter, and contained five to five and one third times in the total length. Dorsal of equal depth throughout. Lateral line ending below the fourteenth or fifteenth dorsal ray. Pectorals about two thirds the length of ventrals, which nearly equals the length of the postorbital part of the head. Brown, with darker spots of unequal size; head specked or vermiculated with blackish; upper jaw bordered with black; pectoral greyish, with the membrane colourless; the other fins blackish; dorsal with some light spots and rings, and a large, oval, black spot, surrounded by a light ring, between the third and seventh rays.

Total length 12 inches.

Three specimens, in spirit.

Batrachidæ.

113. Batrachus grunniens, L.

B. trispinosus, Gthr.

Pediculati.

114. Antennarius nummifer, Cuv.

Cottidæ.

115. Platycephalus insidiator, Forsk.

116. Trigla arabica, sp. n.

D. 7·12. A. 12.

Length of the head one third of the total; length of snout once and a half the diameter of the orbit; interorbital space concave, once and one fourth the diameter of the orbit; profile of snout not concave; præorbital produced into a flat, triangular spine, the length of which equals one third the diameter of the orbit; præoperculum with two small spines, upper largest; operculum with a keel, ending in a strong spine the length of which equals the diameter of the orbit. Supraclavicula with a spine pointing downwards and another, longer, pointing backwards; the length of the supraclavicula equals that of the opercular spine. Scales very small. Dorsal spines strong, not tubercular, third and fourth longest; the width of the rugose plate at the base of the first dorsal equals two thirds the diameter of the orbit. The pectoral reaches to the vertical of the third anal ray. Upper half of body brownish, with numerous small round blackish spots; lower half white; first dorsal with a large black blotch; second dorsal with a series of round black spots; the membrane between the pectorals bluish black.

Total length 9 inches.

A single specimen, in spirit. The discovery of a species of *Trigla* at Muscat is of special interest, as the genus has not yet been recorded from the east coast of Africa nor from India. The nearest ally of *T. arabica* is the Japanese *T. hemisticta*.

Gobiidæ.

*117. Gobius jayakari, sp. n. (Plate LIV. fig. 2.)

D. $6\frac{1}{10}$. A. $\frac{1}{10}$. L. lat. 65–67.

No canine teeth. Length of the head one third of the total without caudal; eye one seventh of the length of the head, nearly equally distant from the end of the snout and from the gill-opening; interorbital space once and a half the diameter of the eye; maxillary extending to below the eye; upper jaw longer than lower. Depth of body five and one third to six times in the total length; sixteen longitudinal series of scales between the second dorsal and the anal; scales on the nape much smaller than those on the sides. The distance between the first dorsal and the eye nearly equals that between the end of the snout and the border of the præoperculum; dorsal fins lower than the body. The extremity of the ventral halfway between its base and the vent. Caudalis rounded. Pale brownish above, with indistinct traces of darker cross bands; dorsal and caudal fins with dark dots.

Total length $6\frac{1}{2}$ inches.

Four specimens, in spirit; from fresh waters near Muscat.

BLENNIIDÆ.

118. SALARIAS TRIDACTYLUS, Bl. Schn.

SPHYRÆNIDÆ.

119. SPHYRÆNA JELLO, C. & V.

120. SPHYRÆNA KENIE, Klunz.

121. SPHYRÆNA OBTUSATA, C. & V.

122. SPHYRÆNA CHRYSOTÆNIA, Klunz.

ATHERINIDÆ.

123. ATHERINA PINGUIS, Lacép.

MUGILIDÆ.

124. MUGIL SCHELI, Forsk.

M. axillaris, C. & V.

125. MUGIL CEYLONENSIS, Gthr.

FISTULARIIDÆ.

126. FISTULARIA SERRATA, Cuv.

CENTRISCIDÆ.

127. AMPHISILE SCUTATA, L.

POMACENTRIDÆ.

128. AMPHIPRION SEBÆ, Blkr.

129. AMPHIPRION CLARKII, Benn.

130. GLYPHIDODON CŒLESTINUS, C. & V.

131. GLYPHIDODON SORDIDUS, Rüpp.

132. DASCYLLUS TRIMACULATUS, Rüpp.

133. HELIASTES OPERCULARIS, Playf.

LABRIDÆ.

134. CHEILINUS LUNULATUS, Rüpp.

135. PSEUDOSCARUS DUSSUMIERI, Blkr.

136. PSEUDOSCARUS JANTHOCHIR, Blkr.

ANACANTHINI.

PLEURONECTIDÆ.

137. PSETTODES ERUMEI, Bl. Schn.

138. PSEUDORHOMBUS RUSSELLII, Gray.

139. PARDACHIRUS MARMORATUS, Lacép.

PHYSOSTOMI.

SILURIDÆ.

140. PLOTOSUS ANGUILLARIS, Bl.

141. ARIUS THALASSINUS, Rüpp.

The single specimen, although $2\frac{1}{2}$ feet long, has all the characters of Rüppell's *A. thalassinus*, thus invalidating the statement, first made by Bleeker, that age alone accounts for the differences between this species and *A. nasutus*, C. & V. The smallest specimen of the latter form preserved in the British Museum measures a little over 1 foot, and the largest 3 feet; yet there is no great difference between them. Besides the produced and pointed snout, they differ from *A. thalassinus* in the shorter maxillary barbel and the presence of granulations on the snout. It may be that the differences between the two forms are sexual; but the material at hand does not enable me to decide. The only adult specimen in spirit in the British Museum is a male, and belongs to *A. nasutus*.

SCOPELIDÆ.

142. SAURUS VARIUS, Lacép.

143. SAURIDA TUMBIL, Bl.

CYPRINIDÆ.

*144. SCAPHIODON MUSCATENSIS, sp. n.

D. $\frac{3}{10-11}$. A. $\frac{2}{7}$. L. lat. 38–39. L. tr.[1] $\frac{}{4}$.

Length of head one fourth of total (without caudal); diameter of eye one fourth the length of head; snout rounded, projecting a little beyond the mouth, glandular; a single barbel on each side, measuring three fifths the diameter of the eye; mandible sharp, with a horny sheath. Origin of dorsal just above the ventrals, midway between the end of the snout and the base of the caudal; last undivided dorsal ray osseous, rather feeble, not serrated. Pectoral as long as the head less the snout. Caudal forked. Bronzy above, whitish below; scales, except the lowermost, with a dark brown margin; a more or less distinct blackish lateral band ending in a spot before the caudal.

Total length 4 inches 3 lines.

Several specimens.

[1] Counted between origin of dorsal and ventral.

Cyprinodontidæ.

*145. Cyprinodon dispar, Rüpp.

Scombresocidæ.

146. Belone choram, Forsk.

147. Hemirhamphus dussumieri, C. & V.

148. Hemirhamphus commersonii, Cuv.

149. Exocœtus evolans, L.

150. Exocœtus brachysoma, Blkr.

Clupeidæ.

151. Engraulis commersonianus, Lacép.

152. Chatoessus nasus, Bl.

153. Clupea scombrina, C. & V.

154. Clupea venenosa, C. & V.

155. Elops saurus, L.

156. Chanos salmoneus, Bl. Schn.

Chirocentridæ.

157. Chirocentrus dorab, Forsk.

Murænidæ.

158. Muræna undulata, Lacép.

Lophobranchii.

Syngnathidæ.

159. Hippocampus guttulatus, Cuv.

Plectognathi.

Sclerodermi.

160. Triacanthus strigilifer, Cant.

161. Balistes macrolepis, sp. n.

D. 3. 26. A. 23. L. lat. 38–40.

Teeth white, uneven, notched. Length of head one fourth of the total (without caudal); a groove in front of the eye, below the nostril; diameter of the eye five and a half times in the length of the head. Greatest depth of the body one third of the total length. Tail compressed. Scales largest on the posterior half of the body and on the tail, granulated in the middle and with a short keel or tubercle; 24 or 25 scales between the origin of the second dorsal and the vent; no enlarged scales behind the gill-opening; no spines on the tail. First dorsal spine about half the length of the head; second dorsal and anal much elevated anteriorly, falciform, their depth equalling the distance between the mouth and the gill-opening. Ventral spine short. Caudal strongly notched. Brown, whitish inferiorly; the tubercle on the scales white.

Total length 1 foot 11 inches.

Two specimens, dry.

162. Balistes niger, Mungo Park.

163. Balistes mitis, Benn.

164. Balistes assasi, Forsk.

165. Monacanthus setifer, Benn.

166. Ostracion gibbosus, L.

167. Ostracion cubicus, L.

168. Ostracion cyanurus, Rüpp.

169. Ostracion cornutus, L.

Gymnodontes.

170. Tetrodon stellatus, Bl. Schn.

171. Tetrodon hispidus, L.

Chondropterygii.

Trygonidæ.

172. Trygon uarnak, Forsk.

EXPLANATION OF PLATE LIV.

Fig. 1. *Opisthognathus muscatensis*, p. 662. Two thirds nat. size.
2. *Gobius jayacari*, p. 663.

4. Descriptions of some new Species of Lepidoptera Heterocera, mostly from Tropical Africa. By Herbert Druce, F.L.S., F.Z.S., &c.

[Received December 6, 1887.]

(Plate LV.)

The specimens from which these descriptions are taken are all in my own collection.

Fam. Agaristidæ.

Eusemia, Dalman.

Eusemia perdix, n. sp.

Primaries black, with all the markings orange-yellow; the apical spot smaller and narrower than in *E. superba*; the two central and the anal spots about the same as in that species; the band near the base crosses almost from the costal to the inner margin, thus differing from *E. superba*; the basal white spots are the same, the bluish lines are very indistinct. Secondaries bright carmine, with a yellowish shade on the costal margin; the outer margin broadly banded with black; a red spot on the black band near the anal angle. The fringe white at the apex of all the wings. Head and thorax black, spotted with white as in *E. superba*; abdomen black, banded with yellow; antennæ black. Both sexes are identical.

Expanse, ♂ and ♀ $2\frac{3}{4}$ inches.

Hab. East Central Africa: Manboia (*Last*); Delagoa Bay (*Mrs. Monteiro*).

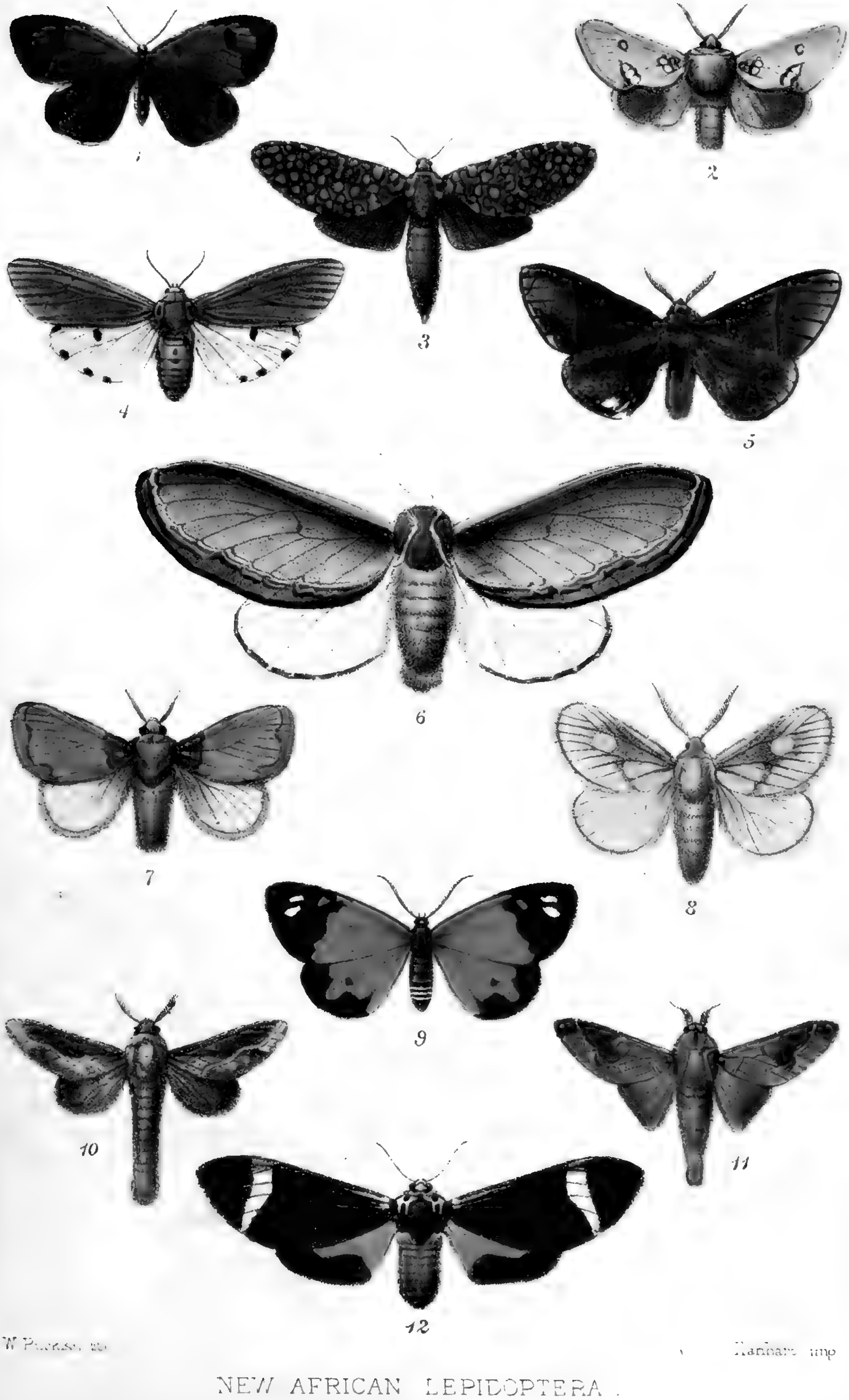
This fine species is allied to *Eusemia superba*, from which it is at once distinguished by the basal band on the primaries and the red spot on the black margin of the secondaries. I have four specimens before me, two ♂ and two ♀.

Eusemia pentelia, n. sp.

Primaries deep black, with two bluish metallic streaks, the first about the middle of the cell, the second at the end of the cell; the ochraceous spots and bands arranged much as in *E. euphemia*, but the apical band is much wider and more curved, and almost joining the small spot at the anal angle. Secondaries ochraceous, shaded with carmine at the base and along the inner margin to the anal angle; the outer margin broadly banded with black, widest at the apex and the anal angle. Underside as above, the secondaries being rather more pink in colour. Head, thorax, palpi, and antennæ black, the thorax and tegulæ spotted with white; abdomen black, each segment banded with yellow, the first three bands nearest the base whitish on the upperside.

Expanse 2 inches.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).



W. Purkiss del.

Hanhart imp.

NEW AFRICAN LEPIDOPTERA.

This species is most nearly allied to *E. butleri*, Walk.; a specimen of this insect is in the National Collection, from the same locality.

Fam. ARCTIIDÆ.

PELOCHYTA, Hübn.

PELOCHYTA FENNIA, n. sp.

Primaries reddish brown, with a large, round, semihyaline spot at the end of the cell, and three minute black dots close to the base. Secondaries pinkish brown, bright pink along the inner margin, and about the middle of the outer margin, from the middle to almost the costal margin, pinkish hyaline. Underside, primaries the same as above; the secondaries bright pink, slightly shaded with brown along the costal margin and at the apex. Head and thorax reddish brown, with two small black dots in front, and one on each of the tegulæ, also three black dots at the base; abdomen bright pink, with a row of black spots on each side; legs dark blackish brown above, and pinkish on the underside; antennæ and palpi black.

Hab. West Africa: Gambia (*Capt. A. Moloney*).

This species is much darker in colour than any other in the genus.

PELOCHYTA LUPIA, n. sp.

Primaries and secondaries pure white, slightly shaded with very pale fawn-colour along the costal margin and apex of the former, a faint darker line at the end of the cell, and one beyond, partly enclosing a large semihyaline spot. Head and thorax and base of abdomen white, a small black dot in front of the head, two on the front of the thorax, and one on each of the tegulæ. Antennæ brownish black. Abdomen above bright carmine, with a row of black dots on each segment on both sides; the underside white; legs white, shaded with carmine.

Expanse $1\frac{6}{10}$ inch.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

This species is quite distinct from any other known to me; it closely resembles *Halesidota? nivea*, Herr.-Sch., from Brazil.

ANACE, Walk.

ANACE HERONA, n. sp.

Primaries almost uniform yellowish white, slightly darker along the costal margin; a red spot on the inner margin close to the base; secondaries uniform pale yellow. Underside of all the wings pale yellowish white, the costal margin of the secondaries shaded with red. The lower part of the head and underside of the thorax reddish; the upper half of the head, collar, thorax, and tegulæ white, with very indistinct reddish lines. Abdomen yellowish, with a tuft of bright red hairs on each side close to the base.

Expanse $1\frac{3}{4}$ inch.

Hab. West Africa: Mongo-ma Lubah (*Thompson*).

A specimen of this species is also in the British Museum, from Aburi.

ANACE ? HERPA, n. sp. (Plate LV. fig. 12, ♀.)

Female. Primaries brownish black, crossed near the apex from the costal margin to the outer margin by a white band, which is the widest on the costal margin, and tapers off to a point on the outer margin. Secondaries dark orange-yellow, broadly bordered with brownish black from the apex to the anal angle; a large black spot at the end of the cell. Head and palpi black; collar dark orange, with a black dot on each side of the head; tegulæ white, with two black dots on each; thorax brownish black. Abdomen and the underside of the thorax orange; a row of black spots on each side of the abdomen; antennæ black.

Expanse $2\frac{1}{4}$ inches.

Hab. West Africa: Cameroons (*Rutherford*).

I am rather doubtful whether this species should be placed in the genus *Anace*, but without seeing male specimens it is better, I think, to place it here provisionally than to make a new genus for it without sufficient material for so doing.

AREAS, Walk.

AREAS MOLONEYI, n. sp. (Plate LV. fig. 4, ♀.)

Primaries creamy white, with the costal margin bright scarlet, and all the veins edged with pale fawn-colour; two minute black dots at the end of the cell. Secondaries white, with a black spot at the end of the cell, and a row of four black spots along the outer margin, extending from the apex to near the anal angle. The underside of all the wings the same as above, but slightly greyer in colour. Head, thorax, the base, and the underside of the abdomen creamy white; the upperside of the abdomen bright red, with a central row of black spots and also a row on each side, which are considerably the smallest; the anus is greyish. Antennæ black; legs greyish.

Expanse $1\frac{3}{4}$ inch.

Hab. West Africa: Gambia (*Capt. A. Moloney*).

This very distinct and pretty species I have much pleasure in naming after its discoverer, Captain A. Moloney, who obtained it with many others from the Gambia.

Fam. LITHOSIIDÆ.

CARYATIS, Hübn.

CARYATIS HERSILIA, n. sp.

Primaries slate-colour, almost the same as in *Caryatis phileta*; the white band crossing the wing as in that species, but much narrower and lobed at the end of the cell. Secondaries bright carmine, with the apical border wider than in *C. phileta*. Head, thorax, and abdomen carmine, the latter with black spots on each segment. Antennæ black; legs slate-colour.

Expanse $1\frac{3}{4}$ inch.

Hab. West Africa: Cameroons.

This species is closely allied to *C. phileta*, from which it is at once distinguished by the difference in the white band on the primaries and the bright carmine colour of the secondaries. Specimens are also in the British Museum from the above locality and Old Calabar.

Fam. Nyctemeridæ.

Aletis, Hübn.

Aletis cunaxa, n. sp. (Plate LV. fig. 9, ♀.)

Male. Primaries black, with the basal half dark yellowish brown, the brown on the outer side sloping off from the end of the cell to near the anal angle on the inner margin, two white spots near the apex. Secondaries dark yellowish brown, the outer margin broadly banded with black from the apex to the anal angle, and much dentated in the middle, a black streak from the base along the inner margin to the anal angle. Underside orange, with all the black margins much narrower and more broken; four white spots on the primaries, the first three close to the apex, the fourth at the anal angle, and five on the outer margin of the secondaries, three near the apex and two quite small, close to the anal angle. Head, antennæ, thorax, and upperside of the abdomen black, the sides of the abdomen with each segment bordered with white, the underside dusky yellow; the tegulæ black, spotted with white; legs black. The female is rather larger than the male and much paler in colour, and the black margins to the wings are not so wide, and it also has a small black spot below the end of the cell on the secondaries, like *A. postica*, Walk; on the underside it is almost identical with that of the male, the white spots being slightly larger.

Expanse, ♂ $1\frac{1}{4}$ inch, ♀ $1\frac{3}{4}$ inch.

Hab. West Africa: Congo (*Huson-More*).

