PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1901, vol. II.
(MAY—DECEMBER.)

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

LONDON:
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PATERNOSTER ROW.

LIST

OF THE

COUNCIL AND OFFICERS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1901.

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(*Elected April 29th*, 1901.)

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PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY

OF LONDON.

1901, vol. II.

PART I.

CONTAINING PAPERS READ IN

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OCTOBER 1st, 1901.

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THE ZOOLOGICAL SOCIETY OF LONDON.

This Society was instituted in 1826, under the auspices of Sir Humphry Davy, Bart., Sir Stamford Raffles, and other eminent Savants, for the advancement of Zoology and Animal Physiology, and for the introduction of new and curious subjects of the Animal Kingdom, and was incorporated by Royal Charter in 1829.

COUNCIL.

The Society consists of Fellows, and Honorary, Foreign, and Corresponding Members, elected according to the Bye-Laws.

The Gardens in the Regent's Park are open from Nine o'clock A.M. till Sunset.

The Offices (3 Hanover Square, W.), where all communications should be addressed, are open from Ten till Five, except on Saturdays, when they close at Two o'clock P.M.

The Library (3 Hanover Square), under the superintendence of Mr. F. H. Waterhouse, Librarian, is open from 10 A.M. to 5 P.M., on Saturdays to 2 P.M. It is closed in the month of September.

The Meetings of the Society for General Business are held at the Office on the Thursday following the third Wednesday in every month of the year, except in September and October, at Four P.M.

The Meetings for Scientific Business are held at the Office twice a month on Tuesdays, except in July, August, September, and October, at half-past Eight o'clock P.M.

The Anniversary Meeting is held on the 29th April, at Four P.M.

TERMS FOR THE ADMISSION OF FELLOWS.

Fellows pay an Admission Fee of £5, and an annual Contribution of £3, due on the 1st of January, and payable in advance, or a Composition of £30 in lieu thereof; the whole payment, including the Admission Fee, being £35.

No person can become a Fellow until his Admission Fee and First Annual Subscription have been paid, or the annual payments have been compounded for.

Fellows elected after the 30th of September are not liable for the Subscriptions for the year in which they are elected.

PRIVILEGES OF FELLOWS.

Fellows have Personal Admission to the Gardens with Two Companions daily, upon signing their names in the book at the entrance gate.

Fellows receive a Book of Saturday and a Book of Sunday Orders every year. These Orders admit *two* persons to the Gardens on each Saturday and *two* on each Sunday in the year. But the Saturday

Orders are *not* available if the FELLOW shall have used his privilege of *personally* introducing two companions on the *same day*.

FELLOWS also receive every year Twenty Free Tickets (Green), each valid for the admission of one adult any day of the week, including Sunday. Children's Tickets (Buff) can be had in lieu of Green Tickets in the proportion of two Children's Tickets to on Adult's. These Tickets, if not made use of in the year of issue, are available for following years.

FELLOWS, if they wish it, can exchange the Book of Saturday Orders for Twenty Green Tickets available for any day. The Book of Sunday Orders can also be exchanged for a similar packet of Twenty Tickets. These books must, however, be returned entire, and the exchange can only be made during the year of their issue.

The annual supply of Tickets will be sent to each FELLOW on the 1st of January in every year, on his filling up a form of Standing Order stating in what way they should be made up, and to what address they should be sent. Forms for this purpose are supplied on application.

The WIFE of a FELLOW can exercise all these privileges in his absence.

FELLOWS have the privilege of receiving the Society's Publications on payment of the additional Subscription of One Guinea every year. This Subscription is due upon the 1st of January and must be paid *before* the day of the Anniversary Meeting, after which the privilege lapses. FELLOWS are likewise entitled to purchase the Transactions and other Publications of the Society at 25 per cent. less than the price charged to the public. A further reduction of 25 per cent. is also made upon all purchases of Publications issued prior to 1871, if above the value of Five pounds.

FELLOWS also have the privilege of subscribing to the Annual Volume of the Zoological Record for a sum of £1, payable on the 1st July in each year, but this privilege is forfeited unless the subscription be paid *before* the 1st of December following.

They may also obtain a TRANSFERABLE IVORY TICKET admitting Two Persons, available throughout the whole period of Fellowship, on payment of Ten Pounds in one sum. A second similar ticket may be obtained on payment of a further sum of Twenty Pounds.

Any Fellow who intends to be absent from the United Kingdom during the space of one year or more may, upon giving to the Secretary notice in *writing*, have his name placed upon the "dormant list," and will be thereupon exempt from the payment of his annual contribution during such absence.

Any Fellow, having paid all fees due to the Society, is at liberty to withdraw his name upon giving notice in *writing* to the Secretary.

Persons who wish to become Fellows of the Society are requested to communicate with the undersigned.

PHILIP LUTLEY SCLATER, M.A., D.Sc., F.R.S.,
Secretary.

3 Hanover Square, London, W.,
October, 1901.

MEETINGS

OF THE

ZOOLOGICAL SOCIETY OF LONDON

FOR

SCIENTIFIC BUSINESS.

(AT 3 HANOVER SQUARE, W.)

Session 1901–1902.

1901.

Tuesday, November 19	Tuesday, December 3 and 17

1902.

Tuesday, January 14	Tuesday, April .. 15
,, February 4 and 18	,, May 6
,, March .. 4 ,, 18	,, June .... 3 and 17

The Chair will be taken at half-past Eight o'clock in the Evening precisely.

LIST OF THE PUBLICATIONS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

THE scientific publications of the Zoological Society of London 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. A large number of 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 last half of the preceding year. Commencing from January 1901 they form two half-yearly volumes.

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 1871, if they exceed the value of five pounds.

Fellows also have the privilege of subscribing to the Annual Volume of the Zoological Record for a sum of £1 (which includes delivery in the United Kingdom *only*), payable on the 1st July in each year; but this privilege is forfeited unless the subscription be paid *before* the 1st of December following.

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*, 1901.]

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THE object of the ZOOLOGICAL RECORD is to give, by means of an annual Volume, complete lists of the Works and Publications relating to Zoology in all its branches that have appeared during the year preceding the issue of the Volume; together with full information as to the points they deal with, arranged in such a manner as to serve as an Index to the literature of Zoology in all parts of the globe, and thus 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.

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P. L. SCLATER,
Secretary.

October, 1901.
ZOOLOGICAL SOCIETY OF LONDON,
3 HANOVER SQUARE, W.

LIST OF VOLUMES OF THE 'ZOOLOGICAL RECORD.'

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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*.

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By order of the Council,

P. L. SCLATER,

Secretary.

3 Hanover Square, London, W.,
October, 1901.

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1901, Vol. II. (May to December).

May 7, 1901.

Prof. G. B. Howes, LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions made to the Society's Menagerie in April 1901:—

The registered additions to the Society's Menagerie during the month of April were 200 in number. Of these 52 were acquired by presentation, 51 by purchase, 2 were born in the Gardens, and 95 were received on deposit. The total number of departures during the same period, by death and removals, was 156.

His Majesty The King has ordered some animals, lately kept at Windsor, to be transferred to the Society's Gardens and placed under our care. Amongst these is the beautiful female Grèvy's Zebra (*Equus grevyi*) which was presented (along with a male of the same animal) to Her late Majesty Queen Victoria in August 1899, and was subsequently removed from the Gardens (where they were temporarily deposited) to Windsor. This animal is now in most perfect health and condition, and through the kind efforts of Lt.-Col. Harrington, H.B.M. Representative in Abyssinia, we are hoping to obtain a young male of the same species.

I may also call attention to two beautiful birds—a Rufous-necked Scimitar Babbler (*Pomatorhinus ruficollis*) and a Golden-backed Woodpecker (*Brachypternus aurantius*)—presented on

April 11th by Mr. W. H. Harper, F.Z.S., who continues to send us most interesting additions to our collection of Indian Birds; and to a fine young male Eland, bred at Woburn, and presented to us on April 26th by H.G. the Duke of Bedford, which will make an excellent match for our young female purchased in April 1899.

Mr. Sclater stated that Mr. E. Bidwell had kindly pointed out to him the following passage in Ludolphus's work[1] on Abyssinia, published in 1682, which apparently referred to Grèvy's Zebra (*Equus grevyi*):—

"But there is a beast which is called *Zecora*, which for beauty exceeds all the four-footed creatures in the World. They of Congo give it the name of Zebra. This creature is about the bigness of a Mule, and is brought out of the woods of Habessinia, and the countries possessed by the *Galans*, and easily tam'd. A present of great esteem and frequently given to the Kings of Habessinia. *Tellez* briefly describes him thus,—'A Circle of black colour encompasses his Loyns like a girdle; adjoining to which, Nature has pencilled out several others, some broader, some narrower, some black, and some of a bright shining Ash-colour; with so much Elegancy and order, as no Painter's Art can equalize. His ears are the only thing that disfigures him; being of a disproportionable length: for which reason he is called by the Portugals "Burro do Matto" (though improperly) the wild Ass.' But you may guess at his beauty, by his price, for King Susneus having given one of these beasts to the Turkish Basha of Suaqena, he sold the same for Two thousand *Venetian* Pieces, to a certain *Indian*, that bought him for a present to the great *Mogul*."

Mr. C. Davies Sherborn, F.Z.S., remarked that it had been his privilege to bring before the Society, from time to time, the progress of the 'Index Animalium.' He had now to inform the Society that the Index was completed from the 1st of January, 1758, to the 31st of December, 1800. This portion of the manuscript was ready for press, and negotiations with the Cambridge University Press were in progress for printing it.

One of the chief difficulties that the compiler had to contend with was the inaccessibility of much of the literature. With the exception of about twenty books, which from their titles might possibly contain specific names, this difficulty had been successfully grappled with, either with the help of those interested in the work or by purchase. He alluded to the impossibility of accurate comparison of various editions, copies of which were in different institutions, and lamented the fact that even in the British Museum (Nat. Hist.), where the collection of books was very complete, this matter of editions had not been fully grasped. He had

[1] Ludolphus, J. A New History of Ethiopia, being a full and Accurate Description of the Kingdom of Abyssinia . . . . called the Empire of Prester John. By the Learned Job Ludolphus. Made English by J. P. Gent. Plates. Folio. *London*, 1682.

H. H. Johnston pinx.
P. J. Smit lith.

THE OKAPI.
(OKAPIA JOHNSTONI)
(reduced one half from Sir Harry Johnston's original painting)

Mintern Bros. imp.

himself been instrumental in purchasing many hundreds of volumes dealing with systematic zoology, published before 1800, and these were now in public libraries and therefore accessible to zoologists. Instancing Buffon's 'Histoire Naturelle,' Mr. Sherborn said that he had purchased no less than six editions, published before the close of the eighteenth century, all of which included specific names of importance to systematists, and none of which had previously been seen in this country. These and many other books were essential to proper work.

A great deal of manuscript had been accumulated towards the 1801–1900 portion of the Index, but as it was beyond the powers of one man to deal with the vast literature of the last hundred years, progress would necessarily be slow unless further assistance were forthcoming. Mr. Sherborn hoped that the first volume would be of service to zoologists, as that would no doubt be an incentive to the further support desirable. This part 1, 1758–1800, had taken him over eight years to compile, arrange, and get ready for press.

Dr. W. G. Ridewood, F.Z.S., exhibited and made remarks on a series of microscopic preparations of the hairs of Antelopes, Giraffe, Zebra, and the so-called *Equus johnstoni*, pointing out that the hairs of the last-named animal were similar to those of the Giraffe as well as those of the Zebra, but differed from those of the Antelopes.

Mr. Sclater exhibited an original water-colour painting (Plate I.) made by Sir Harry Johnston, K.C.B., F.Z.S., of the new Mammal[1], which he had discovered in the forest on the west side of the Semliki River, on the south-western boundary of Uganda, and portions of the skin of which had been already laid before the Society (see P. Z. S. 1900, pp. 774, 950; 1901, vol. i. p. 50).

Mr. Sclater read the following extracts from a letter addressed to him by Sir Harry Johnston on the subject, dated Eldama Ravine, Uganda Protectorate, 31st March, 1901:—

"I am sending you by this mail a water-colour painting I have made of the new animal. I have done this painting with the utmost care from the skin while it was in a fresh condition. I have used the skull to assist me in delineating the exact shape of the head. I have also questioned various Congo natives who are with me as to the shape and appearance of the animal, and the result is this drawing, which I think will be found to be a fairly faithful representation of this wonderful new creature.

"I wish to impress on you this, that the colours in the drawing are absolutely not exaggerated in any way in brightness. I say this, because the skin may have a dulled and faded appearance when it reaches England. I scarcely remember ever coming

[1] See below (June 18th) for the origin of the scientific name now applied to this animal.—P. L. S.

across the skin of a mammal which came so near to having actual bright red in it. I think you will agree with me that the general coloration is of the most extraordinary kind, and that if the skin were not there as evidence, it would be thought to be an invention of my imagination. If you examine the skin, however, you will see that my drawing is correct in the tiniest details of the stripes. In my drawing I have made the tail a trifle longer, because from information received I gathered that the tail of the specimen had suffered a little at its extremity. I am also told that the animal having been roughly skinned, some of the skin on the inner side of the legs and belly is absent.

"These missing portions are not considerable, and were of a creamy-white colour, except in regard to the stomach and chest, of which the fur is blackish-brown. The missing hoofs were bluish-black."

Mr. Sclater remarked that there could now be no doubt that Sir Harry Johnston had made a most important discovery. The animal portrayed in the drawing (Plate I.) was, of course, not a Zebra, nor even a member of the family *Equidæ*. What should be its proper position it would only be possible to say when the skin and two skulls, recently obtained by Sir Harry, were received in this country. It was probable, however, that Sir Harry was not far wrong when, in one of his letters, he called it a *Helladotherium*, and that it would be found to be allied to that or to one of the other extinct forms of Mammals allied to the Giraffe.

The leading facts as yet known concerning this new and extraordinary discovery had been fully given in an article published in 'The Times' of this day, from which the following extracts were read:—

"After sending home incomplete fragments of skin which he obtained *in situ* from the natives of the Congo forest near the Semliki River (fragments of which were considered to indicate the existence of a new species of Horse, which was tentatively named by Mr. Sclater *Equus johnstoni*), Sir Harry Johnston has at last secured, through the kindness of the Belgian authorities at the frontier post of Fort Mbeni, a complete skin and two skulls of this animal, which is now shown to be not at all a horse, but a cloven-hoofed ruminant of extraordinary coloration and appearance, which seemingly is either of the extinct genus *Helladotherium*, or is some closely-allied creature belonging to that somewhat vaguely-defined group of which the Giraffe is an exemplar. The skin and the skulls which have been forwarded by Sir Harry Johnston to the British Museum were obtained by native soldiers of the Congo Free State, in the vicinity of Fort Mbeni, and were very kindly presented to Sir Harry Johnston by Mr. K. Eriksson, a Swedish officer in the service of that State, who has until recently been the Commandant of Fort Mbeni. It is to be hoped that these invaluable specimens will reach London safely.

"We are informed that the complete skin sent home now shows the animal to be coloured in the most extraordinary manner. The cheeks of the rather large head are yellowish-white, and the tapering muzzle is blackish-brown. The forehead is a most vivid red, narrowing down into a thin black line continued along the ridge of the nose to the nostrils. The long ass-like ears are of a deep reddish-brown, with silky black fringes. The neck, shoulders, stomach, and back are a deep reddish-brown, which in parts has almost a crimson tinge, and in others becomes blackish. The hind-quarters and hind legs, down to the hocks, and the front legs from the elbow to the wrist-joint are boldly striped in purplish-black and white, the white having here and there faint touches of orange. The hind legs from the hock downwards are of a creamy colour. The front legs are also cream-colour, but a bold black line runs down the front of the leg in an oblique manner. The fetlocks of all four feet are black and cream-colour. The tail is bright reddish-brown, with a black tuft at the end. There are no horns, but it may be seen from the skulls that far back in its history this creature possessed three horn-cores similar to those of the Giraffe, but that by long disuse these horn-cores have degenerated into rounded bumps on the skull, two of them being situated a little above the eyes, and one at the beginning of the nasal bones. On the skin, just over the two bigger bumps, are two tiny and comical little twists of hair, which represent all that remains outwardly of horns or horn-cores. The animal stands slightly higher at the withers than at the hindquarters, but its neck is not proportionately longer than that of a horse. The head is rather large in proportion to the body, and in outline slightly resembles the head of a Tapir. The nostrils are two long slits, completely covered with hair, and resembling the nostrils of the Giraffe. The lips apparently taper to a point. There are, of course, no front teeth in the upper jaw, as the animal is a true Ruminant. The front teeth in the lower jaw are so small and feeble as to suggest the idea that the creature, like the Giraffe, must possess a prehensile tongue for furnishing food for the molar teeth to grind. If this is not the case, then the rather long and prehensile lips secure most of the animal's nutriment, which consists of leaves. Other particulars will, no doubt, be furnished to us before long by the authorities of the British Museum, when they are able to examine the specimens. The build of the animal is rather heavy in the case of the male. The female is said to be much more lightly built, and her skull is considerably smaller than that of the male. It is not yet known whether any difference of coloration exists between the male and female; the natives say that they differ only in size. The same authorities state that the creature is found only in the densest parts of the forest, and that it goes about in pairs of male and female. It would seem to be quite inoffensive, and very easily killed. It is ordinarily captured in pitfalls, and from what Sir Harry Johnston ascertained on the spot its extinction is being rapidly carried out by the natives of the Congo Free State. Now that this discovery has been made by joint action on the part of British and Belgian officials, we may look with confidence to King

Leopold to issue stringent orders for the protection of this remarkable creature. Its flesh is said to be excellent eating, and there is no reason why an attempt should not be made to domesticate it.

"At the present time the known habitat of the Okapi (as this animal is called by the natives) consists of the forests of the Ituri and the western banks of the Semliki in the Congo Free State, and the adjoining district of Mboga in the Uganda Protectorate."

The following papers were read :—

1. On Spiders of the Family *Attidæ* found in Jamaica. By G. W. Peckham and E. G. Peckham [1].

[Received April 12, 1901.]

(Plates II.–IV.[2])

Most of the Spiders described in this paper were collected by us some years ago. We have also received some specimens from Mr. T. D. A. Cockerell, and from Mr. Taylor of Kingston. Other Attidæ that have been described from Jamaica are :— *Marptusa melanognathus* Lucas ; *Saitis annæ* Cockerell, 'Canadian Entomologist,' p. 343, 1894 ; *Anoka peckhamii*, Cockerell, 'Journal of Institute of Jamaica,' vol. ii. p. 221, 1893 ; *Zygoballus suavis* Peckham, "Spiders of the *Homalattus* Group," Occ. Papers Nat. Hist. Soc. of Wisconsin, vol. ii. p. 173. *Anoka moneagua* Peckham, "Spiders of the *Marptusa* Group," Occ. Papers Nat. Hist. Soc. of Wisconsin, vol. ii. p. 127, 1894, is identical with *Anoka peckhamii* Cockerell. The thirteen species now described probably give a fair idea of the Attid fauna of the island. The genera are like those of Central and North America, excepting *Cybele*, which we have from St. Vincent, and *Nilakantha*, which is new.

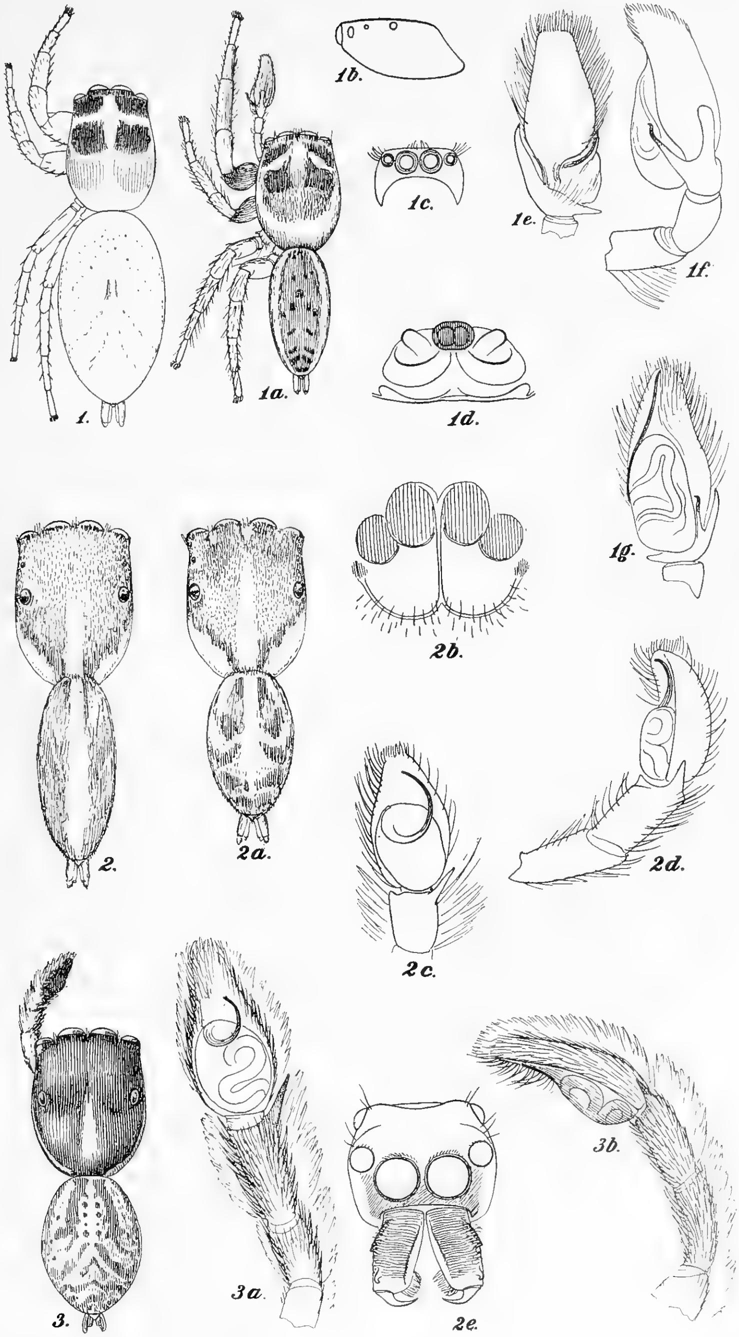
Key to the Attidæ *of Jamaica.*

Males.

1 { Legs of the first, third, and fourth pairs nearly equal ; cephalothorax with red hairs and white bands on the thoracic slope and lower sides ; length 5·5–6·5 mm. .... *Cybele grisea.*
First and fourth, or first and third, or third and fourth legs plainly longer than the others 2

2 { Legs 1 3 4 2 ; palpus blackish, with a fringe of very long white hairs on each side to the end of tarsus .... *Cybele albopalpis.*
First and fourth legs longer than the others 3
Third and fourth legs longer than the others 4

[1] Communicated by R. I. Pocock, F.Z.S.
[2] For the explanation of the Plates, see pp. 15, 16.



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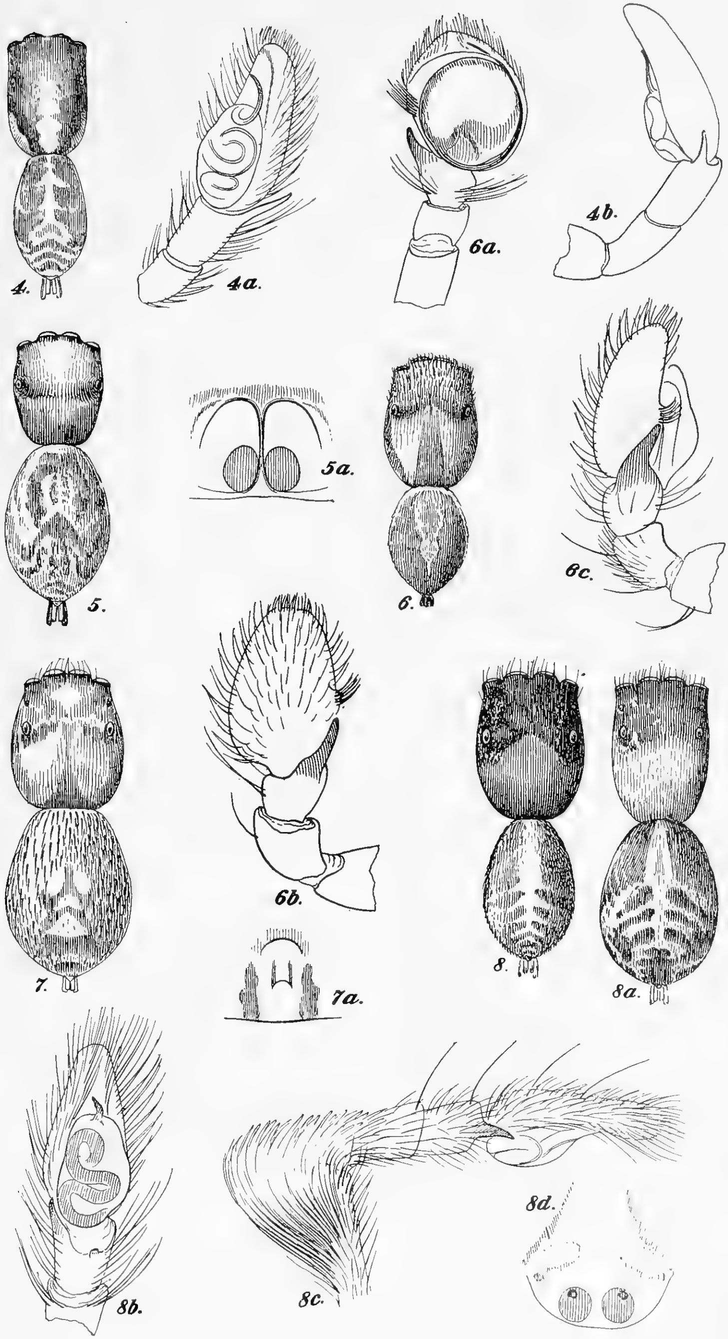

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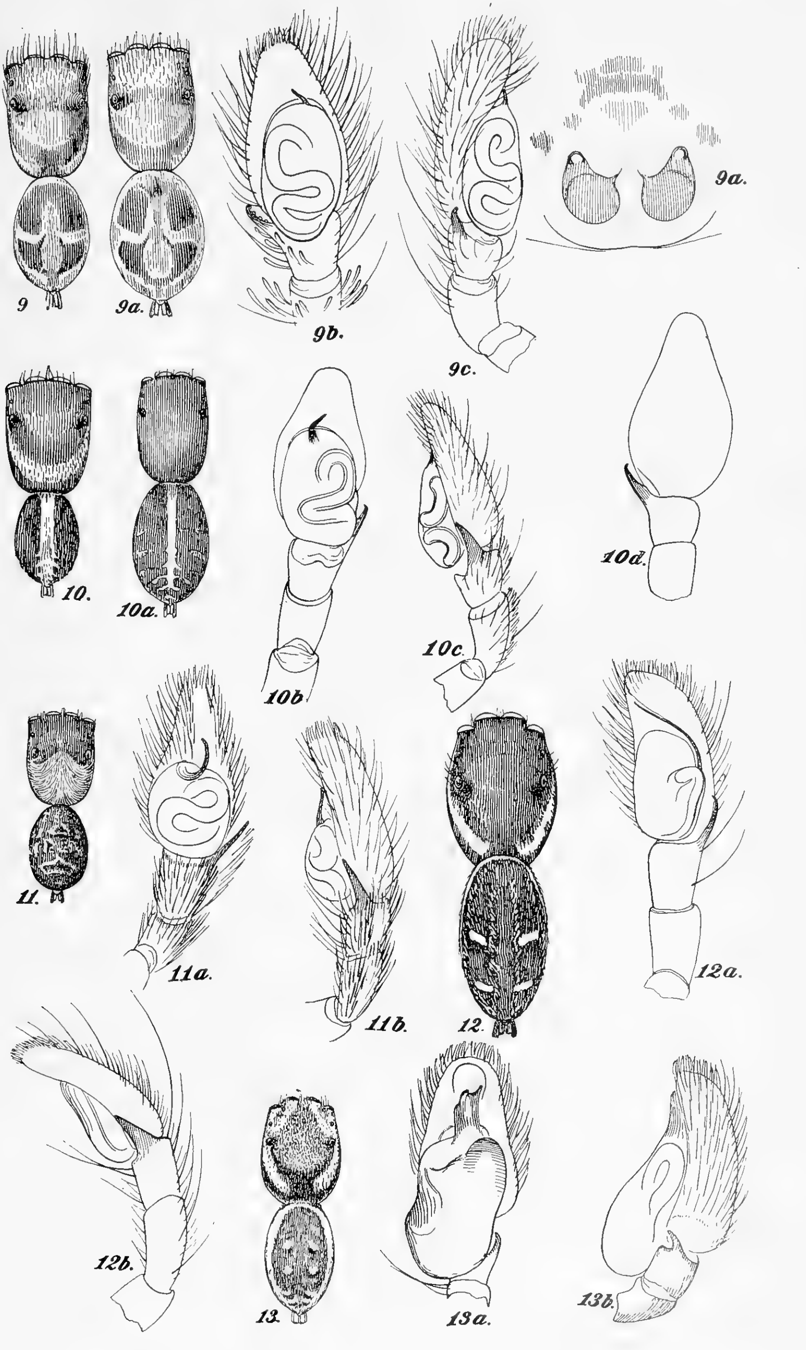
NEW ATTIDÆ FROM JAMAICA.



Bale & Danielsson Ltd

NEW ATTIDÆ FROM JAMAICA.

3 Legs $\overline{1\ 4}\ 3\ 2$; spiders small (4·5 mm.), and pale yellow in colour, with four square black spots on the eye-region .... *Nilakantha cockerelli.*

Legs $\overline{1\ 4\ 3}\ 2$; small spiders (2–3 mm.); palpus brown, with a narrow white line on the outer side .... *Prostheclina viaria.*

Legs 1 4 2 3; small spiders (4·5 mm.); cephalothorax brown, with white bands on sides and red down on upper surface and around eyes .... *Anoka peckhami.*

Legs 1 4 2 3; small spiders (3·5 mm.); abdomen brown, encircled with white, with three or four pairs of white spots ... *Dendryphantes prudens.*

Legs $1\ 4\ \overline{2\ 3}$; small spiders (4–5 mm.); cephalothorax and abdomen bronze-brown encircled with white ...... *Dendryphantes taylori.*

Legs $\overline{1\ 4}\ \overline{2\ 3}$; medium-sized spiders (8 mm.); abdomen with median band of dark rufous and white sides.................... *Marptusa melanognathus.*

Legs 1 4 2 3; falces long, oblique; quadrangle of eyes occupying more than one-half cephalothorax .... *Zygoballus suavis.*

4 Legs $3\ 4\ \overline{1\ 2}$; length about 4·5 mm.; cephalothorax fawn-coloured, with light bands on sides, curving backwards over thorax to dorsal eyes .... *Pellenes translatus.*

Legs $\overline{3\ 4}\ \overline{1\ 2}$; body and legs with crimson and green iridescent scales .... *Prostheclina perplexa.*

Legs $\overline{3\ 4}\ \overline{1\ 2}$; abdomen iridescent, with four velvety black spots .... *Prostheclina morgani.*

Legs $\overline{3\ 4}\ \overline{1\ 2}$; abdomen brown, with longitudinal, median, yellow band .... *Prostheclina venatoria.*

Legs $\overline{4\ 3}\ \overline{2\ 1}$; cephalothorax with red hairs and white bands on sides .... *Saitis* (?) *inutilis.*

Legs $\overline{4\ 3}\ \overline{1\ 2}$; length about 3·5 mm.; cephalothorax and abdomen each with a V-shaped black mark; palpus with terminal portion red-brown, becoming black at end; middle portion with tuft of shining white hairs .... *Saitis annæ.*

Females.

1 Legs $1\ 4\ \overline{2\ 3}$ .... *Anoka peckhami.*
Legs not $1\ 4\ \overline{2\ 3}$ 2

2 Legs $4\ 1\ \overline{2\ 3}$ or $\overline{4\ 1}\ 2\ 3$ 3
Legs not $4\ 1\ \overline{2\ 3}$ or $\overline{4\ 1}\ 2\ 3$ 4

3 Quadrangle occupying plainly more than one-half of the cephalothorax; cephalothorax plainly widest at the dorsal eyes; legs $\overline{4\ 1}\ 2\ 3$ .... *Zygoballus suavis.*

Quadrangle occupying less than one-half of the cephalothorax; cephalothorax not widest at dorsal eyes; legs $4\ 1\ \overline{2\ 3}$ ...... *Dendryphantes prudens.*

4 Legs 4 3 1 2 or $\overline{4\ 3}\ 1\ 2$ 5
Legs 3 4 1 2, $\overline{3\ 4}\ \overline{1\ 2}$ or $\overline{3\ 4}\ 1\ 2$ 6

5 Spiders small (4·5 mm.), pale yellow, with four square black spots on eye-region; legs 4 3 1 2 .... *Nilakantha cockerelli.*

Spiders large (9·5 mm.); dorsum of abdomen grey, with wavy outlines; dark bands on sides; legs 4 3 1 2 .... *Marptusa melanognathus.*

Spiders small (4·5 mm.); cephalothorax with golden iridescent scales except a white band on thorax; legs 4 3 1 2........... *Saitis defloccatus.*

6. Spiders covered with light brown hairs and a few longer black hairs; 3 4 1 2 .... *Pellenes banksi.*
Abdomen brown, with a longitudinal, median, yellow band; legs $\overline{3\ 4}\ \overline{1\ 2}$ .... *Prostheclina venatoria.*
Abdomen iridescent, with four velvety black spots; legs $\overline{3\ 4}$ 1 2. *Prostheclina morgani.*
Green and crimson iridescent scales on cephalothorax, abdomen, and legs .... *Prostheclina perplexa.*

Nilakantha, n. gen.

Small, pale spiders.

The cephalothorax is moderately high and is widest and highest behind the dorsal eyes. The sides are slightly contracted in front and behind. The cephalic part is a little inclined, and the thorax falls steeply from just behind the dorsal eyes. The quadrangle of the eyes is one-third wider than long, is a little wider behind than in front, and occupies one-half of the cephalothorax. The first row of eyes is plainly curved downward, the eyes being all close together, with the middle twice and a half as large as the lateral. The second row is nearer the first than the third, and the third row is as wide as the cephalothorax at that place. The legs in the male are 1 $\overline{4\ 3}$ 2, and in the female 4 3 1 2.

This genus resembles, in a general way, our *Plexippus puerperus* Hentz (Attidæ of North America, p. 33), but the spiders are smaller, the curve of the first row is different, and the middle eyes of this row are larger.

Nilakantha cockerelli, n. sp. (Plate II. figs. 1–1 *g*.)

♂. Length 4·5 mm. Legs $\overline{1\ 4}$ 3 2, first a little stoutest.

♀. Length 4·5–5·5 mm. Legs 4 3 1 2, first stoutest.

This is a small, pale, yellow species, with four square black spots on the eye-region. The lateral eyes of the first row and the small eyes of the second row are upon the front pair of spots, and the dorsal eyes on those that are further back. The clypeus and the sides of the cephalothorax are covered with light yellow hairs, which are found also in the spaces between the four black spots. The abdomen is marked with black specks, which form, more or less distinctly, lines of chevrons over the dorsum. The male has a band of yellow hairs around the front end and the sides. The falces, palpi, and legs are yellow, a little darker in the male.

We have one male and three females from Moneague and Kingston, Jamaica.

This species is named after Mr. T. D. A. Cockerell, of Las Cruces, New Mexico.

Cybele grisea, n. sp. (Plate II. figs. 2–2 *e*.)

Length, ♂ 5·5–6·5 mm., ♀ 6–7 mm.

Legs, ♂ $\overline{1\ 3\ 4}$ 2; ♀ $\overline{4\ 3}$ 1 2, not very unequal.

The cephalothorax is high, with the cephalic part inclined, while the thoracic falls very slightly in the first third, and then abruptly. The sides are vertical and nearly parallel, there being a very slight widening behind the dorsal eyes. The anterior eyes are close together in a straight row. They are large, the lateral being two-thirds the size of the middle. The second row is about halfway between the first and the third, and the third is about as wide as the cephalothorax. The quadrangle of the eyes is one-fourth wider than long, occupies one-half of the cephalothorax, and is equally wide in front and behind.