Terina, Walk.

Terina niphanda, n. sp.

Primaries orange-yellow, slightly hyaline, black at the base round a small white spot; a black band crossing from beyond the middle of the costal margin to the apex, the band is narrow in the middle; the apex broadly black, with a white spot; the outer margin black. Secondaries orange-yellow, the outer margin black, with a white spot at the apex. Thorax white, tegulæ black. Abdomen black, with a white spot on each segment down the middle from the base to the anus, which is yellow; the underside as above.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa: Congo (*Huson-More*).

This species is allied to *T. latifascia,* Walker, but very distinct.

Terina euryanassa, n. sp.

Primaries: the basal half chrome-yellow; the apical half black, crossed from the costal margin almost to the anal angle by a wide, white, slightly hyaline band. Secondaries dark chrome-yellow, shaded with red along the inner margins; the outer margins bordered with black. The underside the same as above. Head and thorax red. Abdomen chrome-yellow, with a black spot on each segment. Palpi, antennæ, and legs brownish black.

Expanse $1\frac{3}{4}$ inch.

Hab. East Africa: Magila (*Craven*).

The type of this distinct species was obtained by Mr. Alfred E. Craven during his expedition to the Usambara country in East Africa.

SECUSIO, Walk.

SECUSIO MANIA, n. sp.

Male. Primaries creamy white, all the veins and the apex pale brownish fawn-colour; secondaries uniform chrome-yellow. Underside as above excepting the primaries, which are more yellow in colour, the veins not brown as above, the head and abdomen chrome-yellow; thorax and tegulæ creamy white, the collar and tegulæ with black marks; antennæ black. The female is the same as the male, but much darker in colour.

Expanse, ♂ $1\frac{1}{2}$ inch, ♀ $1\frac{3}{4}$ inch.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

This species seems to vary very much; I have a male and a female specimen before me that are almost white, with the veins brownish; in all other respects they are identical with the typical form.

GIRPA, Walk.

GIRPA OCTOGESA, n. sp. (Plate LV. fig. 1.)

Primaries creamy white, shaded with orange at the base and along the costal margin; the apical half of the costal margin, the apex and the outer margin black, a black spot at the end of the cell joined on the lower side to the black outer margin. Secondaries creamy white, with an elongated black spot at the apex and a nearly round black spot to the anal angle. The underside the same as above. Head, thorax, and abdomen dusky white. Antennæ brownish black.

Expanse $1\frac{4}{10}$ inch.

Hab. West Africa: Cameroons (*Rutherford*).

A very distinct species, allied to *G. circumdata*, Walk.

HYLEMERA, Butl.

HYLEMERA DEXITHEA, n. sp.

Primaries white, the apical third of the wing broadly black, going almost to a point at the anal angle. Secondaries white, with a small black spot at the apex. Head and antennæ black, thorax and abdomen yellowish white.

Expanse $1\frac{1}{4}$ inch.

Hab. West Africa: Cameroons (*Rutherford*).

A pretty little species allied to *H. puella*, Butler, from Madagascar.

HYLEMERA NEÆRA, n. sp.

Primaries pale slate-colour, from the base to about the middle pinkish yellow. Secondaries yellow, the outer margin from the apex to the anal angle broadly bordered with slate-colour. Head, thorax, and abdomen pale yellow, antennæ black.

Expanse 1 inch.

Hab. West Africa: Cameroons (*Rutherford*).

A pretty little species, in form very like *H. doleris*, but quite different in colour.

Fam. LAPARIDÆ.

CYPRA, Boisd.

CYPRA NYSES, n. sp.

Primaries and secondaries uniform semihyaline white, slightly shaded with pale yellowish along the costal margin of the former, a small black spot at the apex and anal angle of both wings. Head, thorax, and abdomen yellowish white. Antennæ and legs pale brown.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa: Old Calabar (*White*).

This species is allied to *C. crocipes*, Boisd., from Madagascar, from which it is at once distinguished by the black spots on the wings.

ANAPHE, Walk.

ANAPHE MOLONEYI, n. sp. (Plate LV. fig. 5, ♂.)

Male. Primaries creamy white, crossed beyond the middle from the costal margin to the inner margin by a wide black band, not broken in the middle as in *A. carteri*, the costal margin broadly banded with black from the base to the apex, the outer margin narrowly edged with black, and all the veins black, from the outer margin almost up to the black band crossing the wing. Secondaries creamy white, with the fringe black. Underside the same as above, excepting the band on the primaries being very indistinct. Head, the underside of the thorax, and the abdomen pale yellowish brown, the upperside of the thorax creamy white. Antennæ black, legs brownish yellow.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa: Gambia (*Capt. A. Moloney*).

This species is allied to *A. carteri*, Walsingham, but very distinct in the form of the black band and the black costal margin, also the veins being black almost up to the band crossing the wings. The large cocoon from which *A. moloneyi* came out was brought to this country by Captain Moloney, who kindly handed it to me. It is almost the shape of a large pear, about five inches long, and was found hanging from a branch of a tree by a fine silken thread: unfortunately only one moth came out; the large cocoon contains a great number of small cocoons packed very closely together. The silk appears to be of a very tough nature, and is of a reddish-brown colour. The pupa is dark brown in colour, enclosed in a loosely made silken cocoon.

I have lately received, through the kindness of Mr. A. Higgins, the cocoon of *A. infractor*: in shape it is much the same as that of *A. moloneyi*, but rather longer and slightly darker in colour; it was obtained by Mr. A. Higgins at Ile Ife, about fifty miles inland from Lagos, where it was very common, hanging from the trees; but it is not found near the coast. The natives eat the larvæ, which are of a reddish-brown colour; they fry them in palm-oil. Mr. Higgins informs me they are of a sweetish taste when cooked. They also make use of the silk, taking it from the cocoons, washing it, and forming it into hanks, which they sell in the market-places; it is also made into rough cloths by the women. About 60 moths have come out of the cocoon, 25 males and 35 females, some of them crippled. The silk closely resembles that of *A. moloneyi*, but it is darker brown and not quite so glossy. The cocoons were placed in a warm orchid-house, and about a week afterwards two moths came out, then others every day, but only when the sun was shining on the cocoon, which was placed close up to the glass; the moths always emerged between 10 and 12 o'clock in the morning.

ANAPHE CARTERI, Walsingham.

Female. Very like the male but much larger, the black band on the primaries much wider and not divided in the middle; the black border on the costal and inner margin is wider; the antennæ are black and rather deeply pectinated.

Expanse ♀ $2\frac{1}{4}$ inches.

Hab. West Africa: Gambia (*Carter*).

The male of this species was described by Lord Walsingham, Trans. Linn. Soc. ser. 2, Zool. ii. p. 433, t. xlv. f. 9. Through the kindness of Mr. Carter I am now able to describe the female.

CHŒROTRICHE, Butl.

CHŒROTRICHE ORESTES, n. sp.

Male. Primaries citron-yellow, crossed from the costal to the inner margin by six bands of indistinct orange spots, those close to the base being the darkest in colour; a black crescent-shaped narrow line at the end of the cell, and, beyond, a band of small greyish dots extending from near the apex to the inner margin. Secondaries uniform silky cream-colour. The underside of all the wings cream-colour, slightly darker at the base. Head, thorax, and abdomen yellow. Female the same as the male, excepting that the markings on the primaries are much more indistinct, and the abdomen is of a dark brown colour, with a very large anal tuft of hairs.

Expanse, ♂ $1\frac{3}{4}$ inch, ♀ $2\frac{3}{4}$ inches.

Hab. West Africa: Mongo-ma Lubah (*L. W. Thompson*).

A fine species, not unlike *Cispia punctifascia*, Walker, from India.

DASYCHIRA, Steph.

DASYCHIRA CANGIA, n. sp.

Male. Primaries greyish white, with all the veins yellowish, crossed from the costal to the inner margin with many rows of crescent-shaped black lines, those nearest the base and the outer margin being the most distinct; the fringe black and white. Secondaries white, broadly marked with blackish grey from the base to the anal angle. The underside of all the wings pure white. Head, thorax, and the underside of the abdomen white shaded with grey, the upperside of the latter greyish black, with a row of black tufts from the base to the anus.

The female is the same as the male, excepting that it is much larger, and all the markings on the primaries much more indistinct; the secondaries are also much more dusky.

Expanse, ♂ $1\frac{3}{4}$ inch, ♀ $2\frac{1}{4}$ inches.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

This species is allied to *Dasychira mascarena*, Butl., from Madagascar, but resembles *Dicranura vinula*, Linn.

DASYCHIRA? REMOTA, n. sp.

Male. Primaries silvery grey, crossed by two wide brown bands (which are thickly irrorated with silvery scales), the first close to the base, the second beyond nearest the apex, almost joining the first on the inner margin; a black spot at the base, and a marginal row of small black dots from the apex to the anal angle; secondaries silvery white, with an indistinct brownish-black band crossing the wing from the inner margin close to the anal angle (where it is the widest) to the apex, which it does not quite reach, a small spot at the end of the cell, and a marginal row of spots all black. Underside silvery grey, primaries clouded with brownish black beyond the middle; the marginal row of black spots on both wings the same as above. Head, the upper and underside of the thorax, and abdomen pale greyish brown; the upperside of the abdomen bright orange, with a row of small black spots on each side. Antennæ and palpi pale fawn-colour, legs greyish. The female the same as the male but larger, and the dark markings not so distinct.

Expanse, ♂ $1\frac{1}{2}$ inch, ♀ $1\frac{3}{4}$ inch.

Hab. West Africa: Gambia (*Capt. A. Moloney*).

This species varies slightly, some specimens being much paler in colour than others, with the markings very indistinct.

LASIOCAMPIDÆ.

HIBRILDES, n. gen.

Male. Body slender. Abdomen about half the length of the hind wings. Palpi very minute, clothed with hairs. Antennæ rather long, deeply pectinated; legs very short, not clothed with hairs, as in the genus *Sarmalia.* Wings broad and rounded at the apex, the inner margin fringed, subcostal nervure with two branches. The cell is rather long and broad; secondaries narrow, long and rounded at the anal angle.

HIBRILDES NORAX, n. sp.

Male. Semihyaline; primaries and secondaries uniformly covered with yellowish-white scales, with all the veins light brown, the fringe of all the wings creamy white, the underside as above. Head and the collar yellow; thorax and tegulæ white; abdomen and legs brownish yellow; antennæ black. Female unknown.

Expanse $2\frac{1}{2}$ inches.

Hab. East Central Africa: Lake Nyassa (*Thelwall*).

This species is not unlike *Sarmalia radiata*, Walk., from the Philippine Islands. The two male specimens before me were sent some years ago to the late Mr. Hewitson, who kindly gave them to me.

Jana, Boisd.

Jana sciron, n. sp.

Male. Primaries silky fawn-colour, darkest from the base to about the middle, and at the end of the cell beyond two brown lines, the first straight crossing from the inner margin to near the costal margin, which it does not join, the second curved from the inner margin to the apex, bordered on the outer edge with pale whitish fawn-colour; the fringe very pale in colour; a round black spot on the costal margin near the base. Secondaries fawn-colour, broadly shaded with bright orange, from the base to the apex; three brown lines crossing the wing below the middle from the inner margin close to the anal angle to near the apex, only the outer line reaching that point; above and below the band on the inner margin are a few greyish scales, and nearer the base a small tuft of black hairs. Underside of all the wings brownish fawn-colour; the costal margin of the primaries reddish, and a curved brown line extending from the apex to the inner margin. Secondaries crossed beyond the middle by two waved brown lines. Antennæ brownish black, the head and the upperside of the thorax and abdomen fawn-colour; the underside bright red. The coxa and femur red; tarsus brown.

Expanse $4\frac{1}{2}$ inches.

Hab. West Africa: Mongo-ma Lubah.

This fine species is very distinct; the form of the hind wing differs from all other species of *Jana* that are known to me.

Chrysopoloma, Wallgr.

Chrysopoloma bithynia, n. sp.

Male. Uniform mouse-colour, the primaries a shade darker than the secondaries, the former crossed by two curved lines, the first nearest the base very indistinct, the second broken into spots; the underside of all the wings pale mouse-colour; the head, thorax, abdomen, antennæ, and legs of the same colour. The female identical with the male, excepting it is slightly larger and redder in colour.

Expanse, ♂ $1\frac{1}{2}$ inch, ♀ $1\frac{3}{4}$ inch.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

This insect appears pretty common; I have seen a considerable number of specimens.

CHRYSOPOLOMA LABDA, n. sp.

Male. Upper and underside uniform pale citron-yellow; primaries crossed by three narrow purplish-brown bands, the first curved, the second straight from the inner margin, but not reaching the costal margin, the third a row of spots extending from near the apex to the inner margin. Head, thorax, and abdomen pale yellow.

Expanse $1\frac{1}{2}$ inch.

Hab. East Africa: Nyassa.

This pretty little species is allied to *C. rosea.*

CHRYSOPOLOMA? THELDA, n. sp.

Primaries brownish fawn-colour, thickly irrorated with white scales; a small V-shaped brown mark on the costal close to the apex, and a brown mark along the outer margin; a curved line of black lunular-shaped marks extending from the apex to the inner margin above the anal angle. Secondaries pale yellow, crossed below the middle by two fawn-coloured bands of lunular-shaped marks, the first not reaching the costal margin; on the inner margin are three patches of dark-brown hairs, the fringe of all the wings fawn-colour. Underside of all the wings yellowish fawn-colour, with the darker markings as above, and in addition two indistinct rows of small brown spots on each wing, the first between the bands, the second submarginal. The thorax and abdomen above dark fawn-colour, on the underside yellowish.

Expanse 2 inches.

Hab. West Africa: Mongo-ma Lubah.

A fine species, very distinct from any other with which I am acquainted, but in form nearest to *C. citrina.*

EUTRICHA, Hübn.

EUTRICHA AUDEA, n. sp.

Male. Primaries dark brown, shading to pale yellowish-brown at the base and along the inner margin, three brownish-black waved lines crossing from the costal to the inner margin; two crescent-shaped spots close to the apex. Secondaries uniform dark brown, the underside of all the wings of a dark brown colour. Head, thorax, and abdomen dark reddish brown; antennæ and legs brown. The female is like the male, but much larger and with all the markings much more distinct.

Expanse, ♂ 2 inches, ♀ $3\frac{1}{4}$ inches.

Hab. West Africa: Cameroons (*Rutherford, Fuller*).

This species is allied to *E. nitens,* described by Mr. Butler, from Madagascar; a specimen is in the National Collection, from Old Calabar.

LASIOCAMPA, Schr.

LASIOCAMPA MONTEIROI, n. sp.

♂. Pale uniform straw-colour, the primaries crossed near the base and beyond the middle by two brownish-yellow lines and a small yellow spot at the end of the cell. The head, thorax, and abdomen pale yellowish straw-colour; antennæ and legs darker yellow. The female is in all respects identical with the male but considerably larger.

Expanse, ♂ $2\frac{1}{4}$ inches, ♀ $3\frac{1}{4}$ inches.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

This species is very distinct from any other known to me.

Trabala, Walk.

Trabala rosa, n. sp.

Male. Primaries reddish fawn-colour, darkest from the base to about the middle, where it is crossed by a narrow black curved line, which extends from the costal margin to the inner margin, and it is bordered on the outer side by a narrow whitish line; between the line and the outer margin a row of small black spots crosses from the apex to the inner margin near the anal angle; a small white spot edged with black at the end of the cell. Secondaries reddish fawn-colour, darkest at the base and along the inner margin; a narrow indistinct black line crossing the wing from near the apex nearly to the middle of the inner margin, but not quite reaching it. The underside of all the wings pinkish fawn-colour, with the bands and spots as on the upperside, but of a reddish-brown colour, the spots extending across the hind wing. Head, thorax, abdomen, antennæ, and legs uniform reddish fawn-colour. *Female.* Primaries and secondaries uniform pale whitish fawn-colour shaded with pink, thickly irrorated with minute black specks; the primaries crossed from the costal margin to the inner margin by two curved black lines, the first near the base, the second beyond the middle, and a submarginal row of black spots corresponding with those on the primaries of the male; the black band on the secondaries is very indistinct. The underside much paler than above, with the submarginal row of black spots quite large on both wings. Head, thorax, and the abdomen the same colour as the wings; the anal tufts very large and a shade darker in colour than the abdomen. Antennæ and legs reddish fawn-colour.

Expanse, ♂ 3 inches, ♀ 4 inches.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

This fine species is allied to *Eutricha rennei*, Dewitz, from which it is quite distinct.

Megasoma, Hübn.

Megasoma polydora, n. sp. (Plate LV. fig. 11, ♂.)

Male. Primaries reddish brown, paler along the outer margin, and from the anal angle to the base; a small white spot close to the base, beyond which a minute white streak; a round orange-coloured spot at the end of the cell, with a darker spot on the inner side; a narrow white streak crosses the wing from the apex to near the anal angle, but does not quite reach that point. Secondaries uniform reddish brown; the fringe and a few hairs along the inner margin white; the underside of all the wings uniform reddish brown. Head and thorax greyish; antennæ, tegulæ, and abdomen reddish brown. *Female.* Primaries reddish brown, thickly irrorated with black and greyish scales along the costal and the outer margin; a short white streak at the end of the cell extending to the costal margin, and a narrow white streak crossing two thirds of the wing from the apex towards the inner margin. Secondaries uniform reddish brown, speckled with greyish scales along the outer margin and at the anal angle; the fringe of all the wings yellowish white; the underside uniform reddish brown, with a short white streak close to the apex of the primaries. Head, thorax, and abdomen mouse-colour; the tegulæ reddish brown edged with white; antennæ and legs brown.

Expanse, ♂ $1\frac{1}{2}$ inch, ♀ $2\frac{1}{2}$ inches.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

The female of this species closely resembles the female of *M. intensa*, Moore, the white markings being less distinct and the abdomen without the white bands; the males are very different.

MEGASOMA SPLENDENS, n. sp. (Plate LV. fig. 10, ♂.)

Male. Primaries dark brown, a metallic gold spot close to the base and one at the end of the cell; a faint narrow waved white line crossing the wing from the apex to the middle of the inner margin, bordered on the outer side with pale reddish fawn-colour, showing a few black points near the apex. Secondaries dark brown, palest at the base and along the inner margin. Underside dark brown, palest at the base of all the wings; a narrow short submarginal band close to the apex. Head, thorax, and abdomen pale yellowish brown. Antennæ and legs brown. *Female.* Primaries reddish fawn-colour, darkest at the base and along the costal margin, the outer and inner margins broadly bordered with dark brown; a waved submarginal white line, bordered on the outer side with reddish fawn-colour, which extends from the apex to near the base on the inner margin. Secondaries smoky brown, more reddish at the base; the underside identical with that of the male. Head, thorax, and abdomen reddish brown. Antennæ and legs brown.

Expanse, ♂ $1\frac{1}{2}$ inch, ♀ $2\frac{1}{4}$ inches.

Hab. West Africa: Cameroons (*Rutherford*).

Two female specimens of this species are in the British Museum, from Old Calabar.

MEGASOMA VESTA, n. sp. (Plate LV. fig. 6, ♀.)

Female. Primaries pale greyish fawn-colour, darkest at the base and the costal margin near the apex, the costal streaked with white from the base to about the middle; a submarginal waved white line bordered on the outer side with reddish brown, extending from the apex to near the base; the space between the submarginal line and the margin thickly irrorated with white scales; the fringe black. Secondaries creamy white, with the fringe blackish brown; the underside of all the wings the same as above, but the submargined lines are not so distinct. Head and thorax reddish brown; tegulæ brown, edged with white. Abdomen on the upperside creamy white, the underside brownish black; legs dark reddish brown.

Expanse 3 inches.

Hab. West Africa: Cameroons.

This fine species is allied to *M. splendens*, from which it is at once distinguished by the white secondaries. The male of this species is unknown.

PACHYPASA, Walk.

PACHYPASA? MASSILIA, n. sp.

Female. Primaries and secondaries uniform reddish fawn-colour. Primaries with four whitish patches, the first three near the apex, the fourth close to the anal angle; a minute white spot at the end of the cell; the underside of all the wings paler than above, the secondaries broadly banded with greyish white from the base along the costal margin almost to the apex. Head and the thorax reddish fawn-colour. Abdomen dark brown, each segment banded with long whitish hairs, the underside of the abdomen greyish brown; legs dark brown. Antennæ black.

Expanse $5\frac{3}{4}$ inches.

Hab. West Africa: Cameroons (*Rutherford*).

This fine species is quite different to any I have seen; it is the only specimen obtained by the late Mr. Rutherford, and is allied to *Pachypasa subfascia*, Walk.

PACHYPASA? PHOCEA, n. sp.

Female. Primaries reddish brown, darkest near the apex and along the outer margin; a wide dark brown band, which is narrower in the middle, crosses the wing from beyond the middle on the costal margin to about the middle of the inner margin; on each side of the band the wing is thickly irrorated with minute white scales; the fringe reddish brown. Secondaries uniform yellowish fawn-colour, palest at the base, the fringe pale fawn-colour. Underside of all the wings reddish fawn-colour, speckled with a few greyish scales; the upperside of the head and thorax the same colour as the primaries; abdomen yellowish, above the anal segment reddish brown; the underside of the head, thorax, and abdomen dark reddish brown; legs brown, tarsi with white bands. Antennæ white on the upperside, reddish brown on the underside.

Expanse $3\frac{3}{4}$ inches.

Hab. East Africa: Delagoa Bay (*Mrs. Monteiro*).

A fine species, allied to *P. bilinea*, Walk.

GONOMETA, Walk.

GONOMETA NYSA, n. sp.

Male. Primaries and secondaries, upper and inner side, bright chestnut-brown, with all the veins slightly darker; the head, antennæ and thorax the same colour as the wings; the abdomen brownish black.

Expanse $3\frac{1}{2}$ inches.

Hab. West Africa: Mongo-ma Lubah (*Thompson*).

This very fine insect is entirely different from any known to me; it is the only specimen I have seen.

GONOMETA LOMIA, n. sp.

Male. Primaries fawn-colour, a wide brownish-black submarginal line extending from the apex to the inner margin, beyond which on the margin is a row of indistinct spots. Secondaries fawn-colour, slightly paler at the base; a black marginal line from the apex to the anal angle. Head, thorax, and abdomen brownish fawn-colour. Antennæ pale brown at the base, with black tips; legs brown; the underside of all the wings fawn-colour, darkest along the outer margins of the primaries.

Expanse $2\frac{3}{4}$ inches.

Hab. West Africa: Mongo-ma Lubah.

GONOMETA CASSANDRA, n. sp.

Male. Primaries rich purplish brown, slightly reddish along the inner margin; a submarginal row of >-shaped black spots, bordered with white on the outer side, extending from the apex to the anal angle. Secondaries brownish black, with a beautiful greenish-blue shade, the outer margin broadly bordered with cream-colour. The underside the same as above, excepting that the secondaries are without the greenish-blue shade. Head and thorax dark brown. Abdomen brownish black, shaded with greenish blue on the upperside, the underside of the thorax and legs dark brown, of the abdomen dusky white. Antennæ brownish black.

Expanse $3\frac{1}{4}$ inches.

Hab. West Africa: Cameroons.

This fine species is allied to *Gonometa postica*, Walker, from South Africa, figured by Felder in the 'Novara,' tab. 84. f. 1 & 2.

Fam. LIMACODIDÆ.

PARASA, Moore.

PARASA URDA, n. sp. (Plate LV. fig. 7, ♂.)

Male. Primaries pea-green, fawn-colour at the base and along the outer margin from the apex to the anal angle; the inner edge of the fawn-coloured margin is very much waved; the fringe fawn-colour along the outer margin, green on the inner margin. Secondaries yellowish cream-colour, darkest at the base and along the inner margin; the fringe fawn-colour. Underside yellowish, with the outer margins of all the wings shaded with reddish brown; the upperside of the head and thorax bright pea-green, the underside dark reddish brown; the abdomen fawn-colour. Palpi, antennæ, and legs reddish brown.

Expanse, ♂, $1\frac{1}{2}$ inch.

Hab. West Africa: Fantee, Mongo-ma Lubah.

A female specimen of this species is in the British Museum, from the Gaboon.

Pantoctenia, Feld.

Pantoctenia albipuncta, n. sp. (Plate LV. fig. 2, ♂.)

Primaries bright pea-green, three spots close to the base, one at the end of the cell, and three (one above the other) on the inner margin near the anal angle, all white edged with brown, the fringe green. Secondaries blackish brown, yellowish at the base and along the inner margin, the fringe yellow. Underside yellowish fawn-colour, darkest on the costal margin of the primaries, which are slightly green at the apex and along the outer margin; the head, antennæ, and the abdomen yellowish; thorax bright pea-green.

Expanse $1\frac{3}{8}$ inch.

Hab. South Africa: Natal.

This pretty species is allied to *Pantoctenia gemmanus,* Felder, from which it is quite distinct.

Cosuma, Walk.

Cosuma polana, n. sp. (Plate LV. fig. 8.)

Primaries pale primrose-yellow, with all the veins dusky. Secondaries primrose-colour, shading to orange at the base, the fringe of all the wings blackish; the head, front of thorax, and abdomen orange-yellow; the thorax pale primrose-colour. Antennæ black; the underside of the wings uniform pale yellow, shading to orange at the base.

Expanse $1\frac{1}{2}$ inch.

Hab. East Central Africa: Manboia (*Last*).

A pretty species, allied to *C. rugosa,* Walk.

Miresa, Walk.

Miresa hilda, n. sp.

Primaries dark fawn-colour, crossed by two narrow dark brown lines, the first from near the apex to the inner margin close to the base, the second submarginal. Secondaries pale fawn-colour, darkest at the base and along the inner margin. Underside uniformly pale fawn-colour. Head and thorax yellowish brown; thorax and abdomen dark brown. Antennæ reddish brown.

Expanse $1\frac{1}{4}$ inch.

Hab. West Africa: Mongo-ma Lubah (*Thompson*).

A distinct species, not allied to any known to me.

Natada, Walk.

Natada julia, n. sp.

Primaries dark reddish brown, blackish along the median nerve; secondaries fawn-colour, with the fringe and the inner margin darker brown; the underside of all the wings uniform pale reddish brown. Head, palpi, thorax, and abdomen bright golden brown. Antennæ and legs dark brown.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa: Mongo-ma Lubah.

This species is quite distinct from any known to me, but somewhat resembles *E. argentea*, Druce.

NATADA UNDINA, n. sp.

Primaries, the basal half dark brownish black, the outer half pale mouse-colour; a submarginal black line extending from the costal margin close to the apex to the anal angle, where it is broken into black dots. Secondaries silky mouse-colour, the fringe slightly darker; the underside of all the wings uniform reddish brown. Head, collar, and thorax bright citron-yellow. Antennæ and the abdomen dark brown.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa: Mongo-ma Lubah.

Very distinct from any species of *Natada* known to me.

NATADA ELSA, n. sp.

Primaries dark glossy brown; the basal third of the wing and a large apical patch rich chocolate-brown; a narrow waved silvery white line crosses from the costal margin nearest the apex to the inner margin near the base, dividing the dark chocolate-brown from the outer part of the wings; the apical patch is whitish on the inner side. Secondaries blackish brown, darkest along the inner margin. Head, thorax, and antennæ dark brown. Abdomen blackish, the anus brown.

Expanse $1\frac{3}{4}$ inch.

Hab. West Africa: Calabar (*Swan*).

A female specimen of this species is in the British Museum, from the Cameroons.

Fam. BOMBYCIDÆ.

TRILOCHA, Moore.

TRILOCHA IANTHE, n. sp.

Primaries reddish fawn-colour, with three reddish-brown points on the costal margin, a black spot at the end of the cell, and a reddish-brown patch on the outer margin nearest the apex; on the inner margin are three indistinct, waved, narrow lines of a reddish-brown colour crossing to the middle of the wing. Secondaries uniform reddish fawn-colour, darkest at the anal angle and round the outer margin; the inner margin streaked with whitish lines. The underside of all the wings pale fawn-colour. The female the same as the male, but slightly larger.

Expanse, ♂, 1 inch.

Hab. West Africa: Gambia (*Captain Moloney*); South Africa: Grahams Town (*Grote*).

A pretty little species that varies considerably in colour; some of the specimens from Grahams Town are much paler than others.

Norasuma, Moore.

Norasuma kolga, n. sp.

Female. Primaries dark reddish brown, darkest at the base and along the costal and outer margin; a white line extending from the base along about one fourth of the costal, then crossing the wing to the inner margin, a white dot at the end of the cell, and a submarginal row of small white spots extending from near the apex to the inner margin. Secondaries reddish brown, palest near the base. Underside pale reddish brown, with a narrow, white, submarginal line round all the wings. Head and thorax brown; collar pale brown, edged with white. Abdomen and legs dark brown.

Expanse 2 inches.

Hab. West Africa: Cameroons (*Rutherford*).

In form and neuration this species is like *N. javanica*, Moore, but differs in its smaller size, colour, and markings.

Fam. Psychidæ.

Eumeta, Walk.

Eumeta cervina, n. sp.

Male. Like *E. cramerii*, but the primaries redder in colour, with a marginal row of fine whitish spots, and a dark brown elongated patch at the end of the cell. Secondaries smoky brown, with three whitish dots at the apex. Head, thorax, and abdomen brown. Antennæ brownish black, tegulæ with white tips; a white spot at the base of the primaries; on the underside the white marginal spots are more distinct than above.

Expanse $1\frac{3}{4}$ inch.

Hab. West Africa: Gambia (*Captain Moloney*); East Africa: Delagoa Bay (*Mrs. Montiero*).

This species is allied to *E. cramerii*, Westw., but, I think, quite distinct; I have as yet only seen two specimens.

Fam. Cossidæ.

Cossus, Fabr.

Cossus toluminus, n. sp.

Primaries dark greyish brown, with dark black markings in the cell and along the costal margin to the apex; beyond the cell a large greyish-white patch extends from the costal margin almost to the anal angle; seven marginal black spots between the apex and anal angle, the inner margin is browner than any other part of the primaries. Secondaries blackish brown, indistinctly mottled with grey spots. Underside of all the wings blackish brown, thickly irrorated with greyish scales and spots at the apex of both wings. Head and collar dark greyish brown; thorax and upper part of the abdomen greyish. Antennæ black; legs greyish brown.

Expanse $4\frac{1}{2}$ inches.

Hab. West Africa: Gambia (*Captain A. Moloney*).

The larva of this species is about the size of a large *Cossus ligniperda*, of a bright carmine colour, with a wide wedge-shaped yellow band on each segment, and with three round black spots, placed in the form of a triangle, on each segment excepting the first, second, and third. The head, first, second, and third segments brownish black on the top; the anus brownish black; two rows of black spots along each side of the larva. The description is taken from a figure made by Mr. Brady for Captain Moloney.

Zeuzera, Latr.

Zeuzera stephania, n. sp. (Plate LV. fig. 3.)

Primaries glossy green, thickly spotted with dark orange-red. Secondaries uniform glossy green, without any spots; the underside of the wings the same as above; the head and tegulæ orange; thorax, abdomen, and legs glossy green. Antennæ black.

Expanse $1\frac{3}{4}$ inch.

Hab. East Africa: Nyassa.

A beautiful little species allied to *Z. auroguttata*, H.-S., from which it is at once distinguished by its smaller size, different colour, and entire absence of the orange-colour at the base of the thorax and the anus.

Fam. Notodontidæ.

Antheura, Walk.

Antheura carteri, n. sp.

Primaries pure white, spotted with reddish brown along the costal margin and at the apex, and along the inner margin, which has a pinkish tinge. Secondaries pale yellowish fawn-colour, slightly pinkish near the inner margin. Underside of primaries pale yellowish brown, darkest along the outer margin; secondaries yellowish white; the costal margin dark brown from the base to the anal angle. Head and thorax greyish. Abdomen, the underside of the head, and the thorax pale yellowish fawn-colour. Antennæ and legs reddish brown.

Expanse 2 inches.

Hab. West Africa: Gambia (*Carter*).

I have much pleasure in naming this fine species after Mr. G. T. Carter, who kindly gave it to me a few months ago, upon his return home from the Gambia.

Fam. Heliothidæ.

Adisura, Moore.

Adisura splendens, n. sp.

Primaries silvery white, the costal and inner margins broadly banded with deep pink colour, the fringe pink. Secondaries silvery white. Head, thorax, and tegulæ deep pink. Abdomen yellowish white. The underside of all the wings white, slightly pink along the costal margin of the primaries.

Expanse $1\frac{1}{4}$ inch.

Hab. West Africa: Gambia (*Captain Moloney*).

This beautiful species is allied to *Adisura dulcis*, Moore.

Fam. Acontidæ.

Xanthodes, Guén.

Xanthodes camilla, n. sp.

Primaries pale glossy citron-yellow, the apical third of the wing broadly banded with purplish brown, with a slightly darker waved line extending from near the apex to the anal angle. Secondaries glossy yellowish white at the base, shading to pale purplish brown on the outer margin, from the apex to the anal angle. Head, thorax, and abdomen pale primrose-colour. Antennæ pale brown.

Expanse $1\frac{1}{2}$ inch.

Hab. West Africa: Gambia (*Captain Moloney*).

A pretty species, very distinct from all the other described species of *Xanthodes*. A specimen is in the National Collection, from the Cameroons.

Acontia, Ochs.

Acontia zelia, n. sp.

Male. Primaries glossy purplish brown, broadly banded with white at the base, and crossed about the middle by a wide, straight, white band. Secondaries white, shading to smoky brown along the outer margin. Underside silky dusky white. Head, thorax, and abdomen white; collar purplish brown; the legs white. The female is identical with the male, excepting that the secondaries are dark blackish brown.

Expanse, ♂ ♀, 1 inch.

Hab. West Africa: Gambia (*Carter*).

A beautiful little species, very distinct from any known to me.

EXPLANATION OF PLATE LV.

Fig. 1. *Girpa octogesa*, sp. n., p. 672.
2. *Pantoctenia albipuncta*, ♂, sp. n., p. 682.
3. *Zeuzera stephania*, ♂, sp. n., p. 685.
4. *Arcas moloneyi*, ♀, sp. n., p. 670.
5. *Anaphe moloneyi*, ♂, sp. n., p. 673.
6. *Megasoma vesta*, ♀, sp. n., p. 679.
7. *Parasa urda*, ♂, sp. n., p. 681.
8. *Cosuma polana*, sp. n., p. 682.
9. *Aletis cunaxa*, ♀, sp. n., p. 671.
10. *Megasoma splendens*, ♂, sp. n., p. 679.
11. —— *polydora*, ♂, sp. n., p. 678.
12. *Anace? herpa*, ♀, sp. n., p. 670.

APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1887.

Jan. 4. 4 Bramblings (*Fringilla montifringilla*). Purchased.

5. 2 Barn-Owls (*Strix flammea*). Presented by E. Hume, Esq. From S. Africa.

1 Black-headed Gull (*Larus ridibundus*), Presented by W. G. Rawlinson, Esq.

8. 2 Eyed Lizards (*Lacerta ocellata*). Deposited.

10. 1 Red-fronted Lemur (*Lemur rufifrons*), ♂. Presented by Mrs. Pawelzig.

1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Presented by Mrs. Pawelzig.

1 Patas Monkey (*Cercopithecus patas*), ♀. Presented by Mr. George Ellis.

15. 1 Common Otter (*Lutra vulgaris*). Purchased. From Lancashire.

18. 2 Schlegel's Doves (*Chalcopelia puella*). Presented by H. C. Donovan, Esq.

19. 1 Red Kangaroo (*Macropus rufus*), ♀. Born in the Menagerie.

20. 1 Yellow-footed Rock-Kangaroo (*Petrogale xanthopus*), ♀. Born in the Menagerie.

2 Blakiston's Eagle Owls (*Bubo blakistoni*). Presented by J. H. Leech, Esq., F.Z.S. See P. Z. S. 1887, p. 138. From Yesso, Japan.

1 White-whiskered Swine (*Sus leucomystax*), ♀. Presented by H. Pryer, Esq., C.M.Z.S. From the Loochoo Islands.

22. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Deposited.

1 Suricate (*Suricata tetradactyla*). Deposited.

26. 1 Axis Deer (*Cervus axis*), ♂. Born in the Menagerie.

3 Hooker's Sea-Lions (*Otaria hookeri*), 2 ♂, 1 ♀. Presented by the Hon. W. J. M. Larnach, C.M.G. See P. Z. S. 1887, p. 138. From the Auckland Islands.

1 Blue Penguin (*Eudyptula minor*). Presented by Bernard Lawson, Esq. See P. Z. S. 1887, p. 139. From Cook's Straits, New Zealand.

27. 3 Lions (*Felis leo*). Born in the Menagerie.

1 Domestic Sheep (4-horned variety) (*Ovis aries*), ♂. Presented by Major Roland Poole. From Cashmere.

Jan. 28. 1 Common Peafowl (*Pavo cristatus*), ♀. Presented by Mr. J. A. Adams.

2 Wood-Hares (*Lepus sylvaticus*), 2 ♀. Presented by Walter Ingram, Esq., F.Z.S.

1 Spotted-billed Duck (*Anas pœcilorhyncha*). Received in exchange.

29. 1 Blotched Genet (*Genetta tigrina*). Presented by Capt. J. C. Robinson.

1 Grey Ichneumon (*Herpestes griseus*). Presented by Stanlake Batson, Esq.

1 Ring-necked Parrakeet (*Palæornis torquatus*), ♂. Deposited.

Feb. 2. 1 Black-winged Peafowl (*Pavo nigripennis*), ♀. Presented by John Marshall, Esq.

4. 6 Long-fronted Gerbilles (*Gerbillus longifrons*). Born in the Menagerie.

1 Cayenne Lapwing (*Vanellus cayennensis*). Purchased.

8. 1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.

9. 2 Red-winged Parrakeets (*Aprosmictus erythropterus*). Presented by the Executive Commissioners of the Queensland Government.

11. 1 Common Otter (*Lutra vulgaris*), ♂. Presented by John Hall, Esq. From Huntingdonshire.

12. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by Chas. W. Dempsey, Esq.

1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by G. S. Copeland, Esq.

2 White-throated Finches (*Spermophila albogularis*), ♂ ♀. Deposited.

2 Rufous Tinamous (*Rhynchotus rufescens*). Presented by Francis Monckton, Esq.

14. 2 White-fronted Lemurs (*Lemur albifrons*), ♂ ♀. Deposited.

15. 1 Brazilian Hangnest (*Icterus jamaicai*). Presented by W. J. Little Gilmour, Esq.

16. 1 Crowned Hawk-Eagle (*Spizaëtus coronatus*, jr.). Presented by Col. J. H. Bowker, F.Z.S.

1 Secretary Vulture (*Serpentarius reptilivorus*). Presented by Capt. Larmer, s.s. 'Trojan.'

17. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by Julius Wilson, Esq.

2 Crossbills (*Loxia curvirostra*). Presented by W. H. St. Quintin, Esq.

18. 1 Spotted Eagle-Owl (*Bubo maculosus*). Presented by Mr. H. Justice.

19. 1 Capuchin Monkey (*Cebus*, sp. inc.), ♂. Purchased.

2 Brown Milvagos (*Milagro chimango*). Purchased.

1 Brazilian Caracara (*Polyborus brasiliensis*). Purchased.

21. 1 Three-striped Paradoxure (*Paradoxurus trivirgatus* ?). Presented by Gerald Callender, Esq.

1 Stanley Parrakeet (*Platycercus icterotis*). Received in Exchange.

22. 1 Scops Owl (*Scops giu*). Presented by W. M. Holland, Esq. Captured at sea, near Aden.

23. 1 Common Squirrel (*Sciurus vulgaris*). Presented by Miss May Hanrott.

Feb. 24. 1 Black Sternothere (*Sternothærus niger*). Received in Exchange.
1 Burmeister's Cariama (*Chunga burmeisteri*). Received in Exchange. See P. Z. S. 1887, p. 319.
25. 1 White-fronted Heron (*Ardea novæ-hollandiæ*). Presented by F. B. Dyas, Esq. See P. Z. S. 1887, p. 319.
26. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Miss E. James.
1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Miss E. James.
2 Smews (*Mergus albellus*), ♂ ♀. Purchased.
28. 1 Black-winged Kite (*Elanus cæruleus?*). Presented by R. Southey, Esq. See P. Z. S. 1887, p. 319.
2 Bennett's Wallabies (*Halmaturus bennetti*), ♂ ♀. Received in Exchange.
2 Cereopsis Geese (*Cereopsis novæ hollandiæ*). Received in Exchange.
1 Pike (*Esox lucius*). Presented by H. E. Young, Esq.