In the male, the cephalothorax is covered with red hairs, excepting bands of white hairs on the lower sides, and a white median band on the thoracic slope, running backward from the third row of eyes. On the abdomen the hairs are golden-yellow; down the middle, in the anterior half, is a narrow white band, which changes, in the posterior half, into a band of white chevrons. A narrow white band runs around the anterior end and onto the sides, curving upward and inward opposite the point at which the chevrons begin. The legs are pale, with the femur dark in some specimens. The palpus has the patella much elongated, nearly equalling the tibia and tarsus. The patella and tibia are flattened and rugose on the dorsal surface, and there is an apophysis on the inner distal end of the patella. There is a fringe of white hairs throughout the whole length of the palpus, on the inner side. The falces are as wide as the middle eyes and are transversely rugose. In the middle, on the outer edge, is a small apophysis which is edged with minute notches, and below this, near the insertion of the fang, there is a longer, pointed apophysis. The lip is narrow, and only half as long as the maxillæ, which are notched on the middle of the outer edge and project at the outer corner. The female has golden-yellow hairs on the cephalic plate, and has the eyes on dark spots. There are indistinct bands of a lighter colour on the sides and down the median line of the thoracic part. On the abdomen the hairs are red, and there is a yellowish band which passes around the front end onto the sides, from which a short projection runs backward in the middle line. On the middle dorsum there is a white region with wavy outlines, which is mottled with red.

We have numerous examples of both sexes.

Cybele albopalpis, n. sp. (Plate II. figs. 3–3 *b*.)

♂. Length 5·5 mm. Legs $\overline{1\ 3\ 4\ 2}$, the first plainly stoutest, and longer than the second by the tarsus and half the metatarsus.

The cephalothorax is rather high, and slants in both directions from the dorsal eyes, the hinder slope being almost continuous. The anterior eyes are large, and form a slightly curved row, the middle ones touching, and the lateral a little separated from them. The middle are less than twice as large as the lateral. The second row is about halfway between the first and the third. The dorsal eyes are large, and form a row which is as wide as the cephalothorax at that place. The sides of the cephalothorax are vertical, and are nearly parallel, widening a little in the middle. The quadrangle of the eyes is plainly wider in front than behind, is one-fifth wider than long, and occupies one-half of the cephalothorax.

In our specimen the hairs are all rubbed from the abdomen. The cephalothorax is blackish, with red hairs on the eye-region, a white band down the middle of the thoracic slope, and white bands low on the sides. Under alcohol the pattern appears as in the drawing. The palpus is blackish, with a fringe of very long white hairs on each side, extending to the end of the tarsus. The tibia is flattened. The first leg has the femur and tibia reddish, but otherwise the legs are pale, with many fine black spines. The falces are vertical and moderately stout. This species differs from *C. grisea* in having no apophyses on the falces, in the maxillæ, which are rounded and short, and in having the patella of the palpus shorter than the tibia, instead of much longer.

We have a single male of this species.

Saitis (?) inutilis, n. sp. (Plate III. figs. 4–4 *b*.)

♂. Length 3·5 mm. Legs $\overline{4\ 3}\ \overline{2\ 1}$, all slender, and decreasing very gradually in length from the fourth to the first. Second longer than first by tarsus.

The cephalothorax is rather high, and falls distinctly, in both directions, from the dorsal eyes. Its widest point is plainly at the front end, the sides contracting gradually behind. The quadrangle of the eyes occupies about one-half of the cephalothorax. It is only one-fifth wider than long, and is a very little wider in front than behind. The anterior eyes are all large, and are placed close together in a plainly curved row, the middle being less than twice as large as the lateral. The eyes of the second row are about halfway between the lateral and the dorsal, and the third row is as wide as the cephalothorax at that place.

When under alcohol the cephalothorax is brown above, with a pale scalloped band down the middle, and is pale on the sides. The abdomen has the sides brown speckled with white, and a pale central band, which has an enlargement at the middle point, and which is crossed by a number of short pale bars, which form chevrons. In one specimen there is, on each of the anterior sides, a pale spot, and further back there is a short curved pale band, of which only the extremities are visible from above. When dry the upper part of the cephalothorax is seen to be covered with red, and the sides with white hairs. The red hairs grow a little longer above the eyes of the first row, and below them the clypeus is covered with white or yellowish-white hairs. On the abdomen the dark parts are covered with red, and the pale with white hairs. The legs are brown, flecked with pale, the first and second being darker than the third and fourth. The palpus is brown, with rather long white hairs on the tibia and tarsus. The falces are small, vertical, and brown.

We have two males of this spider.

Saitis deflocatus, n. sp. (Plate III. figs. 5, 5 *a*.)

♀. Length 4·5 mm. Legs $\overline{4\ 3}\ 1\ 2$, all slender. The first is almost as long as the third and fourth, but the second is distinctly shorter, the first exceeding it by the length of the tarsus.

The cephalothorax is high at the dorsal eyes, from which point it is strongly inclined in both directions. The upper surface is rounded. The sides are widest at the dorsal eyes, narrowing before and behind, and widening again at the front end. The anterior eyes are close together, the middle being nearly twice as large as the lateral, and form a row which is a little curved downward. The clypeus is narrow. The quadrangle of the eyes is wider in front than behind, is one-fourth wider than long, and occupies nearly one-half of the cephalothorax.

Under alcohol the spider appears as in Mr. Emerton's drawing, but when dry the cephalothorax is seen to be covered with light, golden, iridescent scales, excepting a central white band on the thoracic part. The abdomen has a white band around the front end, but is otherwise covered with silvery iridescent scales, there being some wavy black lines and spots on the posterior part of the dorsum. The legs and palpi are pale brown, ringed with darker brown. The falces are small and brown.

We have one female from Kingston.

Pellenes translatus, n. sp. (Plate III. figs. 6–6 *c*.)

♂. Length 4·5 mm. Legs $3\ 4\ \overline{1\ 2}$. The first and second are considerably shorter than the third and fourth, and the third is longer than the fourth by the length of the tarsus; first stoutest.

The cephalothorax is moderately high. The cephalic plate slants forward; the upper surface and sides are normal for the genus. The anterior legs are close together in a straight row; the middle are not twice as large as the lateral. The quadrangle is a little wider behind, and nearly one-fourth wider than long. The second row is halfway between the outer two, and the third row is as wide as the cephalothorax at that place. One specimen is a good deal rubbed, and under alcohol it appears as in Mr. Emerton's drawing; but when dry, the upper surface of the cephalic part is covered with fawn-coloured hairs, and on each side of the head and thorax there is a wide band of white hairs. These bands are on the lower edge, and unite behind with a wide white band that runs back, on each side, from just behind the dorsal eye, down the posterior slope of the thorax. The space between the two white bands on the posterior slope of the thorax is dark-coloured. The lower white bands, as they pass forward, do not unite in front on the clypeus, but turn down and end in a narrow point on the front face of each falx. The space thus left, under the middle eyes of the first row, is dark-coloured. There are a very few red hairs around the first row of eyes. The abdomen is dark above, nearly surrounded by a wide white band which passes very far down on the sides and stops at the spinnerets. There is a central longitudinal white band from base to apex of the abdomen. The femora of all the legs are pale, darker at the distal ends, and the first and second pairs have black bands on the front faces, running obliquely from end to end. This band is much less distinct on the second pair. The other parts of the legs are darker, and all have many white hairs. The palpi have pale femora and patellæ, covered with white hairs, while the other joints are dark. The dark spot on the clypeus, just under the large middle eyes, is characteristic, and serves to distinguish this from all other spiders thus far found in Jamaica.

Found by Mr. T. D. A. Cockerell at Mandeville.

Pellenes banksi, n. sp. (Plate III. figs. 7, 7 *a*.)

♀. Length 5 mm. Legs 3 4 1 2; first and second much shorter than third and fourth; second is shorter than third by the length of the metatarsus and tarsus; the length of the third is due to the elongation of the femur; the first and second stoutest.

The quadrangle is one-fourth wider than long, is a little wider behind than in front, and occupies two-fifths of the cephalothorax. The anterior eyes are close together and are a little curved. The middle are not twice as large as the lateral. The second row is halfway between the others, and the third is as wide as the cephalothorax at that place. The whole body and the legs are covered by short hairs, light brown in colour, with a few longer black hairs. Under alcohol the pattern appears as in the drawing.

We have a single female from Kingston.

Prostheclina perplexa, n. sp. (Plate III. figs. 8–8 *d*.)

A brilliantly iridescent species.

♂ ♀. Length 5 mm. Legs $\overline{3\ 4}\ \overline{1\ 2}$, the third and fourth decidedly longer than the first and second.

The quadrangle of the eyes is wider in front than behind, occupies two-fifths of the cephalothorax, and is one-fourth wider than long. The anterior eyes project forward and form a slightly curved row, all four being close together, and the middle being plainly less than twice as large as the lateral. The second row is about halfway between the first and third, and the third is narrower than the cephalothorax at that place.

Although we have a good many specimens of this beautiful little spider, they are all more or less rubbed. Under alcohol it appears as in the drawing, with brown background and pale bands. When dry it shows iridescent scales of bright green and crimson on the cephalothorax, and around the front end of and down the middle line of the abdomen, which is otherwise covered with fawn-coloured or golden hair. The clypeus is covered with long iridescent hairs, and the front surface of the falces with iridescent scales. The same scales appear on all of the legs, and on the tibia and tarsus of the palpus. The males are darker than the females, and have at the end of the femur, and on the patella of the palpus, a bunch of long snow-white hairs.

We have numerous examples from Mandeville.

PROSTHECLINA MORGANI, n. sp. (Plate IV. figs. 9–9 *d.*)

Length, ♂ 4 mm., ♀ 4·3 mm. Legs, ♂ $\overline{3\ 4}\ \overline{1\ 2}$; ♀ $\overline{3\ 4}\ 1\ 2$; the first and second are slightly the stoutest and are plainly shorter than the others.

The quadrangle of the eyes is one-fourth wider than long, is a little wider in front than behind, and occupies nearly one-half of the cephalothorax. The anterior eyes are close together in a straight row, the lateral being nearly three-fourths as large as the middle. The second row is halfway between the first and the third, and the third is nearly as wide as the cephalothorax at that place.

The cephalothorax is covered with a mixture of white and iridescent scales. The abdomen is also iridescent with the exception of four large velvety, black spots. The legs are pale brown with white scales. The palpus has iridescent scales mixed with white hairs on the patella and tibia, and with dark hairs on the tarsus. The white hairs are long and conspicuous in the male. The clypeus and falces have white scales in the female, and iridescent scales in the male.

The apophysis on the palpus of the male is notched along the inner edge, like a saw.

We have six specimens from Kingston.

PROSTHECLINA VENATORIA, n. sp. (Plate IV. figs. 10–10 *d.*)

♂ ♀. Length 3·5 mm. Legs $\overline{3\ 4}\ \overline{1\ 2}$, the third being longest through the elongation of the femur, and exceeding the second by the length of the tarsus. The first and second are the stoutest.

The cephalothorax is moderately high. The sides are parallel in the female, but widen a little toward the front in the male; they are nearly vertical. The cephalic part is rounded and inclined forward. The thorax falls but little in the first half, and is narrowed and rounded above, widening out a little below. The quadrangle of the eyes is one-fifth wider than long, is plainly wider in front than behind, and occupies a little more than two-fifths of the cephalothorax. The anterior eyes are close together in a straight row, the lateral being nearly two-thirds as large as the middle. They are rather large for the size of the spider. The second row is plainly nearer the third than the first, especially in the male. The third is about as wide as the cephalothorax at that place.

Our specimens are rubbed. The male shows some metallic scales on the eye-region, and has, on each side, a band of yellow hairs, starting from the lateral eye, and widening as it passes backward to join the one of the opposite side beyond the dorsal eyes. The cephalothorax is otherwise dark brown. The abdomen is brown and has, down the median line, a yellow band which becomes indistinct behind. The anterior sides show some greenish metallic scales. The legs are brown excepting the tarsal and the proximal ends of the femoral joints, which are pale. The palpus has black hairs on the femur, and yellow hairs on the patella, tibia, and tarsus, most marked on the patella, and on all the joints there is a scattering of metallic scales. The female shows no hairs nor scales, but is brown with a yellow, median, longitudinal band on the abdomen. The legs are pale.

We have one male and one female from Port Antonio.

Prostheclina viaria, n. sp. (Plate IV. figs. 11–11 *b*.)

♂. Length 2·5–3 mm. Legs $1\ \overline{4\ 3}\ 2$, femur slightly enlarged in first and second; the first and fourth are nearly equal, and are longer than the third by only a part of the tarsus; the first is longer than the second by the tarsus and a part of the metatarsus.

The cephalothorax is moderately high. The sides are a very little wider in front and are nearly vertical. The highest point is at the dorsal eyes, the cephalic plate being inclined, while the thoracic part falls but little for about one-third of its length, and then abruptly, the upper surface not being so much narrowed and rounded as is usual in *Prostheclina*. The clypeus is narrow. The anterior eyes are close together in a straight row, the lateral being two-thirds as large as the middle. The second row is much nearer the third than the first, and the third is nearly as wide as the cephalothorax at that place. The quadrangle of the eyes is very slightly wider in front than behind, is one-fourth wider than long, and occupies one-half of the cephalothorax.

Our specimens are badly rubbed. Under alcohol the pattern appears as in the drawing, but when dry the whole body looks dark, with a covering of light brown hairs. In the first and second legs the femur has the proximal end pale, and the distal end dark. Otherwise the legs are pale with darker rings. The palpus is brown, with a narrow line of white hairs running along the outer side of all the joints.

We have two males from Moneague.

Dendryphantes taylori, n. sp. (Plate IV. figs. 12–12 *b*.)

♂. Length 4·5 mm. Legs $1\ 4\ \overline{2\ 3}$, the first a very little the stoutest, all being rather slender; the first and fourth do not differ greatly in length, but these two are plainly longer than the second and third. The coxa of the first leg is twice as long as that of the second.

The quadrangle of the eyes is one-third wider than long, is wider behind than in front, and occupies one-half of the cephalothorax, approaching, in this respect, the genus *Eris*. The first row is straight, with the middle eyes subtouching and about twice as large as the lateral, which are a little separated from them. The second row is a little nearer to the first than to the third. The abdomen is bronze-brown, with a white band around the front end, which runs, on the sides, nearly to the spinnerets, with a break at about the middle point. There are two pairs of white spots or transverse bars on the dorsum, one pair across the middle, and the other further back. The cephalothorax is bronze-brown, with a white band across the clypeus which runs back on to the sides. The legs are dark brown, with the tarsi and the proximal ends of the metatarsi lighter. The palpi are long, curving over the falces, and have the femur and patella covered, above, with white hairs. The falces are brown in colour, and are long, oblique, and divergent, with a long fang.

We have a single male.

Dendryphantes prudens, n. sp. (Plate IV. figs. 13–13 *b*.)

Length, ♂ 3·5 mm., ♀ 4·5 mm. Legs, ♂ 1 4 2 3, ♀ 4 1 $\overline{2\ 3}$, the first stoutest.

The quadrangle of the eyes occupies two-fifths of the cephalothorax, is one-fourth wider than long, and is a little wider behind than in front. The first row is curved, with the middle eyes subtouching and less than twice as large as the lateral, which are a little separated from them. In the male, the cephalothorax is bronze-brown with white bands on the sides. The abdomen is brown with an encircling band of white, and three or four pairs of white spots on the dorsum. The legs are barred with lighter and darker brown. The female has the cephalothorax brown with tawny hairs, the abdomen pale with some brown chevrons, and the legs yellow. The falces are brown, short, and vertical. The male has an apophysis on the tibia of the palpus.

We have two males and one female from Kingston.

EXPLANATION OF THE PLATES.

Plate II.

Fig. 1. *Nilakantha cockerelli* (p. 8), dorsal view of female; 1 *a*, dorsal view of male; 1 *b*, side view of cephalothorax of female; 1 *c*, face of male; 1 *d*, epigynum; 1 *e*, dorsal view of palpus; 1 *f*, side view of palpus; 1 *g*, ventral view of palpus.

Fig. 2. *Cybele grisea* (p. 8), dorsal view of male; 2 *a*, dorsal view of female; 2 *b*, epigynum; 2 *c*, ventral view of palpus; 2 *d*, side view of palpus; 2 *e*, face and falces of male.

Fig. 3. *Cybele albopalpis* (p. 9), dorsal view of male; 3 *a*, ventral view of palpus; 3 *b*, side view of palpus.

Plate III.

Fig. 4. *Saitis* (?) *inutilis* (p. 10), dorsal view of male; 4 *a*, ventral view of palpus; 4 *b*, side view of palpus.

Fig. 5. *Saitis defloccatus* (p. 11), dorsal view of female; 5 *a*, epigynum.

Fig. 6. *Pellenes translatus* (p. 11), dorsal view of male; 6 *a*, ventral view of palpus; 6 *b*, dorsal view of palpus; 6 *c*, side view of palpus.

Fig. 7. *Pellenes banksi* (p. 12), dorsal view of female; 7 *a*, epigynum.

Fig. 8. *Prostheclina perplexa* (p. 12), dorsal view of male; 8 *a*, dorsal view of female; 8 *b*, ventral view of palpus; 8 *c*, side view of palpus; 8 *d*, epigynum.

PLATE IV.

Fig. 9. *Prostheclina morgani* (p. 13), dorsal view of male; 9 *a*, dorsal view of female; 9 *b*, ventral view of palpus; 9 *c*, side view of palpus; 9 *d*, epigynum.

Fig. 10. *Prostheclina venatoria* (p. 13), dorsal view of male; 10 *a*, dorsal view of female; 10 *b*, ventral view of palpus; 10 *c*, side view of palpus; 10 *d*, dorsal view of palpus.

Fig. 11. *Prostheclina viaria* (p. 14), dorsal view of male; 11 *a*, ventral view of palpus; 11 *b*, side view of palpus.

Fig. 12. *Dendryphantes taylori* (p. 14), dorsal view of male; 12 *a*, ventral view of palpus; 12 *b*, side view of palpus.

Fig. 13. *Dendryphantes prudens* (p. 15), dorsal view of male; 13 *a*, ventral view of palpus; 13 *b*, side view of palpus.

2. On the Hymenoptera collected during the "Skeat Expedition" to the Malay Peninsula, 1899–1900. By P. CAMERON[1].

[Received April 15, 1901.]

The Hymenoptera of the Malay Peninsula are far from well known. In addition to the species of Aculeata from Tenasserim mentioned in Bingham's 'Fauna of British India, Hymenoptera,' our chief, almost our sole, authority on the subject is the late F. Smith, who in 1858 described (Journ. Linn. Soc. ii. pp. 42–130) the species found by Dr. A. R. Wallace at Malacca and Singapore. Including Ants (which are not dealt with in this paper) Mr. Smith enumerated 136 species from the Peninsula. The collection on which this paper is based was formed by Messrs. Annandale, Evans, and Laidlaw, members of the Skeat Expedition, chiefly on the eastern side of the Peninsula, which entomologically is the least known part. Though small, the collection contains examples of several new and interesting forms.

In Bingham's 'Hymenoptera of British India,' out of a total of 995 species of Aculeata (other than Ants) no less than 376 are recorded from Tenasserim, the extreme northern district of the Malay Peninsula; and there can be no doubt that if the Peninsula were adequately explored it would prove to be extremely rich in Hymenoptera.

I have included a few species that were not found by the members of the Skeat Expedition, and also some allied forms from neighbouring regions. As a matter of convenience these are placed in their proper positions and are distinguished by square brackets.

MUTILLIDÆ.

MUTILLA MALAYANA, sp. n.

Nigra, abdomine ferrugineo, basi apiceque nigris; capite thoracequ dense albo-pilosis; alis violaceis. ♂.

Long. 20 *mm.*

[1] Communicated by Dr. D. SHARP, F.Z.S.

Hab. Bukit Besar, Jalor (District of Patani State), Malay Peninsula.

Antennæ black; the flagellum opaque, covered with a pale dull down; the scape on the upperside is covered with pale pubescence; the underside is bare, hollowed in the middle, the outer sides more acutely pointed and narrower than the inner. Front and vertex strongly punctured and thickly covered with white hair, the front being much more thickly covered than the vertex. Face smooth and shining, stoutly keeled down the middle. Over the clypeus are 6 foveæ, close to each other in a row, the outer is the largest; the sides are furrowed. Mandibles aciculated, and not very sharply pointed at the apex. Thorax thickly covered with silvery pubescence; there is a broad band of depressed pubescence on the hinder edge of the pronotum. Mesonotum shining, coarsely, but not very closely, punctured; there is a keel down the centre and a furrow on either side of it; the hair is close and deep black. Scutellum pyramidal; rugosely punctured, except the upper two-thirds of the base in the centre; the base has an oblique, straight slope, as has also the apex from below the smooth top, which slightly projects; the smooth part of the basal slope projects and is clearly separated; the top is almost transverse; below the centre are two small foveæ. Median segment closely reticulated; its base thickly covered with depressed silvery pubescence, the apical slope with long white hair; the basal area reaches to the top of the apical slope; its basal third is dilated; the base of the dilated part has the sides straight, the apex has them obliquely narrowed; the segment has the sides broadly and roundly dilated; the outer side on the basal half is bordered by a smooth keel. The base of the propleuræ is rugosely punctured, the punctured portion being bordered by a row of elongated foveæ, which are narrowed obliquely at the apex on either side and are there clearly separated from each other. Mesopleuræ, except behind, coarsely punctured and densely covered in the middle with silvery pubescence. Mesosternum densely covered with silvery pubescence. Metapleuræ reticulated.

MUTILLA SKEATI, sp. n.

Nigra, thorace femoribusque rufis; abdomine pallide aureo piloso. ♀.

Long. 13–14 *mm.*

Hab. Kuala Aring, State of Kelantan, Malay Peninsula.

Antennæ entirely black, short and stout; the scape thickly covered with white hair; the flagellum with white pubescence; the 3rd joint is as long as the 4th and 5th united. Head as wide as the thorax, coarsely rugosely punctured, sparsely covered with long black hair; the upper part of the front bears shorter golden hair, the lower is more thickly covered with longer white hair. Antennal tubercles black, the part between them obscure rufous. Eyes oval. Mandibles longish, becoming gradually narrowed towards the apex; the upperside at the middle grooved. Thorax of nearly uniform width, only very slightly and broadly narrowed in the middle; above coarsely, uniformly, and rugosely punctured; the punctation on the lower half of the apical slope is much weaker and the apex itself is almost impunctate. Pleuræ smooth and shining. Legs black, thickly covered with white hair; the spines on the tibiæ are black, on the tarsi bright rufous; the calcaria of a paler rufous colour. Abdomen black; its base bears longish white hair; the basal segment is rather broad at the base and projects laterally in a bluntly triangular smooth and shining tooth; behind the middle of the 2nd segment are two oval marks of pale golden pubescence; the 3rd segment has the apical two-thirds covered with similar pubescence; the 4th has a similar band, but widely interrupted in the middle; the last is thickly fringed on the sides with long pale fulvous hair; it is closely rugose. The ventral keel on the basal segment becomes gradually raised to the apex, which projects roundly, the lower slope being oblique. The ventral segments are all fringed with pale fulvous hair; on the sides of the 2nd segment is a longish longitudinal furrow, covered with pale rufous pubescence. The thorax is fully twice longer than broad; it is rounded in front, transverse behind.

SCOLIIDÆ.

SCOLIA PROCERA Ill.

One example of this fine species from Patalung State.

SCOLIA SPECIOSA Smith.

Bukit Besar.

The male has not been described. Its head is reddish yellow, except behind between the antennæ and at the ocelli, where it is black; above it is smooth and shining; the clypeus is strongly, but not very closely, punctured. Thorax thickly covered with short black pubescence; the mesonotum is closely punctured, except the space on either side of the centre; the scutellum is similarly punctured except at the apex, where it is smooth; the median segment is more closely punctured, and if anything more strongly, the hair, too, on it is longer and thicker. It has the base of the 3rd abdominal segment reddish yellow, as in the female; this yellow line may be interrupted in the centre and is covered with rufous hair.

S. speciosa has hitherto only been recorded from Borneo.

SCOLIA RUBIGINOSA Fab.

One example: Eastern Malay Peninsula, without exact station.

SCOLIA LATHONA, sp. n.

Nigra, thorace abdomineque opalina pulcherrime lavatis; alis fusco-violaceis. ♂.

Long. 22 *mm.*

Hab. Kuala Aring, Malay Peninsula.

Antennæ much shorter than usual, distinctly shorter than the thorax; black, stout; the scape strongly punctured, sparsely haired; the flagellum opaque. The lower part of the front broadly depressed; the basal part clearly separated, broadly rounded above; the apex transverse, with the sides broadly rounded; the upper third is smooth, impunctate; the lower strongly punctured, except in the middle and at the apex. The front is distinctly keeled; the sides of the keel oblique and punctured; the top smooth. The upper half of the clypeus is deeply punctured; the lower smooth, opaque, except at the apex, which is depressed and shining. Except very slightly on the vertex, the head wants the violaceous tint. Thorax very shining; it has all over very brilliant violaceous and blue shining reflections, and is covered with black pubescence; the upper part is closely and uniformly punctured all over, as is also the upper part of the propleuræ and the greater part of the mesopleuræ; the metapleuræ punctured on the upper edges. The apex of the median segment is transverse in the middle; the sides are oblique. The legs have the violaceous tints of the body; they are thickly covered with black hair; the front tibiæ and the tarsi bear dark fuscous pubescence behind; the calcaria black, except the anterior, which are dark piceous and curved. Wings dark fuscous, with a slight violaceous tint, rather dull, without brilliant reflections. Abdomen black, with brilliant violet and blue micaceous reflections and thickly covered with black hair, which is longer and denser on the apex and ventral surface; the basal segment has a distinct neck at the base; the last dorsal segment is smooth and bare on the apex.

Comes near to *S. opalina* Smith, from Borneo. No mention is made of the form of the head in Smith's description, and presumably the front is not depressed: it is said to have only a few scattered punctures, not strongly punctured as in the present species; the disc of the mesothorax has a smooth space, which is not the case here.

ELIS (DIELIS) THORACICA Klug.

This species is in the collection from Singora and from Kota Bharu in Raman (District of Patani). All belong to the form with the pubescence on the collar and mesonotum red, this being also the case with all the specimens I have seen from Singapore and Java. In India the red-haired form is very rare compared with the white.

ELIS (DIELIS) AGLAEA, sp. n.

Nigra, flavo-maculata; femoribus tibiisque anterioribus femoribusque posticis subtus flavis; alis fusco-violaceis. ♂.

Long. 20 *mm.*

Hab. Biserat in Jalor, Malay Peninsula.

Head covered with pale hair; black, the clypeus yellow, except the middle at the apex, where it is black; the lower part of the front is strongly and closely punctured; the vertex below and on either side of the ocelli sparsely punctured; the eye-incisions are more closely but not so strongly punctured; the part above the antennæ has an oblique slope. Clypeus smooth and shining; the base of the mandibles is broadly yellow; they are fringed with long pale hair. Thorax black; the edge of the pronotum broadly, two large marks in the centre of the scutellum, and a mark in the centre of the post-scutellum—transverse in front, rounded behind—yellow. Meso-notum minutely and not very closely punctured all over; this is also the case with the scutellum, except behind, where it is smooth and impunctate. Median segment closely, strongly, and uniformly punctured and thickly covered with long white hair and with a silvery down. Pleuræ thickly covered with long pale hair; the hinder part of the meso- and the metapleuræ are thickly covered with silvery pubescence. Legs black; the front coxæ below, the four front femora broadly towards the apex, the four front tibiæ except at the apex in front, and the hinder femora below, yellow; the legs are thickly covered with long white hair; the calcaria black; the tarsal spines pale. Wings fuscous, darker in the middle, where they have a violaceous tinge. Abdomen black, thickly covered with white hair; the basal three segments are banded with yellow at the apex; the band on the basal segment is broader than the others.

POMPILIDÆ.

[PSEUDAGENIA MALAYANA, sp. n.

Nigra, femoribus posticis rufis; alis hyalinis. ♀.

Long. 7 *mm.*

Hab. Singapore (*Mr. George Lewis*).

Resembles *P. arethusa* Cam.[1], but is a smaller species, has only the hinder femora red; the wings are clearer; the apex of the clypeus rounded, not transverse; the 2nd transverse cubital nervure is roundly and distinctly curved; the transverse anal nervure in the hind wings is not interstitial, but received distinctly in front of the transverse cubital. It also resembles *P. tincta* Smith; but that is a larger and stouter species, has the head more hairy, the hair being longer and thicker, and the hinder tarsi are shorter compared

[1] [*Pseudagenia arethusa* Cam., above alluded to, is an undescribed species from Khasia represented in Mr. Rothney's collection.

Nigra, femoribus tibiisque anterioribus late rufis; abdominis apice supra albo; alis hyalinis. ♂.

Long. 8 *mm.*

Comes into Bingham's Section "C" (Fauna of India, Hymenopt. i. p. 108): "Wings clear hyaline"; and *b*, *b'*. Scape of antennæ densely clothed with short white hair; the flagellum with a close, black, microscopic down. Vertex closely punctured and sparsely covered with longish fuscous hair; the front more strongly punctured than the vertex and obscurely transversely striated; it projects immediately over the antennæ; the projection is keeled down the middle; the keel becomes wider towards the apex. The cheeks, the part below the antennæ, and the clypeus thickly covered with silvery pubescence; the clypeus strongly and closely punctured; roundly dilated, the sides at the apex oblique; the apex transverse; the silvery hair is mixed with some longer golden hair; on either side near the middle is an obscure yellowish-white spot; palpi pale testaceous; the mandibles reddish before the middle. Pronotum rounded, with the length of the tibiæ; the tarsi, too, in *tincta* are distinctly spined, which is not the case with *P. malayana*.

Head opaque; the cheeks and clypeus covered with silvery pubescence, the front and vertex sparsely covered with longish pale hair; the apex of the clypeus rounded, the sides at the base not sharply oblique; the palpi testaceous; the hinder ocelli are separated from the eyes by a distinctly greater distance than they are from each other. Thorax thickly covered with a silvery pile; the scutellum and median segment more sparsely with fuscous hair. The median segment has a gradually rounded slope, is closely obscurely transversely striated in the middle; the oblique furrow on the mesopleuræ is narrow but distinct; its lower part at the base is depressed, clearly separated from the rest, and more strongly punctured. Legs pruinose, the four anterior femora more or less obscure reddish beneath, the hinder femora bright ferruginous, except at the extreme apex; the hinder tarsi are much longer than the tibiæ, which are almost spineless. Wings clear hyaline; the stigma fuscous; the nervures darker; the 2nd cubital cellule at the top and bottom is distinctly, but not much, shorter than the third; the first and second transverse cubital nervures are roundly curved, the first is distinctly, the second scarcely oblique; the first recurrent nervure is received in the middle, the second distinctly in front of the middle of the cellule; in the hind wings the transverse anal nervure is received distinctly in front of the cubital. Abdomen pruinose, shining; the segments are testaceous at the apex.]

[POMPILUS SINGAPORENSIS, sp. n.

Niger, dense argenteo-pruinosus; alis hyalinis, apice fumato. ♀.
Long. 10 *mm.*

Hab. Singapore.

Antennæ densely pruinose, like the body. The eyes distinctly converge above, where they are separated by nearly the length of the 3rd antennal joint; the hinder ocelli are separated from each other by the same distance as they are from the eyes; the front

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thickly covered with silvery pubescence. Mesonotum closely punctured, the middle in front slightly raised; from the base of the tegulæ runs an oblique narrow furrow. The postscutellar region is closely and finely, at the base towards the apex more strongly transversely striated. Median segment with a gradually rounded slope; opaque, finely transversely granular; the middle and apex thickly covered with long white hair. The middle of the propleuræ raised; the lower part triangularly depressed; the mesopleuræ granular, opaque; the apex on the lower part and the sternum thickly covered with long white hair; the base of the metapleuræ obscurely obliquely striated. Legs longish; the apex of the fore femora, the fore tibiæ, and the greater part of the tarsi, the apical two-thirds of the middle femora except at the extreme apex, the middle tibiæ except behind, the hinder femora except at the base, and to a less extent at the apex, red. Wings hyaline, but with a uniform fuscous tinge; the 2nd and 3rd cubital cellules are subequal at the base and apex above and beneath; the first recurrent nervure is received near the middle, the second shortly before the basal third of the cellule. Abdomen pruinose; the apical segment above white, fuscous at the apex.]

has a narrow furrow down the centre. Clypeus transverse in the middle; its sides broadly rounded. Mandibles black; the base thickly covered with greyish pile; the middle rufous. Palpi black, covered with a grey pile. The sides of the pronotum behind are straight and oblique. The median segment is distinctly furrowed down the middle. The cloud in the fore wings commences at the end of the radial cellule; the radial cellule is wide in the middle; the apical abscissa of the radius is oblique; the apical half has a different angle from the basal. The spines on the tibiæ and tarsi are black; the calcaria are two-thirds the length of the metatarsus. The first and third transverse cubital nervures are roundly curved; the second straight and slightly oblique; at the top the second cubital cellule is not quite half the length of the first.

Comes near to *P. pulverosus* Sm., which may be known from it by the cloud commencing "beyond the first submarginal cell," and the calcaria are nearly as long as the metatarsus. The description of *P. pulverosus* is not very complete. A revision of the Hymenoptera collected by Dr. A. R. Wallace in the Malay region, and now in the Hope Museum, Oxford, is a great desideratum. At present the determination of many of the species from the description is mere guesswork. With the *Larridæ*, for example, one is never certain whether the species described belongs to *Larra*, *Notogonia*, *Tachysphex*, or *Tachytes*.]

[SALIUS MISERUS, sp. n.

Niger, capite, pronoto, apice mesonoti scutelloque flavo-testaceis; pedibus rufo-testaceis; coxis posticis nigris; alis fusco-flavis, apice fusco-violaceis. ♂.

Long. 22 *mm.*

Hab. Singapore.

Antennæ rufous; the scape hollowed on the underside; the outer edge is much sharper than the inner; the apical joints are roundly curved above. The head fulvous; the face pale yellow; the vertex (especially at the ocelli) fuscous black. Eyes large, slightly converging above; the lower part parallel; the ocelli large, placed in a triangle, the hinder are separated from each other by a slightly greater distance than they are from the eyes; there is a narrow shallow furrow in the middle of the front. Prothorax rufo-fulvous; the lower and hinder parts of the pleuræ darker coloured. The apical half of the mesonotum, the scutellum, and postscutellum are rufo-fulvous; the black on the mesonotum is triangularly narrowed at the apex. Median segment, except at the apex, transversely striated; it is covered with a golden down and some longish pale fulvous hairs. The scutellum is thickly covered with long pale fulvous hair. Legs rufo-fulvous; the hinder coxæ black; the inner tooth of the claws is half the length of the outer. Wings fulvo-hyaline at the base; the apex with an obscure violaceous-fuscous tinge, which is deeper in the radial and cubital cellules; the discoidal cellule is hyaline, with an elongated fuscous cloud in the centre; this cloud is sharply narrowed towards the apex; the apical abscissa of the radius is curved; the first cubital cellule is shortly but distinctly shorter than the second; the third transverse cubital nervure is roundly curved. Abdomen black; the apical dorsal segment rufous.

Belongs to Bingham's Section B *a* (Fauna of India, p. 124).]

[SALIUS TAPBROBANÆ, sp. n.

Niger, antennis, pedibus, apice pronoti, mesonoto, scutello postscutelloque rufis; coxis trochanteribusque nigris; alis flavis, apice fumatis. ♀.

Long. 25 *mm.*

Hab. Trincomali, Holraputtana, Ceylon (*Colonel Yerbury*).

Belongs to the section with one tooth on the claws, and comes near to *S. flavus*.

Antennæ stout, bare, ferruginous; the scape darker. Head ferruginous, sparsely covered with long black hair; the vertex thickly covered with depressed golden pile. The apex of the clypeus is almost transverse in the middle; the apex of the labrum is slightly rounded and is densely fringed with reddish hair. Thorax black; the apical half of the pronotum, the mesonotum, scutellum, and postscutellum densely covered with silky depressed golden pubescence. The depressed belt behind the postscutellum is dark testaceous, is furrowed down the middle, and is transversely but not closely striated. The median segment is coarsely transversely striated, except on the apical third; the striæ have a brownish hue. The upper part of the metapleuræ is obliquely striated; the apex of the propleuræ is brownish above. Legs ferruginous; the coxæ and trochanters are black. Wings yellowish; the apical margin distinctly smoky all round. Abdomen entirely black, shining; the pygidium and the epipygium velvety and thickly covered with long black hairs.]

SALIUS SYCOPHANTA Grib.

An example from Patalung (*Evans*) is the usual form; one from Kuala Aring has the wings much darker, the fulvous tinge being much darker at the apex; the apex itself is not clouded, and the darker colour of the basal region extends nearer to the apex; the hind wings want the basal tint entirely.

SALIUS MALAYENSIS, sp. n.

Long. 16 *mm.*

Hab. Kuala Aring.

This species has the coloration of the body and wings of *S. peregrinus* Sm., with which it is closely related. *S. peregrinus* may readily be known from it by the 3rd cubital cellule on the top being, if anything, longer than the 2nd, whereas in the present species it is not much more than one-half its length; there is also a marked distinction in the shape of the 2nd transverse cubital nervure, which in *peregrinus* is straight, whereas in *malayensis* it is, on the lower side, obliquely bent backwards towards the base of the wing, while the upper two-thirds are roundly curved towards the apex. The same character separates it from the closely-allied Khasia species, *S. subfervens* Cam.

Head fulvous, yellowish along the eye-orbits; the ocellar region and the middle of the front are black; this black mark extends behind the ocelli to the end of the eyes, where it is roundly narrowed; it is roundly incised at the sides of the ocelli, below which it is roundly and broadly dilated; the lower part is incised. The eyes distinctly converge above; the hinder ocelli are separated from each other by about the same distance they are from the eyes. The clypeus is broadly rounded at the apex; the labrum is broadly black in the middle, its apex fringed with bright fulvous hair. Mandibles broadly black at their apices. Thorax black; the prothorax (except the lower half of the pleuræ), the sides of the mesonotum, its centre largely from near the base to the apex, the scutellum, and postscutellum, rufo-fulvous. The apical two-thirds of the pronotum are furrowed in the centre; this furrow is widest at the base. Wings uniformly fuscous-violaceous; the stigma is pale fulvous in the middle; the first cubital cellule is about twice the length of the second; the first and third transverse cubital nervures are oblique and roundly curved, the second is straight and oblique on the lower third, the rest roundly curved towards the upper apex of the cellule; the first recurrent nervure is received near the base of the apical fourth, the second near the base of the apical third of the cellule. Legs coloured like the thorax; all the coxæ and trochanters, the base of the four anterior femora, and almost the basal half of the hinder pair black; the apical joint of all the tarsi black. Abdomen black, except the upper part of the last segment, which is pale fulvous.

Pompilus analis Fab.

One example, without special locality, of this widely distributed Eastern species.

Sphegidæ.

Sphex lobatus Fab.

Patalung, Biserat, Gunong Inas (Perak), and Bukit Besar. A common Indian species.

Sphex umbrosus Christ.

Bukit Besar.

Sphex aurulentus Fab.

The form of this species agrees with the description of *Sphex flavo-vestita* Sm., a species placed by Kohl, in his monograph of the genus, among the unidentified species. According to some specimens in the Cambridge Museum from North Borneo, it stores its nests with young grasshoppers, and spins a cocoon, which is smooth, bare, brown, and shining on the inner side; on the outer side it is thickly covered with pale, long, woolly yellow hair.

Ammophila atripes Smith.

The female example is very large and has bright red legs; the males are not much more than half its size and have the legs almost entirely black. Special locality not stated.

Sceliphron javanum Lep.

Singora. Several examples of this fine species.

Sceliphron madraspatanum Fab.

Singora. One example.

[Bembex lactea, sp. n.

Long. 22 *mm.*

Hab. Khasia (*coll. Rothney*).

This species wants the U-shaped yellow mark on the mesonotum, and comes into Bingham's Section B near to *B. latitarsis* (Fauna of India, Hymenopt. p. 285).

♀. Antennæ black; the scape of the antennæ yellow, except the apical half above, the 2nd joint, and the base of the 3rd beneath, which are black. The yellow colour has a distinct pale olive tint; on the head, the clypeus, the labrum, the front, except for two large oblique marks on the top continued from the black on the vertex, the inner orbits to near the ocelli, the outer orbits more narrowly from near the top, and the mandibles are yellow. The eyes slightly diverge below; the front and vertex are thickly covered with long fuscous hair; the front is broadly keeled; on the top of the clypeus are two oblique, large, irregular black marks. Mesonotum black; the scutellum black, except for a large transverse line in the centre, which is dilated behind at the sides; the base of the post-scutellum is broadly yellow at the base. Median segment yellow, except broadly in the middle at the base and two oblique lines—broad at the base, becoming gradually narrowed towards the apex—across the middle and one across the apex, black. The base of the pronotum, an irregular mark on the propleuræ behind, the upper two-thirds of the mesopleuræ at the base, the sutures narrowly, and an irregular large mark on the apex of the metapleuræ, black. Legs of the yellow colour of the body; the femora and tibiæ broadly lined with black—the former in front and behind, the latter behind only. The ventral surface of the abdomen entirely, the basal segment except for a large oblique line on either side extending near to the middle of the segment and becoming gradually narrowed from the outer to the inner side, black; the second and third segments are broadly black at the apex, the black bands triangularly dilated in the middle at the apex; near the centre of these segments are two transverse black marks; on the base of the fourth segment is a large black mark, which projects obliquely broadly at the apex and to a less extent on the inner side; the black band between these marks triangularly projects in the middle; two larger black marks, not projecting at the sides, are on the fifth segment; the sixth is entirely black.

The male is similarly coloured to the female, except that the black marks on the clypeus are much smaller, the yellow line on the scutellum is narrower and is interrupted in the middle, the abdominal segments have only their apices narrowly black, and the marks on the 2nd, 3rd, and 4th segments are much narrower; the last segment is yellow, black round the edges, and more broadly and irregularly at the base, where the black band projects broadly in the middle. The 8th, 9th, and 10th joints project and are minutely spined below; the 11th and 12th joints are broadly hollowed, smooth, bare, and brownish below; the last has the apex obliquely rounded. The anterior tarsi are broader than usual; the metatarsus is of almost uniform width and has its lower edge slightly irregularly waved; the 2nd joint is not much narrowed at the base; the 3rd and 4th become gradually wider towards the apex; the middle femora are irregularly, minutely, and closely spined or serrate on the lower edge, the outer two serrations are wider, more regularly rounded than the others. The spine on the 2nd ventral segment is large, becomes gradually wider from the base to the top; its apex has an oblique slope; on the penultimate segment is a distinct rounded tubercle.

A distinct species related to *B. pinguis* and *B. latitarsis*.]

BEMBEX MELANCHOLICA Sm.

Except that the yellow lines on the mesonotum are indistinct and very short, an example from Singapore agrees very well with the description of this species. In the male the incised apex of the last abdominal segment is a characteristic feature.

[BEMBEX BORNEANA, sp. n.

Long. 22 *mm.* ♂.

Hab. Borneo.

This species has the pale lacteous colour of *B. melancholica*, and is closely related to it; but it may be at once separated by the fact that the last abdominal segment is not incised in the middle.

Antennæ black; the scape yellow below; the apical two joints are hollowed below; the last has its apex obliquely truncated and is broadly, roundly incised; the 12th is more obliquely and slightly incised; the 11th is obliquely narrowed at the base; the 10th is slightly spinose in the middle; the 9th is sharply spinose; the 8th has a less distinct spine. Head thickly covered with long, soft, white hair; black, the inner orbits to near the top, the clypeus, labrum, and mandibles, except at the apex, livid yellow; below the antennæ are two black marks, longer than broad, rounded above, obliquely narrowed on the inner side. Mesonotum black; an interrupted U-shaped yellow mark in its centre, and there is a wider line alongside the tegulæ. Scutellum black, yellow round the apex; postscutellum for the greater part yellow. Median segment yellow; a somewhat triangular black mark on either side at the base: on the inner side they are produced narrowly and obliquely to the middle of the segment and outwardly down the metapleuræ, where they become much narrowed on the lower end. On the pleuræ there is an elongated pyriform black mark near the tubercles. Legs coloured like the body; the femora and tibiæ lined with black above; the front tarsi are broadly dilated; the 2nd joint is roundly dilated on the outer side, the dilated part is clearly separated; the base of the joint is not contracted; the middle femora are not toothed beneath; near the apex on the lower side is a shallow incision. The apical slope of the basal segment and the apical third of the others are black; the black bands are dilated broadly and irregularly backwards in the middle; behind the middle of the segments are two narrow, transverse, short lines; the apical segment is black, with two large, somewhat triangular yellow marks in the middle; its apex is broadly, bluntly rounded.]

[Pison fuscipalpis, sp. n.

Niger, nitidus, dense argenteo-pilosus; alis hyalinis, stigmate nervisque nigris. ♀.

Long. 6 *mm.*

Hab. Singapore.

Scape and pedicle of antennæ densely covered with silvery pubescence; the flagellum less densely with a pale pile. The lower part of the front and of the eye-incision, the face, and the clypeus are densely covered with silvery pubescence; the upper part of the front and the vertex with short silvery pubescence; the front and vertex are shagreened and can hardly be called punctured; the front has a shallow but distinct furrow down its centre. The mandibles are broadly rufous in the centre; the palpi are fuscous. Thorax shagreened and thickly covered with silvery pubescence. Pronotum clearly separated behind. The basal part of the median segment has a distinct keel down the middle; a stout keel runs from the spiracles to the apex of the segment; the apex of the segment has an oblique slope; on the upper half is a deep furrow; on either side of this are five curved striæ. Wings clear hyaline; the apex slightly infuscated; the nervures and stigma are black; the pedicle is longer than the lower two transverse cubital nervures, which are roundly curved; the second recurrent nervure is received almost in the middle of the cellule; the first recurrent about the length of the top of the apical cubital cellule from the transverse cubital nervure. Legs densely pruinose; the calcaria pale. The basal segment of the abdomen is as long as the second segment; the two are clearly separated.

The tegulæ are piceous on the outer side; the basal two segments of the abdomen have their margins depressed; the anterior part of the pronotum is distinctly separated from the larger posterior part; both have oblique slopes.

A distinct species from *P. suspiciosus* Sm., which is also from Singapore.]

CRABRONIDÆ.

[CRABRO IMPETUOSUS, sp. n.

Niger, abdomine maculis flavis sex; geniculis tibiisque flavo-lineatis; alis hyalinis, nervis stigmateque nigris. ♀.

Long. 6–7 *mm.*

Hab. Singapore.

Head black; the front and vertex almost bare, alutaceous; the ocelli are in a curve, the hinder are separated from each other by a slightly less distance than they are from the eyes, which, on the inner side above, are obliquely narrowed. The sides of the clypeus are thickly covered with silvery pubescence; the middle has a distinct keel. The basal half of the mandibles is yellow. Thorax black, opaque; yellow are two lines on the pronotum, two marks on the scutellum, and the tubercles. The postscutellum is longitudinally striated. The base of the median segment is depressed and bears stout keels; the basal area is defined by a wide furrow, which is traversed by the striæ; the apical half has a deep furrow in the centre; the sides of the segments are bounded by a stout keel, at the base of which, on the inner side, are two small areæ. Propleuræ strongly aciculated; the hinder part is striated. Mesopleuræ alutaceous; the furrow is crenulated; the apex is obliquely narrowed, with a keel at the base, behind which is a narrow crenulated furrow. Metapleuræ closely and minutely striated, except at the base above, where there is a strongly striated part, bordered behind by a furrow. Wings clear hyaline; the nervures black; the radial cellule is slightly infuscated. Legs black; the four anterior knees, the tibiæ (except broadly behind), the hinder tibiæ behind (except at the apex), and the calcaria yellow. The petiole is nearly as long as the following three segments united; it is opaque and dilated at the apex; there are two yellow oblique lines in the middle of the 2nd segment, two longer ones on the base of the 3rd, and a broad one on the base of the 4th; the latter is slightly incised in the middle at the apex.]

[TRYPOXYLON VARIPILOSUM, sp. n.

Nigrum, abdomine rufo, petiolo nigro; pedibus testaceis, tarsis posticis nigris; facie clypeoque dense aureo-pilosis; alis hyalinis, nervis nigris, stigmate fusco. ♀.

Long. 16 *mm.*

Hab. Singapore.

Antennæ testaceous, paler towards the base. The front and eye-incisions are covered with golden pubescence; on the face and clypeus the pubescence is denser and more silvery in hue. The apex of the clypeus is rufo-testaceous; its middle broadly but not very much projects, the projection is slightly waved in the centre. Mandibles testaceous, paler, more yellowish towards the apex. The upper part of the front is broadly but not deeply furrowed; the lower is stoutly keeled. The hinder part of the head is thickly covered with golden-silvery pubescence. Thorax smooth and shining, thickly covered with longish silvery hair; on the mesonotum the hair has a golden tinge. The basal half of the median segment has a wide shallow furrow, which becomes gradually wider towards the apex; the furrow on the apical slope is wide on the basal two-thirds, much narrower and shallower on the apical. Legs testaceous; the four front femora are more rufous in colour; the posterior darker in tint and are lined with black on the inner and outer sides; the apex of the hinder tibiæ and the hinder tarsi black. Abdomen ferruginous; the petiole, except at its apex, black.

Comes nearest, apparently, to *T. coloratum* Smith. The legs probably vary in tint; the hinder coxæ are black at the base behind. The pleuræ have a plumbeous tint. There are curved lateral furrows on the base of the median segment, but they are not deep or very distinct.]

VESPIDÆ.

VESPA CINCTA Fab.

Biserat. The common Indian form, not the Malayan var. *affinis*. In most of the workers the rufous colour of the abdomen extends on to the basal segment.

POLISTES SAGITTARIUS Sauss.

One specimen of this common species from Biserat.

ICARIA LEPTOGASTER, sp. n.

Flava, capite supra, mesonoto medioque pronoti nigris; alis hyalinis, nervis stigmateque testaceis. ♀.

Long. 14–15 *mm.*

Hab. Patalung, Malay Peninsula.

♀. Antennæ dark rufous; the scape darker in colour. On the head the vertex, the front (except near the eyes and immediately above the antennæ), and the part below the antennæ and above the clypeus, and bordered on the outer side by the sutures, are black; there is an obscure line down the clypeus, which does not extend quite to the apex. The mandibular teeth are black. Mesonotum black. On the apex of the scutellum is a triangular black mark; its central furrow is deep, and does not extend to the base. The furrow on the median segment is narrow at the base; the rest of it is much wider, with the sides obliquely sloped; the centre has a narrow keel. Legs coloured like the body; the apices of the four posterior tibiæ and their tarsi black. Abdomen elongate, without black; the petiole is nearly as long as the 2nd and 3rd segments united.

This is a larger species than *S. sulciscutis*; the femora want entirely the black colour so conspicuous in the last-named species; the abdomen is distinctly longer compared with the thorax, and the rest of the abdomen is clearly longer compared with the petiole; the second segment itself is longer compared with its width at the apex.

[ICARIA SULCISCUTIS, sp. n.

Pallide flava, supra late nigro-maculata; pedibus pallide flavis, tarsis nigris; scutello sulcato; alis hyalinis, stigmate nervisque nigro-fuscis. ☿.

Long. 13 *mm.*

Hab. Bukit Tomah, Singapore.

Antennæ deep black, stout; the joints of the flagellum clearly separated. Head pale yellow; brownish black are the front, except the orbits of the ocelli and a mark above the antennæ, the outer orbits broadly, and the clypeus, except for a black line down its middle on the basal two-thirds, the line becoming wider towards the apex. The black mark on the front is dilated outwardly on the lower edges; there is a narrow but distinct furrow extending from the ocelli to the antennæ; on the black mark between the antennæ are two small yellow marks. The apex of the clypeus is acutely pointed in the middle. Mandibles pallid yellow, except that the teeth are black. The prothorax is black, except the hinder edges narrowly, the upper edges and a broader, more irregular line before the middle. The scutellum is broadly furrowed down the middle; it is yellow, except the middle, narrowly behind, and a large triangular mark behind. The median segment is edged with brown behind and more narrowly down the centre; this central line is much narrowed on the top. The basal line extends obliquely to the spiracles; the pleural furrows are clearly defined; the furrow on the centre of the median segment is keeled. The middle femora are brownish on the basal two-thirds above; the hinder are entirely black, as are also the four hinder tarsi and the apices of the four hinder tibiæ. The petiole is brown, its apex and sides pallid yellow; the other segments are brownish, with the apices and the ventral surface pallid yellow.]

EUMENES CIRCINALIS Fab.

Hab. Patalung, Singora, Malay Peninsula.

The three examples are very dark-coloured, and all differ from each other in coloration.

[ODYNERUS MEPHITIS, sp. n.

Niger, flavo-maculatus; abdominis basi rufa; pedibus flavis, femoribus rufis, tibiis posticis nigris; alis hyalinis, stigmate fusco. ♀.

Long. 6 *mm.*

Hab. Ceylon.

Belongs to the section without a suture on the petiole, and comes close to *O. miniatus* and *O. diffinis.*

Scape of antennæ bright yellow below; the base of the flagellum rufous. Head closely and uniformly punctured; black; the oblique sides of the clypeus, a mark above the antennæ, roundly dilated on either side below the middle, the lateral, the upper, and lower portions being not clearly separated, the end of the eye-incisions, and the outer upper half of the eye-orbits, pale yellow. The central part of the clypeus is flat and strongly punctured; the sides are oblique; the apex transverse. Pro- and mesothorax closely and strongly punctured, as are also the scutellum and postscutellum; the postscutellum has an oblique slope, and does not project at the apex. Median segment opaque, rugose, and thickly covered with silvery pubescence. Legs pallid yellow; the femora rufous; the middle tibiæ are lined behind with black; the posterior are entirely black. On the thorax there are two yellow marks on the pronotum, which become gradually wider outwardly; the tegulæ are yellow at the base and apex; the sides of the scutellum and of the postscutellum more widely are also yellow. Wings clear hyaline, the stigma fuscous; the nervures are darker coloured. The basal half of the petiole is rufous; its apex and the apex of the second segment are yellow; the apical three segments are marked with yellow in the middle; on the sides of the second segment behind the middle is a small yellow mark.]

[RHYNCHIUM TAPROBANÆ, sp. n.

Nigrum, abdomine flavo-lineato; femoribus rufis; alis violaceo-hyalinis, nervis stigmateque nigris. ♀.

Long. 9 *mm.*

Hab. Ceylon.

Antennæ black, brownish beneath. Head black, a line on the lower side of the eye-incision, a small triangular mark over the antennæ, and a large curved mark on either side of the top of the clypeus, yellow. Front and vertex closely and strongly punctured; the lower part of the front, of the eye-incision, and the face and clypeus covered with silvery pubescence; there is a stout keel between the antennæ. Clypeus obliquely narrowed towards the apex, where it is roundly but not deeply incised; the sides are triangular. Pro- and mesothorax closely and strongly punctured; the median segment is more deeply, more rugosely, punctured; the postscutellum has a sharp edge behind and is slightly depressed in the centre there; the sides of the median segment, seen from above, are straight and oblique. The base of the thorax is transverse; in the centre are two small yellow marks; the tegulæ are black. Wings fuscous-violaceous; the violaceous tint is more distinct at the apex and base; the nervures and stigma are deep black. Legs black; the four posterior femora are rufous; the anterior and the anterior tibiæ in front are of a darker rufous colour. The abdomen is closely and rather strongly punctured; the basal segment is cup-shaped, and behind is clearly separated from the 2nd, which becomes distinctly narrowed towards the base; the basal two segments are banded with yellow all round; the 3rd is banded with yellow above; the transverse suture on the base of the second ventral segment has a blistered appearance and is not punctured. The sides of the median segment are broadly rounded, not angular or toothed; the postscutellum is more distinctly raised than usual and is broadly rounded behind.

This species looks not unlike, at first sight, a small example of *R. flavomarginatum*, but is abundantly distinct; *e. g.* the sides of the median segment do not angularly project.]

Apidæ.

[Xylocopa malayana, sp. n.

Nigra, thorace supra abdominisque basi dense fulvo-pilosis; tarsis anterioribus longe albo-pilosis; alis fusco-violaceis. ♂.

Long. 25–26 *mm.*

Hab. Singapore.

Antennæ black; the scape and the fourth and following joints rufous beneath; the scape is only rufous in the middle. Head distinctly narrower than the thorax; black, closely punctured; the vertex behind is covered with yellowish-fulvous pubescence; the sides of the face to the middle of the clypeus with shorter white pubescence; the hair on the upper part of the outer orbits is black, on the lower piceous. In the middle of the clypeus is a pale yellow streak, which reaches near to the apex, which is smooth and shining and is clearly separated; below it is fringed with rufous hair. The mandibles are widely grooved above, narrowly below; the tooth is long and becomes gradually narrowed towards the apex; there is no subapical or upper tooth; the space above the lower tooth is roundly curved. The entire upper part of the thorax is thickly covered with bright yellow pubescence; the pro- and metapleuræ are shining and only sparsely haired; the mesopleuræ black, closely punctured and thickly covered with black, mixed with pale, hair; the hair on the breast is much shorter; the apex of the metapleuræ may be piceous. The four anterior tarsi are thickly fringed with very long white hair; the hair on the four front tibiæ is black, white on the top in front and on the apex behind; on the posterior legs the hair is entirely black. The hair on the basal segment of the abdomen is yellow, passing gradually on the 2nd and 3rd segments into olive colour; on the other segments it is black. The basal ventral segments are more or less rufous; the sides of the 2nd segment bear yellowish hair; those of the 3rd, 4th, and 5th white, the others black hair; the hair on the last segments is long and black. The wings are uniformly deep fuscous-violaceous; the stigma and nervures are deep black.

The ocelli are in a curve ˙.˙; the hinder are separated from each other by about the same distance they are from the eyes.]

[Xylocopa ceylonica, sp. n.

Dense ferrugineo-pilosa, thorace supra abdominisque basi olivaceo-pilosis; alis fusco-violaceis. ♂.

Long. 27–28 *mm.*

Hab. Ceylon.

This species closely resembles *X. rufescens*, but is more slenderly built; the head is narrower compared with the mesothorax, it wants entirely the yellow markings on the face and clypeus; the hair on the top of the thorax and base of abdomen has a distinct olive tint; the 2nd recurrent nervure is not broadly and roundly curved, but has the upper and lower parts straight and oblique, and the face and clypeus are much more densely covered with rufous hair.

The underside of the scape is pale yellowish; the lower part of the flagellum rufous; the third joint darker coloured than the others. Head densely covered with rufous pubescence, which is shorter on the face and clypeus than on the front and vertex. The clypeus is closely and distinctly punctured, except in the centre, where it is smooth, which is also the case with the apex, where it is very smooth and shining; the labrum is more projecting than usual and is keeled in the middle. The ocelli are in a curve; the hinder are separated from each other by a distinctly greater distance than they are from the eyes. Thorax covered with olive-yellow pubescence; the olive tint is more noticeable above than on the pleuræ. The pubescence on the base of the abdomen has a slight olive tint; on the rest it is bright rufous above and below. The pubescence on the legs is long, dense and bright rufous; the apices of the tarsi are piceous. Wings fuscous, with bronzy tints.

The anterior femora are brownish in front; the front trochanters triangularly project at the apex.]

Xylocopa collaris Linn.

Xylocopa pictifrons Smith.

♂. One example of what agrees fairly well with Bingham's description of this species in his Fauna of India, Hymenop. p. 538; but not with Smith's original description, Trans. Ent. Soc. ii. (1852) p. 42, and in his Monograph of the genus, Trans. Ent. Soc. 1874, p. 275.

Xylocopa grandiceps, sp. n.

Nigra, dense fulvo-pilosa; tarsis ferrugineo-pilosis; alis fulvo-hyalinis, nervis nigris. ♀.

Long. 20 *mm.*

Hab. Singapore.

Head large, nearly as wide as the thorax. Ocelli larger than usual, they are placed in a triangle; the hinder are separated from the eyes by one-half the distance they are from each other. Clypeus closely and strongly punctured; its apex has a depressed margin; in the centre is a stout, shining, smooth tooth. The apical tooth of the mandibles is large, triangular; the subapical distinctly projects, is large and rounded at the apex. The front distinctly projects between the antennæ; it is, as is also the vertex, closely, uniformly, and distinctly punctured. The thorax is thickly covered with long rufo-fulvous hair; the mesonotum is smooth and shining; the scutellum is strongly, but not very closely punctured, as is also the median segment, except the basal area, which is alutaceous; the segment has a semiperpendicular slope and is rounded at the top. Wings fulvo-hyaline; rufous in tint along the fore margin;

the 1st recurrent nervure is not interstitial, but is received shortly beyond the 2nd transverse cubital. Tegulæ rufous, black round the inner edges. The hair on the legs is dense, long and bright rufous; the tooth on the apex of the fore tibiæ is short, blunt, and hollowed on the outer side. The hair on the abdomen is similarly coloured to that on the thorax; it is sparse on the back; the ventral segments are fringed with long hair; unless the segments are distorted, the 4th is distinctly longer than the 3rd.

A distinct species; the rufous colour of the pubescence makes it resemble *rufescens* Smith; but, apart from other differences, that species is a *Koptorthosoma*, whereas the present species is a *Xylocopa* s. str. It is a well-marked species, through its head being larger and more particularly wider, compared with the thorax, than usual, most of the species having the head very perceptibly narrower than the mesothorax; the ocelli too are larger and are placed in a triangle, while with most of the species, e. g. *rufescens*, they are placed in a curve; they are also placed nearer to the eyes than in the typical species of *Xylocopa*.]

KOPTORTHOSOMA CÆRULEUM Fab.

One example from Kuala Aring.

KOPTORTHOSOMA ÆSTUANS Linn.

Common, as elsewhere in the Oriental Region.

KOPTORTHOSOMA LATIPES Drury.

Common.

MEGACHILE ERYTHROPODA, sp. n.

Nigra, pedibus rufis; capite dorsoque thoracis dense rufo-pilosis; scapo antennarum rufo; alis fulvo-hyalinis, apice fere fumatis, stigmate nervisque fulvis. ♀.

Long. 14–15 *mm.*

Hab. Singapore.

The scape of the antennæ rufous; the flagellum black, brownish beneath. Except on the clypeus the head is thickly covered with bright fulvo-rufous hair; the face is strongly punctured: the clypeus is more closely rugosely punctured and is strongly keeled on the upper two-thirds; it is covered (but not so thickly as the front) with longish dark rufous hair; on its sides there is a patch of thick fulvous hair, which is obliquely narrowed towards the apex. The apical tooth of the mandibles is bluntly rounded; the subapical tooth is short, broad, bluntly rounded, and is furrowed broadly, but not deeply, in the middle. The entire upper part of the thorax is thickly covered with bright rufous hair, except in the centre of the median segment. The pleuræ are also thickly covered with similar pubescence. Mesosternum closely rugosely punctured and covered with pale fulvous hair. Legs rufous; the coxæ and the four anterior trochanters black; the hair is thick, stiff, and dark rufous; the tarsi are darker in colour, especially towards the apex. Wings fulvo-hyaline, the apex slightly smoky; the stigma and nervures are fulvous. The base of the basal segment of the abdomen and its sides are covered with fulvous pubescence; its apex and the apex of the second are fringed with similarly coloured hair; the hair on the rest of the segment and the ventral scopa deep black. Tegulæ rufous.

The apex of the clypeus is transverse in the middle and has the sides rounded; the central part has an irregular margin, almost toothed on the outer side; the hinder ocelli are separated from each other by twice the distance they are from the eyes.

Comes near to *M. dimidiata* Sm.

MEGACHILE FREDERICI, sp. n.

Long. 21 *mm.* ♀.

Hab. Kuala Aring, Malay Peninsula.

This species closely resembles one from Borneo which is also undescribed. They both agree in being large, in having the pubescence black, except on the apex of the abdomen (where it is pale) and the scopa (which is bright red). The differences between the two may be expressed thus:—

Head and thorax closely and strongly punctured; the apical segment of the abdomen clothed with pale pubescence; the mesonotum not furrowed laterally. Length 21 mm. *frederici.*

Head and thorax sparsely punctured; the apical two segments of the abdomen clothed with pale pubescence; the mesonotum with a wide, deep furrow on either side. Length 23–24 mm. . . . . *bicanaliculata.*

Head strongly and closely punctured; the face is not so strongly or regularly punctured and in the middle is shagreened only; it is distinctly separated from the face. The inner part of the mandibles is irregularly punctured; the outer side has the punctures smaller and more widely separated; the apical tooth is bluntly triangular; the subapical is a bluntly rounded small tubercle. Mesonotum with the scutellum closely, uniformly, and strongly punctured; the postscutellum is closely and minutely punctured: the basal area of the median segment is smooth and shining; the rest of it is closely and minutely punctured; the base of the segment is fringed with long white hair. Pro- and mesopleuræ closely punctured, the metapleura coarsely shagreened. Legs deep black, with deep black pubescence; the pubescence on the underside of the basal joint of the tarsi is bright rufous; the calcaria dull red, almost brown. Wings hyaline, slightly suffused with fulvous tints; the nervures are fuscous black, the stigma darker coloured. Abdomen black; the back almost bare to the last segment, which is thickly covered with greyish-white pubescence; the segments are sparsely punctured at the base and apex; the scopa is bright rufous; the basal ventral segment is for the greater part reddish brown.

[MEGACHILE BICANALICULATA, sp. n.

Long. 23–24 *mm.*

Hab. Borneo, Matang, 3000 feet (*Shelford*).

Vertex shining, sparsely punctured; the punctures shallow, irregular. Below the anterior ocellus is a V-shaped hollow, bordered with stout keels; the sides have an oblique slope. The part of the face below the antennæ is roundly convex and bordered on its lower edge by a keel; the clypeus is keeled down the middle and is more strongly and regularly punctured than the face, its apex is alutaceous, opaque, and impunctate, its sides are roundly, but not very much, dilated. Mandibles opaque, their basal half sparsely punctured; their apical tooth is bluntly rounded, the subapical is indistinct and rounded. Mesonotum shining, sparsely punctured, and having a blistered appearance; its central part is bordered by two shallow, wide furrows; outside these is a narrow, deeper, and more clearly defined one; the outer edge is distinctly and sharply raised and furrowed on the inner side. The scutellum is irregularly punctured like the mesonotum. Median segment closely, distinctly, but not very strongly, punctured; the basal area is smooth and shining, except at the edges (where it is opaque) and at the base on the outer side (where it is punctured); the middle is furrowed; the sides are thickly covered with long white hair. Pleuræ and sternum rugosely punctured; under the wings, below the tegulæ, is a thick patch of white pubescence. Wings hyaline, the apex slightly smoky; the nervures and stigma black. Legs black, thickly covered with stiff black hair. Abdomen black; the dorsal segments closely and minutely punctured; the basal slope is covered with longish, white, soft hair; the apices of the basal four segments are fringed with white hair; the apical two are thickly covered with short white pubescence and with longer white hair; the ventral scopa is bright rufous.]

TRIGONA COLLINA Sm.

Patalung. Described by Smith from Mount Ophir, Malacca.

TRIGONA TESTACEITARSIS, sp. n.

Nigra, capite thoraceque dense albo-pilosis; scapo antennarum apiceque tarsorum testaceis; alis hyalinis, nervis stigmateque piceis. ☿.

Long. fere 4 *mm.*

Hab. Patani, Malay Peninsula.

Scape of antennæ and the second joint testaceous; the flagellum dark testaceous, black on the upperside. Head smooth and shining; densely covered with short white pubescence; the edge of the clypeus is testaceous; the labrum dark testaceous. Mandibles obscure testaceous, darker in the middle. Thorax densely covered with short pale pubescence, except on the median segment; on the pleuræ and sternum it is denser and longer than it is on the mesonotum. Legs black, the tarsi testaceous, the basal joint of the hinder black; the hair on the legs is black, paler on the apical joints of the tarsi. Wings hyaline, highly iridescent; the stigma and nervures are testaceous or piceous. Abdomen smooth and shining; the basal segment may be brownish.

Patani. Several workers.

ICHNEUMONIDÆ.

JOPPINI.

ATANYJOPPA, gen. nov.

Antennæ short, distinctly shorter than the abdomen, thickened and compressed beyond the middle. Clypeus not separated from the face by a suture; a fovea on either side of it above; its apex slightly and roundly incurved in the middle; the labrum distinctly projecting. Face flat. Mandibles bidentate at the apex; the lower tooth much smaller than the upper. Occiput margined, roundly incised. Scutellum flat, broader than long, its sides keeled. Median segment depressed in the middle at the base; it is distinctly areolated. Gastrocœli not very distinct, elongate, narrowed towards the apex. Areolet 5-angled, narrowed above, the recurrent nervure is received in its centre; the apical abscissa of the radius is curved upwards at the base. Legs stout; the base of the front tibiæ deeply incised; the claws are simple. Abdomen long, three times the length of the thorax, which is not much longer than the basal two segments united. Petiole curved at the apex; its spiracles are placed near the base of its apical fourth; the ventral fold extends to the apex of the 4th segment; the segments are produced laterally at the apex; there are 7 segments, the last two are large and form a sharp, somewhat triangular point. Ovipositor short. The middle segments of the abdomen are longitudinally striated.

In Ashmead's classification of the *Joppini* (Proc. U.S. Nat. Museum, xxiii. p. 13) this genus comes nearest to the American genus *Lindigia*, Kreichbaumer, which is, however, very different in form. The characteristics of the genus are the very short, strongly dilated antennæ, the very long abdomen, with its middle segments sharply dilated at the apex, projecting labrum, and flat, strongly keeled scutellum.

[ATANYJOPPA FLAVOMACULATA, sp. n.

Nigra, promesothoraceque albo-maculatis; metathorace rufo; abdomine late albo-lineato; pedibus anterioribus albis, posticis nigris, basi tibiarum late alba; alis hyalinis, stigmate testaceo. ♀.

Long. 17–18 *mm.*

Hab. Borneo (*Shelford*).

Antennæ short, scarcely longer than the thorax. Thorax and basal two segments of the abdomen black; the scape beneath, the basal joints of the flagellum at the apex, and the 7th to 15th more or less white; the scape smooth, thickly covered with long pale hair. Head large; the face, labrum, clypeus, mandibles, palpi, the inner orbits (widest in the middle and behind the ocelli), and the outer orbits (narrow above and becoming wider towards the bottom) yellow; the black on the front and vertex has a plumbeous hue; the front and vertex are very smooth and shining; the face is obscurely punctured in the middle, the clypeus at the base. Labrum thickly fringed with long hair. Thorax: the edge of the pronotum all round above and slightly wider at the apex, a short line on either side of the mesonotum, the sides of the scutellum broadly, its apex more narrowly, the postscutellum, the edge of the propleuræ broadly, the lower half of the mesopleuræ, the tubercles, the edge of the apex of the mesopleuræ, and the sides of the metanotum at the apex, yellow. The mesonotum at the base and sides obscurely punctured; the middle with large deep punctures: it is thickly covered with short black hairs, especially at the base. Scutellum flat, large, slightly narrowed towards the apex; the sides with a stout keel, which extends from the base to near the apex; except along its edges it bears large deep punctures; the apex is longitudinally striated; the depression at the base is narrow and shallow. Postscutellum smooth and shining. The base of the median segment is coarsely shagreened; the rest strongly punctured; the areæ are not distinctly indicated, the keels being faint; the supramedian is longer than broad, and obliquely narrowed at the base; there are no teeth; the apex in the middle is depressed, shining, and finely transversely striated; the keels on the apex of the segment are more distinct than they are on the base; the posterior median area is triangularly narrowed at the base. Propleuræ shining; the upper part strongly obliquely striated; the apex furrowed; the mesopleuræ punctured, more strongly below than above; the middle behind smooth, plumbeous; the apex is crenulated. Metapleuræ strongly and closely punctured. Legs stout, thickly covered with white hair; the four anterior tibiæ and the femora are lined above with black; the hinder coxæ are black, except in the middle behind; the basal joint of the trochanters and the basal half of the hinder tibiæ yellow; the tarsi spinose; the metatarsus and the base of the 2nd joint are testaceous. Wings hyaline, the nervures blackish; the areolet narrowed above, being there somewhat less in length than the space bounded by the first transverse cubital and the recurrent nervures; the latter is received nearly in the middle; the wings are rather short, and hardly reach to the apex of the 4th abdominal segment. The petiole becomes gradually widened from the middle to the apex; yellow, the dilated part blackish, and obscurely longitudinally shagreened; the 2nd, 3rd, and 4th segments are broadly yellowish at the base; the apical three are entirely white; the 2nd and 3rd segments punctured and longitudinally striolated in the middle; the gastrocœli are shallow, and not very clearly indicated; the ovipositor projects, its sheath is black.]

[ATANYJOPPA RUFOMACULATA, sp. n.

Long. 22 *mm.* ♀.

Hab. Khasia (*Rothney*).

Agrees closely with the preceding species, from which it may be known by the median segment being broadly black at the base and in the middle, while the metapleuræ are also broadly black at the base.