Mar. 1. 2 Pike (*Esox lucius*). Purchased.
2. 1 Blossomed-headed Parrakeet (*Palæornis cyanocephalus*), ♀. Received in Exchange.
1 Huia Bird (*Heteralocha gouldi*), ♀. Deposited April 22, 1886. Presented by Sir Walter Buller, K.C.M.G., C.M.Z.S.
3. 1 Hawfinch (*Coccothraustes vulgaris*). Presented by W. H. St. Quintin.
4. 1 Pike (*Esox lucius*). Presented by Mr. G. G. Sykes.
7. 1 Chilian Sea-Eagle (*Geranoaëtus melanoleucus*). Presented by C. Czarnikow, Esq., F.Z.S.
1 Golden Eagle (*Aquila chrysaëtus*). Presented by C. Czarnikow, Esq., F.Z.S.
1 Brazilian Caracara (*Polyborus brasiliensis*). Presented by C. Czarnikow, Esq., F.Z.S.
1 Grey Ichneumon (*Herpestes griseus*). Presented by C. F. Hird, Esq.
8. 1 Hog Deer (*Cervus porcinus*), ♂. Born in the Menagerie.
1 Bronze-winged Pigeon (*Phaps chalcoptera*), ♀. Presented by M. Nicholson, Esq.
9. 2 Red-crested Cardinals (*Paroaria cucullata*). Presented by Col. F. D. Walters.
2 Cockateels (*Calopsitta novæ-hollandiæ*). Presented by Col. F. D. Walters.
2 Crested Newts (*Molge cristata*). Presented by Alban Doran, Esq., F.R.C.S. From Austria.
11. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*), ♂. Deposited.
2 Blue-fronted Amazons (*Chrysotis æstiva*). Deposited.
14. 2 White-crowned Pigeons (*Columba leucocephala*), ♂ ♀. Presented by Lieut.-Col. Dawkins.
15. 5 European Tree-Frogs (*Hyla arborea*). Presented by F. W. Green, Esq.
16. 1 Axis Deer (*Cervus axis*), ♂. Born in the Menagerie.
1 Maugé's Dasyure (*Dasyurus maugæi*). Presented by Mr. W. Miller.
17. 1 Algerian Tortoise (*Testudo mauritanica*). Presented by J. W. Green, Esq.
18. 2 Long-tailed Grass-Finches (*Poëphila acuticauda*), ♂ ♀. Pre-

sented by Mr. Walter Burton, F.Z.S. See P. Z. S. 1887, p. 340. From Derby, King Sound, N.W. Australia.

Mar. 18. 1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.

19. 16 Puff-Adders (*Vipera arietans*). Born in the Menagerie.

20. 1 European Pond-Tortoise (*Emys europæa*). Presented by H. Garle, Esq., F.Z.S.

23. 1 Common Squirrel (*Sciurus vulgaris*, var.). Presented by H. B. Meadows, Esq. From Switzerland.

24. 2 Tree-Pipits (*Anthus arboreus*). Presented by W. B. Tegetmeier, Esq., F.Z.S.

2 Ocellated Sand-Skinks (*Seps ocellatus*). Purchased.

4 Dwarf Chameleons (*Chamæleon pumilus*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.

2 Robben-Island Snakes (*Coronella phocarum*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.

1 Fisk's Snake (*Lamprophis fiski*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S. See P. Z. S. 1887, p. 340.

1 Narrow-headed Toad (*Bufo angusticeps*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.

25. 2 Pondicherry Vultures (*Vultur calvus*). Purchased.

26. 2 Black Lemurs (*Lemur macaco*). Born in the Menagerie.

1 White-fronted Lemur (*Lemur albifrons*). Born in the Menagerie.

1 Malayan Bear (*Ursus malayanus*). Presented by Mrs. Bingham.

28. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mr. W. Spooner.

1 Pinche Monkey (*Midas œdipus*). Deposited. From Carthagena.

1 Ring-hals Snake (*Sepedon hæmachates*). Presented by Wm. L. Holms, Esq.

29. 1 Purple-faced Monkey (*Semnopithecus leucoprymnus*), ♀. Presented by W. H. Markham, Esq.

30. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. F. A. Adeney.

31. 1 Common Guillemot (*Lomvia troile*). Presented by Mr. Howard Bunn.

Apr. 1. 2 Viscachas (*Lagostomus trichodactylus*). Born in the Menagerie.

1 Black-tailed Godwit (*Limosa ægocephala*). Presented by Mrs. Robert Barclay.

2 Blue-bonnet Parrakeets (*Psephotus hæmatogaster*). Purchased.

2 Blue-crowned Conures (*Conurus hæmorrhous*). Purchased.

2. 1 Black Bear (*Ursus americanus*), ♀. Presented by E. Percy Bates, Esq. From British Columbia.

4. 1 American Flying Squirrel (*Sciuropterus volucella*). Presented by A. R. Verschoyle, Esq.

1 Egyptian Mastigure (*Uromastix spinipes*). Presented by V. L. Chamberlain, Esq., M.A., F.L.S.

5. 1 Burchell's Zebra (*Equus burchelli*), ♂. Purchased.

1 Nepalese Hornbill (*Aceros nepalensis*). Deposited.

2 Black-necked Storks (*Xenorhynchus australis*). Purchased.

1 Tuberculated Iguana (*Iguana tuberculata*). Presented by Capt. J. B. Johnson.

6. 1 Rhesus Monkey (*Macacus rhesus*). Born in the Menagerie.

Apr. 6. 1 Short-tailed Wallaby (*Halmaturus brachyurus*). Presented by Herbert Maude, Esq.
2 Adorned Ceratophrys (*Ceratophrys ornata*). Purchased.
7. 1 Sambur Deer (*Cervus aristotelis*), ♂. Born in the Menagerie.
8. 2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.
9. 1 Anaconda (*Eunectes murinus*). Purchased.
12. 1 Ring-Dove (*Columba palumbus*). Presented by C. L. Sutherland, Esq., F.Z.S.
1 Turtle-Dove (*Turtur communis*). Presented by C. L. Sutherland, Esq., F.Z.S.
13. 2 Viscachas (*Lagostomus trichodactylus*). Born in the Menagerie.
2 Brown-throated Conures (*Conurus æruginosus*). Presented by Master Cecil John Newton.
14. 1 Secretary Vulture (*Serpentarius reptilivorus*). Presented by Mr. and Mrs. Newberry.
16. 2 Polar Bears (*Ursus maritimus*). Presented by Joseph Monteith, Esq. See P. Z. S. 1887, p. 396.
2 Crested Ducks (*Anas cristata*). Presented by Fred. E. Cobb, Esq., C.M.Z.S. See P. Z. S. 1887, p. 396. From the Falkland Islands.
1 White-tailed Buzzard (*Buteo albicaudatus*). Presented by Mr. John Lloyd.
3 Common Gulls (*Larus canus*). Presented by J. A. Cotton, Esq.
18. 2 Rhesus Monkeys (*Macacus rhesus*), ♂ ♀. Presented by W. F. Lock, Esq.
1 Common Fox (*Canis vulpes*), ♂. Presented by Mrs. Isaac Bell, jun.
1 Bosch-Bok (*Tragelaphus sylvaticus*), ♂. Presented by Capt. Travers, s.s. 'Tartar.'
19. 2 Turkey Vultures (*Cathartes aura*). Presented by J. H. Moore, Esq. From the Falkland Islands.
20. 1 Common Viper (*Vipera berus*). Presented by Mr. T. E. Gunn.
1 Vulpine Phalanger (*Phalangista vulpina*). Deposited.
1 Chinese Lark (*Melanocorypha mongolica*). Received in Exchange.
21. 1 Burrhel Wild Sheep (*Ovis burrhel*), ♀. Purchased.
1 Hodgson's Partridge (*Perdix hodgsoniæ*). Purchased.
2 White-backed Pigeons (*Columba leuconota*). Purchased.
22. 2 Common Rheas (*Rhea americana*). Received in Exchange.
24. 4 Long-fronted Gerbilles (*Gerbillus longifrons*). Born in the Menagerie.
25. 1 Gayal (*Bibos frontalis*), ♂. Born in the Menagerie.
2 Green-winged Doves (*Chalcophaps indica*). Presented by S. A. Clarke, Esq.
27. 2 White-necked Storks (*Dissura episcopus*). Received in Exchange.
1 Persian Gazelle (*Gazella subgutturosa*), ♂. Born in the Menagerie.
28. 2 Red-vented Cockatoos (*Cacatua philippinarum*). Deposited by H.R.H. the Prince of Wales.
2 Roseate Cockatoos (*Cacatua roseicapilla*). Deposited by H.R.H. the Prince of Wales.

Apr. 28. 2 Leadbeater's Cockatoos (*Cacatua leadbeateri*). Deposited by H.R.H. the Prince of Wales.
2 Slender-billed Cockatoos (*Licmetis tenuirostris*). Deposited by H.R.H. the Prince of Wales.
20 Ruffe or Pope (*Acerina cernua*). Presented by Mr. T. E. Gunn.
29. 1 Whinchat (*Pratincola rubetra*). Purchased.
2 White-faced Tree-Ducks (*Dendrocygna viduata*). Purchased.
2 Demoiselle Cranes (*Grus virgo*), ♂ ♀. Received in Exchange.
30. 1 Weasel (*Mustela vulgaris*). Received in Exchange.
2 Alpine Newts (*Molge alpestris*). Presented by Alban Doran, Esq., F.R.C.S.

May 3. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by G. Lister, Esq.
1 Servaline Cat (*Felis servalina*). Purchased.
4 Prairie-Marmots (*Cynomys ludovicianus*). Born in the Menagerie.
1 Green Turtle (*Chelone viridis*). Presented by Dr. Keenan. From Ascension.
2 Natterer's Snakes (*Thamnodynastes nattereri*). Purchased.
4. 1 Greenfinch (*Ligurinus chloris*). Presented by Master H. J. Walton.
1 Goldfinch (*Carduelis elegans*). Presented by Master H. J. Walton.
1 Reed-Bunting (*Emberiza schœniclus*). Presented by Master H. J. Walton.
1 Smooth Snake (*Coronella lævis*). Presented by W. H. B. Pain, Esq. From Hampshire.
5. 1 Brazilian Tree-Porcupine (*Sphingurus prehensilis*). Presented by Dr. William Studart. From Ceara, Brazil.
1 Black-necked Swan (*Cygnus nigricollis*), ♀. Purchased.
1 Eyed Lizard (*Lacerta ocellata*, jr.). Presented by J. C. Warburg, Esq.
6. 1 Squirrel Monkey (*Chrysothrix sciurea*). Purchased.
1 Domestic Sheep (*Ovis aries*, var. *quadricornis*), ♂. Presented by C. E. Kane, Esq. From Arabia.
7. 1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Presented by R. E. Macdonald, Esq.
1 Tooth-billed Pigeon (*Didunculus strigirostris*). Presented by Wilfred Powell, Esq., C.M.Z.S. See P. Z. S. 1887, p. 482.
1 Great Crested Grebe (*Podiceps cristatus*). Presented by Mr. T. E. Gunn. From Norfolk.
8. 2 Whinchats (*Pratincola rubetra*). Purchased.
9. 4 Midwife Toads (*Alytes obstetricans*). Purchased.
12. 1 Alexandrine Parrakeet (*Palæornis alexandri*). Presented by Miss Ida Marshall.
1 Blood-breasted Pigeon (*Phlogœnas cruentata*). Bred in the Menagerie.
2 Dwarf Chameleons (*Chamæleon pumilus*). Born in the Menagerie.
13. 1 Blue-cheeked Parrakeet (*Platycercus cyanogenys*). Received in Exchange.
1 Pied Crow Shrike (*Strepera graculina*). Received in Exchange.
1 Sun-Bittern (*Eurypyga helias*). Received in Exchange.
2 Chinese Geese (*Anser cygnoides*). Presented by Miss Hoare.

May 16. 1 Brown Bear (*Ursus arctos*), ♀. Presented by John Rhind, Esq. From Russia.

17. 1 Brown Capuchin (*Cebus fatuellus*). Presented by Mr. George Doddrell.

1 Bare-eyed Cockatoo (*Cacatua gymnopis*). Presented by Sir Nathaniel Barnaby.

2 Hawk's-billed Turtles (*Chelone imbricata*). Presented by J. A. Wilson, Esq., F.Z.S.

2 Red-spotted Lizards (*Eremias rubro-punctata*). Presented by G. Wigan, Esq. See P. Z. S. 1887, p. 482. From Moses' Wells.

18. 1 Grey Ichneumon (*Herpestes griseus*). Presented by Mr. J. W. Deacon.

1 Ocellated Sand-Skink (*Seps ocellatus*). Presented by George Russell, Esq. From Tripoli, N. Africa.

1 Horseshoe Snake (*Zamenis hippocrepis*). Presented by George Russell, Esq. From Tripoli, N. Africa.

19. 2 Daubenton's Curassows (*Crax daubentoni*), ♂ ♀. Presented by F. J. Thompson, Esq.

2 Madagascar Porphyrios (*Porphyrio madagascariensis*). Presented by Capt. J. C. Robinson, s.s. 'Roslin Castle.'

20. 1 Rhesus Monkey (*Macacus rhesus*). Presented by Mrs. Livingstone.

1 Ring-tailed Coati (*Nasua rufa*). Presented by Robert R. MacIver, Esq.

1 Common Marmoset (*Hapale jacchus*). Presented by J. H. Hallett, Esq.

1 Western Slender-billed Cockatoo (*Licmetis pastinator*). Presented by Miss Streeter.

21. 1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.

23. 1 Larger Hill-Mynah (*Gracula intermedia*). Presented by G. E. Wroughton, Esq.

6 European Tree-Frogs (*Hyla arborea*). Presented by E. Wroughton, Esq. From Syria.

24. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Mrs. Yeates.

1 Molucca Deer (*Cervus moluccensis*), ♀. Born in the Menagerie.

1 Tuatera Lizard (*Sphenodon punctatus*). Deposited.

3 Tuatera Lizards (*Sphenodon punctatus*). Purchased.

25. 1 Rhesus Monkey (*Macacus rhesus*), ♂. Presented by Mrs. C. J. Fisher.

1 Patagonian Conure (*Conurus patagonus*). Purchased.

3 Lineated Chalcis (*Chalcides lineatus*). Presented by J. C. Warburg, Esq.

2 Dark-green Snakes (*Zamenis atrovirens*). Purchased.

4 Axolotls (*Siredon mexicanus*). Purchased.

26. 2 Little Guans (*Ortalis motmot*). Presented by W. Thomson, Esq.

1 King Vulture (*Gypagus papa*). Presented by W. Allen Sumner, Esq.

1 Common Rhea (*Rhea americana*). Received in Exchange.

27. 1 Common Squirrel (*Sciurus vulgaris*). Presented by Miss Muriel Reed.

1 Japanese Deer (*Cervus sika*), ♀. Born in the Menagerie.

1 Brown Bear (*Ursus arctos*). Presented by John Rhind, Esq. From Russia.

May 28. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*), ♂. Presented by T. H. Kenyon, Esq., R.N.

1 Blyth's Tragopan (*Ceriornis blythi*), ♂. Presented by Major W. Brydon, B.S.C.

29. 1 Scarlet Tree-Frog (*Dendrobates typographus*). Presented by C. H. Blomefield, Esq. See P. Z. S. 1887, p. 482. From Costa Rica.

30. 1 White-crowned Pigeon (*Columba leucocephala*). Presented by Lieut.-Colonel W. G. Dawkins, F.Z.S.

June 1. 1 Common Trumpeter (*Psophia crepitans*). Presented by G. H. Hawtayne, Esq., C.M.Z.S.

2. 1 Wapiti Deer (*Cervus canadensis*), ♀. Born in the Menagerie.

2 Cape Sparrows (*Passer arcuatus*). Purchased.

4 Alario Sparrows (*Passer alario*). Purchased.

1 Crowned Horned Lizard (*Phrynosoma coronatum*). Presented by Claude A. Millard, Esq.

3. 2 Egyptian Jerboas (*Dipus ægyptius*), 2 ♀. Presented by the Hon. Terence Bourke.

1 Moorish Toad (*Bufo mauritanicus*). Presented by the Hon. Terence Bourke.

2 Egyptian Jerboas (*Dipus ægyptius*), ♂ ♀. Deposited.

5. 2 American Robins (*Turdus migratorius*). Bred in the Menagerie.

6. 1 Squirrel Monkey (*Chrysothrix sciurea*), ♂. Presented by Miss Grace Williams.

1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Born in the Menagerie.

7. 1 Negro Tamarin (*Midas ursulus*). Presented by Miss Julia Neilson.

1 Red Brocket (*Cariacus rufus*), ♀. Purchased.

1 Great American Egret (*Ardea egretta*). Purchased.

2 Lanner Falcons (*Falco lanarius*). Presented by Wm. Brodrick, Esq.

2 Scaly Ground-Doves (*Scardafella squamosa*). Presented by Wm. de Castro, Esq.

8. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Miss R. M. Hurt.

1 Common Raccoon (*Procyon lotor*). Presented by F. van Zandt, Esq.

1 Wapiti Deer (*Cervus canadensis*), ♂. Born in the Menagerie.

1 Barbary Wild Sheep (*Ovis tragelaphus*), ♂. Born in the Menagerie.

1 Variegated Sheldrake (*Tadorna variegata*). Bred in the Menagerie.

9 Summer Ducks (*Æx sponsa*). Bred in the Menagerie.

1 Hybrid Ruddy Sheldrake (between *Tadorna casarca* and *Chenalopex ægyptiaca*). Bred in the Menagerie.

9. 3 Sandwich-Island Geese (*Bernicla sandvicensis*), 2 ♂, 1 ♀. Purchased.

10. 1 Wryneck (*Iynx torquilla*). Purchased.

11. 1 Common Marmoset (*Hapale jacchus*). Presented by Miss Constance Hoendorff.

1 Cockateel (*Calopsitta novæ-hollandiæ*), ♂. Deposited.

1 Ring-necked Parrakeet (*Palæornis torquatus*). Presented by Mrs. Hill.

June 11. 1 Yellow-billed Sheathbill (*Chionis alba*). Presented by R. C. Ashton, Esq. From Cape Horn.
9 Barbary Turtle-Doves (*Turtur risorius*). Presented by E. L. Armbrecht, Esq.
13. 1 Common Squirrel (*Sciurus vulgaris*). Presented by Mrs. Dick.
3 Kestrels (*Tinnunculus alaudarius*). Presented by Dr. J. W. Trentler.
2 Yellow-legged Herring-Gulls (*Larus cachinnans*). Bred in the Menagerie.
1 West-African Python (*Python sebæ*). Purchased.
14. 1 Mesopotamian Fallow-Deer (*Dama mesopotamica*). Born in the Menagerie.
15. 9 Horned Vipers (*Vipera cornuta*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S. From Namaqualand, S. Africa.
3 Dwarf Chameleons (*Chamæleon pumilus*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Many-spotted Snake (*Coronella multimaculata*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Rufescent Snake (*Leptodira rufescens*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Mrs. Slatter.
1 Lesser White-nosed Monkey (*Cercopithecus petaurista*), ♀. Presented by Miss Kate Wood.
1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
16. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Beeston.
1 Pig-tailed Monkey (*Macacus nemestrinus*). Deposited.
17. 1 Virginian Deer (*Cariacus virginianus*), ♂. Presented by T. Jay, Esq.
1 Japanese Deer (*Cervus sika*). Born in the Menagerie.
1 Grey Ichneumon (*Herpestes griseus*). Presented by Miss Dudding.
2 Blue Titmice (*Parus cæruleus*). Presented by Miss F. L. Barlow.
4 Herons (*Ardea cinerea*). Purchased. From Holland.
6 Night-Herons (*Nycticorax griseus*). Purchased.
1 Stephen's Tree-Frog (*Hyla stepheni*). Presented by Mr. G. Stephen, H.M.S. 'Champion.' From Port Hamilton, Corea. See P. Z. S. 1887, p. 579.
1 Green Tree-Frog (*Hyla arborea*, var.). Presented by Mr. G. Stephen, H.M.S. 'Champion.' From Port Hamilton, Corea. See P. Z. S. 1887, p. 578.
1 Crowned Horned Lizard (*Phrynosoma coronatum*). Presented by Duff Gordon, Esq.
18. 2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.
1 Blue-eyed Cockatoo (*Cacatua ophthalmica*). Presented by W. H. Fellowes, Esq.
20. 1 Moustache Monkey (*Cercopithecus cephus*), ♀. Presented by Bernard Lawson, Esq.
2 Lions (*Felis leo*), ♂ ♀. Presented by Major J. Humfrey, B.S.C., F.Z.S. From Kathywar, Guzerat, India.
2 Striped Hyænas (*Hyæna striata*). Presented by the Bombay Natural History Society.
1 Australian Crane (*Grus australasiana*). Presented by Mrs. M. S. Richman.