Antennæ black; the scape beneath and the 7th joint to the commencement of the dilatation white; the dilated apex has a brownish hue. Head pale yellow; the middle of the front and of the vertex broadly, the occiput, and the hinder part of the outer orbits to shortly below the middle, black. Face and clypeus shining, flat, sparsely and indistinctly punctured; the face is covered with short, the clypeus with longer pale, hair; the apex of the clypeus is more distinctly punctured than the rest; the projecting labrum is smooth and is fringed with long hair. Mandibles yellow, black at the apex. Thorax black; the edge of the pronotum, two short marks, narrowed at the base and apex, the sides of the scutellum broadly and of its apex more narrowly, the postscutellum, an irregular mark behind the metathoracic spiracles, the apex of the segment from behind the middle and extending obliquely on to the pleuræ, the lower edge of the propleuræ and slightly less than the lower half of the mesopleuræ, yellow. Mesonotum smooth, closely punctured in the middle, where the yellow spots are. Scutellum strongly, but not very closely, punctured. Postscutellum sparsely punctured. Propleuræ closely and distinctly punctured; in the middle are some curved keels, at the apex short striæ; the yellow, lower part of the mesopleuræ closely punctured. Median segment closely, rugosely punctured all over; the posterior median area coarsely, closely, transversely striated. The four front legs are yellow; the femora and tibiæ are black behind; the hinder coxæ are yellow, black below and at the base above; the hinder femora entirely, and the apical part to near the middle and the base narrowly, black; the hinder tarsi are blackish behind. Wings clear hyaline; the stigma testaceous; the apical nervures fuscous. Abdomen black; the basal four segments to near the middle and the apical two segments entirely yellow; the postpetiole is closely shagreened and closely striated; the middle segments are closely punctured; the 2nd and 3rd segments are longitudinally striated at the base.]

Mesostenini.

Skeatia, gen. nov.

♂. Antennæ shorter than the body; the basal joints of the flagellum elongated, the middle ones roundly and broadly dilated on the lower side; the apical ones dilated, about three times broader than long. Thorax three times longer than broad; the parapsidal furrows deep, reaching to shortly beyond the middle. Median segment, except at the base, coarsely, irregularly reticulated; the basal smooth part is bounded by a stout transverse keel; in its centre is a small square area. Metapleural keel distinct, long. Areolet small, square; the apical nervure is faint; the transverse median nervure is received behind the transverse basal; the hind wings as in *Mesostenus*. Legs slender, long; the fore tarsi nearly twice the length of the tibiæ; their claws are small; the hinder coxæ elongate, about three times longer than wide. Petiole of abdomen long, slender, curved, not much dilated towards the apex.

The malar space is moderate; the eyes reaching to the end of the clypeal foveæ, which are deep. Clypeus roundly convex; not separated by a suture above. Mandibles large, bidentate; the upper tooth is slightly smaller than the lower. Mesopleural furrow wide and deep. Scutellum roundly convex, only keeled at the base; postscutellum bifurcate at the base. Median segment armed with two long teeth; it is moderately long. Palpi long; the second joint of the maxillary is dilated towards the apex. The propleuræ are stoutly keeled laterally in front. The head is wider than the thorax; it is obliquely narrowed behind the eyes; the occiput is sharply keeled. The scutellar depression is large, deep, and bears two keels in the middle.

The female has the antennæ stouter than in the male, and they are slightly thickened beyond the middle; the abdominal petiole is shorter and broader towards the apex; the apex of the abdomen is bluntly pointed; the last segment (the 8th) is very short above, below it is much more largely developed; the ovipositor is not one-half the length of the abdomen.

The metathoracic spiracles are small, oval, about twice longer than they are broad; the median segment is depressed at the base, the scutellar and postscutellar furrows are deep and crenulated. The last joint of the hinder tarsi is about equal in length to the third.

Skeatia albispina, sp. n.

Nigra, facie, clypeo, mandibulis tarsisque albis; coxis trochanteribusque anterioribus pallide flavis; alis fere hyalinis, nervis stigmateque nigris. ♂.

Long. 13 *mm.*

Hab. Bukit Besar, Malay Peninsula.

Antennæ black; the 7th to 24th joints white beneath; the scape pale yellow in the middle below; the scape is covered with short pale pubescence. Head smooth and shining; black; the face, clypeus, mandibles, and palpi pale yellow. Ocelli large. Front depressed; a stout keel runs down its centre from the ocelli. Eyes large, parallel. Mesonotum and scutellum smooth and shining. Propleuræ stoutly longitudinally keeled behind. Mesopleuræ opaque and closely longitudinally striated, except on the upper part behind. Metapleuræ above closely, below more stoutly, irregularly, and not so closely, reticulated. The mesosternal furrow is wide and deep, especially at the base, and is closely striated. The base of the median segment is smooth and shining; there are a few narrow irregular striæ on either side of the central area; the basal keels in the middle are curved and end in a squarish area, which is stoutly keeled down the middle; the rest of the segment is stoutly reticulated; the spines are long, curved, and white. All the coxæ are pale yellow (actually they are testaceous yellow, but this may be owing to discoloration);

the front legs, the middle femora at the base, and the greater part of the middle tibiæ are testaceous; the basal joint of the middle tarsi and the basal third of the posterior and the hinder trochanters, the femora, tibiæ, and calcaria are black. Abdomen black, except the apical segment, which is white.

SKEATIA NIGRISPINA, sp. n.

Nigra, coxis, trochanteribus et femoribus anterioribus, basi femorum posticorum late tarsisque posticis flavis; alis hyalinis, nervis stigmateque nigris. ♀.

Long. 13, *terebra* 3 *mm.*

Hab. Bukit Besar, Malay Peninsula.

Antennæ as long as the body, thickened towards the apex; the 6th to 13th joints white, except above. Front and vertex shining; the front below the ocelli stoutly, irregularly longitudinally striated; the lower part excavated, smooth except for a stout keel down the middle. Face coarsely aciculated, slightly and broadly projecting in the centre, where it is yellow; clypeus broadly, roundly convex; its lower part projecting and slightly oblique. Mandibles dark testaceous; their lower border keeled. Mesonotum aciculated; the scutellum is more shining, the post-scutellum still more so. The basal region of the median segment has two keels in the centre, which converge towards the apex; the parts nearest to them are smooth and shining; the rest opaque, with some thin oblique striæ on the inner portion. The middle part of the propleuræ is stoutly striated. Mesopleuræ closely striated, except above. Except at the base above, the metapleuræ are closely, stoutly, obliquely striated. The meso-pleural keel is curved, deep, not very wide, and striated. Meso-sternum smooth and shining. The median segment behind the transverse keel is closely reticulated; the apical slope is irregularly transversely striated; the teeth are stout, curved, black, dull testaceous towards the apex. Legs black; the four anterior coxæ, trochanters, and femora, the hinder coxæ, basal two-thirds of the femora, and the hinder tarsi except the extreme base, yellow. Abdomen black; the apical two segments lemon-yellow above; the 2nd and 3rd segments are shagreened, the others smooth and shining.

VAGENATHA, gen. nov.

Edges of pronotum and median segment stoutly spined. Parapsidal furrows distinct; the first joint of the flagellum distinctly longer than the second. Median segment with one incomplete transverse keel. Middle segments of the abdomen distinctly separated and narrowed at the base; the edges of the second, third, and fourth on the lower edges at the apex projecting into spines. Petiole broadly dilated at the apex, the postpetiole clearly defined; the spiracles are nearer to each other than to the apex; on the lower side at the base are two sharp, oblique teeth.

Metapleural keel complete. Head wider than the mesothorax; its front and vertex reticulated, without spines or keels. Scutellar depression large, shallow, and bearing longitudinal keels. Areolet large, about twice longer than wide; the transverse cubital nervures are parallel and only slightly oblique; the recurrent nervure is received near the base of the apical fourth of the cellule; the transverse median nervure is received behind the transverse basal. Both the transverse cubital nervures are distinct.

The eyes largely project; the head behind them is obliquely narrowed and is well-developed there; the occiput is sharply margined; the scutellum is flat and has the sides keeled; on the basal half of the second segment are two oblique, wide, shallow furrows, which enclose a triangular space; at the apex of this is a narrow transverse furrow; there is a similar, but not quite so distinct, furrow on the third segment. The legs are long; the tarsi are spinose, the anterior are twice the length of the tibiæ; the median segment is coarsely, irregularly reticulated; the spiracles are about three times longer than wide; in the hind wings the transverse median nervure is angularly broken by the subdiscoidal nervure shortly below the middle.

In Ashmead's system (Bull. U.S. Nat. Mus. xxiii. p. 44) this genus comes near *Mesostenoideus* and *Christolia*. Characteristic are the clearly separated middle abdominal segments, spined at their apices, and the spines on the basal ventral segment.

[VAGENATHA SPINOSA, sp. n.

Nigra, flavo-maculata, spinis flavis; pedibus flavis, coxis posticis, apice femorum posticorum apiceque tibiarum posticarum nigris; alis hyalinis, nervis stigmateque nigris. ♂.

Long. 16 *mm.*

Hab. Borneo (*Shelford*).

Antennæ as long as the body; black, the scape beneath and the middle of the flagellum broadly white. Head black; the clypeus yellow. Front and vertex smooth and shining, except the front, which is irregularly reticulated in the middle—more broadly above than below. The face is opaque, coarsely shagreened, and sparsely haired; the outer orbits are thickly covered with longish white pubescence. The spines on the pronotum are large. Mesonotum closely, rugosely punctured, opaque; the parapsidal furrows are irregularly striated. The scutellar depression is large; in the centre are two stout longitudinal keels, with a thinner one between them; on their outer side is another narrow keel. Scutellum sparsely punctured at the base. Median segment strongly, closely, rugosely reticulated. Propleuræ obliquely, stoutly striated; the striæ distinct and clearly separated. Mesopleuræ on the base and lower side closely, rugosely punctured; the middle obliquely striated; the apex behind smooth and shining above. Metapleuræ strongly, obliquely striated; below thickly covered with white pubescence. Legs yellow; the femora with a more fulvous hue;

the hinder coxæ, except above, the base of the trochanters, the apex of the hinder femora and of the hinder tibiæ, black. Abdomen black; the base and apex of the petiole and the apical third of the other segments yellow; they are closely and distinctly punctured, the petiole more coarsely than the others.

There is a short broad tubercle on the centre of the median segment; it is joined to the teeth by an oblique broad yellow band; all the thoracic spines are yellow, as are also the tegulæ, scutellum, and tubercle.]

BRACONIDÆ.

IPHIAULAX MALAYANUS, sp. n.

Luteus, capite, antennis tarsisque posticis nigris; facie clypeoque pallide flavis; alis fusco-violaceis, ad basin late flavis. ♀.

Long. 12, *terebra* 4 *mm.*

Hab. Singora, Malay Peninsula.

Antennæ entirely black, as long as the body; the scape smooth and thickly covered with long fuscous hair; it is more shining than the flagellum. Head black, shining; the face from shortly below the antennæ, the oral region, and the malar space pale yellow. Face smooth; in its centre, below the antennæ, is a deep furrow with oblique sides. The clypeus is surrounded by a keel, which is more distinct on the top, where it forms a semicircle. Thorax smooth and shining; above, and on the sternum, it is thickly covered with long pale hair. The meso- and metapleural furrows are smooth, wide, and deep. Legs coloured like the body, thickly covered with white hair; the hinder tarsi are deep black. Wings to shortly beyond the transverse median nervure yellowish hyaline; the rest deep fuscous, with a violaceous tinge, except the base of the stigma broadly and a narrow oblique mark on the base of the first cubital cellule. Petiole smooth, except the raised central part, which bears large, deep, elongated punctures. The second segment is closely, rugosely punctured; the central basal part is smooth and is not prolonged into a keel; the basal depression is deep; the basal branch is striated in the bottom, the wider apical one is smooth; at its apex are four narrow keels. Securiform articulation deep, wide, stoutly, but not very closely, longitudinally striated; the apical furrow on the segment is narrow, deep, and smooth; the 2nd and 3rd furrows are deep and closely striated, those on the apices of the segments are smooth and deep.

EVANIIDÆ.

[EVANIA SHELFORDI, sp. n.

Nigra, basi flagelli antennarum, trochanteribus anterioribus, basi tibiarum posticarum basique tarsorum posticorum late, albis; alis fusco-violaceis. ♀.

Long. 12 *mm.*

Hab. Borneo (*Shelford*).

Antennæ black; the 3rd joint, except at the apex, white. The front and vertex are stoutly, acutely, longitudinally striated; the face is similarly, but more obliquely, striated; the outer parts of the head are obliquely, and not quite so strongly, striated. The hinder ocelli are separated from each other by about the same distance as they are from the eyes. The lower tooth of the mandibles is rufous before the apex; the palpi are dark fuscous. The base of the pronotum is raised; the raised part slightly projects laterally; the sides are oblique; the base is not quite transverse, the edges being rounded; it bears round, deep, clearly separated punctures. The central part of the mesonotum is alutaceous and impunctate at the base; the rest of it irregularly, deeply, but not very closely punctured; this punctured part is bordered by a deep furrow; outside this it is opaque and alutaceous, and bears two thin keels on the outer side. Scutellum in the middle strongly, irregularly punctured; the centre has a longitudinal keel; the sides are stoutly, obliquely striated; on the postscutellum are two stout keels. Propleuræ alutaceous and bearing some scattered, shallow punctures. The upper two-thirds of the mesopleuræ are smooth and shining, except for an oblique, clearly defined, depressed area; this has the bordering keels more distinct in front than behind and bears, except at the base and apex, some stout keels; the lower part is closely, but not very deeply punctured. Sternum smooth. Median segment closely reticulated; the central portion more closely, rugosely, and irregularly than the rest. The basal part of the wings is fuscous, with a distinct violaceous tinge; the apical part below the radial and second cubital cellules is similarly, but more lightly, clouded. The metasternal fork is short and stout, and obliquely diverges at the apex: behind it is a stout, smooth keel. The front tibiæ and tarsi are fuscous; the four anterior trochanters are broadly white at the base, as is also the base of the hinder tibiæ narrowly, the basal joint of the hinder tarsi, and the second joint broadly in the middle. Petiole smooth at the base: its sides bear stout, oblique striæ; the apical half above is irregularly, coarsely punctured. The hinder tibiæ and tarsi are shortly spined. The sides of the median segment are broadly rounded; the middle transverse; the abdomen is very smooth, shining, and piceous.

This comes nearest, of the known species, to the Australian *E. princeps* West.]

3. On the Arachnida collected during the "Skeat Expedition" to the Malay Peninsula, 1899–1900. By M. Eugène Simon, President of the Entomological Society of France[1].

[Received April 15, 1901.]

[This collection of Arachnida contains examples of 129 species, of which 48 are described as new, and there are also 4 new subspecies. Three new genera are characterized. A few species of Acarina—chiefly Ixodidæ—were obtained, but have not been determined. Not one of the members of the Skeat Expedition was a specialist in Arachnida, so that the large percentage of novelties in this collection indicates that a great deal of work still remains to be done at this class of animals in the region in question.—D. S.]

Ordo ARANEÆ.

Familia Aviculariidæ.

1. Selenocosmia javanensis (Walckenaer).

Mygale javanensis Walck., Apt. i. 1837, p. 216.
M. monstrosa C. Koch, Arachn. v. 1839, p. 14, f. 346.

Biserat in Jalor (District of Patani).

En tout semblable aux exemplaires de Java auxquels je l'ai comparé.

Connu de Java, de Sumatra, de Celebes et des Iles Nicobars.

2. Omothymus thorelli, sp. nov.

Ceph.th. long. 19 *mm.*, *lat.* 18. *Ped. max.* 44 *mm.* *Ped.* i. 81 *mm.*; ii. 70 *mm.*; iii. 63 *mm.*; iv. 76 *mm.*

Cephalothorax nigricans, crebre et longe flavido-pubescens, humilis, non multo longior quam latior sed antice valde attenuatus, fronte sat angusta, fovea thoracica recte transversa, sat profunda sed tuberculo oculorum fere duplo angustiore, impressionibus radiantibus distinctis. Tuberculum oculorum modice altum, ovato-transversum et fere duplo latius quam longius. Oculi quatuor antici in lineam leviter procurvam, inter se fere æquidistantes (spatiis interocularibus diametro minore oculi lateralis non latioribus), medii rotundi, laterales longe ovati atque obliqui mediis saltem $\frac{1}{3}$ *minores. Oculi medii postici albi, parvi, obtuse triquetri, oculi laterales postici ovati et obliqui, mediis posticis majores sed lateralibus anticis multo minores. Clypeus sub oculis mediis convexus, diametro majore oculi lateralis paulo latior. Chelæ nigricantes, flavido-pubescentes, supra setis longissimis fulvo-rufulis hirsutæ, extus crebre scopulatæ, subtus marginibus sulci cum margine interiore coxarum pedum-*

[1] Communicated by Dr. D. Sharp, F.Z.S.

maxillarium crebre coccineo-crinitis. Abdomen breve, setis longissimis et erectis, ad basin fuscis ad apicem pallide ferrugineis crebre vestitum. Pars labialis sternum pedesque nigella, flavido vel cinereo-flavido crebre pubescentia. Pars labialis crebre et minute granulosa. Pedes setis validis fuscis vel nigris hirsuti et setis fulvo-rufulis multo longioribus conspersi, tarsis cunctis, metatarsis 1^i paris usque ad tertiam partem basilarem, metatarsis 2^i paris usque in medio, metatarsis posticis tantum ad apicem late et crebre nigro-cinereo-scopulatis. Tibia 1^i paris apophysi brevi crassa leviter incurva, apice late et obtuse truncata, spinulis nigris incurvis creberrime vestita, intus ad apicem instructa. Pedes-maxillares longissimi, bulbo ad basin nigro, præterea fusco-rufulo, piriformi, spina intus directa, attenuata sed obtusa, subtiliter striata et supra acute carinata.

Ab *Omothymo schiœdtei* Thorell, cui verisimiliter affinis est, differt imprimis tuberculo oculorum duplo (haud triplo) latiore quam longiore et oculis lateralibus posticis anticis multo minoribus.

Perak : Ulu Selama.

Nota.—Il est à noter que le sternum est assez fortement atténué en avant, caractère attribué par R. I. Pocock au genre *Phormingochilus.*

3. Chilobrachys annandalei, sp. nov.

♀. *Ceph.th. long.* 16·3 *mm., lat.* 13·5. *Pedes* i. 47·5 *mm.*; ii. 40·5 *mm.*; iii. 39·5 *mm.*; iv. 48 *mm.*

Cephalothorax fuscus, cinereo-fulvo-pubescens, sat humilis, evidenter longior quam latior, antice modice attenuatus, fovea thoracica profunda sat magna, tuberculo oculorum non multo angustiore, valde procurva semilunari. Tuberculum oculorum ovato-transversum, saltem duplo latius quam longius. Oculi quatuor antici, superne visi, in lineam vix procurvam, medii inter se quam a lateralibus vix remotiores (spatio inter oculum medium et lateralem utrinque diametro minore lateralis minore), medii rotundi, laterales longe ovati et obliqui mediis paulo minores, oculi medii postici albi, parvi, ovati, recti et leviter angulosi, laterales ovati et obliqui mediis majores sed lateralibus anticis evidenter minores. Clypeus diametro majore oculorum lateralium latior. Abdomen oblongum, fuscum, fulvo-ferrugineo-pubescens et hirsutum. Chelæ fuscæ, supra fulvo-ferrugineo-pubescentes et longe hirsutæ, extus fere glabræ et nitidæ sed prope marginem inferiorem minute et creberrime spinulosæ, marginibus sulci cum margine interiore coxarum pedum-maxillarium crasse coccineo-ciliatæ. Partes oris, coxæ sternumque obscure fusca, sat breviter nigro-setosa. Pars labialis apice convexa, minutissime et crebre granulosa. Coxæ pedum-maxillarium intus aculeis pronis bacilliformibus biseriatis, inferioribus longioribus, instructæ. Pedes sat longi, robusti, sed metatarsis tarsisque posticis sat gracilibus, fusci, fulvo-rufulo pubescentes et hirsuti, aculeis parvis apicalibus metatarsorum posticorum exceptis, mutici, tarsis metatarsisque quatuor anticis usque ad basin crasse *scopulatis, tarsis posticis scopulatis sed scopulis tarsorum 4ⁱ paris linea parce setosa subdivisis. Ungues tarsorum (saltem posticorum) dentibus paucis parvis et remotis, in medio muniti.*

Jalor: from floor of cave.

Familia PSECHRIDÆ.

4. PSECHRUS ARGENTATUS (Doleschall).

Jalor: Biserat. Ligeh: Belimbing.

Trouvé pour la première fois dans la presqu'île Malaise, espèce répandue dans l'Austro-Malaisie et la Nouvelle-Guinée.

5. (?) PSECHRUS SINGAPORENSIS Thorell.

Psechrus singaporensis Thorell, Boll. Soc. ent. Ital. xxvi. 1894, p. 1.

Perak: Ulu Selama.

Détermination incertaine, les individus recueillis étant tous jeunes.

Familia ULOBORIDÆ.

6. ULOBORUS GENICULATUS (Olivier).

Ul. zozis Walck., Apt. ii. 1841, p. 197.

Ul. latreillei Thorell, Vet. Ak. Forh. xv. 1858, p. 197.

Orithyia williami Blackwall, Ann. Mag. Nat. Hist. 3rd ser. ii. 1858, p. 331.

Ul. domesticus Doleschall, Tweede Bijdr. etc. 1859, p. 46.

Ul. borbonicus Vinson, Aran. Réun. etc. 1863, p. 258, pl. 1. f. 3.

Jalor: Biserat. Kelantan: Kuala Aring.

Espèce répandue dans toutes les régions tropicales du monde.

7. ULOBORUS PTEROPUS (Thorell).

Philoponus pteropus Thorell, in Ann. Mus. Civ. Gen. xxv. 1887, p. 128.

Patalung.

Décrit de Birmanie.

Familia SICARIIDÆ.

8. SCYTODES MARMORATA L. Koch.

Scytodes marmorata L. Koch, Ar. Austr. i. 1872, p. 292, tab. xxiv. f. 4.

Jalor: Biserat.

Espèce très répandue dans toute l'Asie tropicale, la Malaisie et la Polynésie.

Familia ZODARIIDÆ.

9. STORENA PSELIOPHORA Thorell.

St. pseliophora Thorell, Bih. t. K. Sv. Handl. xx. 1894, p. 5.

St. annulipes Thorell, Bull. Soc. ent. Ital. xxiv. 1892, p. 209 (non L. Koch).

Perak : Ulu Selama.

Décrit de Singapore.

10. Storena obnubila, sp. nov.

♀. *Long.* 6·5 *mm.—Cephalothorax ovatus, valde convexus, fronte obtusa, nigro-nitidus et glaber. Oculi cuncti parvi et subæquales, lineas binas validissime et fere æqualiter procurvas designantes, medii antici et postici a sese subcontigui sed a lateralibus latissime distantes, aream parallelam fere duplo longiorem quam latiorem occupantes. Clypeus latus. Abdomen breviter ovatum, supra duriusculum, nigro-nitidum et glabrum, sed postice, supra mamillas, minute albo-testaceo, notatum, subtus confuse dilutius. Mamillæ albo-testaceæ. Chelæ sternumque fusco-rufula sublævia. Pedes, præsertim antici, sat breves et robusti, lutei, tibiis ad basin late olivaceis, pedes quatuor antici femoribus supra parce aculeatis, tibia* 1*ⁱ paris subtus aculeis binis parvis setiformibus uniseriatis, metatarso aculeo basali aculeisque apicalibus binis similibus, tibia* 2*ⁱ paris subtus aculeis trinis uniseriatis aculeisque binis interioribus, metatarso aculeis binis subbasilaribus aculeisque apicalibus binis, cunctis parvis et debilibus, armatis. Pedes postici aculeis validioribus numerosis muniti. Metatarsi antici usque ad basin, postici ad apicem crasse nigro-pilosi. Pedes-maxillares fulvo-rufuli, robusti, tarso acuminato. Regio epigasteris leviter coriacea, rufula, postice tenuiter nigro-marginata et plagula media rufula minutissima notata.*

Perak : Ulu Selama.

Species fere inter *Storenam* et *Asceuam.*

11. Storena sciophana, sp. nov.

♀. *Long.* 8 *mm.—Cephalothorax ovatus, modice convexus, fronte obtusa, nigro-piceus, omnino subtilissime coriaceus, opacus et glaber. Oculi quatuor postici in lineam validissime procurvam semicircularem, medii a lateralibus quam inter se saltem* $\frac{1}{3}$ *remotiores, quatuor antici in lineam minus procurvam, inter se anguste et fere æque separati, oculi medii antici cum lateralibus posticis lineam leviter recurvam designantes, oculi quatuor medii aream subquadratam occupantes, antici reliquis oculis, inter se subæqualibus, multo majores. Clypeus altissimus. Abdomen ovatum, supra nigrum, immaculatum, sed postice, supra mamillas, minute testaceo-notatum, subtus obscure fulvo-testaceum et vittis trinis parallelis sat angustis nigricantibus notatum, regione epigasteris leviter coriacea rufula, mamillis fulvis. Chelæ robustæ, subtiliter coriaceæ, nigro-piceæ, apice leviter dilutiores. Sternum fusco-rufulum, subtiliter coriaceum, parce nigro-setosum. Partes oris fuscæ apice dilutiores et testaceæ. Pedes longi fulvo-rufuli, coxis trochanteribusque dilutioribus, femoribus* *infuscatis et olivaceis. Fovea genitalis semicircularis, plagulam rufulam transversam leviter procurvam includens.*

Perak: Ulu Selama.

Familia HERSILIIDÆ.

12. HERSILIA SAVIGNYI Lucas.

Hersilia savignyi Lucas, Mag. Zool. 6e Ann. 1836, cl. viii. p. 10, tab. xiii. f. 1.

? *H. calcuttensis* Stoliczka, J. A. S. Beng. xxxviii. 1869, p. 216, pl. xx. f. 9.

Perak: Ulu Selama. Raman: Kota Bharu.

Espèce très répandue dans l'Inde et la Birmanie.

Familia PHOLCIDÆ.

13. PHOLCUS OPILIONOIDES (Schrank).

Perak: Gunong Inas.

Espèce répandue en Europe, dans l'Asie centrale et en Chine.

Trouvée sur le Mt. Inas (environ 6000 pieds).

14. PHOLCUS V-NOTATUS Thorell.

Pholcus v-notatus Thorell, St. Rag. Mal. etc. 1878, p. 163 (300).

Kelantan: Kuala Aring.

Décrit d'Amboine, indiqué depuis de Birmanie (Bhamo) par Thorell.

15. PHOLCUS VESCULUS, sp. nov.

♀. *Long.* 4·5 *mm.—Cephalothorax fere orbiculatus, pallide luteus, parte thoracica macula fusca media magna postice ampliata et subtriquetra, linea media pallida divisa, notata, parte cephalica thoracica vix altiore, clypeo leviter infuscato sed linea media pallida notato. Oculi ordinarii, quatuor antici apicibus in lineam rectam, medii parvi, nigri, a sese contigui a lateralibus spatio oculo laterali non majore distantes. Oculi laterales utrinque a sese contigui, anticus reliquis paulo major. Abdomen sat longe ovatum, supra convexum, postice longe declive, nec truncatum nec angulosum, albidum, supra in dimidio basali, linea longitudinali fusca angusta et leviter lanceolata notatum, subtus vittis binis obscurioribus parum expressis, postice valde divaricatis et leviter ampliatis ornatum. Chelæ, partes oris, sternum pedesque lutea, patellis fuscis, tibiis annulo apicali fusco parvo notatis. Tuberculum genitale magnum, altum et subglobosum, albidum sed postice, in declivitate, rima transversa fusco-rufula coriacea notatum.*

Perak: Gunong Inas.

16. PHOLCUS DIOPSIS, sp. nov.

♂. *Long.* 5–6 *mm.—Cephalothorax fere orbiculatus, luteo-rufescens, parte thoracica in medio confuse infuscata, cephalica brevi, late truncata, in medio setis erectis inordinatis munita,* *utrinque tuberculo longo (parte cephalica haud breviore) divaricato, luteo apice nigro, gracili, versus basin sensim angustiore, apice minute mucronato, oculos laterales gerente, insigniter instructa. Oculi medii antici minutissimi fere obsoleti, oculi laterales utrinque mediocres, longissime pediculati. Abdomen longum, teretiusculum, apice leviter convexum, omnino albido-testaceum. Chelæ debiles, rufulæ, intus prope apicem tuberculo nigro, obtuso, cariniformi et granuloso munitæ. Partes oris, sternum pedesque longissimi pallide lutea, patellis leviter infuscatis, tibiis ad apicem minute fuscis. Pedes-maxillares maximi; trochantere parvo, subtus ad apicem apophysi lutea, erecta, acuta et sat longa armato; tibia longe et late ovata; tarso brevi, supra apice acuminato; apophysi fusco-rufula, longa, leviter sinuosa.*

♀. *Long.* 6–7 *mm.—Cephalothorax pallide luteus, paulo latior quam longior, utrinque ample rotundus. Oculi antici in lineam rectam, medii a sese contigui, minutissimi et punctiformes, a lateralibus late distantes (spatio interoculari oculo laterali multo latiore). Oculi laterales utrinque contigui, interior reliquis paulo minor. Tuberculum genitale magnum, latum sed apice acuminatum, postice verticale, triquetrum, planum, testaceum sed utrinque rufulum et leviter coriaceum.*

Gua Glap ("Dark Cave"), Biserat, Jalor.

A *P. podophthalmo* E. Sim. (ex ins. Taprobane), cui sat affinis est, imprimis differt, tuberculis oculiferis apice minute ampliatis haud truncatis sed minute et acute mucronatis, tarso pedum-maxillarium apice acuminato, haud truncato, etc.

17. Spermophora tessellata, sp. nov.

♀. *Long.* 2 *mm.—Cephalothorax pallide luteus, parte cephalica clypeoque infuscatis fere nigris, brevis, latior quam longior, utrinque ample rotundus, parte cephalica a thoracica sulco profundo semicirculari discreta, antice leviter elevata et latissime truncata, thoracica convexa, sulco longitudinali profundo secta. Oculi in turmas duas, inter se late remotas, ordinati, utrinque tres, duo exteriores inter se contigui, alter interior a reliquis leviter sejunctus, paulo minor et ovatus. Abdomen valde convexum et postice subverticale, albido-testaceum, maculis nigris iniquis, medianis majoribus et subquadratis, parum regulariter seriatis, supra ornatum, subtus late nigricanti-plagiatum, mamillæ prominentes. Chelæ debiles, fuscæ, antice opacæ et leviter inæquales. Sternum latius quam longius, nigrum, sublæve. Partes oris et pedes-maxillares minutissimi, fusci. Pedes tenues et longi, minutissime rugosi, lutei, femoribus, præsertim posticis, prope apicem leviter infuscatis et subannulatis. Plaga genitalis maxima, medium ventris occupans, rufula et convexa sed in medio depressa, latior quam longior, utrinque oblique truncata, postice leviter prominula.*

Jalor: Biserat.

A *S. maculata* Thorell, cui verisimiliter affinis est, differt parte thoracica haud vittata, tibiis pedum haud annulatis, etc.

Genus Uthina E. Simon.

Uthina Simon, Hist. Nat. Ar. 2e éd. t. i. p. 476.
Belisana Thorell, in Ann. Mus. civ. Gen. 2a s. xix. 1898, p. 278.

18. Uthina atrigularis, sp. nov.

♀. *Long.* 3 *mm.—Cephalothorax haud longior quam latior, utrinque ample rotundus, parte cephalica brevi, lata et convexa, sulco semicirculari profundo discreta, luteo-testaceus nitidus, regione oculari clypeoque (margine excepto) nigris, parte thoracica area ovata longitudinali fusco-marginata notata. Oculi utrinque valde prominuli et pediculati a sese contigui, anticus reliquis major, spatio inter tubercula sat angusto, leviter convexo, a clypeo, leviter proclivi, stria transversa discreto. Abdomen angustum et longissimum, utrinque leviter bisinuosum, albido-testaceum, supra tenuiter albido-pubescens sed vitta media glabra et postice maculis nigris biseriatis, parvis, longis et obliquis ornatum, subtus glabrum, duriusculum, et nitidum. Chelæ et partes oris nigricantes, hæ testaceo-marginatæ. Sternum pedesque pallide lutea, patellis cunctis nigris, tibiis ad apicem minute nigris. Area genitalis subrotunda, magna, latitudinem epigasteris totam occupans, antice convexa, nigricans, lævis et semicircularis, præterea rufula, depressa et transversim rugata.*

Ab *U. luzonica* E. Sim. imprimis differt oculis utrinque longius pediculatis, clypeo nigro, femoribus annulo fusco subapicali carentibus, etc.

19. Micromerys vermiformis E. Simon.

Calapnita vermiformis E. Simon, Ann. Soc. ent. Fr. 1892, p. 42

Détermination incertaine, le seul individu recueilli étant en mauvais état.

Kelantan: Kuala Aring.

Familia Theridiidæ.

20. Ariamnes flagellum (Dol.) nigritus, subsp. nov.

♀. *Long.* 29 *mm.—Cephalothorax nigricans, prope marginem vix dilutior. Abdomen longissimum et vermiforme, obscure fusco-testaceum, vitta dorsali lata et integra nigricanti et utrinque punctis nigris inordinatis notatum. Sternum fuscum, utrinque fulvo-marginatum. Pedes obscure fusci, crebre nigricanti-punctati, coxis trochanteribusque anticis luteis, femoribus anticis prope basin luteis et subvittatis. Pedes-maxillares nigricantes.*

Patalong.

21. Argyrodes miniaceus (Doleschall).

Patalung: Ban-Kong-Rak. Raman: Kota-Bharu.

Vit en parasite sur la toile de *Nephila imperialis* Doleschall.

22. Argyrodes fissifrons O. P. Cambridge.

A. fissifrons O. P. Cambr. in Journ. Linn. Soc., Zool. x. 1869, p. 380, tab. xii. ff. 31–38.

A. inguinalis et *fissifrons* Thorell, St. Rag. Mal. etc. ii. 1878, pp. 145–148.

A. procrastinans O. P. Cambr. in Proc. Zool. Soc. Lond. 1880, p. 330, tab. xxix. f. 9.

Kelantan : Kuala Aring.

Vit en parasite sur la toile des *Nephila*.

Espèce très répandue dans l'Inde et la Malaisie.

23. Phoroncidia lygeana (Walckenaer).

Plectana lygeana Walck. Apt. ii. 1841, p. 11.

Phor. acrosomoides V. Hasselt, Midd.-Sum. etc., Ar. 1882, p. 30, tab. i. f. 7.

Kelantan : Kuala Aring. Perak : Gunong Inas.

Décrit de Sumatra.

24. Episinopsis rhomboidalis E. Simon.

Episinopsis rhomboidalis Simon, in Ann. Soc. ent. Fr. 1895, p. 136.

Jalor : Bukit Besar.

Décrit de Singapore.

25. Theridion rufipes Lucas.

Jalor : Biserat.

Espèce répandue dans toutes les régions tropicales du monde.

26. Theridion mundulum L. Koch.

Th. mundulum Koch. Ar. Austr. i. 1872, p. 263, tab. xxii. f. 3.

Th. amœnum Thorell, St. Rag. Mal. etc. i. 1877, p. 463.

Ligeh.

Décrit d'Australie, trouvé depuis à Celebes, en Birmanie et à Penang.

27. Theridion nigrum (O. P. Cambridge).

Argyrodes nigra O. P. Cambr. in Proc. Zool. Soc. Lond. 1880, p. 341, tab. xxx. f. 20.

? *Theridion oxyurum* Thorell, St. Rag. Mal. etc. iv. i. 1889, p. 265.

Nawng-Chik.

Décrit de Ceylan, indiqué depuis de Java.

28. Theridion subradiatum, sp. nov.

♂. *Long.* 4 *mm.—Cephalothorax niger postice sensim dilutior et rufescens. Oculi quatuor antici in lineam leviter procurvam, inter se anguste et fere æque separati, medii lateralibus paulo majores. Oculi postici minores, inter se æqui, in lineam leviter procurvam, medii a lateralibus quam inter se vix remotiores. Area quatuor mediorum subquadrata. Clypeus area oculorum non multo latior, chelis multo brevior, sub oculis depressus, dein convexus. Abdomen breviter ovatum, convexum, supra nigrum,* *linea media longitudinali integra, sat angusta, sed postice in declivitate valde ampliata et maculam magnam triquetram formante, prope medium linea transversa simili recta angusta sed utrinque abrupte et valde dilatata et maculam subrotundam formante, albis, decoratum, subtus fulvo-testaceum, sed vitta media latissima mamillas includente et antice ad rimam vitta transversa angustiore nigris notatum. Mamillæ fulvo-rufulæ. Chelæ et partes oris fusco-ferrugineæ, laminæ longæ et angustæ. Sternum nigrum, opacum. Pedes longi et robusti, inter se valde inæquales, pallide lutei, rufulo nigroque annulati, femoribus* 1[i] *paris annulo medio rufulo annuloque apicali nigro ornatis, reliquis femoribus immaculatis, patellis* (3 *exceptis*) *rufulis, tibiis* 1[i] *paris et* 4[i] *paris apice nigro-annulatis, reliquis tibiis apice rufulo-annulatis, metatarsis tenuibus immaculatis, setis longis, in annulis nigris densioribus, conspersi, patellis ad apicem seta spiniformi erecta et longa, tibiis setis similibus binis supra instructis. Tuberculum genitale magnum, ovato transversum, foveola postice lobata marginata et septo triquetro divisa, impressum.*

Jalor : Bukit Besar.

A *T. plumipedi* V. Hasselt et *saropodi* Thorell, cui versimiliter affine est, differt cephalothorace sternoque fere nigris, metatarsis pedum concoloribus, haud annulatis.

29. Steatoda perakensis, sp. nov.

♂. *Long.* 6 *mm.—Cephalothorax ovatus, postice sat abrupte angustior et breviter productus, parte cephalica elevata, sulcis profundis discreta, niger, valde coriaceus, granulis parvis setiferis conspersus, in processu postico transversim striatus. Oculi magni, inter se subæquales, postici albi, in lineam subrectam, inter se fere æquidistantes (spatiis interocularibus oculis saltem duplo minoribus), antici in lineam sat procurvam, inter se æque et anguste distantes, medii nigri lateralibus albis saltem haud majores. Area quatuor mediorum subquadrata, antice convexa. Clypeus area oculorum saltem haud angustior, sub oculis depressus, ad marginem valde convexus. Chelæ angustæ et sat longæ, fusco-piceæ, nitidæ, prope basin minute et parce rugosæ. Laminæ inclinatæ, piceæ, in medio late depressæ. Pars labialis nigra, latior quam longior, transversim plicata. Sternum postice acuminatum, nigrum, antice parce postice crebre arcuato-rugosum et subvermiculatum. Abdomen subglobosum, supra duriusculum, opacum et parcissime setosum, nigrum, lineolis paucis transversis exilibus testaceis vix expressis segmentatum, ad marginem anticum, supra processum cephalothoracis, prominulum et obtuse emarginatum, subtus regione epigasteris convexa, sublævi et ferrugineo-tincta. Pedes longi, parum robusti, parce tenuiter et sat longe setosi, femoribus anticis subtus subtiliter rugosis, nigri, metatarsis tarsisque cunctis fusco-piceis, coxis et præsertim trochanteribus posticis dilutioribus. Pedes-maxillares fusco-picei vel nigricantes ;*

femore longo, recto apicem versus sensim et levissime ampliato; patella convexa; tibia patella longiore, ad basin angustiore sed apicem versus sensim et valde ampliata; tarso magno, ovato, apice acuminato, bulbo magno.

Perak: Ulu Selama.

Espèce de classification incertaine, différant des *Steatoda* typiques par ses yeux antérieurs égaux; des *Teutana* par ses yeux antérieurs en ligne fortement procurvée; des *Crustulina* par son sternum acuminé en arrière.

Familia MIMETIDÆ.

30. MIMETUS MARGARITIFER, sp. nov.

♀. *Long.* 4 *mm.—Cephalothorax pallide fulvus, lævis, nitidus et glaber, sed setis nigris longissimis et erectis biseriatis* (5–5 *vel* 6–6) *supra munitus, convexus, antice longe attenuatus. Oculi medii, præsertim postici, a lateralibus quam inter se multo remotiores, aream paulo longiorem quam latiorem et antice quam postice latiorem occupantes, antici prominuli, posticis vix* $\frac{1}{3}$ *majores. Oculi laterales utrinque parvi, æqui, contigui et prominuli. Clypeus oculis mediis anticis vix latior. Abdomen sat longum, ovatum et convexum, fulvo-testaceum, utrinque, præsertim antice late, et fere inordinate albo-opaco plagiatum, supra tuberculis rufulis et nitidis subglobosis sed longe setiferis, quadriseriatis, medianis majoribus, insigniter ornatum, subtus parce et minute albido-punctatum. Chelæ fulvo-rufulæ, angustæ et longissimæ, a partibus oris sat late distantes, antice fere planæ, subtus, præsertim ad basin, convexæ. Partes oris, sternum pedesque lutea, tibiis metatarsisque anticis rufulo tinctis late et confuse annulatis, pedes cuncti numerose et longissime aculeati, tibiis et metatarsis anticis* (*valde curvatis*) *intus aculeis erectis longissimis aculeisque parvis et uncatis numerosissimis et uniseriatis armatis. Tuberculum genitale nigrum, transversum.*

Kelantan: Kuala Aring.

Espèce très remarquable qui pourrait devenir le type d'un genre spécial.

Familia ARGIOPIDÆ.

Subfamilia LINYPHIINÆ.

31. SPHECOZONE DENTIMANUS (E. Simon).

Nematogmus dentimanus E. Simon, in Act. Soc. Linn. Bord. xl. 1886 (p. 21).

Perak: Gunong Inas.

Répandu dans l'Indo-Chine et à Ceylan.

32. LINYPHIA PASSERCULA, sp. nov.

♂. *Long.* 4 *mm.—Cephalothorax subtilissime coriaceus et opacus, rufescens, regione oculorum leviter infuscata et oculis, præsertim* *mediis posticis, singulariter nigro-cinctis. Oculi quatuor antici in lineam leviter procurvam, parvi et inter se subæquales, medii nigri a sese appropinquati a lateralibus plus triplo remotiores. Oculi postici in lineam fere æqualiter procurvam, sed inter se fere æquidistantes et medii reliquis oculis evidenter majores. Oculi quatuor medii aream haud longiorem quam latiorem et postice quam antice fere duplo latiorem occupantes. Oculi laterales utrinque parvi æqui et contigui. Clypeus area oculorum latior, antice oblique proclivis. Abdomen sat longe oblongum, antice rotundum, postice leviter ampliatum, obtusum et convexum, antice fusco-olivaceum, postice nigro-nitidum, in medio cingulo dilutiore albido cinctum. Chelæ longæ et parallelæ, fulvo-rufulæ, fere læves, margine inferiore sulci dentibus 6 (4 et 5 reliquis paulo minoribus), margine superiore dentibus minutissimis 7 vel 8, lineam sinuosam designantibus, armatis. Sternum fusco-rufescens, subtilissime coriaceum et opacum, parcissime setosum. Pedes graciles et longi, minute et parce aculeati, obscure olivacei, coxis cunctis, femoribus quatuor anticis usque ad apicem, posticis ad basin dilutioribus et flavido-aurantiacis. Pedes-maxillares obscure fusci vel nigri, femore tereti ad basin dilutiore, patella parva convexa et nodosa, tibia majore, æqualiter convexa mutica sed superne longe nigro-crinita, tarso bulboque maximis late ovatis, reliquis articulis simul sumptis haud vel vix brevioribus.*

Jalor: Bukit Besar.

Nota.—Le genre *Linyphia* est représenté dans l'Asie tropicale et dans la Malaisie par des espèces analogues aux nôtres mais confinées dans les régions les plus élevées des montagnes, où elles trouvent sans doute des conditions de vie analogues à celles d'Europe. Thorell en a décrit deux (*L. beccarii* et *L. phyllophora*) du Mont Singalang à Sumatra.

Subfamilia Tetragnathinæ.

33. Tetragnatha mandibulata Walckenaer.

Tetragnatha mandibulata Walckenaer, Apt. ii. 1841, p. 211.
T. minatoria E. Simon, in Ann. Soc. ent. Fr. 1877, p. 83.
T. leptognatha Thorell, St. Rag. Mal. etc. i. 1877, p. 441 (101).

Patalung: Ban-Kong-Rak.

Espèce largement distribuée en Asie, en Malaisie et en Polynésie.

34. Tetragnatha novia, sp. nov.

♂. *Long.* 7–10 *mm.—Cephalothorax angustus et longus, obscure fulvus, plus minus olivaceo fuscove reticulatus, fovea thoracica profunda, transversa sulcisque cephalicis impressa, fronte lata, parte thoracica vix angustiore. Oculi singulariter nigro-cincti, quatuor postici, superne visi, in lineam sat recurvam, inter se æqui et æquidistantes, quatuor antici, antice visi, in lineam paulo angustiorem, validissime recurvam, medii lateralibus* *plus triplo majores et a lateralibus quam inter se plus triplo remotiores. Oculi quatuor medii aream saltem haud longiorem quam postice latiorem et antice quam postice multo angustiorem occupantes, antici posticis vix majores. Oculi laterales utrinque a sese appropinquati (spatio interoculari oculo postico non majore), anticus postico plus duplo minor. Abdomen angustum et longissimum, omnino fulvum. Chelæ cephalothorace haud vel vix breviores, proclives, fulvo-rufulæ, læves, supra in parte apicali extus apophysi longa, gracili, arcuata apice minute bifida, et supra dente minore nigro et conico armatæ, margine superiore sulci dente 1º mediocri recto vel leviter uncato, ad radicem unguis sat remoto, dente 2º minutissimo et uncato (sæpe obsoleto), dente 3º maximo recto et acuto (reliquis dentibus multo majore) et prope basin dentibus seriatis 6–7, versus basin sensim minoribus, margine inferiore dente 1º, prope radicem unguis sito, parvo, dente 2º fere duplo majore antice oblique directo, dente 3º valde remoto minore et prope basin dentibus parvis 4 vel 5, versus basin sensim minoribus, armatis, ungue longo, simplici haud dentato. Pars labialis sternumque fusco-testacea, laminæ pedesque fulvi. Pedes longissimi, tibiis anticis utrinque aculeis quatuor aculeisque dorsalibus binis, metatarsis aculeis basilaribus binis aculeisque exterioribus binis (rarius trinis), altero subbasilari altero submedio, armatis. Pedes-maxillares ordinarii.*

♀. *Long.* 10 *mm.—A mari, cui subsimilis est, differt chelis brevioribus et validioribus, apophysi denteque superioribus carentibus, margine superiore sulci dentibus* 1, 2 *et* 3, *inter se subsimilibus, sat late et fere æque distantibus,* 1º *antice oblique directo, dein dentibus minoribus et inter se appropinquatis* 4 *vel* 5, *margine inferiore dente* 1º *parvo, dente* 2º *reliquis dentibus majore, dente* 3º *paulo minore, reliquis dentibus* 3 *vel* 4 *multo minoribus. Pedes-maxillares lutei, tarso infuscato, patella seta apicali longa supra munita sed tibia mutica.*

Jalor: Bukit Besar.

35. Eucta isidis E. Simon.

Espèce commune à l'Egypte et à l'Inde.

36. Orsinome phrygiana, sp. nov.

♂. *Long.* 4 *mm.—Cephalothorax fusco-olivaceus, parte thoracica late dilutiore sed vitta media fusca notata et versus marginem sensim infuscata. Oculi antici in lineam leviter recurvam, inter se fere æque et non late distantes, medii prominuli, lateralibus circiter* $\frac{1}{3}$ *majores. Oculi postici in lineam fere æqualiter recurvam, medii majores et a lateralibus quam inter se remotiores. Oculi quatuor medii magni, aream haud vel vix longiorem quam latiorem et antice quam postice paulo latiorem, occupantes. Oculi laterales utrinque valde prominuli et subcontigui, anticus postico major. Clypeus oculis mediis anticis paulo angustior. Abdomen breviter ovatum, supra obscure fulvum, utrinque et postice* *albido-testaceum et grosse argenteo-punctatum, area fulva dorsali, in dimidio basali vitta nigra flexuosa marginata et maculis mediis binis magnis et subrotundis læte argenteo-punctatis, in dimidio apicali maculis parvis nigris sex biseriatis ornatum, subtus atrum sed utrinque dilutius. Chelæ fulvo-rufulæ, læves, longæ, apicem versus attenuatæ et leviter divaricatæ. Partes oris sternumque fusco-olivacea, lævia. Pedes longi, aculeis nigris ordinariis longissimis instructi, lutei, femoribus tibiisque annulo medio annuloque apicali olivaceis vel nigricantibus notatis, patellis cunctis, coxa trochantereque* 1[i] *paris fuscis. Pedes-maxillares pallide lutei, tarso nigro, bulbo olivaceo; femore gracili apicem versus sensim et leviter ampliato atque arcuato; patella convexa seta longissima supra munita; tibia patella paulo longiore; tarso ovato, intus ad basin apophysi divaricata, gracili, recta sed apice uncata armato; bulbo maximo, simpli et nitido, subgloboso, leviter reniformi.*

Jalor: Bukit Besar.

37. Argyroepeira elegans (Thorell).

Meta elegans Thorell, St. Rag. Mal. etc. i. 1877, p. 416.

Callinethis elegans Thorell, in Ann. Mus. Civ. Gen. 2[a] ser. v. 1887, p. 134.

Jalor: Biserat.

Décrit de Celebes, trouvé depuis en Birmanie.

38. Argyroepeira fastigata (E. Simon).

Meta fastigata E. Simon, in Ann. Soc. ent. Fr. 1877, p. 79, t. iii. fig. 10.

Ligeh.

Répandu dans une grande partie de la Malaisie et aux Iles Philippines.

39. Argyroepeira gemmea (V. Hasselt).

Meta gemmea V. Hasselt, Midd.-Sum. etc., Aran. 1882, p. 26, t. ii. f. 4.

Perak: Ulu Selama. Jalor: Bukit Besar.

Connu de Sumatra, de Singapore et de Pinang.

40. Argyroepeira tessellata (Thorell).

Callinethis tessellata Thorell, in Ann. Mus. Civ. Gen. xxv. 1887, p. 135.

Jalor: Bukit Besar.

Décrit de Birmanie.

41. Argyroepeira ventralis (Thorell).

Meta ventralis Thorell, St. Rag. Mal. etc. i. 1877, p. 423.

Nawng-Chik. Raman.

Décrit de Celebes, indiqué depuis de Birmanie et des îles Nicobars. Se trouve aussi à Java et à Sumatra.

NOTA.—Répond à la description du Dr. T. Thorell, sauf pour la taille qui est plus forte (8 à 9 mill.).

Subfamilia NEPHILINÆ.

42. NEPHILA IMPERIALIS (Doleschall).

Nephila flagellans L. Koch, Ar. Austr. i. 1872, p. 153, t. xii. f. 5–6.
N. baeri E. Simon, in Ann. Soc. ent. Fr. 1877, p. 82.
N. holmeræ Thorell, St. Rag. Mal. etc. iii. 1881, p. 141.

Patalung. Jalor. Raman.
Trouvé en grand nombre.

43. NEPHILA MACULATA (Fabricius).

Forma typica.

Patalung. Nawng-Chik.

44. NEPHILA MACULATA (Fabr.) JALORENSIS, subsp. nov.

♀ (subadulta). *A typo differt pedibus nigricantibus coxis luteis, femoribus subtus tibiis metatarsisque crebrius et longius nigro-pilosis sed tibiis* 1^i *paris et* 4^i *paris annulo subbasilari et metatarsis* 4^i *paris annulo angustiore subbasilari fulvis, brevius et parcius pilosis ornatis, abdomine supra olivaceo, in medio lineolis longitudinalibus parallelis subcontiguis 3 vel 4, in lateribus lineolis numerosis sinuosis et inordinatis dilutioribus et breviter albo-argenteo pilosis ornato, prope marginem anticum vitta transversa lata albida, dein zonis transveris fuscis leviter procurvis quatuor fuscis notato.*

Jalor: Bukit Besar.

45. NEPHILA MALABARENSIS (Walckenaer).

Perak: Ulu Selama. Raman. Ligeh. Kelantan.
Espèce répandue dans presque toutes les régions tropicales.

Subfamilia ARGIOPINÆ.

46. ARGIOPE PULCHELLA Thorell.

Argiope pulchella Thorell, St. Rag. Mal. etc. iii. 1881, p. 74.

Patalung: Ban-Kong-Rak.
Répandu en Birmanie, dans le Siam, etc.

47. GEA DECORATA Thorell.

Gea decorata Thorell, St. Rag. Mal. etc. iv. i. 1890, p. 105.

Perak: Gunong Inas. Jalor: Bukit Besar.
Décrit de Sumatra.

48. Gea festiva (Thorell) nigrifrons, subsp. nov.

A typo differt cephalothoracis regione frontali nigra.

Jalor: Bukit Besar

Le type est décrit de Birmanie et indiqué de Singapore.

49. Gea nocticolor Thorell.

Gea nocticolor Thorell, in Ann. Mus. civ. Gen. xxv. 1887, p. 170.

Ligeh.

Décrit de Birmanie.

50. Cyrtophora cicatrosa (Stoliczka).

Epeira (Nephila) cicatrosa Stoliczka, in Journ. Asiat. Soc. Bengal, xxxviii. p. 11, no. iv. 1869, p. 242, pl. xx. f. 5.

Epeira salebrosa Thorell, St. Rag. Mal. etc. ii. 1878, p. 49.

Jalor: Biserat.

Répandu dans l'Inde, l'Indo-Chine et la Malaisie.

51. Cyrtophora unicolor (Doleschall).

Epeira unicolor Dol., in Nat. Tijdr. Nederl. Ind. xiii. 1857, p. 419.

Epeira stigmatisata Karsch, in Zeitschr. f. g. Naturw. li. 1878, p. 326.

Epeira serrata Thorell, St. Rag. Mal. iv. i. 1890, p. 33.

Kelantan: Kuala Aring.

52. Arachnura melanura E. Simon.

Arachnura melanura E. Simon, in Rev. et Mag. de Zoologie, 1867 (p. 3).

Jalor: Bukit Besar.

Connu de l'Inde et de Java.

53. Araneus caput-lupi (Doleschall).

Jalor: Biserat.

Indiqué de Sumatra, des Moluques, de N.-Guinée, etc.

54. Araneus submucronatus (E. Simon).

Epeira submucronata E. Simon, in Journ. Asiat. Soc. Bengal, lvi. p. 11, no. 1, 1887, p. 106.

Nota.—Cette espèce a été réunie à tort, par le Dr. Thorell, à l'*A. de haani* Dol.; elle en diffère par les tubercules des yeux latéraux plus longs et plus acuminés, le sternum garni de granulations beaucoup plus grosses, inégales et irrégulières. Son abdomen est pourvu à l'angle apical de trois tubercules contigus dont le médian est plus gros, ce qui s'observe quelquefois aussi chez *A. de haani.*

Perak: Ulu Selama.

55. ARANEUS LAGLAIZEI (E. Simon).

Epeira thomisoides Doleschall, Bijdr. etc. 1857, p. 422.
Epeira laglaizei E. Simon, in Ann. Soc. ent. Fr. 1877, p. 65.
Epeira thelura Thorell, St. Rag. Mal. ii. 1878, p. 84 (273–293).
Ligeh.

Très répandu en Malaisie, en Océanie et dans l'Indo-Chine.

56. ARANEUS NAUTICUS (L. Koch).

Perak: Ulu Selama.
Répandu dans presque toutes les régions tropicales du monde.

57. CYCLOSA BIFIDA (Dol.) MACRURA Thorell.

Epeira macrura Thorell, St. Rag. Mal. etc. i. 1877, p. 404.
Kelantan: Kuala Aring.

58. CYCLOSA INSULANA (Costa).

Jalor: Biserat. Ligeh. Kelantan: Kuala Aring.

59. CÆROSTRIS PARADOXA (Doleschall).

Patalung: Ban-Kong-Rak.

60. GASTERACANTHA FORNICATA (Fabr.) JALORENSIS, subsp. nov.

♀. *Abd. long.* 8·5 *mm., lat.* 18·5 *mm.—A typo differt magnitudine majore, aculeis lateralibus principalibus longioribus sed aculeis posticis minoribus.*

Jalor: Bukit Besar.

61. GASTERACANTHA ARCUATA (Fabricius).

Patalung. Nawng-Chik. Kelantan.

62. GASTERACANTHA HASSELTI (C. Koch).

Jalor: Bukit Besar. Kelantan: Kuala Aring.

63. GASTERACANTHA PERAKENSIS, sp. nov.

♀. *Scutum abd. long.* 7 *mm., lat.* 9·5 *mm. Acul. angul. long.* 4·7 *mm.—Cephalothorax niger, margine clypei anguste testaceo, parte cephalica obtuse sulcata, albido-pilosa, apice minute et parce granulosa. Oculi medii inter se subæquales (antici vix majores), aream paulo latiorem quam longiorem et antice quam postice angustiorem, occupantes. Oculi laterales utrinque valde prominuli. Abdomen vix* $\frac{1}{5}$ *latius quam longius, antice truncatum, postice valde ampliatum et late truncatum (fere ut in* G. hasselti *C. K.), supra nitidum, flavum, utrinque in sigillis nigro-bimaculatum, aculeis sex nigris armatum, utrinque aculeis binis, ad angulum anticum quam a sese plus duplo remotioribus, antico mediocri, gracili, recto, acutissimo et antice oblique directo, altero, angulari fere triplo longiore, in parte basali crasso subtus convexo et granuloso, in parte apicali abrupte angustiore, lævi, recto et acuto, ad marginem posticum aculeis binis, lateralibus* *anticis fere duplo longioribus, rectis et acutis, sed ad basin leviter incrassatis et granulosis; sigillis anticis quatuor parvis longis et rectis, in lineam rectam, utrinque, in declivitate, sigillis trinis paulo majoribus, antico ovato alteris subrotundis, sigillis posticis sex in lineam rectam, laterali ovato et obliquo, alteris minutissimis, sigillis medianis quatuor sat parvis, aream trapeziformem haud longiorem quam latiorem occupantibus, subtus sat crebre granulosum, in medio convexum haud tuberculatum, nigrum, maculis flavis sat parvis et iniquis conspersum. Sternum valde et crebre granulosum sed antice tuberculo parvo humillimo læviore et rufulo notatum, nigrum, utrinque ad marginem maculis parvis flavis trinis ornatum. Chelæ nigro-nitidæ. Pedes fulvo-rufuli, versus extremitates sensim obscuriores, metatarsis tarsisque anticis fere nigris.*

A *G. globulata* Walckenaer, cui valde affinis et subsimilis est, differt imprimis sigillis abdominis, præsertim anticis, multo minoribus, aculeis angularibus in parte basali minus globosis, in parte apicali gracilibus et divaricatis haud erectis.

Perak: Ulu Selama. Kelantan: Kuala Aring.

64. Gasteracantha leucomelas (Doleschall).

Gasteracantha annamita E. Simon, in Act. Soc. Linn. Bord. xl. 1886, p. 14.

Jalor. Ligeh. Raman.

Espèce très répandue dans l'Indo-Chine et la Malaisie.

65. Anepsia fuscolimbata, sp. nov.

♀. *Long.* 3 *mm.—Ab* A. depressa Thorell, *cui affinis est, differt magnitudine saltem duplo minore, cephalothorace lævi et nitido, pallide luteo sed regione frontali et clypei infuscata, sterno luteo (haud nigro), abdomine breviore, subrotundo, supra plano, nitido, grosse sed parce impresso-punctato, sigillis medianis obsoletis, supra pallide luteo sed utrinque late fusco-marginato, subtus, pone plicam genitalem, vitta media fusca sat angusta et confusa notato, mamillis fusco-marginatis, pedibus fere muticis, obscurioribus, fusco-olivaceis, femoribus quatuor anticis fere nigris, coxis cunctis femoribusque posticis, præsertim subtus, dilutioribus, unco vulvæ fulvo obtusiore.*

Perak: Gunong Inas (6000 ft.).

66. Anepsia depressa (Thorell).

Paraplectana depressa Thorell, St. Rag. Mal. etc. i. 1877, p. 14 (354).

Jalor: Biserat.

Décrit de Celebes.

67. Pronous affinis, sp. nov.

♀. *Long.* 3 *mm.—Cephalothorax parce et minute rugosus, parce et longe albo-setosus, fusco-rufescens, regione frontali sensim nigra. Area oculorum mediorum magna, leviter prominula,* *haud longior quam latior et antice quam postice vix angustior, oculi medii postici anticis saltem $\frac{1}{3}$ majores. Clypeus subverticalis, area oculorum mediorum circiter æquilatus. Abdomen convexum, breviter oblongum, antice leviter attenuatum atque obtusum, postice paululum ampliatum, obtusum sed supra tuberculis duobus latis et humillimis notatum, fusco-lividum, nitidum, fere glabrum, antice linea longitudinali abbreviata alba, utrinque, prope medium, macula parva et postice macula majore nigris, notatum, subtus atro-purpureum. Chelæ rufescentes, glabræ et læves. Sternum fusco-pupureum, inæquale et valde coriaceo-granulosum. Pedes fusco-olivacei, femoribus dilutioribus et luteis sed fusco-vittatis. Tuberculum genitale simplex, breve, ovato-transversum, nigro-nitidum.*

A *P. taprobanico* E. Sim., cui affinis est, imprimis differt tuberculo genitali altiore et minus transverso, subrotundo, pictura corporis obscuriore sed sterno rufulo haud nigro.

Jalor: Bukit Besar.

68. THERIDIOSOMA NEBULOSUM, sp. nov.

♀. *Long. 2 mm.—Cephalothorax lævis et nitidus, fulvo-olivaceus, parte cephalica confuse infuscata, regione oculorum nigra. Oculi medii postici a sese subcontigui. Oculi quatuor antici a sese subcontigui, medii nigri, lateralibus albis vix majores. Area quatuor mediorum subdirecta, longior quam latior et subparallela, oculi medii antici posticis minores. Abdomen magnum, subglobosum, atro-olivaceum, zonis transversis paulo dilutioribus vix expressis atque antice maculis magnis obliquis binis convergentibus albo-punctatis supra notatum, subtus atrum. Sternum nigrum, in medio late dilutius et rufescens. Chelæ pedesque obscure olivacei, coxis femoribusque (apice excepto) dilutioribus et testaceis. Pedes breves, parce sed longe setosi. Tuberculum genitale maximum fere* Theridiosomatis gemmosi *L. K., transversim ovatum, antice læve et rufulum, postice fovea magna testacea semicirculari, marginata et apice minute excisa, notatum.*

Jalor: Biserat.

A *T. picteti* E. Sim. (ex Java) et *fasciato* Workman (ex Singapore) præsertim differt abdomine cingulo argenteo carente.

69. ANDASTA CYCLOSINA, sp. nov.

♀. *Long. 3·5 mm.—Cephalothorax lævis et nitidus, atro-olivaceus, parte thoracica vitta media lata fulvo-rufula notata, cephalica angusta et longa, antice leviter attenuata, postice a thoracica sulco tenui semicirculari discreta, fronte angusta, regione oculari postice leviter depressa. Oculi quatuor postici, præsertim medii, maximi, inter se anguste et fere æque distantes (spatiis interocularibus oculis mediis triplo minoribus). Oculi antici in lineam rectam, inter se subcontigui, medii nigri lateralibus albis majores. Area quatuor mediorum subquadrata, antice valde prominula, superne convexa. Clypeus oculis mediis anticis* *latior, sub oculis leviter depressus. Abdomen longius quam latius, supra deplanatum, antice rotundum, postice sensim attenuatum et pone mamillas in tuberculum obtusum productum, supra parce et longe albido-pilosum, nigrum, antice macula maxima testacea, utrinque lobata et vittam mediam albo-punctatam includente, notatum, subtus atrum vel testaceum et vitta fusca lata notatum, mamillæ inferiores rufulæ extus fusco-vittatæ, reliquæ testaceæ. Sternum fusco-rufescens, nigricanti-marginatum. Pedes breves et robusti, sat longe setosi haud aculeati, lutei, femoribus tibiisque anticis apice late nigris, reliquis minute fusco-notatis, coxis sæpe maculatis. Plaga genitalis parva, rufula, unco nigro gracili et brevi recto sed apice minute uncato munita. Chelarum margo superior dentibus quatuor valde iniquis, 1° et 2° parvis, 3° multo longiore et acuto, ultimo mediocri, margo inferior dentibus binis validis et subæquis instructi.*

Perak: Gunong Inas.

Ab *A. semiargentea* E. Sim. (ex ins. Taprobane) imprimis differt magnitudine multo majore, abdomine postice acuminato et producto, oculis quatuor posticis inter se æquidistantibus, et plaga genitalis unco munita.

Familia THOMISIDÆ.

70. AMYCIÆA FORTICEPS (O. P. Cambridge).

Amycle forticeps O. P. Cambr., in Pr. Zool. Soc. Lond. 1873, p. 122.

Nawng-Chik.

Espèce très commune à Ceylan, indiquée aussi de Singapore, de Birmanie et de Java.

ZYGOMETIS, nov. gen.

A Runcinia *cui affinis est imprimis differt cephalothorace plano, haud longiore quam latiore, utrinque ample rotundo, oculis mediis posticis et anticis a lateralibus quam inter se multo remotioribus, oculis quatuor anticis in lineam rectam, tibiis quatuor anticis omnino muticis, metatarsis aculeis 4–4 tantum armatis, abdomine brevi, antice posticeque recte truncato, postice ampliato fere* Thomisi.

71. ZYGOMETIS CRISTULATA, sp. nov.

♀ (pullus). *Long. 5 mm.—Cephalothorax latus, utrinque ample rotundus, planus, fronte late truncata subcarinata, utrinque ante oculum lateralem posticum minute turbinata, subtilissime coriaceus et granulis nigris minutissimis, in parte thoracica lineas radiantes abbreviatas designantibus, ornatus, pallide flavus, regione oculorum alba sed antice linea exili fusca, oculos anticos includente, limitata, parte cephalica lineis binis flexuosis, thoracica maculis submarginalibus iniquis et laciniosis albo-opacis ornatis. Abdomen paulo latius quam longius, postice* *valde ampliatum, antice posticeque recte sectum, supra fulvo-cinereo-testaceum leviter albido-variegatum et postice in declivitate vitta transversa lata fusca notatum, granulis nigris paucis conspersum, subtus albidum. Chelæ, partes oris, sternum pedesque pallide flavida, patellis quatuor anticis superne macula obliqua, tibiis subtus annulo submedio, metatarsis tarsisque subtus vitta obliqua fusco-olivaceis notatis, tibiis muticis, metatarsis* 1^i *paris aculeis inferioribus 4–4 interioribus (superioribus) minoribus, metatarsis* 2^i *paris aculeis 4–4, exterioribus (inferioribus) minoribus, instructis.*

Perak : Gunong Inas.

Familia Clubionidæ.

Subfamilia Selenopinæ.

72. Selenops aculeatus, sp. nov.

♀. *Long. 7 mm.—Cephalothorax planissimus, latior quam longior, pallide fulvus, tenuiter fusco-marginatus, margine frontali ad oculos nigra, flavido-sericeo pubescens, ad marginem longe et valde crinitus. Oculi quatuor antici a sese contigui, in lineam subrectam vix recurvum, medii lateralibus evidenter minores. Oculi exteriores minutissimi albi et ovati a lateralibus anticis parum distantes. Oculi postici utrinque prominuli reliquis oculis majores. Abdomen planissimum, longius quam latius, pallide fulvum, flavido-sericeo pubescens, postice anguste fusco-marginatum. Sternum pedesque lutea, femoribus* 1^i *paris subtus usque ad basin, femoribus* 2^i *paris ad apicem late nigricanti-plagiatis, tibiis metatarsisque superne minute, parce et inordinate fusco-variatis, tibiis quatuor anticis aculeis 7–7 (interioribus longioribus), metatarsis aculeis 5–5 subtus armatis. Plaga genitalis nigra, fovea testacea magna, postice ampliata, truncata et tubercula minuta ovata et obliqua includente, impressa.*

Perak : Gunong Inas.

A *S. montigena* E. Sim., cui præsertim affinis est, imprimis differt magnitudine minore, tibiis metatarsisque anticis aculeis numerosioribus instructis (in *S. montigena* metatarsis anticis 3–3 aculeatis).

Subfamilia Sparassinæ.

73. Heteropoda regia (Fabr.).

Heteropoda venatoria auct. (non *Aranea venatoria* L.).

Perak. Kelantan. Raman. Patalung.

Répandu dans les régions tropicales du monde entier.

74. Heteropoda leprosa E. Simon.

Heteropoda leprosa E. Simon, in Ann. Mus. civ. Gen. xx. 1884, p. 336.

Perak : Ulu Selama. Kelantan : Kuala Aring. Jalor : Bukit Besar.

Décrit de Birmanie.

75. Heteropoda sexpunctata E. Simon.

Heteropoda sexpunctata E. Simon, in Bull. Soc. Zool. Fr. x. 1885 (p. 14).

Ligeh.

Décrit de l'Inde Centrale.

76. Spariolenus tigris E. Simon.

Spariolenus tigris E. Simon, Rev. Sparass. 1880, p. 61.

Jalor: Biserat.

Décrit du Bengale.

77. Sparassus annandalei, sp. nov.

♀. *Long.* 11 *mm.—Cephalothorax convexus, vix longior quam latior, fronte lata, fulvus, albido-sericeo pubescens, regione frontali leviter obscuriore et rufescenti-tincta. Oculi quatuor antici in lineam plane rectam, inter se fere æquidistantes (spatiis interocularibus oculis paulo minoribus), medii lateralibus paulo majores. Oculi quatuor postici multo minores et inter se subæquales, in lineam latiorem vix procurvum, a sese late et fere æque separati. Area quatuor mediorum circiter æque longa ac lata et postice quam antice angustior, medii antici posticis saltem duplo majores. Clypeus oculis mediis anticis angustior. Abdomen oblongum, fulvum, crebre et longe sericeo-pubescens, supra in dimidio apicali linea media fusca exili notatum, subtus concolor. Chelæ validæ et convexæ, nigro-rufescentes, læves et parce crinitæ, margine inferiore sulci dentibus validis quatuor contiguis, ultimo reliquis paulo minore, armato. Partes oris castaneæ. Pars labialis convexa, evidenter latior quam longior. Sternum, pedes-maxillares pedesque lutea, tarso pedum-maxillarium metatarsis tarsisque pedum, præsertim anticis, obscurioribus et rufulo-tinctis, tarsis cunctis, metatarsis anticis usque ad basin, metatarsis* 4^i *paris ad apicem, longe et crebre cinereo-scopulatis, aculeis ordinariis longis. Plaga genitalis magna, fulva et nitida, parallela, postice truncata, in parte secunda sulco longitudinali divisa.*

Nawng-Chik: Ban.

Trouvé dans une coque de tissu très résistant logée dans une feuille roulée et contenant un cocon ovigère globuleux de tissu simple et assez mince appliqué sur les œufs.

78. Rhitymna xanthopus, sp. nov.

♀. *Long.* 21 *mm.—Cephalothorax latior quam longior, nigro-piceus, postice in declivitate paulo dilutior et rufescens, albido-luteo-pubescens et longe hirsutus. Oculi medii antici lateralibus paulo majores et a lateralibus quam inter se circiter* $\frac{1}{3}$ *remotiores. Abdomen ovatum, antice leviter emarginatum, supra crebre flavido-pubescens et setis erectis longissimis pallide flavidis conspersum, antice lineolis binis convergentibus, dein macula* *ovata vel subrotunda, postice arcubus transversis seriatis tenuibus et utrinque evanescentibus, nigricantibus supra ornatum, subtus crebre fulvo-pubescens, regione ventrali lineis nigricantibus binis leviter incurvis notata. Chelæ validissimæ et convexæ, nigræ, nitidæ et glabræ, sed marginibus sulci longe et crasse rubro-pilosis, inferiore dentibus trinis subcontiguis, 1° paulo minore armato. Partes oris nigræ ad marginem crasse rubro-pilosæ. Sternum coxæque nigra, nigro-setosa. Pedes crassi et longi, fusco-picei, supra fulvo-pilosi et longe hirsuti, subtus patellis nigris, femoribus tibiisque crebre et longe flavo-pilosis et hirsutis, sed femoribus cunctis annulo apicali, tibiis 1ⁱ paris annulo subapicali, reliquis tibiis annulis binis nigris ornatis, metatarsis tarsisque usque ad basin crasse nigro-scopulatis. Pedes-maxillares nigri, nigro-pilosi. Plaga genitalis subrotunda, rubro-nitida, costis parvis trinis, lateralibus antice divergentibus, notata.*

Kelantan: Kuala Aring.

A *R. ingenti* E. Sim. (ex Java), cui affinis est, imprimis differt oculis mediis anticis a sese minus distantibus, femoribus tibiisque subtus flavo (haud albido) pilosis, tibiis 1ⁱ paris annulo nigro singulo notatis et plaga genitali rubra haud nigra.