June 22. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Deposited.
3 Green Turtles (*Chelone viridis*). Presented by Captain C. Theobald, R.N.
1 Ring-necked Parrakeet (*Palæornis torquatus*). Deposited.
1 Alligator (*Alligator mississippiensis*). Presented by Hugh Bellas, Esq.
23. 5 Common Dormice (*Muscardinus avellanarius*). Deposited.
1 Yak (*Poephagus grunniens*). Born in the Menagerie.
1 Little Egret (*Ardea garzetta*). Purchased.
1 Buff-backed Egret (*Ardea russata*). Purchased.
1 Horrid Rattlesnake (*Crotalus horridus*). Purchased.
24. 3 Wood-Hares (*Lepus sylvaticus*). Born in the Menagerie.
1 European Pond-Tortoise (*Emys europæa*). Presented by Alban Doran, Esq., F.R.C.S.
25. 1 Green Monkey (*Cercopithecus callitrichus*). Presented by G. Cloutte, Esq.
1 Suricate (*Suricata tetradactyla*). Presented by Mrs. H. A. Warwood.
2 Edible Frogs (*Rana esculenta*). Presented by Mr. H. A. Crossfield, F.Z.S.
27. 3 Blotched Genets (*Genetta tigrina*). Presented by General J. J. Bisset.
1 Barn-Owl (*Strix flammea*). Presented by — Wickham, Esq.
1 Gould's Monitor (*Varanus gouldi*). Purchased.
28. 2 Blood-breasted Pigeons (*Phlogœnas cruentata*). Bred in the Menagerie.
29. 2 Mule Deer (*Cariacus macrotis*), 2 ♂. Born in the Menagerie.
1 Yellow-fronted Amazon (*Chrysotis ochrocephala*). Deposited.
1 White-tailed Sea-Eagle (*Haliaëtus albicilla*). Presented by J. Mayes, Esq.
1 Ceylonese Jungle-fowl (*Gallus stanleyi*). Presented by Hugh Neville, Esq., F.Z.S.

July 1. 1 Burrowing Owl (*Speotyto cunicularia*). Purchased.
2. 1 Ocelot (*Felis pardalis*), ♀. Presented by the Earl of Dudley. From Panama.
1 Yellow-footed Rock-Kangaroo (*Petrogale xanthopus*), ♂. Born in the Menagerie.
2 Hoopoes (*Upupa epops*). Purchased.
6 Land-Rails (*Crex pratensis*, jr.). Presented by J. B. Willows. Esq. From Yorkshire.
6 Chinchillas (*Chinchilla lanigera*), 3 ♂, 3 ♀. Purchased.
3. 1 Magpie (*Pica rustica*). Presented by W. H. Ince, Esq.
4. 2 Gluttons (*Gulo luscus*). Purchased. From Russia.
1 Dingo (*Canis dingo*), ♀. Deposited.
5. 1 Mandarin Duck (*Æx galericulata*). Born in the Menagerie.
2 Red-crested Pochards (*Fuligula rufina*). Born in the Menagerie.
6. 1 Entellus Monkey (*Semnopithecus entellus*), ♀. Presented by Capt. W. L. Prentice.
1 Grey Squirrel (*Sciurus cinereus*). Presented by F. Percival Farrer, Esq.
2 Weasels (*Mustela vulgaris*), ♂ ♀. Presented by Clement Wykeham Archer, Esq.
7. 1 White-fronted Capuchin (*Cebus albifrons*). Deposited.
2 Blue-headed Pigeons (*Starnœnas cyanocephala*). Presented by John Marshall, Esq.

July 7. 1 Speckled Terrapin (*Clemmys guttata*). Presented by Samuel Garman, Esq., C.M.Z.S.

1 American Black Snake (*Coluber constrictor*). Presented by Samuel Garman, Esq., C.M.Z.S.

1 Alligator Terrapin (*Chelydra serpentina*). Presented by Alex. Agassiz, Esq.

8. 1 Redshank (*Totanus calidris*). Purchased.

2 Lapwings (*Vanellus vulgaris*). Purchased.

2 Common Gulls (*Larus canus*). Presented by T. A. Cotton, Esq.

9. 2 Lapwings (*Vanellus vulgaris*). Presented by Gervase F. Matthews, Esq., F.Z.S.

11. 1 Ruffed Lemur (*Lemur varius*), ♂. Purchased.

1 Elate Hornbill (*Ceratogymna elata*). Purchased.

2 Common Boas (*Boa constrictor*). Purchased.

12. 1 Tiger (*Felis tigris*), ♂. Received in Exchange.

1 Pig-tailed Monkey (*Macacus nemestrinus*). Presented by Mrs. Lewis.

2 Alligators (*Alligator mississippiensis*). Deposited.

2 Common Toads (*Bufo vulgaris*). Deposited.

13. 1 Squirrel-like Phalanger (*Belideus sciureus*). Born in the Menagerie.

8 Unspotted Starlings (*Sturnus unicolor*). Deposited. From Spain.

2 Booted Eagles (*Nisaetus pennatus*). Deposited.

14. 1 Yellow-footed Rock-Kangaroo (*Petrogale xanthopus*). Born in the Menagerie.

15. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Deposited.

1 Golden-crowned Conure (*Conurus aureus*). Deposited.

1 Turtle-Dove (*Turtur communis*). Presented by Mr. R. Humphries.

16. 2 Diuca Finches (*Diuca grisea*). Bred in the Menagerie.

1 Auriculated Dove (*Zenaida auriculata*). Bred in the Menagerie.

18. 1 Bonnet-Monkey (*Macacus sinicus*). Presented by Mr. Francis Yard.

1 Cape Zorilla (*Ictonyx zorilla*). Presented by J. A. Willet, Esq.

1 Cuckoo (*Cuculus canorus*). Presented by W. M. Alexander, Esq.

19. 1 Spotted Ichneumon (*Herpestes nepalensis*). Presented by T. C. Bacon, Esq.

1 Lesser Kestrel (*Tinnunculus cenchris*). Presented by Mrs. M. Travers.

2 Corn-Crakes (*Crex pratensis*). Presented by S. C. Hincks, Esq.

20. 2 Cardinal Grosbeaks (*Cardinalis virginianus*). Presented by S. Nicholson, Esq.

2 Slender Ducks (*Anas gibberifrons*). Bred in the Menagerie.

2 Viperine Snakes (*Tropidonotus viperinus*). Presented by the Rev. T. W. Haines.

1 Bordeaux Snake (*Coronella girondica*). Presented by the Rev. T. W. Haines.

21. 1 Arizona Squirrel (*Sciurus arizonensis*). Presented by Dr. R. W. Shufeldt. From New Mexico, U.S.A.

2 Hybrid Herring-Gulls (between *Larus argentatus* ♂ and *L. dominicanus* ♀). Presented by Lord Lilford, F.Z.S.

July 21. 1 Aldrovandi's Skink (*Plestiodon auratus*). Deposited.
22. 1 Crested Porcupine (*Hystrix cristata*). Born in the Menagerie.
1 Egyptian Jerboa (*Dipus ægypticus*). Deposited.
23. 2 Spotted Cavies (*Cœlogenys paca*). Presented by W. F. Kitson, Esq. From Trinidad.
25. 1 Magpie (*Pica rustica*). Presented by H. Stacy Marks, Esq., F.Z.S.
26. 1 Crested Pigeon (*Ocyphaps lophotes*), ♀. Deposited.
2 Indian Crocodiles (*Crocodilus palustris*). Deposited.
27. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♂. Born in the Menagerie.
1 Common Crowned Pigeon (*Goura coronata*). Bred in the Menagerie.
1 Cockateel (*Calopsitta novæ-hollandiæ*). Bred in the Menagerie.
28. 2 White-eared Bulbuls (*Pycnonotus leucotis*). Presented by General W. H. Breton.
2 Turtle-Doves (*Turtur communis*). Presented by Mr. N. Brooks.
1 Secretary Vulture (*Serpentarius reptilivorus*). Deposited.
1 Loggerhead Turtle (*Thalassochelys caouana*). Presented by Mr. R. T. Ward.
2 Green Lizards (*Lacerta viridis*). Presented by the Rev. F. W. Haines.
2 Marbled Newts (*Molge marmorata*). Presented by the Rev. F. W. Haines.
29. 8 Ocellated Sand-Skinks (*Seps ocellatus*). Purchased. From Malta.
6 Wall Lizards (*Lacerta*) *muralis*. Purchased. From Malta.
1 Daubenton's Curassow (*Crax daubentoni*), ♀. Presented by Dr. A. Batchelor.
30. 1 Elliot's Pheasant (*Phasianus ellioti*), ♂. Deposited.
1 Cabot's Tragopan (*Ceriornis caboti*), ♂. Deposited.
4 Spotted Tinamous (*Nothura maculosa*). Purchased.
1 Wall Lizard (*Lacerta muralis*). Presented by Mr. Geo. Skegg.

Aug. 1. 1 Malbrouck Monkey (*Cercopithecus cynosurus*), ♂. Presented by T. Sutton Flack, Esq.
2. 2 Griffon Vultures (*Gyps fulvus*). Deposited.
1 One-streaked Hawk (*Melierax monogrammicus*). Purchased.
3. 1 Blue-and-Yellow Macaw (*Ara ararauna*). Presented by W. Reade-Revell, Esq.
1 Red-and-Yellow Macaw (*Ara chloroptera*). Presented by W. Reade-Revell, Esq.
4. 1 Elegant Grass-Parrakeet (*Euphema elegans*), ♀. Purchased.
1 Green Turtle (*Chelone viridis*). Presented by James M'Gregor, Esq.
1 Dark-green Snake (*Zamenas atrovirens*). Presented by A. Benham, Esq.
5. 1 Suricate (*Suricata tetradactyla*). Presented by Mr. W. Joyce.
2 Australian Wild Ducks (*Anas superciliosa*).
2 Shoveller Ducks (*Spatula clypeata*).
6 Chilian Pintails (*Dafila spinicauda*). Bred in the Menagerie.
8. 1 Carrion Crow (*Corvus corone*). Presented by G. Nicholson, Esq.

Aug. 8. 4 Turkish Geckos (*Hemidactylus turcicus*). Purchased. From Sardinia.

2 Three-toed Chalcis (*Chalcides tridactylus*). Purchased. From Sardinia.

2 Dark-green Snakes (*Zamenis atrovirens*). Purchased. From Sardinia.

2 Natterjack Toads (*Bufo calamita*). Purchased.

4 Painted Frogs (*Discoglossus pictus*). Purchased. From Sardinia.

10. 1 Bennett's Wallaby (*Halmaturus bennetti*), ♀. Born in the Menagerie.

1 Fieldfare (*Turdus pilaris*). Presented by Col. Verner.

11. 3 Wood-Hares (*Lepus sylvaticus*). Born in the Menagerie.

1 Red-and-Blue Macaw (*Ara macao*). Presented by Dr. and Mrs. F. W. Allwright.

12. 2 Viscachas (*Lagostomus trichodactyla*). Born in the Menagerie.

1 Bronze-spotted Dove (*Chalcopelia chalcospilos*). Bred in the Menagerie.

2 Hybrid Spotted Zenaida Doves (between *Zenaida maculata* ♂ and *Zenaida auriculata* ♀). Bred in the Menagerie.

15. 2 Black-eared Marmosets (*Hapale penicillata*). Presented by G. Best, Esq.

3 Oyster-catchers (*Hæmatopus ostralegus*). Purchased.

1 Hygian Snake (*Elaps hygiæ*). Presented by W. K. Sibley, Esq. From Port Elizabeth.

1 Spider (*Mygale*, sp. inc.). Presented by Mrs. Blake.

17. 1 Purple-faced Monkey (*Semnopithecus leucoprymnus*), ♂. Presented by H. Hart, Esq.

1 Common Cormorant (*Phalacrocorax carbo*). Presented by T. M. Oldham, Esq.

18. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Charles Crocker, Esq.

1 Ruffed Lemur (*Lemur varius*), ♂. Presented by Mrs. M. Kertell-Cornish.

1 Great Eagle-Owl (*Bubo maximus*). Presented by Charles Clifton, Esq., F.Z.S.

1 Virginian Eagle-Owl (*Bubo virginianus*). Presented by Charles Clifton, Esq., F.Z.S.

19. 1 Moustache Monkey (*Cercopithecus petaurista*). Presented by J. B. Elliott, Esq.

2 Lesser White-nosed Monkeys (*Cercopithecus petaurista*). Presented by J. B. Elliott, Esq.

2 White-crowned Mangabeys (*Cercocebus æthiops*). Presented by J. B. Elliott, Esq.

1 African Civet Cat (*Viverra civetta*). Presented by J. B. Elliott, Esq.

1 Blotched Genet (*Genetta tigrina*). Presented by J. B. Elliott, Esq.

1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by J. B. Elliott, Esq.

5 Tambourine Pigeons (*Tympanistria bicolor*). Presented by J. B. Elliott, Esq.

3 Schlegel's Doves (*Chalcopelia puella*). Presented by J. B. Elliott, Esq.

1 White-crested Tiger Bittern (*Tigrisoma leucolophum*). Presented by J. B. Elliott, Esq.

Aug. 19. 1 Madagascar Porphyrio (*Porphyrio madagascariensis*). Presented by J. B. Elliott, Esq.
1 Blood-breasted Pigeon (*Phlogœnas cruentata*). Bred in the Menagerie.
20. 2 Black-eared Marmosets (*Hapale penicillata*). Presented by John Crick, Esq.
1 Slender-billed Cockatoo (*Licmetis tenuirostris*). Deposited.
1 Prince Albert's Curassow (*Crax alberti*), ♂. Purchased.
21. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Thos. D. Wickenden, Esq.
1 Sand-Lizard (*Lacerta agilis*). Presented by F. T. Mason, Esq.
22. 1 Rhesus Monkey (*Macacus rhesus*). Presented by Miss Austin.
2 Hybrid Ibises (between *Ibis strictipennis* ♂ and *Ibis bernieri* ♀). Bred in the Menagerie.
1 Lion Marmoset (*Midas rosalia*). Purchased.
1 Six-banded Armadillo (*Dasypus sexcinctus*). Purchased.
2 Blue-bearded Jays (*Cyanocorax cyanopogon*). Purchased.
1 Ariel Toucan (*Ramphastos ariel*). Purchased
3 Bahama Ducks (*Dafila bahamensis*). Purchased.
1 Laughing Gull (*Larus atricilla*). Purchased.
23. 2 Common Boas (*Boa constrictor*, var. *diviniloqua*). Presented by H. A. Alford Nicholls, Esq., M.D., F.L.S. From Dominica, W. I.
24. 1 Black-handed Spider Monkey (*Ateles melanochir*), ♀. Purchased.
1 Smooth Snake (*Coronella lævis*). Presented by Sidney G. Smith, Esq. From Hampshire.
2 Horned Lizards (*Phrynosoma cornutum*). Presented by Maxwell Blackie, Esq.
26. 1 Monkey (*Cebus*, sp. inc.). Presented by J. H. Williams, Esq.
27. 8 Blanding's Terrapins (*Clemmys blandingi*). Purchased. From Michigan, U.S.A.
30. 1 Carrion-Crow (*Corvus corone*). Presented by Mrs. MacLachlin.
31. 1 Malabar Parrakeet (*Palæornis columboides*), ♂. Deposited.
1 Malaccan Parrakeet (*Palæornis longicauda*), ♂. Deposited.
1 Pig-tailed Monkey (*Macacus nemestrinus*), ♂. Presented by Mr. B. Lynch.

Sept. 1. 1 Fettered Cat (*Felis maniculata*). Presented by Dr. E. Holub, C.M.Z.S.
1 Spotted Eagle-Owl (*Bubo maculosus*). Presented by Dr. E. Holub, C.M.Z.S.
1 Hoary Snake (*Coronella cana*). Presented by Dr. E. Holub, C.M.Z.S.
4 Spotted Slowworms (*Acontias meleagris*). Presented by Dr. E. Holub, C.M.Z.S.
1 Collared Fruit-Bat (*Cynonycteris collaris*). Born in the Menagerie.
2. 1 Red-faced Ouakari (*Brachyurus rubicundus*), ♀. Received in Exchange.
1 Tiger Bittern (*Tigrisoma brasiliense*). Purchased.
3. 2 African Lepidosirens (*Protopterus annectens*). Presented by H. H. Lee, Esq.
1 Martinique Gallinule (*Ionornis martinicus*). Presented by R. Dane, Esq.
1 Laughing Kingfisher (*Dacelo gigantea*). Deposited.

Sept. 5. 1 Larger Hill-Mynah (*Gracula intermedia*). Presented by P. Wilmot Bennett, Esq., F.Z.S.
6. 1 Oyster-catcher (*Hæmatopus ostralegus*). Deposited.
2 Common Squirrels (*Sciurus vulgaris*). Purchased.
1 White-eyebrowed Guan (*Penelope superciliaris*). Purchased.
1 Mexican Crocodile (*Crocodilus rhombifer?*). Presented by Capt. J. Smith, s.s. 'Godiva.'
7. 1 Green Bittern (*Butorides virescens*). Presented by Miss M. Meyrick.
8. 2 Smaller Rattlesnakes (*Crotalus miliarius*). Purchased.
1 Testaceous Snake (*Ptyas testacea*). Purchased.
1 Copper-bellied Snake (*Tropidonotus erythrogaster*). Purchased.
2 Milk-Snakes (*Coluber eximius*). Purchased.
9 Smaller Rattlesnakes (*Crotalus miliarius*, jr.). Deposited.
4 Testaceous Snakes (*Ptyas testacea*). Deposited.
2 Alleghany Snakes (*Coluber alleghaniensis?*). Deposited.
7 Milk-Snakes (*Coluber eximius*). Deposited.
1 Seven-banded Snake (*Tropidonotus liberis*). Deposited.
1 Striped Snake (*Tropidonotus sirtalis*). Deposited.
1 Painted Frog (*Discoglossus pictus*). Presented by Alban Doran, Esq., F.R.C.S.
9. 1 Red-and-White Flying Squirrel (*Pteromys alborufus*). Presented by Percy Montgomery, Esq. See P. Z. S. 1887, p. 559. From the Province of Szechuen, China.
1 Peaceful Dove (*Geopelia tranquilla*), ♀. Presented by R. O. Law Ogilby, Esq.
7 Angulated Tortoises (*Chersina angulata*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
2 Hoary Snakes (*Coronella cana*). Presented by the Rev. G. H. R. Fisk, C.M.Z.S.
10. 10 Short-nosed Sea-Horses (*Hippocampus antiquorum*). Presented by Prof. Flower, C.B., F.R.S.
12. 1 Sonnerat's Jungle-fowl (*Gallus sonnerati*). Bred in the Menagerie.
2 Tessellated Snakes (*Tropidonotus tessellatus*). Purchased.
4 Dark-green Snakes (*Zamenis atrovirens*). Purchased.
7 Common Snakes (*Tropidonotus natrix*, var.). Purchased.
13. 1 Mississippi Alligator (*Alligator mississippiensis*). Presented by Wm. J. Craig, Esq.
14. 1 White-crowned Mangabey (*Cercocebus æthiops*). Presented by C. Washington Eves, Esq.
15. 2 Vervet Monkeys (*Cercopithecus lalandii*). Presented by Capt. Archibald Douglas, R.N.
6 Aurora Snakes (*Lamprophis aurora*). Presented by Walter K. Sibley, Esq.
16. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mrs. La Primandage.
Sharp-nosed Crocodile (*Crocodilus acutus*). Presented by E. H. Blomefield, Esq.
17. 1 Brown Capuchin (*Cebus fatuellus*). Presented by W. R. Sheppard, Esq.
1 Raven (*Corvus corax*). Deposited.
4 Common Chameleons (*Chamæleon vulgaris*). Presented by H. Thornton, Esq.
1 Serval (*Felis serval*). Presented by T. Mackenzie, Esq.
1 Urva (*Urva cancrivora*). Purchased. See P. Z. S. 1887, p. 559.