79. Seramba pennata, sp. nov.

♂. *Long. 9 mm.—Cephalothorax late ovatus, antice valde attenuatus, fronte sat angusta, fulvo-rufescens, lævis, parce albido-pilosus, linea marginali vittisque dorsalibus binis latis et dentatis, tenuiter fusco-reticulatis parum expressis notatus. Oculi antici in lineam leviter procurvam, inter se æque et sat anguste distantes (spatiis interocularibus oculis minoribus), medii lateralibus majores. Oculi postici multo minores, in lineam latiorem leviter procurvam, inter se subæquales et fere æquidistantes. Area quatuor mediorum latior quam longior, medii antici posticis fere duplo majores. Abdomen sat anguste ovatum, postice attenuatum, testaceum, supra utrinque valde nigricanti-maculatum, antice vitta longitudinali, postice arcubus transversis fuscis seriatis, apicem versus sensim minoribus et sæpe confluentibus, supra ornatum, subtus parce fusco-punctatum. Mamillæ inferiores testaceæ, superiores fuscæ. Chelæ, sternum pedesque fulvo-rufescentia. Chelæ sat debiles, margine inferiore sulci dentibus minutissimis 6 armato. Tibiæ anticæ aculeis inferioribus longis (apicalibus minoribus) 6–6 et utrinque lateralibus minoribus binis, metatarsis aculeis inferioribus longissimis 2–2, lateralibus exterioribus trinis interioribus binis instructis. Pedes-maxillares lutei, tibia rufescenti, tarso bulboque fuscis nigrisve; tibia patella breviore et latiore, supra et extus valde ampliata et apophysibus nigris iniquis armata, apophysi superiore subrecta, crassa apice leviter arcuata et truncata, media paululum sinuosa et acutissima, inferiore minore et dentiformi; tarso late ovato, extus ample rotundo, intus subrecto; bulbo magno.*

Nawng-Chik.

Subfamilia Clubioninæ.

80. (?) Chiracanthium melanostoma (Thorell).

Entittha melanostoma Thorell, Descr. Cat. Spid. Burma, 1895, p. 44.

Jalor: Biserat.

Décrit de Birmanie.

81. Chiracanthium caudatum (Thorell).

Entittha caudata Thorell, in Ann. Mus. civ. Gen. xxv. 1887, p. 58.

Patalung: Ban-Kong-Rak.

Décrit de Birmanie.

82. Matidia aeria E. Simon.

Matidia aeria E. Simon, in Ann. Soc. ent. Fr. 1896, p. 503.

Patalung: Ban-Kong-Rak.

Espèce très répandue, décrite de Jolo (Philippines).

Subfamilia Cteninæ.

83. Ctenus valvularis V. Hasselt.

Ctenus valvularis V. Hasselt, in Midd.-Sum. etc., Ar. 1882, p. 45, tab. v. f. 12.

Ctenus valvularis Thorell, St. Rag. Mal. etc. iv. 2, 1891–92, p. 135.

Jalor: Biserat.

Décrit de Sumatra, indiqué depuis de Java.

84. Caloctenus oreus, sp. nov.

♀. *Long.* 10 *mm.—Cephalothorax ovatus, parte cephalica attenuata et antice leviter acclivi, thoracica convexa, sulco profundo et longo secta, fusco-olivaceus, vitta media integra et fere parallela, lineaque submarginali angustiore et flexuosa dilutioribus albo fulvoque pilosis ornatus. Oculi medii aream haud longiorem quam latiorem et antice quam postice multo angustiorem occupantes, antici posticis fere duplo minores. Oculi laterales antici parvi ovati et albi prope marginem inferiorem oculorum mediorum posticorum siti. Clypeus verticalis planus, area oculorum mediorum circiter æquilatus, fuscus, utrinque dilutior. Abdomen oblongum, supra atrum, obscure cervino-cinereo-pubescens, vitta media sat angusta, antice acuminata, postice leviter ampliata et dentata albido-fulvoque pilosa et utrinque punctis nigris seriatis* 4–5 *notatum, subtus paulo dilutius et obscure cinereo-pubescens. Chelæ longæ, cylindratæ, fusco-rufulæ, læves et nitidæ, margine inferiore sulci quinquedentato. Partes oris fulvo-rufulæ, pars labialis infuscata, convexa, circiter æque longa ac lata, dimidium laminarum haud attingens et apice truncata. Sternum pedesque fulva. Pedes longissimi* *et gracillimi, tibiis anticis aculeis pronis longissimis (apicalibus minoribus) 8–8 vel 9–9, metatarsis aculeis similibus 4–4 subtus instructis. Tuberculum genitale paulo latius quam longius, rufulum, in medio valde crinitum utrinque incisura vel fovea parva impressum.*

Jalor: Bukit Besar.

Subfamilia LIOCRANINÆ.

85. TEUTAMUS POLITUS Thorell.

Teutamus politus Thorell, in Ann. Mus. civ. Gen. 2 ser. x. (1890), p. 281.

Perak: Gunong Inas, Ulu Selama.

Décrit de Pinang.

Familia PISAURIDÆ.

86. HYGROPODA LONGIMANUS (Stoliczka).

Dolomedes longimanus Stoliczka, in Journ. As. Soc. Beng. xxxviii. pt. 2, p. 218, tab. xx. f. 3.

Raman: Kota Bharu.

Décrit du Bengale.

87. THALASSIUS ALBOCINCTUS (Doleschall).

Dolomedes albocinctus Dol., in Verh. N. V. Ned. Ind. v. 1859, p. 9.

Titurius marginellus E. Simon, Ann. Mus. civ. Gen. xx. 1884, p. 329.

Raman: Kota Bharu. Kelantan: Kuala Aring.

Répandu dans l'Indo-Chine, la Birmanie et une partie de la Malaisie.

88. DOLOMEDES PAROCULUS, sp. nov.

♀ (subadulta). *Long.* 18 *mm.—Cephalothorax fusco-olivaceus, breviter cervino-pubescens, utrinque, prope marginem et antice in clypeo, maculis parvis, iniquis et inordinatis albo-pilosis, vittam latam confusam designantibus, in medio vitta longitudinali flavido-pilosa, in parte cephalica lata et linea media exili secta, in parte thoracica abrupte angustiore, ornatus. Oculi quatuor antici inter se æqui et fere æquidistantes, medii leviter prominuli. Oculi quatuor postici maximi in lineam valde recurvam, laterales prominuli, medii a lateralibus quam inter se remotiores (spatio interoculari oculo plus duplo minore) et spatium transversum oculorum linea antica tota non multo angustius occupantes. Area quatuor mediorum circiter æque longa ac lata et antice quam postice multo angustior, medii antici posticis plus triplo minores. Clypeus subverticalis, area oculorum mediorum latior. Abdomen magnum, ovatum, obscure fulvum, cervino-pubescens, antice linea media angusta dilutiore,* *utrinque et præsertim postice maculis parvis lineolisque flexuosis albo-pilosis ornatum, subtus concolor. Chelæ longæ, parallelæ, fusco-rufulæ, crebre et longe albido-hirsutæ, marginibus sulci longis, inferiore dentibus quatuor, 1° reliquis paulo majore, armato. Sternum, partes oris pedesque olivacea. Pedes versus extremitates sensim obscuriores, cervino-pubescentes, maculis albis parvis conspersi et subannulati, aculeis ordinariis, validis et longis armati, tarsis gracilibus subtus setosis utrinque anguste scopulatis.*

Raman: Kota Bharu.

Species fere inter *Dolomedem* et *Anoteropem*, oculis posticis insigniter magnis, eximie distincta.

Familia LYCOSIDÆ.

89. PARDOSA IRRETITA E. Simon.

Pardosa irretita E. Simon, in Act. Soc. Linn. Bord. xl. 1886 (p. 6).

Ligeh.

Décrit du Cambodge, retrouvé depuis à Saigon, à Singapore et à Borneo.

90. PARDOSA LAIDLAWI, sp. nov.

♀. *Long. 6 mm.—Cephalothorax nigellus, vitta media lata, antice oculos haud attingente, in parte thoracica leviter dentata atque attenuata fulvo-rufula, antice fulvo-rufulo postice albido-pilosa, lineaque submarginali fulva exili et dentata ornatus, clypeo in medio nigro utrinque dilutiore. Oculi antici in lineam procurvam, medii evidenter majores et a sese quam a lateralibus remotiores (spatio interoculari oculo haud angustiore), laterales a margine clypei quam ab oculis magnis ser. 2æ plus duplo remotiores. Area oculorum quatuor posticorum postice quam antice latior. Abdomen oblongum, nigellum, area media vel vitta latissima dilutiore, antice albido postice fulvo-pilosa, antice lineolis binis nigris figuram acute lanceolatam designantibus, postice arcubus transversis fuscis seriatis albo-pilosis ornata, supra notatum, subtus dilutius, obscure testaceum albido-cinereo-pubescens. Chelæ nigræ vel fuscæ, parce albo-pilosæ. Sternum nigrum, albo-pilosum, sæpe antice minute testaceo-maculatum. Pedes longi, obscure fulvo-rufescentes, metatarsis tarsisque dilutioribus, coxis infuscatis, femoribus annulis nigris quatuor valde sinuosis, tibiis valde, metatarsis vix distincte fusco- vel olivaceo-annulatis, tibiis metatarsisque anticis aculeis tenuibus et longis 2-2 aculeisque apicalibus binis multo minoribus subtus armatis. Plaga genitalis ovato transversa, utrinque nigra sed pilis crassis niveis convergentibus munita, in medio depressa, late foveolata et carinula fulva tenui et integra divisa.*

Perak: Ulu Selama.

A *P. birmanica* Thorell verisimiliter affinis.

Familia Oxyopidæ.

91. Oxyopes lineatipes (C. Koch).

Sphasus lineatipes, C. Koch, Arachn. xv. 1848, p. 55, fig. 1455.
Oxyopes lineatipes Thorell, St. Rag. Mal. etc. iv. 2, 1891–92, p. 190.

Kelantan: Kuala Aring.

Espèce très répandue en Birmanie et en Malaisie.

92. Oxyopes patalongensis, sp. nov.

♂. *Long.* 10 *mm.—Cephalothorax altus sat brevis, fronte lata et obtusa, fusco-ferrugineus, pilis simplicibus pronis fuscis, versus marginem, præsertim postice, nigricantibus, vestitus, sed zona marginali inæquali paulo dilutiore et subglabra cinctus, regione clypei leviter obscure reticulata (haud lineata), regione oculorum nigra et flavido-pilosa. Oculi ordinarii. Abdomen sat angustum, antice rotundum, postice valde attenuatum et cylindraceum, supra nigrum, obscure olivaceo-pubescens sed utrinque vitta niveo-pilosa, laciniosa, extremitates haud attingente, marginatum, subtus antice fulvum et aurantiaco-pubescens, præterea nigrum et lineis tenuibus trinis, media abbreviata, albo-pilosis, ornatum. Mamillæ nigræ. Chelæ fusco-ferrugineæ, leviter reticulatæ. Sternum fulvum. Pedum coxæ, trochanteres femoraque lutea, antica, subtus, usque ad basin, infuscata et subvittata, femora postica apice infuscata, reliqui articuli nigricantes supra parce albo-pilosi, sed tarsi (præsertim antici) dilutiores et sublutei, aculeis ordinariis longissimis nigris armati. Pedes-maxillares sat breves et robusti, nigri, femore utrinque dilutiore, tibia supra ad apicem minute albo-pilosa; tibia patella haud longiore, extus ad apicem minute dentata, subtus depressa et apophysi nigro-nitida crassa obtusissima et oblique costiformi munita; tarso magno, supra valde convexo, ad apicem breviter acuminato, extus ad basin breviter prominenti et anguloso.*

Patalung.

Familia Salticidæ.

1°. Salticidæ pluridentati.

93. Linus fimbriatus (Doleschall).

Salticus fimbriatus Dol., in Verh. N. V. Ned. Ind. v. 1859, p. 22.
Sinis fimbriatus Thorell, St. Rag. Mal. etc. ii. 1878, p. 270.

Jalor: Biserat.

Espèce largement distribuée, commune dans la Malaisie et la Papuasie, à Ceylan et à Madagascar.

Genus Padillothorax E. Simon.

A Bavia *differt cephalothorace humiliore et multo longiore ovato, parte thoracica quadrangulo oculorum fere duplo longiore,* *impressione transversa parva sulcoque remotis submediis munita, oculis anticis inter se contiguis et validissime iniquis, clypeo angustissimo glabro, oculis lateralibus anticis et posticis minoribus.*

94. PADILLOTHORAX SEMIOSTRINUS, sp. nov.

♂. *Long.* 7·5 *mm.—Cephalothorax humilis, longus et ovatus, rubro-castaneus versus marginem infuscatus, valde coriaceo-vermiculatus sed parte thoracica in medio læviore, parte cephalica antice et utrinque, sub oculis, pilis albo-argenteis ornata, thoracica vittis medianis binis latis subcontiguis, lineaque marginali exili, albo-argenteo-pilosis decorata. Pili oculorum pauci albidi. Clypeus angustissimus nudus. Abdomen angustum et longissimum, supra fusco-violaceum, vitta media lata et integra luteo-testacea, antice lineis postice maculis seriatis albo-argenteo-pilosis marginata, ornatum, utrinque in lateribus antice linea recta postice lineis obliquis binis albis, notatum, subtus fulvum, mamillæ fuscæ. Chelæ nigro-nitidæ, breves sed divaricatæ, extus convexæ, intus subcostatæ, margine inferiore sulci depresso, dein valde elevato et dentibus seriatis, contiguis, medianis majoribus, armato. Partes oris nigræ, laminæ apice truncatæ, convexæ, sed angulo compresso et leviter prominulo. Sternum luteum. Pedes* 1^i *paris reliquis multo longiores et crassiores, femore clavato, tibia longe ovata, fusco-castanei, coxa femoreque nigris, tarso luteo, tibia metatarsoque subtus sat longe sed parum dense nigro-ciliatis. Reliqui pedes pallide lutei, aculeis paucis et parvis, ut in* Bavia *ordinatis, muniti. Pedes-maxillares sat parvi, pallide lutei, crasse albo-pilosi; tibia patella breviore, extus ad apicem apophysi sat longa, antice directa, apice nigra et acuta, instructa.*

Jalor: Biserat. Kelantan: Kuala Aring.

95. COPROCROSSA [1] POLITIVENTRIS, sp. nov.

♂. *Long.* 4 *mm.—Cephalothorax humilis et longus, leviter ovatus atro-purpureus, prope oculos niger, supra planus et glaber, in medio crebre, antice posticeque parcius impresso-punctatus, utrinque in declivitate parum dense albo-pilosus. Oculi antici inter se validissime inæquales et contigui, medii maximi, altitudinem faciei totam occupantes. Clypeus nullus. Chelæ brevissimæ, nigræ, reclinatæ et antice planæ. Abdomen angustum et longum, teretiusculum, supra nigro-nitidum, micanti-tinctum, glabrum, sed in lateribus zonis obliquis abbreviatis albo-pilosis ornatum, subtus atrum. Sternum et partes oris nigro-nitida, laminæ extus ad apicem prominulæ et divaricatæ sed obtusæ. Pedes* 1^i *paris longissimi, nigro-nitidi, coxa in lateribus et subtus, metatarso (basi excepta) tarsoque pallide luteis, femore compresso longo, patella sat parva, tibia longissime ovata, subtus, in dimidio apicali, aculeis brevibus sed robustis et singulariter*

[1] *Coprocrossa=Stenodina* E. Simon (olim), nomen præoccupatum.

elevatis 3–3, armata, metatarso gracili sat longo, præsertim ad basin curvato, subtus aculeis minutissimis et erectis 2–2 munito. Reliqui pedes pallide lutei, omnino mutici. Pedes-maxillares parvi fusci, apice tarso bulboque luteis; tibia tereti, patella paulo breviore, extus ad apicem apophysi parva acuta et leviter curvata armata; tarso tibia multo longiore sed vix latiore; bulbo ad basin valde convexo et subgloboso, ad apicem stylo valido nigro, circulum magnum formante, munito.

Perak: Gunong Inas.

96. Myrmarachne annandalei, sp. nov.

♂. *Long.* 6·5 *mm.—Cephalothorax niger, opacus, parce et tenuiter olivaceo alboque pubescens, in contractura linea fulva sat exili, valde biangulosa atque in medio interrupta, notatus, parte cephalica alta superne plana, thoracica cephalica æquilonga vel paulo breviore, in medio convexa, antice profunde et late depressa postice declivi. Oculi antici inter se valde inæquales et contigui, apicibus in lineam rectam, pilis albis longis cincti. Clypeus angustus, fere glaber. Pediculum abdominale sat breve, superne visum subquadratum. Abdomen breviter ovatum, supra scuto duriusculo nitido et glabro nigro omnino obtectum, subtus atrum, mamillæ testaceæ. Chelæ porrectæ, cephalothorace paulo breviores, superne planæ et muticæ, extus dilatato-arcuatæ, fusco-rufulæ, valde rugosæ et parce albo-pilosæ, margine superiore sulci, prope apicem, dentibus trinis subæquis,* 1° *paulo validiore et uncato, dente minore submedio, dentibusque parvis binis remotis, margine inferiore dentibus minutissimis* 6 *vel* 7, *apicalibus inter se distantibus, reliquis appropinquatis, instructis, ungue ad basin atque ad apicem curvato, subtus carinato sed mutico. Partes oris longissimæ, pars labialis fusca, laminæ dilutiores. Sternum angustum fusco-olivaceum. Pedes tenues, obscure olivacei, patellis tibiisque anticis, tarsis posticis trochanteribusque* 4^i *paris dilutioribus; pedes* 1^i *paris, patella longa, tibia subtus aculeis* 7–7 *longis et pronis (apicalibus minoribus), metatarsis tibiis multo brevioribus, aculeis similibus* 2–2 *munitis; pedes* 2^i *paris tibiis aculeis debilioribus subtus armatis sed pedes quatuor postici omnino mutici. Pedes-maxillares fusco-ænei; femore compresso subtus carinato; patella tibia tarsoque superne deplanatis; tibia patella longiore, versus apicem sensim et valde ampliata subtriquetra, extus ad apicem apophysi gracili sinuoso-arcuata armata; bulbo ovato simplici.*

Kelantan: Kuala Aring.

M. (*Toxeo*) *maxilloso* C. Koch et *M.* (*Saltico*) *nemoreo* Peckham sat affinis.

2°. Salticidæ unidentati.

97. Chrysilla versicolor (C. Koch).

Plexippus versicolor C. Koch, Arachn. xiii. 1846, p. 103, f. 1165 (♂).

Mævia picta C. Koch, Arachn. xiv. 1848, p. 72, f. 1328 (♂ jn.).

Chrysilla versicolor Thorell, K. Sv. Vet.-Ak. Handl. xxiv. 2, 1891, p. 117.

Jalor: Biserat. Ligeh.

Décrit de Bintang, indiqué depuis de Singapore, de Pinang et de Sumatra.

98. Thiania bhamoensis Thorell.

Thiania bhamoensis Thorell, in Ann. Mus. civ. Genova, xxv. 1887, p. 357.

Kelantan; Kuala Aring.

Décrit de Birmanie.

99. Thiania subserena, sp. nov.

♀. *Long.* 8 *mm.—Cephalothorax lævis et nitidus, niger, parte thoracica in medio vix dilutiore, utrinque et postice sat breviter pallide luteo-pilosus, antice et in medio squamulis viridibus parvis conspersus. Pili oculorum pallide lutei. Pili clypei longissimi, albidi. Abdomen longe oblongum, supra nigro-nitidum, squamulis parvis et longis viridi-micantibus conspersum (fere omnino depile), subtus obscure testaceum, vitta media fusca lata, postice attenuata et mamillas haud attingente notatum. Mamillæ nigræ. Chelæ nigræ, antice deplanatæ, coriaceæ, valde et inordinate transversim rugatæ. Partes oris sternumque nigro-nitida. Pedes* 1ⁱ *paris reliquis robustiores, fusco-castanei, coxa tarsoque luteis, femore ad basin, tibia patellaque in medio paulo dilutioribus, reliqui pedes lutei femoribus ad apicem infuscatis et subannulatis, tibiis* 2^{i} *et* 3^{i} *parium ad basin atque ad apicem minute fuscis et tibiis* 2^{i} *paris subtus nigro-vittatis. Tibia* 1^{i} *paris subtus aculeis validis et longis* 3–3 *et utrinque lateralibus minoribus binis, metatarsus aculeis inferioribus longis et validis* 3–3 *aculeoque minore exteriore apicali instructi. Tibia* 2^{i} *paris similiter aculeata, sed metatarsus aculeis inferioribus* 2–2 *et utrinque lateralibus binis, basali longiore, armatus. Plaga genitalis magna rufula, antice fovea testacea transversa, acute emarginata, impressa.*

Perak: Ulu Selama.

100. Bianor diversipes, sp. nov.

♀. *Long.* 4 *mm.—Cephalothorax niger, subtilissime coriaceus, supra parce et tenuissime setosus, utrinque, in declivitate, parum dense luteo-pubescens, parte thoracica in medio pilis crassis pronis niveis vestita. Pili oculorum et faciei lutei. Pili clypei longissimi decumbantes nivei. Oculi quatuor antici apicibus in lineam rectam, inter se contigui et valde inæquales, medii maximi viridi-ænei. Abdomen oblongum, atrum, luteo-pubescens, ad marginem anticum setis albis longis ornatum. Chelæ, partes oris sternumque nigra, chelæ antice valde rugosæ et parce albo-*

crinitæ. Pedes 1[i] *paris robustissimi, femore compresso et late clavato nigro sed supra fusco-rufulo et subvittato, patella nigra, tibia ad basin fusco-rufula ad apicem nigra, metatarso pallide fusco-rufulo, tarso luteo, patella tibiaque et subtus et intus longissime et sat crebre albo-setosis, reliqui pedes omnino lutei, aculeis ordinariis armati.*

Kelantan: Kuala Aring.

101. Hyllus ianthinus (C. Koch).

Plexippus ianthinus C. Koch, Arachn. xiii. 1846, p. 97, f. 1160.

(?) *Plexippus succinctus* C. Koch, Arachn. xiii. 1846, p. 98, f. 1161.

Ligeh.

Répandu en Malaisie et en Birmanie.

102. Pseudamycus albomaculatus (V. Hasselt).

Amycus albomaculatus V. Hasselt, in Midden-Sumatra, etc., Aran. p. 52, tab. iii. f. 10.

Perak: Gunong Inas. Ligeh.

Connu de Sumatra.

103. Plexippus culicivorus (Doleschall).

Perak. Jalor. Rahman.

Très répandu en Malaisie.

104. Plexippus paykulli (Audouin).

Ligeh.

Répandu dans toutes les régions tropicales et subtropicales du monde.

3°. Salticidæ fissidentati.

Panysinus, nov. gen.

Ab Hasario *præsertim differt metatarsis anticis aculeis inferioribus et saltem intus aculeis lateralibus binis instructis, a* Chapoda Peckh. *differt oculis quatuor anticis a sese subcontiguis et lineam rectam seu subrectam designantibus.—Typus* P. niten *E. Sim.*

105. Panysinus nitens, sp. nov.

♀. *Long.* 5 *mm.—Cephalothorax niger, squamulis lanceolatis et striatis viridi-aureis crebre vestitus, parte thoracica linea marginali exili alba, linea submarginali paulo latiore lutea et utrinque, pone oculos, macula parva alba, notata. Pili oculorum densi et longi flavi. Clypeus subglaber, parce albo-setosus. Abdomen oblongum, supra atrum et cupreo-squamulatum, zonis transversis recurvis viridi-aureis et postice utrinque macula alba supra ornatum, subtus luteum, argenteo-micanti-squamulatum. Chelæ convexæ, nitidæ et glabræ, sternum et partes oris fusco-olivacea, chelarum margine superiore dentibus principalibus* *binis æquis dentibusque minoribus binis, inferiore carinula sat longa fere æqualiter bifida, armatis. Pedes lutei, parce nitido-squamulati, femoribus quatuor anticis subtus late nigricanti-vittatis. Plaga genitalis fulvo-nitida, utrinque area magna subrotunda, in medio carinula triquetra notata.*

Jalor: Bukit Besar.

106. Lollianus perakensis, sp. nov.

♂. *Long.* 5–6 *mm.—Cephalothorax niger, subtiliter coriaceus et opacus, pilis simplicibus sed crassis, obtusis et pronis, flavo-nitidis parum dense vestitus. Pili oculorum flavi. Clypeus sub oculis glaber, ad marginem pilis longissimis uniseriatis pallide flavidis munitus. Oculi antici magni et contigui, apicibus in lineam rectam. Clypeus dimidio oculorum mediorum paulo angustior. Abdomen breviter ovatum, supra fusco-piceum et flavo-pilosum sed postice, supra mamillas, nigrum et subglabrum, subtus paulo dilutius, mamillæ sat longæ luteæ. Chelæ validæ, glabræ, nigro-virescentes, valde coriaceæ et intus, prope apicem, valde rugatæ. Partes oris fusco-piceæ. Sternum obscure fulvum, læve et glabrum. Coxæ trochanteresque lutei, antici paulo obscuriores. Pedes* 1[i] *paris reliquis robustiores et paulo longiores, nigricantes, tarso vix dilutiore, patella tibiaque supra, metatarso ad basin flavido-pilosis, subtus sat longe sed parcissime nigro-setosis, tibia aculeis inferioribus mediocribus* 3–3 *et lateralibus interioribus binis, metatarso aculeis multo longioribus* 2–2 *subtus armato sed aculeis lateralibus carente. Pedes* 2[i] *paris fusci, femore ad basin, metatarso tarsoque luteis, subtus similiter aculeatis sed tibia utrinque aculeo laterali submedio, metatarso aculeis lateralibus interioribus binis armatis. Pedes quatuor postici longitudine fere æqui* (iv *vix longiores*), *minute et sat parce aculeati, metatarso* 3[i] *paris aculeis subbasilaribus binis aculeisque apicalibus verticillatis munito, sed metatarso* 4[i] *paris, aculeis apicalibus parvis binis exceptis, mutico. Pedes-maxillares fulvo-rufuli, breves et robusti; femore crasso, curvato, subtus ad basin obtuse prominulo; patella convexa, haud longiore quam latiore; tibia patella breviore, extus ad apicem apophysi gracili longissima, articulo plus duplo longiore, incurva et antice, secundum tarsum directa, insigniter armata; tarso longo, cylindraceo; bulbo maximo, ad basin valde prominulo et globoso, ad apicem sensim attenuato.*

Perak: Ulu Selama.

107. Siler pulcher, sp. nov.

♂. *Long.* 4 *mm.—Cephalothorax niger, crebre olivaceo-pubescens, versus marginem late dilutior et coccineo-pilosus sed linea marginali exili nigra pallide viridi-squamulata cinctus. Pili oculorum albidi. Clypeus angustus fere nudus. Abdomen angustum longum et teretiusculum, nigrum, supra in dimidio basali læte coccineo-pubescens et maculis quatuor pallide viridi-micantibus, anticis longis obliquis et arcuatis alteris minoribus et* *ovatis decoratum, in parte altera violaceo-micanti squamulatum, subtus parce micanti-squamulatum et pone plicam genitalem albido-pilosum. Chelæ antice deplanatæ, valde coriaceo-granulosæ, fuscæ apice sensim rufulæ, margine inferiore sulci carinula longa tenuissime serrata et oblique secta cum angulo postico prominulo armato. Partes oris sternumque obscure fulva, albido-pilosa et parce squamulata. Pedes 1^i paris robusti, fulvo-rufuli, patella et præsertim tibia valde infuscatis, metatarso tarsoque pallide luteis, patella læte violaceo-micanti-squamulata, femore clavato subtus ad marginem exteriorem in dimidio apicali tibia et subtus et supra longissime nigro-fimbriatis. Reliqui pedes graciliores, lutei, patellis tibiisque cunctis, metatarsisque 4 posticis utrinque tenuiter fusco-lineatis. Pedes-maxillares lutei, crasse nigro-pilosi; tibia patella breviore haud vel vix longiore quam latiore, extus ad apicem apophysi nigra brevi, compressa valde uncata atque acuta instructa, tarso longe ovato.*

Kelantan: Kuala Aring.

108. Harmochirus malaccensis E. Simon.

Harmochirus malaccensis E. Simon, in Bull. Soc. zool. Fr. 1885, p. 441.

A typo differt magnitudine duplo majore.

Kelantan: Kuala Aring.

Ordo PEDIPALPI.

Familia Tarantulidæ.

109. Stygophrynus cerberus, sp. nov.

Long. 20–28 mm.—Fusco-piceus, abdomine paulo dilutiore, pedibus, saltem sex posticis, fulvo-rufulis, tegumentis cephalothoracis et pedum-maxillarium subtiliter rugosis et granulis parvis nigris conspersis, abdominis subtilius rugosis, pedum femoribus granulis minutis nigris seriatis ornatis. Pedes-maxillares cephalothorace fere triplo longiores, trochantere intus spinis mediocribus iniquis plurimis atque ad marginem apicalem spina multo longiore arcuata (non truncata) compressa et superne leviter et obtuse serrata armato; femore subtus ad marginem superiorem spinis 5, 1^o minore et obliquo a 2^o fere contiguo, 3^o reliquis longiore, 5^o minore, ad marginem inferiorem spinis 4, 2^o reliquis longiore; tibia (brachio) ad marginem superiorem, in dimidio apicali, leviter dilatata spinis longissimis et inter se subæquis trinis, spinisque minoribus trinis, 1^a ante spinas principales, 2^a leviter uncata, inter spinas princ. 2^a et 3^a, 3^a apicali, margine inferiore spinis 4 et inter eas spinis parvis numerosis seriatis, spina princ. 3^a reliquis multo longiore, 4^a apicali brevi sed crassa et dentiformi; metatarso (manu) utrinque spinis parvis 4 (apicalibus longioribus) et prope basin spina longissima et divaricata, inferiore simplici, superiore subramosa subtus ad basin dente brevi sat valido et leviter retro directa armata, instructis.

A *S. cavernicola* Thorell præsertim differt tegumentis corporis pedum-maxillarium femorumque subtiliter rugosis et parce granulosis, magnitudine multo majore, spina minore inter spinas principales marginis superioris tibiæ pedum-maxillarium et ramulo inferiore spinæ superiore metatarsi crassiore et divaricato.

Jalor: Caves (v.–vi. 1899), Gua Glap ("Dark Cave"), Biserat (26 v. 1899).

110. CATAGÆUS RIMOSUS, sp. nov.

♀. *Long.* 7 *mm.—Fusco-piceus, subtus dilutior, cephalothorace leviter rufulo-variegato, pedibus-maxillaribus chelisque rufescentibus, pedibus versus apicem sensim fulvis. Cephalothorax impressus et inæqualis, subtiliter et crebre rugosus, pilis rufulis brevibus, obtusis et subclaviformibus conspersus, margine frontali angusta, spinis rufulis quatuor, medianis longioribus, munita. Segmenta abdominalia subtilissime rugosa. Pedes-maxillares robusti, subtiliter coriacei, pilis spiniformibus rufulis conspersi; trochantere intus spinis parvis* 2 *vel* 3, *ad marginem apicalem subtus, spina vel apophysi majore, ad marginem inferiorem tridentato spinaque minore armato; femore subtus, ad marginem superiorem, spinis* 4 *inter se fere æquidistantibus, basali paulo longiore, apicali minore, ad marginem inferiorem spinis* 3, *basali longiore; tibia (brachio) ad marginem superiorem spinis* 5 *vel* 6 *(basali minutissimo vel obsoleto), apicali* (6^a) *mediocri, subapicali longissima apice acutissima et leviter curvata,* 3^a *præcedenti paulo breviore, reliquis basin versus sensim minoribus; metatarso (manu) ad marginem inferiorem spina unica submedia, ad marginem superiorem aculeis longis acutis et leviter curvatis, inter se subsimilibus, armato; tarso (ungue) ad marginem superiorem, prope basin, spinis minutissimis binis munito.*

A *Catagœo pusillo* Thorell imprimis differt manu pedum-maxillarium ad marginem superiorem aculeis binis, inter se æquis armato (in *C. pusillo* aculeo 2° 1° multo minore atque recto, sec. Kraepelin, Rev. Tarant. fig. 34).

Kelantan: Kuala Aring.

Familia THELYPHONIDÆ.

111. HYPOCTONUS KRAEPELINI, sp. nov.

♀. *Long.* 30–32 *mm.—Cephalothorax segmentaque dorsalia abdominis nigro-opaca, segmenta ventralia rufula et nitida, pedes-maxillares (coxis exceptis) nigerrimi et nitidi, pedes* 1^i *paris obscure fusci, reliqui pedes rufi. Cephalothorax antice sat grosse et crebre, præterea tenuiter granulosus, antice, ante oculos laterales, depressione media longitudinali leviter lanceolata, minus granulosa et utrinque costa lata obliqua et obtusissima lævi munita. Tuber oculorum mediorum læve et nitidum, inter oculos leviter convexum et subcostatum, spatio inter oculos medios oculo non multo latiore. Segmenta dorsalia abdominis opaca, minute et parce granulosa, cuncta ad marginem posticum granulis* *minutissimis densioribus et uniseriatis munita, segmenta ventralia nitida. Segmentum anale nitidum, macula albida oculiformi parva utrinque munitum. Pedes-maxillares robusti, nitidissimi; trochantere supra dente angulari sat valido et acuto, ad marginem anteriorem dente simili, ad interiorem dentibus trinis paulo minoribus, inter se æquis et æquidistantibus armato; apophysi tibiali valida sed acuta, ad marginem interiorem dentibus sat parvis 6–7 inter se æquidistantibus (basalibus binis minoribus), ad marginem exteriorem dente apicali minutissimo denteque subbasilari paulo majore instructa. Pedes 1^i paris tarsi articulo 2^o plus triplo longiore quam latiore, 3^o saltem duplo longiore quam latiore, 4^o, 5^o, 6^o paulo brevioribus inter se subæquis. Pedes 3^i paris tibia mutica. Pedes 4^i paris tibia aculeo medio-apicali subtus armata.*

Ab *H. saxatili* Oates, qui verisimiliter affinis est, differt imprimis tibia 3^i paris mutica.

Jalor: Biserat. Nawng-Chik: Bukit Grah.

112. Thelyphonus linganus C. Koch.

Thelyphonus linganus C. Koch, Arachn. x. 1843, p. 31, f. 774.

Thelyphonus jahorensis Oates, in Journ. Asiat. Soc. Beng. lviii. 1889, p. 11.

Thelyphonus linganus Kraepelin, Rev. Uropygi, 1897, p. 25.

Perak: Ulu Selama. Kelantan: Kuala Aring.

Ordo SCORPIONES.

Familia Buthidæ.

113. Archisometrus scutatus (C. Koch).

Lychas scutatus (*scutillus*) C. Koch, Arachn. xii. 1845, p. 3, f. 962.

Isometrus weberi Karsch, in Berl. ent. Zeitschr. xxvi. 1882, p. 184.

Isometrus messor E. Simon, in Ann. Mus. civ. Genova, xx. 1884, p. 371.

Isometrus phipsoni Oates, in J. Bombay Soc. iii. 1888, p. 248.

Archisometrus scutatus Kraepelin, in Tierr., Scorp. et Ped. 1899, p. 44.

Jalor: Bukit Besar. Patalung: Ban-Kong-Rak.

Familia Scorpionidæ.

114. Palamnæus longimanus (Herbst).

Forma *angustimanus* Thorell.

Patalung: Singgora.

Forma *thorelli* Pocock.

Jalor: Bukit Besar, Biserat, Patani. Patalung: Ban-Kong-Rak.

115. Hormurus australasiæ (Fabricius).

Perak: Gunong Inas, Ulu Selama. Kelantan: Kuala Aring. Jalor: Biserat, Bukit Besar. Patalung: Ban-Kong-Rak.

116. Hormurus caudicula (L. Koch).

Ligeh.

Familia Chærilidæ.

117. Chærilus truncatus Karsch.

Chœrilus truncatus Karsch, in Mitt. Münch. ent. Ver. iii. 1879, p. 108; Kraepelin, *loc. cit.* p. 163.

Jalor: Biserat. Kelantan: Kuala Aring.

Ordo CHERNETES.

Familia Garypidæ.

118. Garypus personatus, sp. nov.

Long. 3·5 *mm.—Sat longus, postice sensim ampliatus, subtiliter et uniformiter coriaceus, pilis carens (?). Cephalothorax evidenter longior quam latior, antice, usque ad oculos, leviter attenuatus, ante oculos abrupte angustior, longe productus, oblique proclivis et leviter sulcatus, prope medium vix distincte transversim depressus. Oculi utrinque bini, a sese juxta contigui, anticus postico vix minor. Pedes-maxillares longi, sat graciles, subtiliter coriaceo-rugosi, digitis setis tenuissimis paucis munitis; trochantere brevissime pediculato, dein lato, convexo sed intus haud producto, saltem haud longiore quam latiore; femore longo, parallelo, haud pediculato; tibia femore fere* $\frac{1}{3}$ *breviore, circiter æquilata, basin versus sensim et longe attenuata; manu tibia circiter æquilonga, haud duplo latiore, longe ovata, intus quam extus paulo convexiore; digitis tenuibus, leviter curvatis, manu saltem haud brevioribus.—Truncus fulvo-testaceus, regione frontali fusca, maculam postice laciniosam, formante, segmentis abdominis maculis fuscis parvis quadriseriatis ornatis. Pedes-maxillares fusco-olivacei, digitis pallidioribus rufulis. Pedes pallide lutei subpellucentes.*

Kelantan: Kuala Aring.

Familia Cheliferidæ.

119. Chelifer (Lamprochernes) javanus Thorell.

Chelifer javanus Thorell, in Ann. Mus. civ. Genova, xviii. 1882, p. 37, tab. v. f. 20–23.

Kelantan: Kuala Aring.

Espèce très répandue en Malaisie.

120. Chelifer cocophilus, sp. nov.

Long. 4 *mm.—Sat depressus, cephalothorax anophthalmus (sed* *antice utrinque macula testacea oculiformi munitus) fusco-olivaceus vel niger, minute et crebre rugosus, sed postice (pone sulcum 2um) albo-testaceus atque in medio fusco-maculatus, sulcis transversis binis tenuibus et rectis, 1o submedio, altero a sulco 1o atque ad marginem posticum fere æque remoto. Segmenta abdominalia supra subtilissime coriacea, antica testacea, postica infuscata, subtus lævia, nitida et pallide testacea, pilis simplicibus tenuibus et brevibus conspersa. Pedes-maxillares longi et robusti, et supra et subtus læves et nitidi, nigri, digitis rufulis, pilis simplicibus tenuibus et sat brevibus conspersi; trochantere breviter pediculato, vix longiore quam latiore, supra convexo et obtusissimo; femore crasso, intus recto, extus valde convexo, ad basin brevissime et abrupte pediculato; tibia femore circiter æque longa et lata (vel vix latiore), longe ovata, ad basin atque ad apicem fere æqualiter attenuata, intus quam extus convexiore, ad basin breviter pediculato; manu tibia latiore, ad basin globosa, apicem versus parum attenuata, digitis robustis, curvatis, manu circiter æquilongis. Pedes breves, luteo-olivacei, subpellucentes.*

Kelantan: Kuala Aring.

Ordo OPILIONES.

1°. Opiliones plagiostethi.

Synopsis specierum.

1. Truncus supra muticus spina carens	2.
Truncus supra spina media vel spinis duabus instructus	3.
2. Tuber oculorum humile. Pedum-maxillarium patella intus ad apicem ramulo longo munita. Pedes nigricantes tibiis ad apicem late albis	*Zaleptus festivus* Th.
Tuber oculorum angustum et altum. Pedum-maxillarium patella simplex ramulo carens. Pedes nigricantes concolores ...	*Verpulus spumatus* s. n.
3. Tuber oculorum supra, ante oculos, dentibus sat longis binis munitum. Scutum abdominale spinis duabus armatum. Patella pedum-maxillarium intus ad apicem ramulo longo munita.........	*Gagrella bicornigera* s. n.
Tuber oculorum muticum vel minute biseriatim dentatum. Scutum abdominale spina unica armatum. Patella pedum-maxillarium simplex ramulo carens	4.
4. Tuber oculorum humillimum, saltem duplo latius quam longius, ad basin haud angustatum. Scutum abdominale antice parce et inordinate granulosum, postice subtilissime coriaceum, spina crassa denticulis validis scabrosa	*Gagrella semigranosa* s. n.
Tuber oculorum sat altum, versus basin angustatum. Scutum abdominale uniformiter granosum vel coriaceum, spina graciliore armatum	5.

5. Tuber oculorum supra, inter oculos, dentibus parvis biseriatis 4–4 munitum. Corpus omnino nigrum	*Gagrella patalungensis* s. n.
Tuber oculorum læve et muticum nec dentatum nec spinulosum	6.
6. Tarsus pedum-maxillarium subtus in parte basali linea spinularum parvarum armatus.	*Gagrella illusa* s. n.
Tarsus pedum-maxillarium muticus, linea spinosa carens	7.
7. Truncus niger, abdomine maculis albis pulverulentis albis biseriatis ornato, spina dorsali lævi armato	*Gagrella biseriata* s. n.
Truncus læte fulvo-rufescens, tubere oculorum apice nigro-æneo, scuto abdominali in medio late nigro-opaco, spina nigra minute scabrosa armato	*Gagrella atrorubra* s. n.

121. Zaleptus festivus Thorell.

Zaleptus festivus Thorell, in Ann. Mus. civ. Gen. 2ª ser. vii. 1889, p. 611.

Kelantan : Kuala Aring.

Décrit du Tenasserim.

122. Gagrella bicornigera, sp. nov.

Long. 3 *mm.—Truncus brevis, subrotundus, convexus, rufo-coccineus, tubere oculorum spinisque abdominis nigris, crebre et minute rugosus, spinis duabus gracilibus, acutissimis et subtilissime rugosis, antica altera paulo minore, armatus, margine antico cephalothoracis longe declivi, tuberculis rugosis binis geminatis munito. Tuber oculorum modice altum, antice visum multo latius quam altius et basin versus angustius, supra, inter oculos profunde sulcatum, minute granosum et ante oculos tuberculis binis, erectis, leviter divaricatis atque obtusis armatum. Truncus subtus cum coxis subtiliter coriaceus et opacus. Chelæ luteæ, læves et nitidæ, articulo 2º (manu) cylindrato. Pedes-maxillares lutei, graciles et longi, patella supra ad apicem convexa sed intus haud producta ramulo carente ; tibia saltem quadruplo longiore quam latiore. Pedes longissimi, mutici et parce dentati, obscure fusci, coxis trochanteribusque dilutioribus sed femoribus ad basin sensim infuscatis fere nigris.*

Ligeh.

A *G. bidentata* Thorell, cui verisimiliter valde affinis et subsimilis est, differt (sec. Thorell) corpore subtus coriaceo (haud læve) et femoribus pedum ad basin fere nigris.

123. Gagrella illusa, sp. nov.

Long. 4·8 *mm.—Truncus niger, cephalothorace utrinque macula magna subtriquetra, scuto abdominali vittis binis longitudinalibus angustis, sinuosis, sæpe extus dentatis et antice abbreviatis albis et pulverulentis ornatus, breviter ovatus, convexus, crebre et sat minute granulosus, spina media erecta, gracili et acutissima omnino lævi (haud granulosa) armatus. Tuber oculorum* *muticum, nec dentatum nec spinosum, altum, antice visum, haud latius quam altius, versus basin angustius, supra, inter oculos, profunde sulcatum, ante et pone oculos minute et obtuse prominulum. Regio ventralis coxæque materia subcerea albida omnino obtectæ. Chelæ læves et nitidæ, fulvo-rufulæ, articulo basali infuscato, apicali cylindrato. Pedes-maxillares mediocres, femore patellaque nigricantes, præterea fulvo-rufuli, femore subtus minute et inordinate dentato, patella simplici ramulo carente, tibia patella paulo longiore et graciliore sed non triplo longiore quam latiore, subtus omnino lævi et mutica, tarso subtus in dimidio basali, prope marginem interiorem, linea spinularum parvarum armato. Pedes longissimi, nigri, apicem versus vix dilutiores, minutissime et parce spinulosi.*

Jalor: Bukit Besar, in silvis.

124. Gagrella biseriata, sp. nov.

Long. 4·5 *mm.—Truncus niger, cephalothorace utrinque maculis albis binis, antica subtriquetra, altera (prope tuber oculorum sita) longa, obliqua et sæpe arcuata, scuto abdominali utrinque ad marginem plus minus testaceo plagiato, supra maculis parvis albis biseriatis* (5–5 *vel* 6–6) *ornato. Tuber oculorum altum, ad basin angustius, supra, inter oculos, profunde sulcatum, haud prominulum, sed ante oculos sæpe minute dentatum. Scutum crebre granulosum, spina media, erecta, gracili et acutissima lævi, haud granulosa, armatum. Regio ventralis coxæque materia subcerea albida obtectæ. Chelæ læves et nitidæ, fulvo-rufulæ, articulo basali infuscato, apicali cylindrato. Pedes-maxillares mediocres, femore patellaque nigricantes, præterea fulvo-rufuli, femore subtus sat minute inordinate et crebre dentato, patella simplici, ramulo carente, tibia patella paulo longiore et graciliore sed non duplo longiore quam latiore, subtus ad marginem exteriorem, præsertim ad basin, spinulis parvis armata, tarso omnino mutico, lævi. Pedes longissimi, nigri, apicem versus vix dilutiores, minutissime et parce spinulosi.*

Perak: Gunong Inas.

A præcedente, cui valde affinis est, imprimis differt tibia pedum-maxillarum subtus spinulosa sed tarso mutico, linea granulosa carente.

125. Gagrella patalungensis, sp. nov.

Long. 4·5 *mm.—Omnino niger. Truncus breviter ovatus, convexus, cephalothorace segmentisque abdominis posticis sat subtiliter coriaceis et opacis, scuto abdominis crebre et uniformiter coriaceo-granuloso, spina media erecta sat gracili et acutissima, parce granulosa, armato. Tuber oculorum sat altum, versus basin angustatum, læve sed supra, inter oculos, denticulis parvis biseriatis* 4–4, *duobus ante oculos reliquis a sese subcontiguis et pone oculos sitis, armatum. Chelæ læves et nitidæ, articulo* 2° *(manu) anguste cylindrato apicem versus paulo dilutiore. Pedes-maxillares modice longi, fusci apice dilutiores, femore subtus* *minute et sat crebre denticulato, patella simplici ramulo carente, tibia haud triplo longiore quam latiore subtus minutissime crebre et inordinate spinulosa, tarso leviter curvato, compresso, apicem versus levissime ampliato, tibia cum patella simul sumptis multo longiore. Processus sternalis coxæque sat grosse sed parce granosi, segmenta ventralia abdominis subtiliter coriaceis haud granosis. Pedes nigricantes, longissimi, femoribus minutissime inordinate et parce spinulosis.*

Patalung: Ban-Kong-Rak.

A *G. histrionica* Thorell, cui præsertim affinis est, differt trunco sat grosse haud subtiliter coriaceo-granuloso, maculis albis carente, pedibus-maxillaribus fuscis, patella simplici ramulo carente.

126. Gagrella semigranosa, sp. nov.

Long. 4·8 *mm.—Truncus breviter ovatus, valde convexus, interdum omnino niger, interdum fulvo-ferrugineo-variatus (cephalothorace late marginato, scuto abdominali antice lineis binis sinuosis postice convergentibus et postice vitta marginali latissima et dentata), subtiliter coriaceus et opacus, parte abdominali antice granulis transversim uniseriatis, scuto in dimidio anteriore granulis similibus inordinatis sat parce consperso, spina media erecta, crassa sed acuta, fere usque ad apicem granulis grossis et iniquis dentiformibus instructa. Tuber oculorum muticum, nec spinosum nec dentatum, insigniter humile, saltem duplo latius quam altius, ad basin haud angustatum et vix sulcatum. Chelæ læves et nitidæ, fusco-rufulæ, articulo* 2° *(manu) cylindrato. Pedes-maxillares modice longi, fusci apice dilutiores, femore subtus minute et sat parce dentato, patella simplici, ramulo carente, tibia haud triplo longiore quam latiore, subtus spinulis minutissimis paucissimis munita, tarso leviter curvato, compresso, apicem versus levissime ampliato, tibia cum patella simul sumptis multo longiore. Processus sternalis coxæque sat grosse sed parce granosi, segmenta ventralia abdominis subtiliter coriacea et granulis parvis transversim seriatis munita. Pedes longissimi, nigri, metatarsis tarsisque dilutioribus et obscure fulvis, interdum pedes fusco-rufuli cum basi femorum patellisque nigricantibus, femoribus minutissime inordinate et parce spinulosis.*

Jalor: Biserat, Bukit Besar. Kelantan: Kuala Aring.

A *G. ephippiata* Thorell (ex Sumatra) verisimiliter sat affinis.

127. Gagrella atrorubra, sp. nov.

Long. 4·5 *mm.—Truncus brevis subrotundus, valde convexus, fulvo-rufescens, scuto abdominali cum spina nigro, antice et utrinque testaceo-marginato, maculam magnam subquadratam formante, segmentis posticis dorsalibus nigris, ultimis binis macula media albida notatis, cephalothorace fere lævi, in declivitate anteriore minutissime vix distincte et parcissime rugoso, scuto segmentisque posticis opacis, minutissime et regulariter granulosis, spina dorsali erecta, longa, sat gracili et acutissima,* *sublævi, parce et minute scabra. Tuber oculorum ad basin luteum ad apicem nigro-æneum, longum, reclinatum, ad basin valde angustatum, muticum, nitidissimum et profunde sulcatum. Chelæ luteæ, nitidæ, articulo 2º (manu) cylindrato. Pedes-maxillares mediocres, fulvo-rufuli, tarso luteo, femore subtus in medio denticulis parvis triseriatim ordinatis munito, patella tibiaque utrinque minutissime et parce dentatis, patella simplici, intus ad apicem leviter convexa, sed ramulo carente, tibia haud triplo longiore quam latiore, tarso gracili compresso, tibia cum patella longiore. Coxæ minutissime et parce granosæ. Processus sternalis segmentaque abdominis subtus haud granosa fere lævia. Pedes longissimi, fusco-rufuli, trochanteribus femoribusque dilutioribus sed femoribus 4i paris ad basin infuscatis, spinulis minutissimis et inordinatis conspersi.*

Perak: Gunong Inas. Kelantan: Kuala Aring.

VERPULUS, nov. gen.

A Gagrella *differt scuto abdominali dorsali mutico, spinis tuberculisque carente et tubere oculorum altiore quam latiore, ab* Hypsibuno Thorell *differt tubere oculorum reclinato, angusto sed apice leviter ampliato omnino mutico et læve, et pedibus-maxillaribus simplicibus, patella convexa intus haud producta ramulo carente et tibia patella haud longiore.*

128. VERPULUS SPUMATUS, sp. nov.

Long. 2·5—3 *mm.—Truncus brevis, subrotundus, minute et crebre rugosus, niger, cephalothorace materia subcerea flavida crasse obtecto, tuberculo oculorum sat reclinato, lævi et mutico, altiore quam latiore, apice sensim incrassato et subrotundo, inter oculos haud sulcato sed convexo, ad basin rufulo ad apicem nigro. Chelæ læves, articulo basali nigro, apicali fulvo-rufulo angusto, teretiusculo, a basi haud prominulo, digitis apice nigris. Pedes-maxillares simplices fusci, tarso fulvo, patella convexa, intus haud prominula, tibia patella circiter æquilonga, paulo angustiore, haud triplo longiore quam latiore. Pedes longissimi, nigri, metatarsis tarsisque leviter dilutioribus. Processus sternalis, coxæ segmentaque abdominis subtus coriacea et opaca.*

Jalor: Bukit Besar.

2º. **Opiliones mecostethi.**

129. ONCOPUS TRUNCATUS Thorell.

Oncopus truncatus Thorell, in Ann. Mus. civ. Genova, 2ª ser. x. 1891, p. 764.

Perak: Gunong Inas.

Connu de Singapore et de Pinang.

J. Smit del. et lith.

Mintern Bros. imp.

GENETTA VICTORIÆ.

May 21, 1901.

Dr. W. T. Blanford, F.R.S., Vice-President, in the Chair.

Mr. R. I. Pocock, F.Z.S., exhibited two nests of a tree Trap-door Spider, brought by Mr. J. T. Maury from Rio Janeiro, as an instance of the perfection of the instinct displayed by these animals in the construction of their domiciles on the trunks of trees. One of these nests was still tenanted by a living Spider with her family. It was suggested that the Spider probably belonged to the species known as *Pseudidiops rastratus*, described in the 'Proceedings' for 1889, p. 250, specimens of which had been kept alive in the Insect House of the Society's Gardens.

The following papers were read:—

1. On the more notable Mammals obtained by Sir Harry Johnston in the Uganda Protectorate. By Oldfield Thomas.

[Received May 7, 1901.]

(Plate V.[1])

The valuable scientific exploring and collecting work which Sir Harry Johnston did in Nyasaland, during his residence there, he has continued while acting as Special Commissioner in the Uganda Protectorate. With his usual generosity he has sent all the specimens obtained by him to the National Museum, and I have had the pleasure of working out the Mammals.

During the autumn of last year Sir Harry made an expedition to investigate the Fauna and Flora of Mount Ruwenzori, and obtained a number of interesting forms, by far the most remarkable of which is the wonderful new Mammal, of which Mr. Sclater gave us an account at the last meeting (see above, p. 3). Other specimens obtained at the same time were exhibited to the Society by Mr. Sclater on March 19th (see P. Z. S. 1901, vol. i. p. 222), but these he has been good enough to hand over to me, and an account of them is included in the present paper.

On this occasion it has not been thought worth while to record all the mammals sent, and my notes are restricted to the rarer and more remarkable forms.

Colobus ruwenzorii, sp. n.

Two native skins; Buamba Country, N.W. flank of Ruwenzori.

A black and white *Colobus* allied to *C. palliatus* and *C. angolensis*.

Fur of back enormously long, longer than that of any known

[1] For explanation of the Plate, see p. 87.

species, and wavy, so that it is very like that of a long-haired Angora Goat. Over the shoulders the black hairs are 9 to 11 inches in length, isolated ones being found up to 13 inches long. White cheek-tufts long and bushy. Distribution of black and white very much as in *C. palliatus*, there being apparently a white superciliary band, although this is cut away entirely in one specimen, and there is only a faint indication of it in the other (the type). In the anal region, however, the white is more extended, for an area from 4 to 6 inches each way below the callosities is either white or grizzled with white, while in *C. palliatus* only a small spot or streak in the middle line is white. The tail differs markedly from that of the allied species by having practically no white tuft at all, for the terminal 6 inches are merely grizzled, more blackish than white, and it is only the hairs at the extreme end (and these are only some $2\frac{1}{2}$ inches in length) which are altogether white.

Type. B.M. No. 1.8.9.13.

This splendid monkey is probably the Colobus referred to by Scott Elliot (P. Z. S. 1895, p. 341) as seen by him in the Yeria and Msonje valleys, near Butanuka, Ruwenzori, but he was not able to obtain a specimen.

Colobus occidentalis Rochebr.

♀. Mpanga Forest, September 1900. "Iris light hazel."

A beautiful skin, with skull, of this rare species, which is as yet very imperfectly represented in our collections.

The tail-tuft of this monkey is as well-developed as in Rochebrune's figure, and shows no approximation to the reduction said to be characteristic of *C. matschiei* Neumann[1].

Colobus rufomitratus Peters.

Several specimens from the Ruahara River, altitude 4000 ft., August 1900.

"Eyes bright hazel."

The occurrence in the Uganda Protectorate of this remarkable monkey, not hitherto represented in the Museum collections, is of much interest. It was originally discovered by the German traveller Dr. G. A. Fischer on the Tana River, and was described and figured by Dr. Peters[2]. It does not appear to have since been met with, and the present is therefore only its second recorded occurrence.

So far as Dr. Peters's figure and descriptions enable me to judge, there is no difference at all between the Tana and Ruahara specimens.

Cercopithecus stuhlmanni Matsch.

♂. Mpanga Forest, altitude 4000 ft., Sept. 1900.

The local representative of *C. pluto* Gray.

[1] SB. Ges. nat. Fr. Berl. 1899, p. 15.
[2] MB. Ak. Berl. 1879, p. 829, pl. I A.

Genetta victoriæ, sp. n. (Plate V.)

A single skin from Entebbe.

Size nearly twice as great as in any known species of the genus, and almost rivalling that of a Civet, to which at first sight there is a general resemblance. Fur comparatively short, very close and thick; hairs of back about 23–26 mm. in length. Median dorsal crest not or scarcely developed, though there is a black line in its usual position. Markings throughout very strong and prominent. Light ground-colour above yellowish white, the hairs smoky grey basally, with a subterminal ring of yellowish white and a black tip. Top of muzzle and centre of face between eyes whitish, with a black median line commencing level with the anterior canthus. Sides of muzzle and a narrow orbital ring black; a prominent white suborbital spot. Crown and nape with a very handsome intensification of the usual Genet markings; the two dark divergent bands which run backwards from behind the ears very prominent and sharply defined, deep glossy black, contrasting with the clear yellowish-white bands outside them; outside these again, on the sides of the neck, the usual dark blotches are deep glossy black. Spots on body generally very numerous, well-defined, black. Centre of posterior back with a black line, but its hairs not lengthened into a crest. Under surface spotted black and whitish, not defined from the dorsal colour. Shoulders spotted like body; forearms and hands fuscous brown throughout, obscurely spotted proximally. Hind limbs similar to fore. Tail long, bushy, cylindrical, its hairs about 25–30 mm. in length; prominently and completely ringed with black and white, the black bands about twice the breadth of the white ones, which latter are six in number; the tip black.

Dimensions (approximate, taken on a badly made skin):—Head and body 540 mm.; tail 400 mm.; breadth of naked rhinarium below nostrils 14 mm. (as compared with less than 10 mm. in a well-grown ordinary Genet).

Hab. Entebbe, Uganda.—Date and other particulars not recorded.

Type. B.M. No. 1.8.9.29.

This fine animal, which appears to be nearly double the bulk of an ordinary Genet, is quite distinct from any species hitherto known. With its large size, conspicuous banding, and ringed tail, it has a general resemblance to a Civet, but the character of its foot-pads and other details of structure show that it is really a Genet. Unfortunately no skull was obtained.

Hystrix galeata Thos.

A fine adult skull of this Porcupine, hitherto only represented in the Museum by the immature type from Lamu, measures:—

Basilar length 149 mm.; greatest breadth 91; nasals 101×60; frontal suture 27; parietal suture (measured to occiput) 39; palate from henselion 84.

PROCAVIA CRAWSHAYI Thos.

Three specimens from the Ruwenzori region.

This Dassie does not appear to be distinguishable from the species which I described from Kenya and Roromo, from specimens obtained respectively by Messrs. Mackinder and Crawshay.

It is evidently a variable species, as Sir H. Johnston's three specimens differ considerably among themselves.

PROCAVIA (DENDROHYRAX) MARMOTA, sp. n.

Nearly allied and very similar externally to the West-African *P. dorsalis*, but smaller and with some cranial differences.

Fur long and shaggy, hairs of back 40–50 mm. in length, a few much longer hairs being intermixed. General colour dark fuscous brown, very like that of specimens of *P. dorsalis* in faded fur. Dorsal area rather darker, sides rather paler, the hairs being here subterminally ringed with dull isabelline. Bases of hairs deep brown on back, whitish brown on sides. Under surface dull brown, but little paler than sides, the hairs tipped with dull buffy; in the inguinal region they are buffy throughout. Hands and feet uniformly brown.

Naked part of dorsal gland about 35 mm. long by 12 mm. wide. Hairs surrounding the gland black for their basal and dull white for their terminal halves; the resulting white line on the back about 3 inches in length.

Skull, as compared with that of *P. dorsalis*, more slender in the muzzle, the nasals narrower, and the zygomata more expanded anteriorly, so that their broadest point is opposite the back of the orbit. Postorbital bar complete. Malar bones feebler, their least height (opposite the temporal fossa) about 5 instead of at least 7 mm. Temporal crests less developed than in *P. dorsalis*, and the fossæ not running so far back on the skull, terminating 14 mm. from the lambdoid edge.

Molar teeth smaller and lighter, the breadth of m^1 6·0 as against 6·6–6·8 in *P. dorsalis*.

Dimensions of the type, immature, measured in skin:—Head and body 430 mm.; hind foot 70. Skull: basal length 85; greatest breadth 50·5; nasals 24·3×17·7; interorbital breadth 19·5; distance between temporal fossæ across parietals 22; diastema 16; length of palate 46; length of tooth-row (mp^1 to m^2) 31·5.

Hab. Mengo, N. of Entebbe, Uganda.

Type. Immature female. B.M. No. 1.8.9.42. Collected December 8, 1900.

"Iris dark hazel."

This Dassie is no doubt most closely allied to the West-African *P. dorsalis*, which it appears to represent in Uganda.

The type is in Stage V. of my table of age-stages[1], but the skull is neither so large, so stoutly built, nor so heavily ridged as that of a *P. dorsalis* in Stage III.

[1] P. Z. S. 1892, p. 53.

CEPHALOPHUS JOHNSTONI, sp. n.

Most closely allied to *C. weynsi* Thos.[1], but fur thicker and woollier, and general colour very much darker.

Size, so far as can be judged from a young specimen, about as in *C. weynsi*. Hairs of middle line of nape reversed forwards as in that species.

Forehead grizzled blackish brown; coronal tufts uniform chestnut rufous (rather darker than Ridgway's "hazel"). Cheeks paler brown. Anteorbital region dull buffy; an inconspicuous buffy-orange supraorbital streak present. Outer side of ears blackish brown. Neck and fore-quarters shining brown, gradually reddening posteriorly until the whole rump and hind-quarters are a deep reddish russet; middle line of back not markedly darker than sides. Belly dull brownish. Fore limbs brown, darkening terminally to black on the fetlocks; hind limbs reddish to the hocks, then brown darkening to black. Tail black along its upper surface and white below.

Owing to the youth of the type, the only dimensions worth giving are:—Hind foot, including hoof, 205; ear (contracted) 65. Combined length of three milk-premolars 29.

This species is related on the one side to *C. weynsi* Thos., of the Congo, and on the other to *C. spadix* True, of Mt. Kilima-njaro. From the former, of which one of the co-types is of just similar age to the present specimen, it differs by its much thicker fur and darker colour, being dark brown and dark rufous as compared with pale brown and pale rufous; it shares, however, with *C. weynsi* the characteristic reversal of the nuchal hairs. From *C. spadix*, on the other hand, it differs by this reversal of the hairs, that species having the neck-hairs all directed backwards, and also by the more rufous colour of the posterior back, for Mr. Miller tells me that the general colour of *C. spadix* is "Prouts brown, darkening to nearly black along spine and on rump, buttocks, and tail." The coronal tufts of *C. spadix* are partly black, and the tail is only whitish at the tip, not throughout its length below.

Hab. Toro, east of Ruwenzori.

Type. Young female. B.M. No. 1.8.9.64. July 1900.

CEPHALOPHUS RUBIDUS, sp. n.

Fur thick, close and slightly woolly. General colour of neck and body uniform rich chestnut-rufous, something between "hazel" and "cinnamon-rufous" of Ridgway, but brighter and richer than either; bases of the hairs rather greyer, and along the middle line of the back, especially posteriorly, these greyer bases are more decidedly grey-brown, and, showing through, give a darker hue to the dorsal line. Hairs of neck directed backwards as usual. Middle line of nape rather browner, probably in continuation of a darker area on the head. Sides of neck particularly bright rufous. Under surface paler rufous, not sharply

[1] Described for the Belgian Congo Museum, and now in the press. Co-types in that collection and in the British Museum.

defined; axillæ and groins whitish. Shoulders darker rufous, this colour darkening downwards on the fore limb until at the knee (and probably thence to the hoof) it is blackish brown. Hind limbs similarly deep chestnut rufous on the thighs, changing at the hocks to black or blackish brown. Tail short, only about two inches in length [1]; above black, more or less grizzled with rufous and white, below and at the extreme tip grizzled white.

In all probability this handsome Duiker is most nearly related to the West-African *C. nigrifrons* Gray, but differs in its thicker and more woolly hair, deeper and more uniform general colour, and by the greater extent of the black on the hind feet.

Hab. Ruwenzori district.

Type a flat skin, without head, purchased from the natives. B.M. No. 1.8.9.65.

Kobus thomasi Scl. (?).

A single native skin from the Semliki Valley is marked in an unusual and striking manner with grey, so symmetrically arranged that it has been supposed to represent a new species.

But without further material I am not prepared to give in my adhesion to this view, and would rather suggest that the grey marking is due to senility, just as domestic dogs and other animals occasionally turn grey in patches. I would freely admit that I know of no such striking case as the present; but as the skin agrees in all other respects with one from approximately the same region brought home by Mr. Scott Elliot, and of the usual fulvous colour, I do not at present feel justified in describing Sir H. Johnston's specimen as a distinct species.

2. On some Arctic Nemerteans. By R. C. Punnett, B.A.[2]

[Received April 20, 1901.]

(Plates VI. & VII.[3])

(Text-figures 1–6.)

The Nemerteans described below formed part of the collection in the Museum of University College, Dundee, and were kindly handed to me for examination by Prof. D'Arcy W. Thompson, after whom I have much pleasure in naming one of the new forms. I have been able to refer two to species already known, whilst five other forms are new, viz.:—*Amphiporus thompsoni*, *A. arcticus*, *A. paulinus*, *Drepanophorus borealis*, and *Cerebratulus greenlandicus*. It is worthy of note that whilst the Metanemerteans, and especially the genus *Amphiporus*, are well represented, only two specimens of Heteronemerteans, belonging to the same species, were found.

[1] Although not obviously imperfect, it is possible that the tail has been broken and healed in life.

[2] Communicated by Dr. S. F. Harmer, F.Z.S.

[3] For explanation of the Plates, see p. 106.

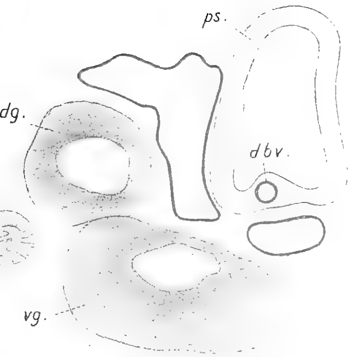

Fig. 1.

Fig. 4.

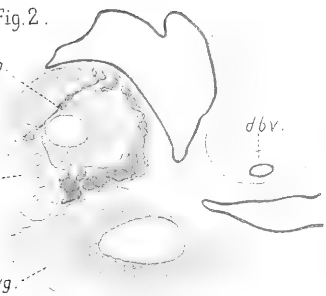

Fig. 2.

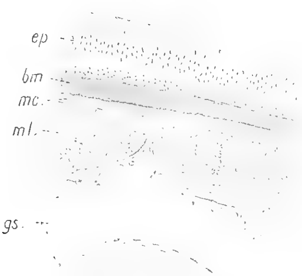

Fig. 5.


Fig. 6.

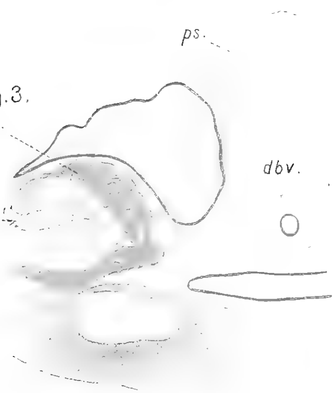

Fig. 3.


Fig. 7.

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ARCTIC NEMERTEANS.

Fig. 8.

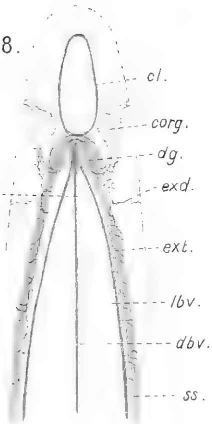


Fig. 13.

Fig. 12.

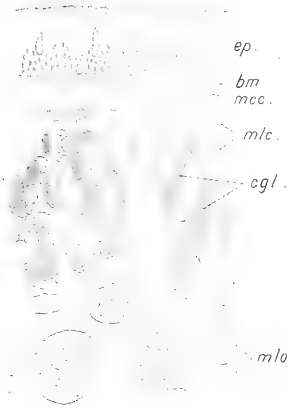


Fig. 14.

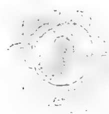


Fig. 16.

Fig. 9.

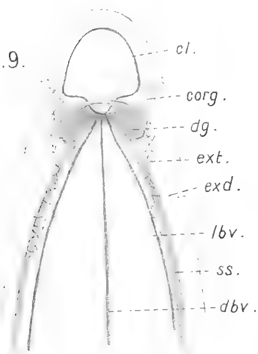


Fig. 15.

Fig. 17.

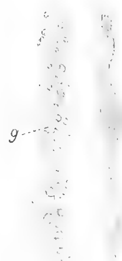


Fig. 11.

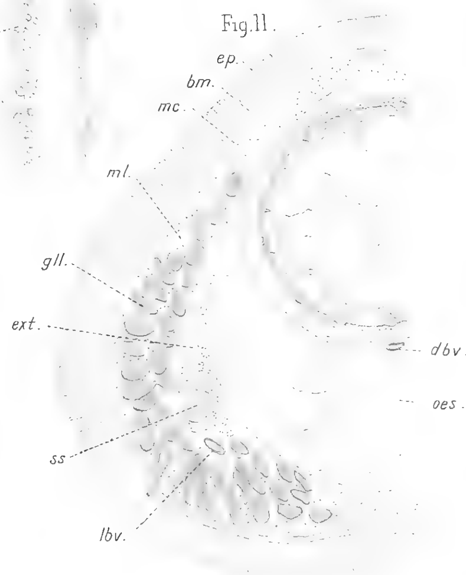
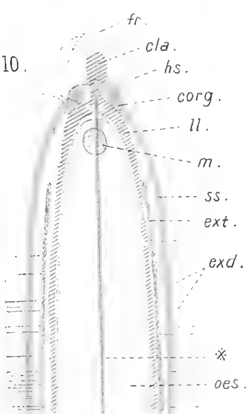


Fig. 10.



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ARCTIC NEMERTEANS

In the following paper I have first given an account of the new species, and have added at the end some notes on such points of more general interest as have arisen in connection with them.

[1] Metanemertini.

Amphiporus thompsoni, n. sp. (Plate VI. fig. 6 & Plate VII. fig. 8.)

Numerous examples from three localities, *i. e.* N. Greenland (collected by Herr Lohmann), Upernavik, and Davis Strait.

Average length about 50 mm., with a breadth of 3 mm. when not greatly contracted. Body rounded and tapering at either end. One very large specimen measured 120 mm. in length and 6 mm. in breadth. Colour dorsally reddish brown, ventrally pale yellowish buff, probably white in life. A darker streak occurs on the snout dorsally (Plate VI. fig. 6), and behind this there are two transverse white lines marking the position of the head-furrows.

The epithelium, which is devoid of unicellular glands, rests on a basement-membrane of about one-half its thickness. In the head-region the basement-membrane is pierced by numerous small nerves. The muscular system is of the usual type. The circular muscle-layer is of about one-third the thickness of the basement-membrane (*i. e.* about 20 μ). The longitudinal layer is about 5 times as thick as the circular. Dorso-ventral muscle-strands occur in the œsophageal and intestinal regions. The vascular system shows a well-marked cephalic loop. The limbs of this loop converge to pass through the nervous ring, and as they lie upon the ventral commissure the median dorsal vessel is given off from either the right or the left, and not from both as is usually the case where a median dorsal vessel exists. A similar arrangement was observed by Dr. Willey in a small Amphiporid from New Britain.

Text-fig. 1.

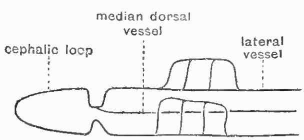


Diagram of anterior part of vascular system of *Amphiporus thompsoni*. (For explanation, see text.)

In the œsophageal region of *A. thompsoni*, where the excretory tubules are present, the lateral vessels give off dorsal branches which are united by a longitudinal vessel running for a short distance along the side of the proboscis-sheath (*vide* text-fig. 1). The dorsal blood-vessel leaves the proboscis-sheath very soon after the brain ends, and before the level of the excretory pore (Plate VII. fig. 8*).

[1] The classification given in Bürger's Monograph (1895) has been followed.

The alimentary canal presents no peculiar features. The most anterior pair of the blind-gut diverticula do not reach to the brain. The œsophagus opens into the rhynchodæum about half-way between the tip of the snout and the commencement of the brain. The proboscis-sheath extends back to the posterior extremity of the body.

The proboscis is well developed. Its armature consists of a central stylet 210 μ in length attached to a rather shorter base, 185 μ long. There are two pockets of reserve stylets each containing 4. A somewhat remarkable variation [1] occurs in the number of the proboscis-nerves. Whilst the females show 12 nerves in the proboscis, the males may have either 12, 17, or 18. The excretory system resembles that usually found in the genus. The branched tubules commence just behind the cerebral organ and extend backwards for several mm. (Plate VII. fig. 8). There is a single excretory pore on either side shortly behind the brain; it opens laterally and somewhat ventrally.

The gonidial sacs are numerous and irregularly arranged. Both ova and spermatozoa are almost or quite ripe.

The nervous system shows no marked peculiarities. Shortly after its commencement the dorsal ganglion gives off laterally a nerve to the cerebral organ. A small median dorsal nerve is present. There is a supra-anal nerve commissure posteriorly.

The cerebral organs are well developed and lie for the most part in front of the brain. Seen in transverse section, their height somewhat exceeds their breadth (av. height 350 μ, av. breadth 250 μ). Their opening is in front of the brain about $\frac{1}{4}$ of the distance between the anterior extremity of the brain and the tip of the snout (Plate VII. fig. 8).