Sept. 19. 1 Pig-tailed Monkey (*Macacus nemestrinus*), ♀. Presented by S. P. Grieve, Esq.
1 Black-eared Marmoset (*Hapale penicillata*). Presented by J. J. Foster, Esq.
1 Vulpine Phalanger (*Phalanger vulpina*), ♀. Presented by O. F. Armytage, Esq.
1 Aldrovandi's Skink (*Plestiodon auratus*). Presented by A. Colls, Esq.
20. 2 Crested Pigeons (*Ocyphaps lophotes*). Bred in the Menagerie.
2 Hybrid Zenaida Doves (bred between *Zenaida maculata* + *Zenaida auriculata*). Bred in the Menagerie.
22. 1 White-collared Mangabey (*Cercocebus collaris*), ♀. Presented by W. Tudor, Esq.
1 Pale-headed Tree-Boa (*Epicrates angulifer*). Presented by H. A. Blake, Esq. From the Bahamas.
23. 1 Common Jackal (*Canis aureus*), ♀. Presented by Capt. W. J. Geake.
1 Raven (*Corvus corax*). Deposited.
1 Alligator Terrapin (*Chelydra serpentina*). Presented by G. S. Blythe, Esq.
24. 1 Red Fox (*Canis fulvus*). Presented by Miss Cameron.
1 Chinese Jay-Thrush (*Garrulax chinensis*). Presented by Col. Verner.
1 Crested Lark (*Alauda cristata*). Presented by Col. Verner.
26. 2 Macaque Monkeys (*Macacus cynomolgus*), ♂ ♀. Presented by Miss Barker.
1 Mule Deer (*Cervus macrotis*), ♂. Born in the Menagerie.
2 Red-footed Foxes (*Canis fulvipes*). Presented by Miss Mildred M. Buckworth. From Tierra del Fuego.
27. 3 Arctic Foxes (*Canis lagopus*). Presented by T. Nordenfelt, Esq., C.E. From the Faroë Islands.
1 Macaque Monkey (*Macacus cynomolgus*). Presented by R. Taylor, Esq.
1 Wedge-tailed Eagle (*Aquila audax*). Received in Exchange.
28. 1 Ring-Dove (*Columba palumbus*). Presented by F. T. Mason, Esq.
1 Corn-Crake (*Crex pratensis*). Presented by Mr. Howard Bunn.
1 Sumatran Wild Dog (*Canis javanicus*), ♀. Purchased.

Oct. 4. 1 Chinchilla (*Chinchilla lanigera*). Born in the Menagerie.
5. 1 Pheasant (*Phasianus colchicus*, var.). Presented by A. L. Sawer, Esq.
6. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mr. H. R. Sherren.
1 Common Toad (*Bufo vulgaris*). Presented by John Scovell, Esq.
8. 1 Leopard (*Felis pardus*), ♂. Presented by W. T. Manger, Esq.
1 Guilding's Amazon (*Chrysotis guildingi*). Presented by Mrs. Ellice.
10. 1 Gorilla (*Anthropopithecus gorilla*), ♂. Purchased. See P.Z.S. 1887, p. 559.
3 Pluto Monkeys (*Cercopithecus pluto*). Deposited.
11. 1 Crested Lark (*Alauda cristata*), ♂. Presented by Col. Verner.
1 Proteus (*Proteus anguinus*). Presented by Prof. W. H. Corfield, M.A., F.Z.S. From the Cave of Adelsberg.
1 Proteus (*Proteus anguinus*). Presented by Dr. E. Rickards. From the Cave of Adelsberg.

Oct. 13. 1 Erxleben's Monkey (*Cercopithecus erxlebeni*), ♀. Deposited.
16. 2 Coypus (*Myopotamus coypus*). Born in the Menagerie.
1 Spotted Salamander, yellow variety (*Salamandra maculosa*). Presented by Alban Doran, Esq., F.R.C.S.
17. 1 Pennant's Parrakeet (*Platycercus pennanti*). Presented by Mrs. Brooks.
18. 1 Buzzard (*Buteo vulgaris*). Presented by F. Austen, Esq.
19. 1 Dusty Ichneumon (*Herpestes pulverulentus*). Presented by L. G. Morrell, Esq.
20. 1 Three-striped Paradoxure (*Paradoxurus trivirgatus*), ♂. Presented by Mr. J. Miller.
21. 2 Patas Monkeys (*Cercopithecus ruber*), ♂ ♀. Presented by Mrs. Benett-Stanford.
1 Brown Capuchin (*Cebus fatuellus*), ♂. Presented by Edward A. B. Pitman, Esq.
1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. Absell.
22. 2 Burrowing-Owls (*Speotyto cunicularia*). Presented by J. C. Hawkshaw, Esq., F.Z.S.
24. 6 Painted Terrapins (*Clemmys picta*). Received in Exchange.
2 Corn-Snakes (*Coluber guttatus*). Received in Exchange.
2 Milk-Snakes (*Coluber eximius*). Received in Exchange.
2 Mocassin Snakes (*Tropidonotus fasciatus*). Received in Exchange.
2 Ribbon-Snakes (*Tropidonotus saurita*). Received in Exchange.
2 Hog-nosed Snakes (*Heterodon platyrhinos*). Received in Exchange.
1 Grass-Snake (*Cyclophis vernalis*). Received in Exchange.
6 Dekay's Snakes (*Ischnognathus dekayi*). Received in Exchange.
9 American Green Frogs (*Rana halecina*). Received in Exchange.
10 Noisy Frogs (*Rana clamata*). Received in Exchange.
1 Wood-Frog (*Rana sylvatica*). Received in Exchange.
1 Changeable Tree-Frog (*Hyla versicolor*). Received in Exchange.
9 Red-backed Salamanders (*Plethodon erythronotus*). Received in Exchange.
1 Water-Rattlesnake (*Crotalus adamanteus*). Presented by the Natural History Society of Toronto.
1 Water-Viper (*Cenchris piscivorus*). Presented by the Natural History Society of Toronto.
2 American Black Snakes (*Coluber constrictor*). Presented by the Natural History Society of Toronto.
1 Chicken Snake (*Coluber quadrivittatus*). Presented by the Natural History Society of Toronto.
1 Mocassin Snake (*Coluber fasciatus*, var. *niger*). Presented by the Natural History Society of Toronto.
1 Mocassin Snake (*Coluber fasciatus*, var. *sipedon*). Presented by the Natural History Society of Toronto.
25. 1 Grand Eclectus (*Eclectus roratus*). Presented by Miss P. Lockwood.
26. 1 Algerian Tortoise (*Testudo mauritanica*). Deposited.
27. 1 Blood-breasted Pigeon (*Phlogœnas cruentata*). Bred in the Menagerie.
2 Green Lizards (*Lacerta viridis*). Presented by Messrs. Paul & Co.

Oct. 27. 12 Spotted Salamanders (*Salamandra maculosa*). Presented by Messrs. Paul & Co.

2 Common Snakes (*Tropidonotus natrix*, var.). Presented by Messrs. Paul & Co.

28. 1 Aye-Aye (*Chiromys madagascariensis*). Purchased. See P. Z. S. 1887, p. 559.

1 Goffin's Cockatoo (*Cacatua goffini*). Presented by Miss Barton.

31. 1 Naked-footed Owlet (*Athene noctua*). Presented by Mr. R. E. Holding.

Nov. 1. 1 Raccoon-like Dog (*Canis procynides*). Presented by W. T. Manger, Esq.

1 Laughing Kingfisher (*Dacelo gigantea*). Presented by G. E. Frodsham, Esq.

2. 1 Weeper Capuchin (*Cebus capucinus*). Presented by C. N. Skeffington, Esq.

3. 1 Campbell's Monkey (*Cercopithecus campbelli*), ♀. Presented by C. B. Mitford, Esq. From Sherboro', W. Africa.

1 Javan Mynah (*Gracula javanensis*). Presented by Mrs. J. S. Beale.

4. 1 Indian Antelope (*Antilope cervicapra*), ♀. Presented by Mrs. M. V. Charrington.

1 Larger Hill-Mynah (*Gracula intermedia*). Presented by J. M. Cook, Esq., F.Z.S.

6 Mocassin Snakes (*Tropidonotus fasciatus*). Born in the Menagerie.

1 West-African Python (*Python sebæ*). Deposited.

1 Common Boa (*Boa constrictor*). Deposited.

2 Testaceous Snakes (*Ptyas testacea*). Deposited.

1 Alleghany Snake (*Coluber alleghaniensis*). Deposited.

5. 1 Leopard (*Felis pardus*). Presented by the Adigar Dullewe Disrawe of Tamankadua. From Ceylon.

1 Common Squirrel (*Sciurus vulgaris*). Presented by Arthur Townsend, Esq.

6. 1 Grey-headed Porphyrio (*Porphyrio poliocephalus*). Presented by Lady Morshead.

7. 1 Himalayan Scops Owl (*Scops pennatus*). Presented by J. H. Leech, Esq., F.Z.S. From Baltistan, Himalayas.

8. 1 Peregrine Falcon (*Falco peregrinus*). Presented by Mr. J. G. Keulemans.

1 Anubis Baboon (*Cynocephalus anubis*), ♀. Presented by Capt. Augustus Kent.

1 Angolan Vulture (*Gypohierax angolensis*). Presented by Capt. Augustus Kent.

9. 2 Rough-scaled Lizards (*Zonurus cordylus*). Presented by W. K. Sibley, Esq.

10. 1 Black-headed Lemur (*Lemur brunneus*), ♂. Presented by Capt. J. Bonnerville.

1 Grey Lemur (*Hapalemur griseus*). Presented by Capt. J. Bonnerville.

14. 8 Silky Bower-birds (*Ptilonorhynchus violaceus*). Received in Exchange.

2 Silky Bower-birds (*Ptilonorhynchus violaceus*). Deposited.

59 Pleurodele Newts (*Molge walti*). Presented by Lord Lilford, F.Z.S. From Spain.

7 Marbled Newts (*Molge marmorata*). Presented by Lord Lilford, F.Z.S. From Spain.

Nov. 16. 2 South-American Flamingos (*Phœnicopterus ignipalliatus*). Deposited.

17. 2 Mouflons (*Ovis musimon*), ♂ ♀. Deposited.

2 Barbary Wild Sheep (*Ovis tragelaphus*), ♂ ♀. Deposited.

18. 1 African Wild Ass (*Equus tæniopus*), ♂. Born in the Menagerie.

21. 2 White-backed Piping-Crows (*Gymnorhina leuconota*). Presented by C. Sadler, Esq.

22. 1 Knot (*Tringa canutus*). Presented by Mr. Howard Bunn.

23. 1 Crowned Hawk-Eagle (*Spizaëtus coronatus*, jr.). Presented by E. A. Hart, Esq.

2 Cereopsis Geese (*Cereopsis novæ-hollandiæ*), ♂ ♀. Presented by His Grace The Duke of Northumberland, F.Z.S.

2 Thunder-fish (*Misgurnus fossilis*). Presented by Messrs. Paul & Co.

4 Chub (*Leuciscus cephalus*). Presented by Messrs. Paul & Co.

26. 1 Cheetah (*Cynælurus jubatus*). Presented by Fred. Holmwood, Esq. From East Africa.

2 Cape Crowned Cranes (*Balearica chrysopelargus*). Deposited.

1 Common Crossbill (*Loxia curvirostra*). Presented by Mr. S. R. Arnold.

27. 1 Mealy Amazon (*Chrysotis farinosa*). Deposited.

28. 1 Striped Hyæna (*Hyæna striata*). Presented by Ernest Heydon Marquis, Esq.

1 Zebu (*Bos indicus*), ♀. Deposited.

30. 1 Crested Porcupine (*Hystrix cristata*). Presented by His Grace The Duke of Hamilton, K.T., F.Z.S.

Dec. 1. 1 Horned Tragopan (*Ceriornis satyra*), ♂. Presented by R. J. Lloyd Price, Esq., F.Z.S.

1 Vinaceous Dove (*Turdus vinaceus*). Presented by R. H. Mitford, Esq.

2. 2 Common Squirrels (*Sciurus vulgaris*), 2 ♀. Presented by Mrs. Henry Alex. Hankey.

3. 2 Sandwich-Island Geese (*Bernicla sandvicensis*), ♂ ♀. Deposited.

5. 3 American Flying Squirrels (*Sciuropterus volucella*). Presented by Henry D. Harrison, Esq.

2 Common Wolves (*Canis lupus*), ♂ ♀. Received in Exchange.

6. 2 Great Eagle-Owls (*Bubo maximus*). Deposited.

14. 1 Common Wolf (*Canis lupus*), ♂. Presented by C. S. Hardy, Esq.

1 Spotted Crake (*Porzana maruetta*). Presented by T. W. Proger, Esq.

16. 2 Golden Plovers (*Charadrius pluvialis*). Purchased.

19. 2 Viscachas (*Lagostomus trichodactylus*). Born in the Menagerie.

1 White-crested Guan (*Pipile jacutinga*). Presented by Capt. Jas. Smith, s.s. 'Godiva.'

22. 2 Silky Bower-birds (*Ptilonorhynchus violaceus*). Deposited.

29. 1 Common Otter (*Lutra vulgaris*). Presented by Edward Hart, Esq., F.Z.S.

1 Griffith's Fox (*Canis griffithi*). Presented by Lieut.-Col. Sir Oliver B. C. St. John, K.C.S.I., F.Z.S. From Afghanistan.

2 Spotted Ichneumons (*Herpestes nepalensis*). Presented by Lieut.-Col. Sir Oliver B. C. St. John, K.C.S.I., F.Z.S.

30. 1 Red-throated Diver (*Colymbus septentrionalis*). Presented by Chas. A. Howell, Esq.

31. 2 Greater Sulphur-crested Cockatoos (*Cacatua galerita*). Presented by Master Rankin.

INDEX.

THE END.

Printed by Taylor and Francis, Red Lion Court, Fleet Street.

LIST OF THE PUBLICATIONS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

THE scientific publications of the Zoological Society are of two kinds — "Proceedings," published in an octavo form, and "Transactions," in quarto.

According to the present arrangements, the "Proceedings" contain not only notices of all business transacted at the scientific meetings, but also all the papers read at such meetings and recommended to be published in the "Proceedings" by the Committee of Publication. From fifty to seventy coloured plates and engravings are attached to each annual volume of the "Proceedings," to illustrate the new or otherwise remarkable species of animals described in them. Amongst such illustrations, figures of the new or rare species acquired in a living state for the Society's Gardens are often given.

The "Proceedings" for each year are issued in four parts, on the first of the months of June, August, October, and April, the part published in April completing the volume for the preceding year. The price is 12*s.* per part for the edition with coloured, and 3*s.* per part for that with uncoloured Plates.

The "Transactions" contain such of the more important communications made to the scientific meetings of the Society as, on account of the nature of the plates required to illustrate them, are better adapted for publication in the quarto form. They are issued at irregular intervals.

Fellows and Corresponding Members, upon payment of a Subscription of One Guinea before the day of the Anniversary Meeting in each year, are entitled to receive all the Society's Publications for the year. They are likewise entitled to purchase the Publications of the Society at 25 per cent. less than the price charged for them to the Public. A further reduction of 25 per cent. is made upon purchases of Publications issued prior to 1861, if they exceed the value of five pounds.

The following is a complete list of the publications of the Society already issued. They may be obtained at the Society's Office (3 Hanover Square, W.), at Messrs. Longmans', the Society's publishers (Paternoster Row, E.C.), or through any bookseller.

[August 1, 1887.]

TRANSACTIONS OF THE ZOOLOGICAL SOCIETY OF LONDON.

4to. 11 vols. and Six Parts.

					To Fellows. £	s.	d.		To the Public. £	s.	d.
Vol. I.,	containing	59 Plates	(1833–35)	Price	3	13	6	....	4	18	0*
Vol. II.,	,,	71 ,,	(1835–41)	,,	4	0	0	....	5	6	6*
Vol. III.,	,,	63 ,,	(1842–49)	,,	3	8	3	....	4	11	0*
Vol. IV.,	,,	78 ,,	(1851–62)	,,	6	2	0	....	8	2	6*
Vol. V.,	,,	67 ,,	(1862–66)	,,	5	4	3	....	6	19	0
Vol. VI.,	,,	91 ,,	(1866–69)	,,	11	5	0	....	15	0	0
Vol. VII.,	,,	73 ,,	(1869–72)	,,	8	17	0	....	11	16	0
Vol. VIII.,	,,	82 ,,	(1872–74)	,,	9	8	3	....	12	11	0
Vol. IX.,	,,	99 ,,	(1875–77)	,,	12	0	0	....	16	0	0
Vol. X.,	,,	94 ,,	(1877–79)	,,	10	0	3	....	13	7	0
Index, Vols. I.–X.				,,	0	7	6	....	0	10	0
Vol. XI., part 1,	containing	4 Plates	(Jan. 1880)	,,	0	12	0	....	0	16	0
Vol. XI., ,, 2,	,,	7 ,,	(Aug. 1880)	,,	0	18	0	....	1	4	0
Vol. XI., ,, 3,	,,	8 ,,	(Mar. 1881)	,,	1	2	6	....	1	10	0
Vol. XI., ,, 4,	,,	3 ,,	(Apr. 1881)	,,	0	7	6	....	0	10	0
Vol. XI., ,, 5,	,,	13 ,,	(June 1881)	,,	0	18	6	....	1	4	0
Vol. XI., ,, 6,	,,	6 ,,	(Jan. 1882)	,,	0	12	0	....	0	16	0
Vol. XI., ,, 7,	,,	9 ,,	(Oct. 1882)	,,	0	15	0	....	1	0	0
Vol. XI., ,, 8,	,,	11 ,,	(Jan. 1883)	,,	0	12	0	....	0	16	0
Vol. XI., ,, 9,	,,	10 ,,	(Oct. 1883)	,,	0	12	0	....	0	16	0
Vol. XI., ,, 10,	,,	12 ,,	(May 1885)	,,	1	11	6	....	2	2	0
Vol. XI., ,, 11,	,,	14 ,,	(Nov. 1885)	,,	1	11	6	....	2	2	0
Vol. XII., ,, 1,	,,	6 ,,	(Feb. 1886)	,,	0	9	0	....	0	12	0
Vol. XII., ,, 2,	,,	7 ,,	(Apr. 1886)	,,	0	12	0	....	0	16	0
Vol. XII., ,, 3,	,,	2 ,,	(Aug. 1886)	,,	0	4	6	....	0	6	0
Vol. XII., ,, 4,	,,	12 ,,	(Oct. 1886)	,,	0	15	0	....	1	0	0
Vol. XII., ,, 5,	,,	5 ,,	(Dec. 1886)	,,	0	9	0	....	0	12	0
Vol. XII., ,, 6,	,,	7 ,,	(Apr. 1887)	,,	0	12	0	....	0	16	0

PROCEEDINGS OF THE COMMITTEE OF SCIENCE AND CORRESPONDENCE OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 2 vols.

				To Fellows.		To the Public.
Part I.	1830–31.	1 vol. 8vo.	Price	4*s.* 6*d.*	..	6*s.*†
,, II.	1832.	,, ...	,,	4*s.* 6*d.*	..	6*s.*

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 15 vols. and Index. (First Series.)

			Price to Fellows.	Price to the Public.
Part I.	1833.	1 vol. 8vo.	4*s.* 6*d.* ..	6*s.*
,, II.	1834.	,,	4*s.* 6*d.* ..	6*s.*
,, III.	1835.	,,	4*s.* 6*d.* ..	6*s.*
,, IV.	1836	,,	4*s.* 6*d.* ..	6*s.*
,, V.	1837.	,,	4*s.* 6*d.* ..	6*s.*
,, VI.	1838.	,,	4*s.* 6*d.* ..	6*s.*
,, VII.	1839.	,,	4*s.* 6*d.* ..	6*s.*
,, VIII.	1840.	,,	4*s.* 6*d.* ..	6*s.*†
Part IX.	1841.	1 vol. 8vo.	4*s.* 6*d.* ..	6*s.*
,, X.	1842.	,,	4*s.* 6*d.* ..	6*s.*
,, XI.	1843.	,,	4*s.* 6*d.* ..	6*s.*
,, XII.	1844.	,,	4*s.* 6*d.* ..	6*s.*
,, XIII.	1845.	,	4*s.* 6*d.* ..	6*s.*
,, XIV.	1846.	,,	4*s.* 6*d.* ..	6*s.*
,, XV.	1847.	,,	4*s.* 6*d.* ..	6*s.*
Index	1830–1847.	,,	4*s.* 6*d.* ..	6*s.*

* No perfect copies of these volumes remain in stock. † Out of print.

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 13 vols. and Index. (Second Series.)

		Letterpress only. To Fellows.	To the Public.		With Plates Coloured. To Fellows. £ s. d.	To the Public. £ s. d.
Part XVI. 1848.	1 vol. 8vo.	4*s*. 6*d*.	6*s*.	Price	1 0 9	1 7 6†
„ XVII. 1849.	„	4*s*. 6*d*.	6*s*.	„	1 0 9	1 7 6†
„ XVIII. 1850.	„	4*s*. 6*d*.	6*s*.	„	1 8 6	1 18 0†
„ XIX. 1851.	„	4*s*. 6*d*.	6*s*.	„	0 15 9	1 1 0†
„ XX. 1852.	„	4*s*. 6*d*.	6*s*.	„	0 15 9	1 1 0†
„ XXI. 1853.	„	4*s*. 6*d*.	6*s*.	„	0 18 0	1 4 0†
„ XXII. 1854.	„	4*s*. 6*d*.	6*s*.	„	0 19 6	1 6 0
„ XXIII. 1855.	„	4*s*. 6*d*.	6*s*.	„	1 8 6	1 18 0†
„ XXIV. 1856.	„	4*s*. 6*d*.	6*s*.	„	1 0 9	1 7 6†
„ XXV. 1857.	„	4*s*. 6*d*.	6*s*.	„	1 0 9	1 7 6
„ XXVI. 1858.	„	4*s*. 6*d*.	6*s*.	„	1 11 6	2 2 0
„ XXVII. 1859.	„	4*s*. 6*d*.	6*s*.	„	1 11 6	2 2 0†
„ XXVIII. 1860.	„	4*s*. 6*d*.	6*s*.	„	1 11 6	2 2 0
Index 1848–1860.	„	4*s*. 6*d*.	6*s*.			

ILLUSTRATIONS TO THE PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON, 1848–60. 8vo. 6 vols.

		Plates Uncoloured. To Fellows. £ s. d.	To the Public. £ s. d.		Plates Coloured. To Fellows. £ s. d.	To the Public. £ s. d.
Mammalia	1 vol.,	1 2 6	1 10 0	Price	2 7 3	3 3 0†
Aves	2 vols.,	2 7 3	3 3 0	„	4 14 6	6 6 0†
Reptilia et Pisces ...	1 vol.,	0 15 9	1 1 0*	„	1 2 6	1 10 0†
Mollusca..............	1 vol.,	0 15 9	1 1 0*	„	1 2 6	1 10 0†
Annulosa et Radiata	1 vol.,	1 11 6	2 2 0	„	2 7 3	3 3 0†

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

	Letterpress only. To Fellows.	To the Public.	Plates only. To Fellows.	To the Public.	Complete. To Fellows.	To the Public.
1861, cloth	4*s*. 6*d*.	6*s*.	30*s*. 9*d*.	41*s*.‡	33*s*. 9*d*.	45*s*.
1862, „	4*s*. 6*d*.	6*s*.	30*s*. 9*d*.	41*s*.‡	33*s*. 9*d*.	45*s*.
1863, „	4*s*. 6*d*.	6*s*.	30*s*. 9*d*.	41*s*.‡	33*s*. 9*d*.	45*s*.
1864, „	4*s*. 6*d*.	6*s*.	30*s*. 9*d*.	41*s*.‡	33*s*. 9*d*.	45*s*.
1865, „	4*s*. 6*d*.	6*s*.	30*s*. 9*d*.	41*s*.‡	33*s*. 9*d*.	45*s*.
1866, „	4*s*. 6*d*.	6*s*.	30*s*. 9*d*.	41*s*.	33*s*. 9*d*.	45*s*.

	With Plates, uncoloured. To Fellows.	To the Public.	With Plates, coloured. To Fellows.	To the Public.
1867	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.
1868	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.
1869	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.
1870	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.
Index, 1861–1870	4*s*. 6*d*.	6*s*.		
1871	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.
1872	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.§
1873	9*s*. 0*d*.	12*s*.	33*s*. 9*d*.	45*s*.§
1874	9*s*. 0*d*.	12*s*.§	36*s*. 0*d*.	48*s*.§
1875	9*s*. 0*d*.	12*s*.	36*s*. 0*d*.	48*s*.§
1876	9*s*. 0*d*.	12*s*.	36*s*. 0*d*.	48*s*.§

* No perfect copies of these volumes remain in stock.
† Out of print.
‡ Only uncoloured copies of these plates can now be supplied, at 10*s*. 6*d*. each volume.
§ Out of print, but odd parts may be obtained.

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON (*continued*).

	With Plates, uncoloured.		With Plates, coloured.	
	To Fellows.	To the Public.	To Fellows.	To the Public.
1877	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1878	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1879	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1880	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*†
Index, 1871–1880	4*s.* 6*d.*	6*s.*		
1881	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1882	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1883	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1884	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1885	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1886	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1887, part 1 (Jan. & Feb.)	2*s.* 3*d.*	3*s.*	9*s.* 0*d.*	12*s.*
1887, „ 2 (Mar. & Apr.)	2*s.* 3*d.*	3*s.*	9*s.* 0*d.*	12*s.*

(Bound in Cloth 3*s.* extra.)

† Out of print, but odd parts may be obtained.

LISTS OF THE ANIMALS IN THE SOCIETY'S GARDENS.

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. 8vo. 1862. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Second Edition.) 8vo. 1863. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Third Edition.) 8vo. 1865. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Fourth Edition.) 8vo. 1866. Price 1*s.* 6*d.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. 8vo. 1872. Price 2*s.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—Supplement, containing Additions received in 1872, 1873, and 1874. 8vo. 1875. Price 1*s.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Sixth Edition.) 8vo. 1877. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Seventh Edition.) 8vo. 1879. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—First Supplement, containing Additions received in 1879. 8vo. 1880. Price 1*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Eighth Edition.) 8vo. 1883. Price 3*s.* 6*d.*

Catalogue of the Library of the Zoological Society of London. (Fourth Edition.) 1887. In cloth. Price 4*s.*

These publications may be obtained at the SOCIETY'S OFFICE (3 *Hanover Square, W.*), *at Messrs.* LONGMANS' (*Paternoster Row, E.C.*), *or through any bookseller.*

LIST OF THE PUBLICATIONS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

The scientific publications of the Zoological Society are of two kinds — "Proceedings," published in an octavo form, and "Transactions," in quarto.

According to the present arrangements, the "Proceedings" contain not only notices of all business transacted at the scientific meetings, but also all the papers read at such meetings and recommended to be published in the "Proceedings" by the Committee of Publication. From fifty to seventy coloured plates and engravings are attached to each annual volume of the "Proceedings," to illustrate the new or otherwise remarkable species of animals described in them. Amongst such illustrations, figures of the new or rare species acquired in a living state for the Society's Gardens are often given.

The "Proceedings" for each year are issued in four parts, on the first of the months of June, August, October, and April, the part published in April completing the volume for the preceding year. The price is 12*s*. per part for the edition with coloured, and 3*s*. per part for that with uncoloured Plates.

The "Transactions" contain such of the more important communications made to the scientific meetings of the Society as, on account of the nature of the plates required to illustrate them, are better adapted for publication in the quarto form. They are issued at irregular intervals.

Fellows and Corresponding Members, upon payment of a Subscription of One Guinea before the day of the Anniversary Meeting in each year, are entitled to receive all the Society's Publications for the year. They are likewise entitled to purchase the Publications of the Society at 25 per cent. less than the price charged for them to the Public. A further reduction of 25 per cent. is made upon purchases of Publications issued prior to 1861, if they exceed the value of five pounds.

The following is a complete list of the publications of the Society already issued. They may be obtained at the Society's Office (3 Hanover Square, W.), at Messrs. Longmans', the Society's publishers (Paternoster Row, E.C.), or through any bookseller.

[October 1, 1887.]

TRANSACTIONS OF THE ZOOLOGICAL SOCIETY OF LONDON.

4to. 11 vols. and Six Parts.

						To Fellows. £	s.	d.		To the Public. £	s.	d.
Vol. I.,	containing	59	Plates	(1833–35)	Price	3	13	6	....	4	18	0*
Vol. II.,	„	71	„	(1835–41)	„	4	0	0	....	5	6	6*
Vol. III.,	„	63	„	(1842–49)	„	3	8	3	....	4	11	0*
Vol. IV.,	„	78	„	(1851–62)	„	6	2	0	....	8	2	6*
Vol. V.,	„	67	„	(1862–66)	„	5	4	3	....	6	19	0
Vol. VI.,	„	91	„	(1866–69)	„	11	5	0	....	15	0	0
Vol. VII.,	„	73	„	(1869–72)	„	8	17	0	....	11	16	0
Vol. VIII.,	„	82	„	(1872–74)	„	9	8	3	....	12	11	0
Vol. IX.,	„	99	„	(1875–77)	„	12	0	0	....	16	0	0
Vol. X.,	„	94	„	(1877–79)	„	10	0	3	....	13	7	0
Index, Vols. I.–X.					„	0	7	6	....	0	10	0
Vol. XI., part 1,	containing	4	Plates	(Jan. 1880)	„	0	12	0	....	0	16	0
Vol. XI., „ 2,	„	7	„	(Aug. 1880)	„	0	18	0	....	1	4	0
Vol. XI., „ 3,	„	8	„	(Mar. 1881)	„	1	2	6	....	1	10	0
Vol. XI., „ 4,	„	3	„	(Apr. 1881)	„	0	7	6	....	0	10	0
Vol. XI., „ 5,	„	13	„	(June 1881)	„	0	18	6	....	1	4	0
Vol. XI., „ 6,	„	6	„	(Jan. 1882)	„	0	12	0	....	0	16	0
Vol. XI., „ 7,	„	9	„	(Oct. 1882)	„	0	15	0	....	1	0	0
Vol. XI., „ 8,	„	11	„	(Jan. 1883)	„	0	12	0	....	0	16	0
Vol. XI., „ 9,	„	10	„	(Oct. 1883)	„	0	12	0	....	0	16	0
Vol. XI., „ 10,	„	12	„	(May 1885)	„	1	11	6	....	2	2	0
Vol. XI., „ 11,	„	14	„	(Nov. 1885)	„	1	11	6	....	2	2	0
Vol. XII., „ 1,	„	6	„	(Feb. 1886)	„	0	9	0	....	0	12	0
Vol. XII., „ 2,	„	7	„	(Apr. 1886)	„	0	12	0	....	0	16	0
Vol. XII., „ 3,	„	2	„	(Aug. 1886)	„	0	4	6	....	0	6	0
Vol. XII., „ 4,	„	12	„	(Oct. 1886)	„	0	15	0	....	1	0	0
Vol. XII., „ 5,	„	5	„	(Dec. 1886)	„	0	9	0	....	0	12	0
Vol. XII., „ 6,	„	7	„	(Apr. 1887)	„	0	12	0	....	0	16	0

PROCEEDINGS OF THE COMMITTEE OF SCIENCE AND CORRESPONDENCE OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 2 vols.

			To Fellows.		To the Public.
Part I.	1830–31.	1 vol. 8vo.	Price 4*s.* 6*d.*	..	6*s.*†
„ II.	1832.	„	„ 4*s.* 6*d.*	..	6*s.*

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 15 vols. and Index. (First Series.)

			Price to Fellows.		Price to the Public.
Part I.	1833.	1 vol. 8vo.	4*s.* 6*d.*	..	6*s.*
„ II.	1834.	„	4*s.* 6*d.*	..	6*s.*
„ III.	1835.	„	4*s.* 6*d.*	..	6*s.*
„ IV.	1836	„	4*s.* 6*d.*	..	6*s.*
„ V.	1837.	„	4*s.* 6*d.*	..	6*s.*
„ VI.	1838.	„	4*s.* 6*d.*	..	6*s.*
„ VII.	1839.	„	4*s.* 6*d.*	..	6*s.*
„ VIII.	1840.	„	4*s.* 6*d.*	..	6*s.*†
Part IX.	1841.	1 vol. 8vo.	4*s.* 6*d.*	..	6*s.*
„ X.	1842.	„	4*s.* 6*d.*	..	6*s.*
„ XI.	1843.	„	4*s.* 6*d.*	..	6*s.*
„ XII.	1844.	„	4*s.* 6*d.*	..	6*s.*
„ XIII.	1845.	„	4*s.* 6*d.*	..	6*s.*
„ XIV.	1846.	„	4*s.* 6*d.*	..	6*s.*
„ XV.	1847.	„	4*s.* 6*d.*	..	6*s.*
Index	1830–1847.	„	4*s.* 6*d.*	..	6*s.*

* No perfect copies of these volumes remain in stock. † Out of print.

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 13 vols. and Index. (Second Series.)

		Letterpress only. To Fellows.	To the Public.		With Plates Coloured. To Fellows. £ s. d.	To the Public. £ s. d.
Part XVI. 1848.	1 vol. 8vo.	4s. 6d.	6s.	Price	1 0 9	1 7 6†
,, XVII. 1849.	,,	4s. 6d.	6s.	,,	1 0 9	1 7 6†
,, XVIII. 1850.	,,	4s. 6d.	6s.	,,	1 8 6	1 18 0†
,, XIX. 1851.	,,	4s. 6d.	6s.	,,	0 15 9	1 1 0†
,, XX. 1852.	,,	4s. 6d.	6s.	,,	0 15 9	1 1 0†
,, XXI. 1853.	,,	4s. 6d.	6s.	,,	0 18 0	1 4 0†
,, XXII. 1854.	,,	4s. 6d.	6s.	,,	0 19 6	1 6 0
,, XXIII. 1855.	,,	4s. 6d.	6s.	,,	1 8 6	1 18 0†
,, XXIV. 1856.	,,	4s. 6d.	6s.	,,	1 0 9	1 7 6†
,, XXV. 1857.	,,	4s. 6d.	6s.	,,	1 0 9	1 7 6
,, XXVI. 1858.	,,	4s. 6d.	6s.	,,	1 11 6	2 2 0
,, XXVII. 1859.	,,	4s. 6d.	6s.	,,	1 11 6	2 2 0†
,, XXVIII. 1860.	,,	4s. 6d.	6s.	,,	1 11 6	2 2 0
Index 1848–1860.	,,	4s. 6d.	6s.			

ILLUSTRATIONS TO THE PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON, 1848–60. 8vo. 6 vols.

		Plates Uncoloured. To Fellows. £ s. d.	To the Public. £ s. d.		Plates Coloured. To Fellows. £ s. d.	To the Public. £ s. d.
Mammalia	1 vol.,	1 2 6	1 10 0	Price	2 7 3	3 3 0†
Aves	2 vols.,	2 7 3	3 3 0	,,	4 14 6	6 6 0†
Reptilia et Pisces ...	1 vol.,	0 15 9	1 1 0*	,,	1 2 6	1 10 0†
Mollusca..............	1 vol.,	0 15 9	1 1 0*	,,	1 2 6	1 10 0†
Annulosa et Radiata	1 vol.,	1 11 6	2 2 0	,,	2 7 3	3 3 0†

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

	Letterpress only. To Fellows.	To the Public.	Plates only. To Fellows.	To the Public.	Complete. To Fellows.	To the Public
1861, cloth	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1862, ,,	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1863, ,,	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1864, ,,	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1865, ,,	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1866, ,,	4s. 6d.	6s.	30s. 9d.	41s.	33s. 9d.	45s.

	With Plates, uncoloured. To Fellows.	To the Public.	With Plates, coloured. To Fellows.	To the Public.
1867	9s. 0d.	12s.	33s. 9d.	45s.
1868	9s. 0d.	12s.	33s. 9d.	45s.
1869	9s. 0d.	12s.	33s. 9d.	45s.
1870	9s. 0d.	12s.	33s. 9d.	45s.
Index, 1861–1870	4s. 6d.	6s.		
1871	9s. 0d.	12s.	33s. 9d.	45s.
1872	9s. 0d.	12s.	33s. 9d.	45s.§
1873	9s. 0d.	12s.	33s. 9d.	45s.§
1874	9s. 0d.	12s.§	36s. 0d.	48s.§
1875	9s. 0d.	12s.	36s. 0d.	48s.§
1876	9s. 0d.	12s.	36s. 0d.	48s.§

* No perfect copies of these volumes remain in stock.
† Out of print.
‡ Only uncoloured copies of these plates can now be supplied, at 10s. 6d. each volume.
§ Out of print, but odd parts may be obtained.

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON (*continued*).

	With Plates, uncoloured.		With Plates, coloured.	
	To Fellows.	To the Public.	To Fellows.	To the Public.
1877	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1878	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1879	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1880	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*†
Index, 1871–1880	4*s.* 6*d.*	6*s.*		
1881	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1882	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1883	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1884	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1885	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1886	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1887, part 1 (Jan. & Feb.)	2*s.* 3*d.*	3*s.*	9*s.* 0*d.*	12*s.*
1887, „ 2 (Mar. & Apr.)	2*s.* 3*d.*	3*s.*	9*s.* 0*d.*	12*s.*
1887, „ 3 (May & June)	2*s.* 3*d.*	3*s.*	9*s.* 0*d.*	12*s.*

(Bound in Cloth 3*s.* extra.)

† Out of print, but odd parts may be obtained.

LISTS OF THE ANIMALS IN THE SOCIETY'S GARDENS.

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. 8vo. 1862. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Second Edition.) 8vo. 1863. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Third Edition.) 8vo. 1865. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Fourth Edition.) 8vo. 1866. Price 1*s.* 6*d.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. 8vo. 1872. Price 2*s.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—Supplement, containing Additions received in 1872, 1873, and 1874. 8vo. 1875. Price 1*s.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Sixth Edition.) 8vo. 1877. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Seventh Edition.) 8vo. 1879. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—First Supplement, containing Additions received in 1879. 8vo. 1880. Price 1*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Eighth Edition.) 8vo. 1883. Price 3*s.* 6*d.*

Catalogue of the Library of the Zoological Society of London. (Fourth Edition.) 1887. In cloth. Price 4*s.*

These publications may be obtained at the Society's Office (3 *Hanover Square, W.*), *at Messrs.* Longmans' (*Paternoster Row, E.C.*), *or through any bookseller.*

THE ZOOLOGICAL RECORD.

THE object of the ZOOLOGICAL RECORD is to give, in an annual Volume, reports on, abstracts of, and an index to, the various Zoological publications which have appeared during the preceding year; to acquaint Zoologists with the progress of every branch of their science in all parts of the globe; and to form a repertory which will retain its value for the Student in future years.

The 'Zoological Record' is published for the Society by Messrs. Gurney and Jackson at the price of 30*s.* per volume. But all Members of the Zoological Society of London have the privilege of receiving it, including the cost of delivery (within the United Kingdom), at a subscription price of 20*s.* per annum. This Subscription is due on the 1st of July in every year, but the privilege of Subscription is forfeited unless the amount be paid before the 1st of December following.

The Zoological Society, having purchased the entire stock of the 'Zoological Record,' are able to supply complete sets of the first twenty-two volumes at the price of £5 10*s.*, that is, at 5*s.* per volume. Volumes of any single year (exclusive of the last two volumes) can likewise be supplied at 10*s.* per volume.

Members of the Society wishing to subscribe to the 'Record' are requested to apply at this office for a Form, to be returned when filled up and signed by the subscriber. In order to facilitate the payment of the subscription, a Banker's Order Form is also furnished to those who prefer that mode of payment. This order, when filled up and signed, should be sent to the Society's office for registration; it will then be sent to the Agents named therein.

Learned Societies and Institutions and members of the former Zoological Record Association are permitted to subscribe to the 'Record' on the same conditions as are accorded to Members of the Zoological Society.

P. L. SCLATER,
Secretary.

Jan. 1st, 1888.

ZOOLOGICAL SOCIETY OF LONDON,
3 HANOVER SQUARE, W.

LIST OF VOLUMES

OF THE

'ZOOLOGICAL RECORD.'

The Record of Zoological Literature, 1864. Volume First. Edited by ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.Z.S., &c. London, 1865. Price 10*s.*

The Record of Zoological Literature, 1865. Volume Second. Edited by ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.Z.S., &c. London, 1866. Price 10*s.*

The Record of Zoological Literature, 1866. Volume Third. Edited by ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S., F.Z.S., &c. London, 1867. Price 10*s.*

The Record of Zoological Literature, 1867. Volume Fourth. Edited by ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S., F.Z.S., &c. London, 1868. Price 10*s.*

The Record of Zoological Literature, 1868. Volume Fifth. Edited by ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S., F.Z.S., &c. London, 1869. Price 10*s.*

The Record of Zoological Literature, 1869. Volume Sixth. Edited by ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S., F.Z.S., &c. London, 1870. Price 10*s.*

The Zoological Record for 1870; being Volume Seventh of the Record of Zoological Literature. Edited by ALFRED NEWTON, M.A., F.R.S., Professor of Zoology and Comparative Anatomy in the University of Cambridge, F.L.S., V.P.Z.S., &c. London, 1871. Price 10*s.*

The Zoological Record for 1871; being Volume Eighth of the Record of Zoological Literature. Edited by ALFRED NEWTON, M.A., F.R.S., Professor of Zoology and Comparative Anatomy in the University of Cambridge, F.L.S., V.P.Z.S., &c. London, 1873. Price 10*s*.

The Zoological Record for 1872; being Volume Ninth of the Record of Zoological Literature. Edited by ALFRED NEWTON, M.A., F.R.S., Professor of Zoology and Comparative Anatomy in the University of Cambridge, F.L.S., V.P.Z.S., &c. London, 1874. Price 10*s*.

The Zoological Record for 1873; being Volume Tenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., Librarian to the Royal Geographical Society. London, 1875. Price 10*s*.

The Zoological Record for 1874; being Volume Eleventh of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1876. Price 10*s*.

The Zoological Record for 1875; being Volume Twelfth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1877. Price 10*s*.

The Zoological Record for 1876; being Volume Thirteenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1878. Price 10*s*.

The Zoological Record for 1877; being Volume Fourteenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1879. Price 10*s*.

The Zoological Record for 1878; being Volume Fifteenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1880. Price 10*s*.

The Zoological Record for 1879; being Volume Sixteenth of the Record of Zoological Literature. Edited by EDWARD CALDWELL RYE, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1881. Price 10*s*.

The Zoological Record for 1880; being Volume Seventeenth of the Record of Zoological Literature. Edited by Edward Caldwell Rye, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1881. Price 10*s.*

The Zoological Record for 1881; being Volume Eighteenth of the Record of Zoological Literature. Edited by Edward Caldwell Rye, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1882. Price 10*s.*

The Zoological Record for 1882; being Volume Nineteenth of the Record of Zoological Literature. Edited by Edward Caldwell Rye, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1883. Price 10*s.*

The Zoological Record for 1883; being Volume Twentieth of the Record of Zoological Literature. Edited by Edward Caldwell Rye, F.Z.S., M.E.S., Editor Ent. M. Mag., Librarian to the Royal Geographical Society. London, 1884. Price 10*s.*

The Zoological Record for 1884; being Volume the Twenty-first of the Record of Zoological Literature. Edited by F. Jeffrey Bell, M.A., Sec. R.M.S., Professor of Comparative Anatomy and Zoology in King's College, London. London, 1885. Price 10*s.*

The Zoological Record for 1885; being Volume the Twenty-second of the Record of Zoological Literature. Edited by F. Jeffrey Bell, M.A., Sec. R.M.S., Professor of Comparative Anatomy and Zoology in King's College, London. London, 1886. Price 30*s.*

The Zoological Record for 1886; being Volume the Twenty-third of the Record of Zoological Literature. Edited by Frank E. Beddard, M.A., F.Z.S., Prosector and Davis Lecturer to the Zoological Society of London. London, 1887. Price 30*s.*

These publications may be obtained at the Society's Office *(3 Hanover Square, W.), of Messrs.* Gurney and Jackson *(Paternoster Row, E.C.), or through any bookseller.*

LIST OF THE PUBLICATIONS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

THE scientific publications of the Zoological Society are of two kinds — "Proceedings," published in an octavo form, and "Transactions," in quarto.

According to the present arrangements, the "Proceedings" contain not only notices of all business transacted at the scientific meetings, but also all the papers read at such meetings and recommended to be published in the "Proceedings" by the Committee of Publication. From fifty to seventy coloured plates and engravings are attached to each annual volume of the "Proceedings," to illustrate the new or otherwise remarkable species of animals described in them. Amongst such illustrations, figures of the new or rare species acquired in a living state for the Society's Gardens are often given.

The "Proceedings" for each year are issued in four parts, on the first of the months of June, August, October, and April, the part published in April completing the volume for the preceding year. The price is 12*s.* per part for the edition with coloured, and 3*s.* per part for that with uncoloured Plates.

The "Transactions" contain such of the more important communications made to the scientific meetings of the Society as, on account of the nature of the plates required to illustrate them, are better adapted for publication in the quarto form. They are issued at irregular intervals.

Fellows and Corresponding Members, upon payment of a Subscription of One Guinea before the day of the Anniversary Meeting in each year, are entitled to receive all the Society's Publications for the year. They are likewise entitled to purchase the Publications of the Society at 25 per cent. less than the price charged for them to the Public. A further reduction of 25 per cent. is made upon purchases of Publications issued prior to 1861, if they exceed the value of five pounds.

The following is a complete list of the publications of the Society already issued. They may be obtained at the Society's Office (3 Hanover Square, W.), at Messrs. Longmans', the Society's publishers (Paternoster Row, E.C.), or through any bookseller.

[**April, 1888.**]

TRANSACTIONS OF THE ZOOLOGICAL SOCIETY OF LONDON.

4to. 11 vols. and Seven Parts.

					To Fellows. £	s.	d.		To the Public. £	s.	d.
Vol. I.,	containing	59 Plates	(1833–35)	Price	3	13	6	....	4	18	0*
Vol. II.,	„	71 „	(1835–41)	„	4	0	0	....	5	6	6*
Vol. III.,	„	63 „	(1842–49)	„	3	8	3	....	4	11	0*
Vol. IV.,	„	78 „	(1851–62)	„	6	2	0	....	8	2	6*
Vol. V.,	„	67 „	(1862–66)	„	5	4	3	....	6	19	0
Vol. VI.,	„	91 „	(1866–69)	„	11	5	0	....	15	0	0
Vol. VII.,	„	73 „	(1869–72)	„	8	17	0	....	11	16	0
Vol. VIII.,	„	82 „	(1872–74)	„	9	8	3	....	12	11	0
Vol. IX.,	„	99 „	(1875–77)	„	12	0	0	....	16	0	0
Vol. X.,	„	94 „	(1877–79)	„	10	0	3	....	13	7	0
Index, Vols. I.–X.				„	0	7	6	....	0	10	0
Vol. XI., part 1,	containing	4 Plates	(Jan. 1880)	„	0	12	0	....	0	16	0
Vol. XI., „ 2,	„	7 „	(Aug. 1880)	„	0	18	0	....	1	4	0
Vol. XI., „ 3,	„	8 „	(Mar. 1881)	„	1	2	6	....	1	10	0
Vol. XI., „ 4,	„	3 „	(Apr. 1881)	„	0	7	6	....	0	10	0
Vol. XI., „ 5,	„	13 „	(June 1881)	„	0	18	6	....	1	4	0
Vol. XI., „ 6,	„	6 „	(Jan. 1882)	„	0	12	0	....	0	16	0
Vol. XI., „ 7,	„	9 „	(Oct. 1882)	„	0	15	0	....	1	0	0
Vol. XI., „ 8,	„	11 „	(Jan. 1883)	„	0	12	0	....	0	16	0
Vol. XI., „ 9,	„	10 „	(Oct. 1883)	„	0	12	0	....	0	16	0
Vol. XI., „ 10,	„	12 „	(May 1885)	„	1	11	6	....	2	2	0
Vol. XI., „ 11,	„	14 „	(Nov. 1885)	„	1	11	6	....	2	2	0
Vol. XII., „ 1,	„	6 „	(Feb. 1886)	„	0	9	0	....	0	12	0
Vol. XII., „ 2,	„	7 „	(Apr. 1886)	„	0	12	0	....	0	16	0
Vol. XII., „ 3,	„	2 „	(Aug. 1886)	„	0	4	6	....	0	6	0
Vol. XII., „ 4,	„	12 „	(Oct. 1886)	„	0	15	0	....	1	0	0
Vol. XII., „ 5,	„	5 „	(Dec. 1886)	„	0	9	0	....	0	12	0
Vol. XII., „ 6,	„	7 „	(Apr. 1887)	„	0	12	0	....	0	16	0
Vol. XII., „ 7,	„	8 „	(Apr. 1888)	„	0	9	0	....	0	12	0

PROCEEDINGS OF THE COMMITTEE OF SCIENCE AND CORRESPONDENCE OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 2 vols.

				To Fellows.		To the Public.
Part I.	1830–31.	1 vol. 8vo.	Price	4*s.* 6*d.*	..	6*s.*†
„ II.	1832.	„	„	4*s.* 6*d.*	..	6*s.*

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 15 vols. and Index. (First Series.)

			Price to Fellows.		Price to the Public.
Part I.	1833.	1 vol. 8vo.	4*s.* 6*d.*	..	6*s.*
„ II.	1834.	„	4*s.* 6*d.*	..	6*s.*
„ III.	1835.	„	4*s.* 6*d.*	..	6*s.*
„ IV.	1836	„	4*s.* 6*d.*	..	6*s.*
„ V.	1837.	„	4*s.* 6*d.*	..	6*s.*
„ VI.	1838.	„	4*s.* 6*d.*	..	6*s.*
„ VII.	1839.	„	4*s.* 6*d.*	..	6*s.*
„ VIII.	1840.	„	4*s.* 6*d.*	..	6*s.*†
Part IX.	1841.	1 vol. 8vo.	4*s.* 6*d.*	..	6*s.*
„ X.	1842.	„	4*s.* 6*d.*	..	6*s.*
„ XI.	1843.	„	4*s.* 6*d.*	..	6*s.*
„ XII.	1844.	„	4*s.* 6*d.*	..	6*s.*
„ XIII.	1845.	,	4*s.* 6*d.*	..	6*s.*
„ XIV.	1846.	„	4*s.* 6*d.*	..	6*s.*
„ XV.	1847.	„	4*s.* 6*d.*	..	6*s.*
Index	1830–1847.	„	4*s.* 6*d.*	..	6*s.*

* No perfect copies of these volumes remain in stock. † Out of print.

PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

8vo. 13 vols. and Index. (Second Series.)

			Letterpress only.		With Plates Coloured.	
			To Fellows.	To the Public.	To Fellows. £ s. d.	To the Public. £ s. d.
Part XVI.	1848.	1 vol. 8vo.	4s. 6d.	6s.	Price 1 0 9	1 7 6†
„ XVII.	1849.	„	4s. 6d.	6s.	„ 1 0 9	1 7 6†
„ XVIII.	1850.	„	4s. 6d.	6s.	„ 1 8 6	1 18 0†
„ XIX.	1851.	„	4s. 6d.	6s.	„ 0 15 9	1 1 0†
„ XX.	1852.	„	4s. 6d.	6s.	„ 0 15 9	1 1 0†
„ XXI.	1853.	„	4s. 6d.	6s.	„ 0 18 0	1 4 0†
„ XXII.	1854.	„	4s. 6d.	6s.	„ 0 19 6	1 6 0
„ XXIII.	1855.	„	4s. 6d.	6s.	„ 1 8 6	1 18 0†
„ XXIV.	1856.	„	4s. 6d.	6s.	„ 1 0 9	1 7 6†
„ XXV.	1857.	„	4s. 6d.	6s.	„ 1 0 9	1 7 6
„ XXVI.	1858.	„	4s. 6d.	6s.	„ 1 11 6	2 2 0
„ XXVII.	1859.	„	4s. 6d.	6s.	„ 1 11 6	2 2 0†
„ XXVIII.	1860.	„	4s. 6d.	6s.	„ 1 11 6	2 2 0
Index 1848–1860.		„	4s. 6d.	6s.		

ILLUSTRATIONS TO THE PROCEEDINGS OF THE ZOOLOGICAL SOCIETY OF LONDON, 1848–60. 8vo. 6 vols.

		Plates Uncoloured.		Plates Coloured.	
		To Fellows. £ s. d.	To the Public. £ s. d.	To Fellows. £ s. d.	To the Public. £ s. d.
Mammalia	1 vol.,	1 2 6	1 10 0	Price 2 7 3	3 3 0†
Aves	2 vols.,	2 7 3	3 3 0	„ 4 14 6	6 6 0†
Reptilia et Pisces	1 vol.,	0 15 9	1 1 0*	„ 1 2 6	1 10 0†
Mollusca	1 vol.,	0 15 9	1 1 0*	„ 1 2 6	1 10 0†
Annulosa et Radiata	1 vol.,	1 11 6	2 2 0	„ 2 7 3	3 3 0†

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON.

	Letterpress only.		Plates only.		Complete.	
	To Fellows.	To the Public.	To Fellows.	To the Public.	To Fellows.	To the Public
1861, cloth	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1862, „	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1863, „	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1864, „	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1865, „	4s. 6d.	6s.	30s. 9d.	41s.‡	33s. 9d.	45s.
1866, „	4s. 6d.	6s.	30s. 9d.	41s.	33s. 9d.	45s.

	With Plates, uncoloured.		With Plates, coloured.	
	To Fellows.	To the Public.	To Fellows.	To the Public.
1867	9s. 0d.	12s.	33s. 9d.	45s.
1868	9s. 0d.	12s.	33s. 9d.	45s.
1869	9s. 0d.	12s.	33s. 9d.	45s.
1870	9s. 0d.	12s.	33s. 9d.	45s.
Index, 1861–1870	4s. 6d.	6s.		
1871	9s. 0d.	12s.	33s. 9d.	45s.
1872	9s. 0d.	12s.	33s. 9d.	45s.§
1873	9s. 0d.	12s.	33s. 9d.	45s.§
1874	9s. 0d.	12s.§	36s. 0d.	48s.§
1875	9s. 0d.	12s.	36s. 0d.	48s.§
1876	9s. 0d.	12s.	36s. 0d.	48s.§

* No perfect copies of these volumes remain in stock.
† Out of print.
‡ Only uncoloured copies of these plates can now be supplied, at 10s. 6d. each volume.
§ Out of print, but odd parts may be obtained.

PROCEEDINGS OF THE SCIENTIFIC MEETINGS OF THE ZOOLOGICAL SOCIETY OF LONDON (*continued*).

	With Plates, uncoloured.		With Plates, coloured.	
	To Fellows.	To the Public.	To Fellows.	To the Public.
1877	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1878	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1879	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1880	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*†
Index, 1871–1880	4*s.* 6*d.*	6*s.*		
1881	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1882	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1883	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1884	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*
1885	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*†
1886	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*†
1887	9*s.* 0*d.*	12*s.*	36*s.* 0*d.*	48*s.*

(Bound in Cloth 3*s.* extra.)

† Out of print, but odd parts may be obtained.

LISTS OF THE ANIMALS IN THE SOCIETY'S GARDENS.

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. 8vo. 1862. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Second Edition.) 8vo. 1863. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Third Edition.) 8vo. 1865. Price 1*s.* 6*d.*

List of Vertebrated Animals Living in the Gardens of the Zoological Society of London. (Fourth Edition.) 8vo. 1866. Price 1*s.* 6*d.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. 8vo. 1872. Price 2*s.*

Revised List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—Supplement, containing Additions received in 1872, 1873, and 1874. 8vo. 1875. Price 1*s.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Sixth Edition.) 8vo. 1877. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Seventh Edition.) 8vo. 1879. Price 3*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London.—First Supplement, containing Additions received in 1879. 8vo. 1880. Price 1*s.* 6*d.*

List of the Vertebrated Animals now or lately Living in the Gardens of the Zoological Society of London. (Eighth Edition.) 8vo. 1883. Price 3*s.* 6*d.*

Catalogue of the Library of the Zoological Society of London. (Fourth Edition.) 1887. In cloth. Price 4*s.*

These publications may be obtained at the Society's Office (3 *Hanover Square, W.*), *at Messrs.* Longmans' (*Paternoster Row, E.C.*), *or through any bookseller.*

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1887.

PART I.

CONTAINING PAPERS READ IN

JANUARY AND FEBRUARY.

JUNE 1st, 1887.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.
LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*]

LIST OF CONTENTS.

PART I.—1887.

January 18, 1887.

February 1, 1887.

Contents continued on page 3 of wrapper.

2. VERTIGO TANTILLA.

Pupa (*Vertigo*) *tantilla*, Gould, Proc. Bost. Soc. Nat. Hist. 1847, p. 197 ; Pfeiffer, Mon. Hel. iii. p. 557 ; (*Vertigo*) Mousson, Journ. de Conch. 1870, p. 127 ; (*Vertigo*) Schmeltz, Cat. Mus. Godeff. iv. p. 69 ; (*Pupinella*) Paetel, Cat. Conch. 1873, p. 108.

Vertigo tantilla, Gould, Expl. Exp., Shells, p. 92, fig. 103 ; (*Aiæa*) H. & A. Adams, Gen. Moll. ii. p. 172 ; Pease, Proc. Zool. Soc. 1871, pp. 460, 463, 474 ; Garrett, Journ. Phil. Acad. Nat. Sci. 1881, p. 400, 1885, p. 84.

Pupa pleurophora, Shuttleworth, Bern. Mittheil. 1852, p. 296 ; Pfeiffer, Mon. Hel. iii. p. 560.

Vertigo pleurophora, Pease, Proc. Zool. Soc. 1871, p. 474.

Pupa dunkeri, "Zelebor," Pfeiffer, Mon. Hel. vi. p. 333.

Vertigo dunkeri, Pease, Proc. Zool. Soc. 1871, p. 474.

Vertigo armata, Pease, Proc. Zool. Soc. 1871, pp. 461, 474.

Pupa armata, Pfeiffer, Mon. Hel. viii. p. 407.

Vertigo dentifera, Pease, Proc. Zool. Soc. 1871, pp. 462, 474.

Pupa dentifera, Pfeiffer, Mon. Hel. viii. p. 408.

Ranges from the Society to the Viti Islands. This and the preceding species are found beneath rotten wood, under stones, and amongst decaying leaves.

In shape it varies from an abbreviate-ovate to oblong-oval, and also in a greater or less degree in the relative proportion of the whorls. Colour pale corneous under a brownish, more or less distinctly shagreened epidermis, which in perfect examples is furnished with oblique membranous riblets. The last whorl, behind the peristome, is frequently bisulcate.

CONTENTS (*continued*).

LIST OF PLATES.

1887.

PART I.

NOTICE.

According to present arrangements the 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November and December, on April 1st.

The price is 12*s*. per part for the edition with coloured, and 3*s*. per part for that with uncoloured Plates.

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1887.

PART II.

CONTAINING PAPERS READ IN

MARCH AND APRIL.

AUGUST 1st, 1887.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.
LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*]

LIST OF CONTENTS.

PART II.—1887.

March 1, 1887.

March 15, 1887.

April 5, 1887.

Contents continued on page 3 of wrapper.

of damaging the *L. atrocroceus.* At length (several interlacing branches partly screening the birds) he ventured a shot, and had the satisfaction of securing the prize in excellent condition. The *L. atrococcineus* still kept in close proximity, apparently looking out for his opponent. Mr. Eriksson shot this specimen also, in order to make sure of its being a male.

"This discovery of a second example of *L. atrocroceus* in a locality so little removed from that of the first is of much interest; and in the complete absence of any record of so conspicuous and striking a bird from any other part of Africa, tends strongly to localize the race or variety within very narrow limits. [The sex of Dr. Bradshaw's specimen was not ascertained.]

"The case of this *Laniarius* seems much to resemble those of the singular form of Cheetah (*Felis lanea* of Sclater), of which only five specimens are known, all from the very limited area of Nel's Point, in the Beaufort District of the Cape Colony, and the equally aberrant Leopard (*F. pardus*, L., var. *melas*; see Trimen, P. Z. S. 1883, p. 535, and Günther, P. Z. S. 1885, pl. xvi. p. 243), of which only three examples are known, from the neighbourhood of the Koonap River, in the Fort-Beaufort District on the eastern side of the Cape Colony. It is very noticeable that, in all three cases, the abnormal form does not replace the normal one to which it is so nearly related, but occurs in the midst of the latter, quite isolated, yet appearing to maintain and perpetuate (albeit in but very few individuals) its peculiarities of colouring or of pattern."

CONTENTS (*continued*).

April 19, 1887.

May 3, 1887.

LIST OF PLATES.

1887.

PART II.

NOTICE.

According to present arrangements the 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November and December, on April 1st.

The price is 12*s*. per part for the edition with coloured, and 3*s*. per part for that with uncoloured Plates.

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON,

FOR THE YEAR

1887.

PART III.

CONTAINING PAPERS READ IN

MAY AND JUNE.

OCTOBER 1st, 1887.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*]

LIST OF CONTENTS.

PART III.—1887.

May 3, 1887.

May 17, 1887.

June 7, 1887.

Contents continued on page 3 of wrapper.

CONTENTS (*continued*).

June 23, 1887.

LIST OF PLATES.

1887.

PART III.

NOTICE.

According to present arrangements the 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November and December, on April 1st.

The price is 12*s.* per part for the edition with coloured, and 3*s.* per part for that with uncoloured Plates.

PROCEEDINGS

OF THE

SCIENTIFIC MEETINGS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON,

FOR THE YEAR

1887.

PART IV.

CONTAINING PAPERS READ IN

NOVEMBER AND DECEMBER.

APRIL 1st, 1888.

PRINTED FOR THE SOCIETY,
SOLD AT THEIR HOUSE IN HANOVER SQUARE.

LONDON:
MESSRS. LONGMANS, GREEN, AND CO.,
PATERNOSTER-ROW.

[*Price Twelve Shillings.*].

LIST OF CONTENTS.

PART IV.—1887.

Page

June 23, 1887 (*continued*).

November 15, 1887.

Contents continued on page 3 of wrapper.

December 6, 1887.

December 20, 1887.

LIST OF PLATES.

1887.

PART IV.

NOTICE.

According to present arrangements the 'Proceedings' are issued in *four* parts, as follows:—

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.
III. ,, ,, ,, May and June, on October 1st.
IV. ,, ,, ,, November and December, on April 1st.

The price is 12*s.* per part for the edition with coloured, and 3*s.* per part for that with uncoloured Plates.