Numerous eyes are present, amounting to about 40 on each side. They are arranged as a row from the tip of the head to the anterior brain-region, where they form a cluster.

Scanty head-glands are present opening ventrally.

AMPHIPORUS PAULINUS, n. sp. (Plate VII. fig. 11.)

Several specimens collected by Prof. D'Arcy Thompson in the Pribyloff Is., Behring Straits. In external form a long slender species tapering at either end. The specimens varied in length from about 50–90 mm. In a specimen 90 mm. long the greatest breadth was 4 mm.—which proportions in the preserved state point to this species being longer and more slender than most other members of the genus. Colour after preservation a pale yellowish brown dorsally and almost white ventrally. There are no distinctive markings.

The epithelium is high, and rests upon a comparatively thin basement-membrane (about 18 μ thick).

The circular layer of the muscular system is rather thicker than the basement-membrane. Ventrally there is a thin diagonal layer

[1] See note on p. 104.

between the circular and longitudinal layers. The last layer is not very strongly developed.

On either side of the animal, and lying partly in the longitudinal muscle-layer, partly in the gelatinous connective tissue within the body of the animal, is a well-marked layer of gland-cells (Plate VII. fig. 11, *gll.*). This layer stretches back to the intestinal region. Their secretion does not stain with borax-carmine, picric acid, or nigrosin, but takes an intense purple hue with thionin. The glands pierce the circular muscle-layers and the basement-membrane to open to the exterior. They are really the backward extensions of the enormously developed head-glands, which in the snout-region comprise the bulk of the tissue lying within the basement-membrane. A similar arrangement is found in the genera *Prosadenoporus*[1] and *Eunemertes*[2] (some species), and also in one other species of *Amphiporus*, viz. *A. carinelloides*[3]. In the last-named species the backward extent of these glands is not so great as in *A. paulinus*.

The vascular system is of the normal Amphiporid type. The median dorsal vessel is formed by both branches of the head loop. The vessels are small throughout.

The blind gut does not reach nearly to the brain. Its anterior limit is halfway between its point of origin and the tip of the snout.

The proboscis-sheath does not extend to the end of the body, being wanting in the posterior $\frac{1}{7}$th.

The proboscis is about $\frac{3}{4}$ of the total body length. It is found coiled in the anterior $\frac{1}{3}$ of the rhynchocœlom. Behind this the proboscis-sheath becomes much smaller. The proboscis contains 15 nerves. Its epithelium is raised into numerous large papillæ. The armature consists of a central stylet and two pockets each containing 4 reserve stylets. The stylet and base are of the same length, viz. 130 μ.

The excretory system commences shortly after the brain. The tubules lie round the lateral nerve-cords, and are numerous and fairly large (Plate VII. fig. 11, *ext.*). There is a single duct on either side situated at the junction of the anterior $\frac{1}{3}$ with the rest of the system. The backward extent of the tubules is greater than in *A. thompsoni* (Plate VII. fig. 8), and considerably greater than in *A. arcticus* (Plate VII. fig. 9).

The brain is fairly well developed. The ventral commissure is very short and straight; the dorsal fine and curved. The median dorsal nerve is very small. The side stems form a strong supra-anal commissure.

The cerebral organs lie just in front of the brain. They are small, and the greater part of their bulk consists of gland-cells.

The head-furrows are small, not encircling more than half the

[1] Bürger, O.: "Untersuchungen über die Anatomie und Histologie der Nemertinen, u.s.w.," Zeit. f. wiss. Zool. 1890 (p. 30).

[2] Bürger, O.: Naples Monograph, The Nemertines, 1895 (p. 126).

[3] Bürger, O.: ibid. (p. 559).

circumference of the head. The openings of the cerebral organ are ventro-lateral and rather in front of the organ.

Numerous eyes are present.

Amphiporus arcticus, n. sp. (Plate VII. fig. 9.)

A single specimen from Davis Strait. Length 28 mm. and greatest breadth 3·5 mm. The anterior end is slightly blunted; the posterior end tapers to a point. Colour a uniform pale buff in preserved specimen. There is a well-marked groove round the head.

The epithelium is about 70–80 mm. high, and contains a number of small oval glandular concretions which take a brilliant yellow stain with picric acid. The basement-membrane is about half the thickness of the epithelium in the œsophageal region. The circular muscle-layer is well developed, its thickness being about the same as that of the basement-membrane. The longitudinal muscle-layer is also well developed.

The vascular system is of the normal Amphiporid type. The limbs of the cephalic loop lie closely apposed to the cerebral organ in the region where this is present.

The alimentary canal is more complicated than the usual arrangement in the genus. It closely resembles that figured by Joubin for *A. marmoratus* [1]. The ventral unpaired diverticulum, however, is longer than in this last species, extending past the median portion of the true blind gut. The blind-gut pockets do not reach forward as far as the brain.

The rhynchocœlom extends throughout the whole length of the animal, being spacious even in its hinder portion. It reaches backwards over the hind nerve commissure, a condition which is apparently of rare occurrence according to Montgomery [2].

The proboscis is large and contains only 10 nerves. The armature has unfortunately been dissolved out.

The excretory system extends forward past the brain to the anterior level of the cerebral organ (Plate VII. fig. 9). The backward extent of the tubules is, however, short. The excretory duct is found on either side at the junction of the hindermost $\frac{1}{3}$ of the system with the rest.

The genital sacs, which contain ova, are large and alternate fairly regularly with the intestinal diverticula, a somewhat unusual condition in the genus. They open just dorsally to the nervous side-stems.

The brain is well developed.

The cerebral organ is small and is situated just in front of the brain (Plate VII. fig. 9, *corg.*). Its greatest size in transverse section is 150 μ in breadth and 200 μ in depth.

Numerous eyes are present.

The head-glands are well marked and extend backwards, though

[1] Joubin, L.: Archiv. Zool. Exp. et Gén. 1890, p. 564.
[2] Montgomery, T. H.: Zoolog. Jahrb., Abt. Syst. 1897, p. 4.

they are sometimes scantier here, to the side of the cerebral organs, where many of them open.

AMPHIPORUS LEUCIODUS.

Ref. *Coe, W. R.* Proc. Wash. Acad. Sc. 1901.

To this species I have referred several small white Nemerteans labelled from "Copper Island '97." The largest specimen measured not more than $18 \times 1 \cdot 5$ mm. They agree as regards their anatomy fairly closely with Coe's description. Owing, however, to the circumstance of their having been preserved in formalin the proboscis armature is not present. For this reason it is impossible to be absolutely certain that these specimens belong to the species to which I have referred them. The excretory ducts are numerous, being about 10–12 in number on either side. The posterior ones, however, have not the dorsal position described by Coe (*loc. cit.* p. 53) for his specimens. There are 12 nerves present in the proboscis. In his account of *A. leuciodus* this feature is omitted by Coe. All the specimens collected by Prof. D'Arcy Thompson were immature.

DREPANOPHORUS BOREALIS, n. sp. (Plate VI. figs. 4, 5, 7; Plate VII. figs. 13–17; and text-figs. 2, p. 97, and 3, p. 98.)

Several specimens obtained from Davis Strait. Even making allowance for the contracted state of the specimens, this is an extremely broad form compared with its length. The following are the dimensions in millimetres found in two entire specimens:

	Length.	Breadth.	Depth.
(1)	58	16	4
(2)	35	10	3·5

From this it will be seen that after preservation the breadth is more than a quarter of the depth, making this the relatively broadest Nemertean, with the possible exceptions of *Pelagonemertes*, *Nectonemertes*, and *Malacobdella*.

Both anterior and posterior ends are somewhat blunted. The colour and markings are characteristic. The dorsal surface is dark reddish brown. Towards the tip of the head the colour is deepened and there is a white band on either side, extending nearly to the mid-dorsal line (Plate VI. fig. 7) and marking the position of the head-furrows. The lateral margins of the dorsal surface, and the whole of the ventral surface, are nearly white. It is somewhat remarkable that the coloration and markings should so closely resemble those of *A. thompsoni*, a representative of another genus from a neighbouring region.

The epithelium is high and almost devoid of gland-cells. It rests upon a strong basement-membrane which is considerably thicker than the circular muscle-layer (Plate VI. fig. 5). The relative thickness of the various body-layers is best seen in the following table, which refers to the ventral surface in the middle of the body:—

Epithelium	110 μ
Basement-membrane	75 μ
Circular muscle	35 μ
Longitudinal muscle	185 μ

The epithelium is relatively somewhat higher dorsally. The basement-membrane is considerably thinner below the epithelium of the head-furrow. Powerful dorso-ventral muscles occur throughout the body behind the brain.

The vascular system shows the ordinary arrangement, such as has been figured by Oudemans[1] for *D. spectabilis* (=*rubrostriatus*). The alimentary canal offers no points of special interest. There is a short well-marked proctodæum lined by comparatively low epithelium. The first pair of blind-gut pouches reach forwards and lie against the hinder portion of the cerebral organ.

The proboscis-sheath exhibits the peculiar basket-work arrangement of the circular and longitudinal muscle-fibres characteristic of the genus. It possesses also the peculiar diverticula. In this species they are slender with a fine layer of muscle-fibres, and the whole surrounded by a layer of parenchyma-cells (Plate VI. fig. 4, *rd*). The 1st two diverticula unite with one another anteriorly (cf. *D. lankesteri* Hubrecht, Challenger Reports, vol. ix. p. 106). They form an irregular network which extends anteriorly over the brain and here gives off a number of large expansions (Plate VI. fig. 4, *rde*) whose wall consists only of the rhynchocœlomic epithelium—the muscular and parenchymatous layers disappearing. Consequently in the cerebral region we meet with 4 distinct sets of cavities lying in the gelatinous connective tissue, viz.:

(1) Blood-vessels.
(2) Excretory tubules.
(3) Rhynchocœlomic diverticula and their expansions.
(4) Irregular spaces in the connective tissue (Plate VI. fig. 4, *cts.*).

The proboscis is well developed and of about the same length as the body. Its epithelium is raised up into large papillæ, and through the extremely thick basement-membrane, upon which they rest, may be traced strong nerves entering their bases. The proboscis contains 14 nerves and is attached near the end of the body to the ventral wall of the proboscis-sheath.

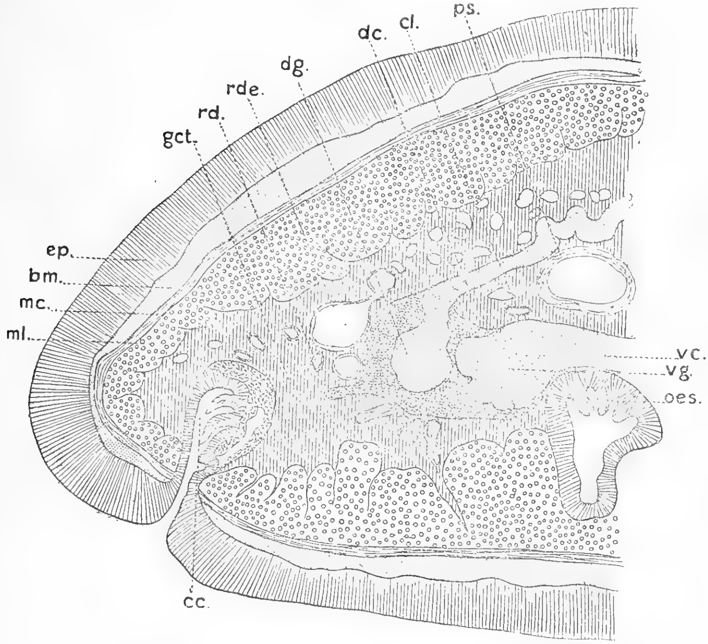
The excretory system reaches forward to the cerebral organ, and backward some way along the posterior division of the œsophagus (" Magendarm "). The duct is situated at the level of the hind end of the cerebral organ. The tubules lie closely round the lateral nerve-cords.

The gonads are large and arranged in three rows either side, which all open on the dorsal surface. They take the form of elongated

[1] *Loc. cit.* pl. i. fig. 7.

tapering sacs, the widest portion of which is near the ducts (Plate VI. fig. 5). A most interesting feature is that they show ova at all the various stages of development. These are referred to in more detail on p. 104. The brain is well developed. In shape

Text-fig. 2.



Drepanophorus borealis. Section through the commissural region of the brain, showing the opening of the cerebral organ. × 30.

bm., basement-membrane; *cc.*, ciliated canal of cerebral organ; *cl.*, cephalic vascular loop; *dc.*, dorsal nervous commissure; *dg.*, dorsal ganglion; *ep.*, epithelium; *gct.*, gelatinous connective tissue; *mc.*, circular muscle-layer; *ml.*, longitudinal muscle-layer; *oes.*, œsophagus; *ps.*, proboscis-sheath; *rd.*, rhynchocephalic diverticulum; *rde.*, expansions of rhynchocœlomic diverticula; *vc.*, ventral brain-commissure; *vg.*, ventral ganglia.

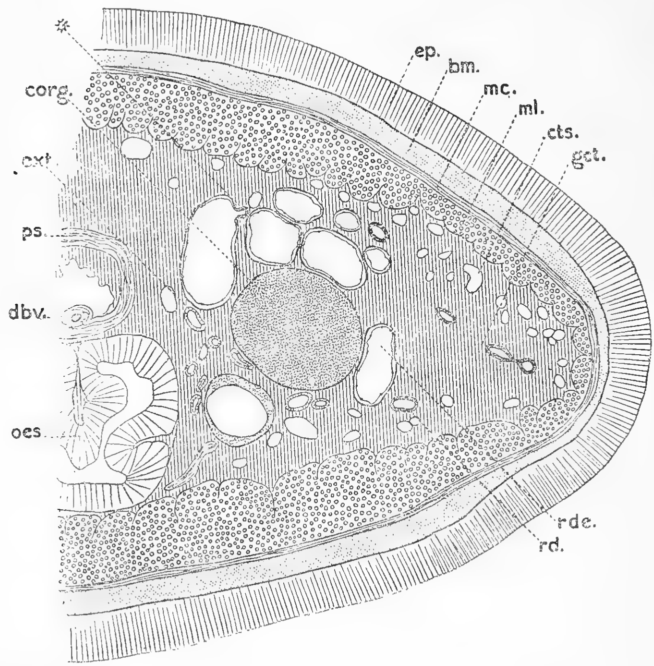
it is considerably flattened, so that the dorsal ganglion comes to lie on the outer side of the ventral, and not above it as is usually the case. The ventral commissure is short, straight, and strong; the dorsal thinner and more curved. A single large neurochord-cell occurs on either side. It is oval in shape, measuring about 83 $\mu \times$ 40 μ. Its nucleus measures 25 $\mu \times 18$ μ and contains a well-marked circular nucleolus 8 μ in diameter.

The lateral nerve-cords lie ventrally, and each is situated at the same distance from its fellow as it is from the lateral margin of the body. They are united by ventral commissures at intervals.

There are no dorsal commissures. There is a well-marked supra-anal commissure behind the termination of the proboscis-sheath and the dorsal vascular commissure.

The cerebral organ is large. It begins shortly after the commencement of the brain, to the outer side of which it lies. It extends backwards behind the brain, where it lies dorsally and slightly externally to the ventral nerve-cord. It is very large, *i. e.* about half as large again as the dorsal ganglion, and is richly clothed with gland-cells, especially on the dorsal surface. The opening of the ciliated canal is ventro-lateral, and is situated at the anterior end of the organ. The organ is innervated by a single large nerve which is given off from the hind end of the dorsal ganglion.

Text-fig. 3.



Drepanophorus borealis. Section slightly behind the preceding one, showing the expansions of the rhynchocœlomic diverticula over the cerebral organ. (The details of the cerebral organ are omitted.) × 30.

corg., cerebral organ ; *cts.*, spaces in gelatinous connective-tissue ; *dbv.*, median dorsal blood-vessel ; *ext.*, excretory tubules.

Other letters as in text-figure 2.

Portion marked by * enlarged on Pl. VI. fig. 4.

There is a well-marked transverse head-furrow on either side, and the two furrows between them surround more than half the circumference of the head.

About 4 large eyes are present on each side just in front of the brain. They are arranged in an irregular horizontal row. The total number of eyes is smaller than in any other member of the genus[1], *D. willeyanus* coming next with a total of 16.

EUNEMERTES NEESI (Œrsted, 1844).

Nemertes neesi, McIntosh, 1873–74.
Eunemertes neesi, Bürger, 1895.

Fragments of a large specimen from Greenland, amounting to 35 cm. in length with a breadth of 7 mm. I have compared a series of sections from this animal with a similar series from a specimen of *E. neesi* procured at Plymouth. The Greenland specimen is typical both with regard to external colour and form and also internal anatomy.

HETERONEMERTINI.

CEREBRATULUS GREENLANDICUS, n. sp. (Plate VI. figs. 1–3 and Plate VII. figs. 10, 12.)

Portions of two specimens from Greenland and from North Greenland (collected by Herr Lohmann). The anterior end was preserved in each case. The fragments from Greenland amounted to about 8 cm. in length and 7 mm. in width. The fragments from N. Greenland belonged to a larger specimen and amounted to 44 cm. in length and 8 mm. in breadth. The worms were of a pale dirty brown hue, all traces of the original coloration having probably been extracted by a 10 years' sojourn in alcohol. The head-slits do not extend so far as the mouth, which is very evident as a round hole.

The epithelium is fairly high and contains a few unicellular glands (Plate VII. fig. 12). It rests upon a fine basement-membrane, beneath which is the delicate circular muscle-layer of the cutis. The connective tissue is fairly well developed in the cutis. Its more superficial portion contains small scattered bundles of longitudinal muscle-fibres (Plate VII. fig. 12, *mlc.*). Beneath these are the cutis-glands, which rest directly upon the outer longitudinal muscle-layer of the body-wall.

In the œsophageal region the outer muscle-layer is about $2\frac{1}{2}$ times as thick as the circular layer. The last-named layer is of the same thickness as the inner longitudinal layer. The three muscle-layers preserve approximately the same proportions in the intestinal region. There is no well-marked layer of horizontal muscles over the mouth. No diagonal muscle-layer.

The vascular system in the head-region presents some slight points of divergence from that usually found in the Lineidæ. In front of the brain there is a single lacuna which is not divided up by muscle-strands (Plate VII. fig. 10, *cla.*). It possesses a longitudinal muscle-coat which, together with the rhynchodæum, is

[1] Punnett: Willey's Zoological Results, pt. v. p. 571.

surrounded by a fine circular muscle-layer. Just in front of the brain this lacuna divides into two limbs which almost immediately reunite. From this junction is given off the median dorsal vessel, which at once enters the proboscis-sheath. A little more posteriorly the main lacuna gives off two large trunks—the lateral lacunæ, which extend over the cerebral organ and surround its hinder portion. Almost immediately after giving off the lateral lacunæ to the cerebral organ, the median lacuna ends by giving off two lateral branches—the buccal lacunæ, which at once fuse with the lateral lacunæ in the region of the cerebral organ. The chief points of divergence from the usual arrangement lie in the single head-lacuna, and in the short course and large size of the buccal lacunæ. A similar cephalic lacuna has, so far as I am aware, only been described among the Lineidæ for *L. sanguineus*[1].

The backward extent of the rhynchocœlom relative to the body-length cannot, owing to the imperfection of the specimen, be given. The proboscis is slender, measuring in the smaller individual not more than ·75 mm. in cross-section. Its layers are arranged in the following order—proboscis epithelium, nervous layer, circular muscles, longitudinal muscles, rhynchocœlomic epithelium. There are two ill-defined muscle crosses.

The excretory system is extensive and possesses numerous ducts on either side (Plate VII. fig. 10, *exd.*). Most of these make an angle of about 45° with a line joining the nervous side-stems. Some open nearer the level of the side-stems, though none open more dorsally. The excretory tubules do not extend ventral to the level of the nervous side-stems. Many of them project as long tufts into the lateral lacunæ, which here are easily distinguished from the œsophageal lacunæ.

The brain is fairly well developed, the dorsal ganglia being half as large again as the ventral. The dorsal commissure is very short, and the ganglion-cells of the two dorsal ganglia here almost meet dorsally over the proboscis-sheath. The dorsal lobe of the dorsal ganglion does not reach as far as the commencement of the cerebral organ. No neurochord-cells are present.

The cerebral organ is not large. It lies directly over the side-stems (Plate VI. figs. 1, 2, 3). It is rounded in transverse section, and is almost completely sheathed in gland-cells.

The head-slits are deep and end before the level where the cerebral organ starts (Plate VII. fig. 10). The head-glands are well marked dorsally and ventrally. Before the level of the brain they merge into the cutis-glands.

A small frontal organ of the typical Lineid form is present. Eyes are absent.

Synopsis of the Genus Amphiporus.

By adding new species to the genus *Amphiporus* this paper raises the total of the named species referred to that genus to over 40.

[1] Oudemans, A. C.: *loc. cit.* p. 45.

		Position of cerebral organ relative to brain.	Number of proboscis-nerves.	Position of 1st blind-gut pockets relative to brain.	Eyes.	Number of reserve stylet-pockets.	Relative lengths of stylet (S) and its base (B).	Peculiar features.
I. Arctic Circumpolar.	*A. pulcher*	Behind.	McI. 14 P.	Not to br.	Many.	2	S>B McI.	O.
	A. lactifloreus	In front. P.	14 P.	To br. P.	Many. P.	2 P.	S=B P.	Many excretory ducts. P.
	A. arcticus	In front. P.	10 P.	Not to br. P.	Many. P.	? P.	? P.	Œsophagus with dorsal and ventral unpaired diverticula. P.
	A. thompsoni	In front.	10–18	Not to br.	Many.	2	S>B	Vascular network in œsophageal region.
II. Atlantic boreal.	*A. pulcher*	...	...	(See	above)			
	A. marmoratus ...	Beside.	16	Not to br.	Many.	2	S=B	J. Œsophagus with dorsal and ventral unpaired diverticula.
	A. lactifloreus ...	...	...	(See	above)			
	A. bioculatus	?	?	?	2 McI.	2 McI.	McI. $S=\frac{B}{2}$ McI.	O.
								dorsally.
I. Indo-Pacific.	*A. amboinensis* ...	Beside.	?	Not to br.	?	?	?	Diagonal muscle-layer.
	A. pulcher	...	...	(See	above)			10 proboscis-nerves. S=B.
	A. reticulatus	Behind.	10	?	Many.	2	S=B	Opening of cerebral organ in front of brain.
	A. glandulosus ...	Behind.	?	To brain.	12	2	S=B	
	A. stanniusi	Behind.	14	Not to br.	None	2	?	

As descriptions of these species are scattered over numerous papers, it has seemed worth while to collect them into a list and to give in each case a brief diagnosis based upon such characters as have been shown to exhibit marked and definite divergences among the various species (see Table facing this page). The details necessary for forming a complete list are not forthcoming in all the species, and the list has in part been made with the idea of drawing to such omissions the attention of those who may be able to remedy them. In the original description of some species the external appearance alone has been chronicled. The names of such species are given in a footnote at the bottom of the table. The species have been tabulated according to their geographical distribution. In the nomenclature of the marine regions the classfication suggested by Ortmann [1] has been followed. The species found in the North Atlantic and in the Mediterranean are fairly well known, though perhaps the region for which our knowledge is most accurate is the North Pacific, owing to the recent publication of a valuable paper by Coe [2]. With the exception of a few South-Georgian forms described by Bürger, we have practically no knowledge of the genus south of the Equator. Until our knowledge of Southern and Tropical forms is somewhat more extensive, it is safest to avoid any elaborate discussion on the affinities of the groups of species inhabiting the various regions. A few points, however, call for short notice. Numerous collections of Nemerteans have now been worked out from the tropics—more particularly from the Indian Ocean. A feature of such collections is the almost total absence of species of *Amphiporus*. As nearly all the species of the genus are of fair size, often very plentiful, and readily found where they occur, it would appear that they are relatively scarce in the tropics, where their place is taken by the genera *Drepanophorus* and *Prosadenoporus*. Whether the genus is well represented or not in the South, it is not yet possible to say. The few Antarctic species worked out by Bürger are interesting when compared with those from other regions. A careful examination of the table will bring out the fact, that whilst the species of *Amphiporus* inhabiting the Arctic circumpolar, the Atlantic boreal, and the Mediterranean respectively, show as groups considerable amount of resemblance, they differ as much from the Pacific boreal forms as these do from the Antarctic forms. In fact it might be said that the Pacific boreal forms are more closely allied to the Antarctic forms than to the North-Atlantic forms. In the Pacific boreal and Antarctic forms, as compared with the rest, the cerebral organ is more often in front of the brain, the average number of proboscis-nerves is a great deal higher (about 20 °/₀), the number of reserve stylet-pockets is much more frequently greater than two, and lastly there is a greater tendency for the central stylet to be shorter than its base. That there should be

[1] Ortmann, A. E.: 'Grundzüge der marinen Tiergeographie,' Jena, 1896.
[2] Coe, W. R.: "Papers from the Harriman Alaska Expedition: The Nemerteans," Proc. Wash. Acad. Sc. 1901.

Region		Species	Position of cerebral organ relative to brain.	Number of proboscis-nerves.	Position of 1st blind-gut pockets relative to brain.	Eyes.	Number of reserve stylet-pockets.	Relative lengths of stylet (S) and its base (B).	Peculiar features.
A. Arctic Region.	I. Arctic Circumpolar.	*A. pulcher*	Behind.	McI. 14	Not to br.	Many.	2	S>B	
		A. lactifloreus	In front.	P 14	To br.	Many.	2	McI. S=B	O. Many excretory ducts.
		A. arcticus	P. In front.	P. 10	P. Not to br.	P. Many.	P. ?	P. ?	P. Œsophagus with dorsal and ventral unpaired diverticula.
		A. thompsoni	P. In front.	P. 10–18	P. Not to br.	P. Many.	P. 2	P. S.-B	P. Vascular network in œsophageal region.
	II. Atlantic boreal.	*A. pulcher*	...	...	(See	above)			
		A. marmoratus ...	Beside.	16	Not to br.	Many.	2	S=B	J. Œsophagus with dorsal and ventral unpaired diverticula.
		A. lactifloreus ...	...	...	(See	above)			
		A. bioculatus	?	?	?	2	2	McI. $S=\frac{B}{2}$	
		A. hastatus.........	?	?	?	McI. Many.	McI. 4	McI. $S=\frac{B}{2}$	O. Cephalic vascular lacunæ instead of loop.
		A. dissimulans ...	R In front.			R. Many.			
		A. greenmani	M. Beside.	M 11	M. To brain.	M. Few.	M. 2	M. S=B	
		A. glutinosus	M. Beside.	M 11	M To brain.	M. Few.	M. 2	M. S>B	
	III. Pacific boreal.	*A. paulinus*	P. In front.	P. 15	P. Not to br.	P. Many.	P. 2	P. S=B	P. Head-glands reach to intestine.
		A. angulatus	C. In front.	C. 17–20	C. To brain.	C. Many.	C. 2	C. S=B	C. Occasionally more than one pair of excretory ducts.
		A. bimaculatus ...	C. Beside.	C. 16	C. To brain.	C. Many.	C. 4	C. S=2B	
		A. tigrinus.........	C. In front.	?	C. Not to br.	C. Many.	C. 2	C. $S=\frac{B}{2}$	
		A. nebulosus	C. In front.	C. 17	C. To brain.	C. Many.	C. 2	C. S=B	C. Lateral glands in œsophageal region.
		A. leuciodus	C. In front.	?	C. To brain.	C. Many.	C. 3	C. S<B	C. Many excretory ducts.
		A. exilis	C In front.	?	C. To brain.	C. Many.	C 6 12	C. S<B	C. Many excretory ducts opening dorsally.
B. Circumtropical Region.	I. Indo-Pacific.	*A. amboinensis* ...	Beside.	?	Not to br.	?	?	?	Diagonal muscle-layer.
	II. West African. (Mediterranean.)	*A. pulcher*	...	...	(See	above)			10 proboscis-nerves. S=B.
		A. reticulatus......	Behind.	10	?	Many.	2	S=B	Opening of cerebral organ in front of brain.
		A. glandulosus ...	Behind.	?	To brain.	12	2	S=B	
		A. stanniusi	Behind.	14	Not to br.	None	2	?	
		A. marmoratus ..	...	...	(See	above)			
		A. virgatus........	Beside.	14	Not to br.	Many.	2	S=B	
		A. dubius	In front.	?	To brain.	Few.	2	S<B	Cerebral organ far in front of brain.
		A. algensis	In front.	?	?	Many.	2	$S=\frac{B}{2}$	
		A. oligommatus .	In front.	?	Over br.	Many.	2	?	
		A. polyommatus...	In front.	?	To brain.	Many.	2	?	
		A. lactifloreus......	...	...	(See	above)			
		A. carinelloides ..	In front.	14	To brain.	None.	2	?	Well developed subepithelial glands in front of brain.
		A. langiægeminus.	In front.	12	Not to br	None.	2	$S=\frac{B}{2}$	
		A. validissimus ...	In front.	?	To brain.	Many.	5	S B	
		A. hastatus	...	...	(See	above)			
	(Guinea.)	*A. pugnax*	?	?	?	2	7	?	
		A. dubius	...	...	(See	above)			
C. Antarctic Region.		*A. spinosus*.........	In front.	18	Not to br.	None.	8	S.-B	
		A. spinosissimus .	In front.	16	Not to br.	None.	11–12	S.-B	
		A. cruciatus	In front.	16	Not to br.	None.	3	?	

The letters occurring in the table *above* each statement denote the authors on whose authority the facts are given. C.=Coe, J.=Joubin, M.=Montgomery, McI.=McIntosh, O.=Oudemans, P.=Punnett, R.=Riches. Where no letter occurs the statement concerned is due to Bürger. The following species have been made by Verrill (Trans. Connecticut Acad. 1892) on external features alone—*A. multisorus*, *heterosorus*, *tetrasorus*, *ochraceus*, *frontalis*, *mesorus*, *cruentatus*, *agilis*.

Hubrecht also ('Challenger' Reports, vol. ix.) has described two additional species, *A. marioni* and *A. moseleyi*, but the morphological details given are insufficient to make it worth while tabulating them.

this agreement in the features chiefly relied upon in classification, would seem to point to a connection between the Amphiporids of these two regions closer than that between those of either of them and the Northern Atlantic forms. It is possible that the present wave of Antarctic enterprise may bring to light fresh forms which may help to settle an interesting point.

With the affinities of the new species other than *Amphiporus* described in this paper, I hope to deal on some future occasion when considering in detail the genus *Drepanophorus* and the family of the Lineidæ.

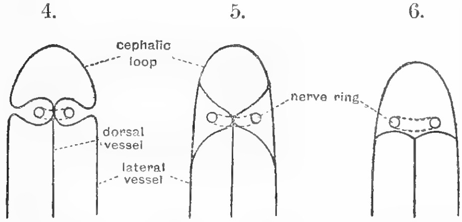
Note on the Vascular System of Metanemerteans.

In the writings of several authors who have treated of this group are to be found discrepancies with regard to the somewhat important point of the relation of the lateral blood-vessels and cephalic loop to the brain and the rhynchodæum. McIntosh [1], in his monograph on the British Nemerteans, states that "At the ganglionic region the vessels which go to form the cephalic arch pass below the commissures (*i. e.* brain-commissures) and unite in front beneath the channel of the snout (*i. e.* the rhynchodæum);" and his conception of the arrangement is represented by a diagram on p. 42 of the same work and by several figures of *Amphiporus* among the plates. On the other hand, the excellent figure representing the anatomy of *Tetrastemma candidum* (pl. xiv. fig. 1) shows the cephalic loop entirely above the rhynchodæum and the lateral vessels passing through the nervous ring. This is the condition described by Oudemans for the Metanemerteans, and arrived at after studying nine members of various genera by the method of serial sections. Oudemans [2] finds "in the head two vessels which communicate in front, forming a vascular loop above the proboscidian sheath (=rhynchodæum). These vessels also communicate within the cerebral ring, but now beneath it (*i. e.* the rhynchodæum)." I have been unable to find any specific statements for the Metanemerteans with regard to these points in Bürger's monograph. In a previous paper [3], however, he mentions that "Die Seitengefässe vereinigt in der Kopfspitze vor dem Gehirn über dem Rhynchodæum eine geräumige Kopfschlinge," though here again he does not distinctly state whether the two vessels are surrounded by the nervous ganglionic ring or pass beneath it. Moreover, his figures are at variance with regard to the last point. In his Naples monograph, Bürger distinctly represents the cephalic vessels of *Tetrastemma coronatum* (pl. ix. fig. 7) and of *Amphiporus virgatus* (pl. vii. fig. 16) as passing *beneath* the ventral commissure of the brain; whilst in another place (pl. xvi. fig. 16) he figures a section of the last-named species showing these vessels lying *upon* the ventral brain-com-

[1] *Loc. cit.* p. 80.
[2] *Loc. cit.* p. 58.
[3] Zeitsch. für wiss. Zool. 50 Bd. 1890, p. 204.

missure, within the nervous ring. This last arrangement, which I take to be the true one, is also shown by Bürger in section for other Metanemerteans, viz., for *Eunemertes marioni* (pl. xv. fig. 10), for *Drepanophorus albolineatus* (pl. xvii. fig. 2), for *Tetrastemma cruciatum* (pl. xviii. fig. 6), and for *Ototyphlonemertes duplex* (pl. xviii. fig. 17). On pl. xviii. fig. 3, however, Bürger figures a section through the brain and its commissures in *Malacobdella grossa*, where the lateral vessels are shown lying entirely outside the nervous ring. In a series of sections made through a specimen of this species, I have been unable to confirm this arrangement. In my specimen the cephalic loop divided just before the brain, and whilst one branch ran along the lateral edge of the body, as in Bürger's figure, the other lay just over the ventral brain-commissure, and consequently within the nervous ring. The vessels lying outside the nervous ring are probably to be regarded as secondary. In many Metanemerteans (esp. *Amphiporus* and *Drepanophorus*) the cephalic and

Text-figs. 4–6.



Amphpiorus, &c. *Malacobdella.* *Malacobdella* according to Bürger.

lateral vessels are strongly bent just before entering and just after leaving the nervous ring (text-fig. 4). It is probably by the confluence of these arches that the outer lateral vessels of *Malacobdella* are formed (text-fig. 5). If now we suppose the portion of the lateral vessels lying within the nervous ring, anterior to the point of origin of the median dorsal vessel, to disappear, we arrive at a condition similar to that described by Bürger (text-fig. 6). Such a condition must, however, be regarded as secondary, and derived from the normal Metanemertean type. The conclusion then, I think, is justified, that in the Metanemerteans, as in all the rest of the phylum, the lateral blood-vessels pass *through* the nervous ring formed by the brain and its commissures, and that the limbs of the cephalic loop unite at the tip of the snout *above* the rhynchodæum.

I have laid upon this point partly because of its morphological importance, and partly because erroneous statements on this head tend to become perpetuated in text-books. Thus in the 'Cambridge Natural History,' vol. ii. p. 106, Miss Sheldon gives a diagram in which the relations of the vascular system on both these points are entirely wrong. At the same time the account given in the text is erroneous.

Note on a Secondary Sexual Character in a Nemertean.

Hitherto no instance of an anatomical difference between the sexes of any species of Nemertean has been observed. Occasionally during the breeding-season the male may be distinguished by its colour from the female, but such differences are always directly due to the hue of the gonads themselves. It has already been mentioned (p. 92) that the number of proboscis-nerves in *A. thompsoni* is subject to considerable variation. Fourteen specimens taken at random were sectioned, and the number of their proboscis-nerves and their sex noted. From the subjoined table it will be seen that the sexes are in almost equal proportions. All were collected together from the same locality, all were of about the same size, and all were sexually mature.

No. of proboscis-nerves......	10	11	12	13	14	15	16	17	18
♀	1	—	5	—	—	—	—	—	—
♂	—	—	4	—	—	—	—	2	2

From this it would appear that whilst the female has 12 nerves or less in the proboscis, the male has either 12 or else a much greater number, *i. e.* 17 or 18, though this proboscis itself was in all cases of about the same size. If a considerably greater number could be examined with regard to these points, it is not improbable that we should obtain for the male a bimodal curve, such as has been described by Bateson and Brindley [1] in the case of certain earwigs and beetles. It is interesting to notice that we have here a case of sexual dimorphism where the organ affected is, so far as we know, in no way concerned with sexual functions. That the proboscis has nothing to do with copulation may be gathered from McIntosh's [2] interesting account of the deposition of the ova and spermatozoa in an allied form—*Eunemertes gracilis*, where the individuals of either sex did not approach within three inches of one another, and fertilization took place in the surround-sea-water. Into the possible *raison d'être* of such a phenomenon as this it seems at present useless to enquire. It is sufficient here to draw to such facts the attention of those who propound theories concerning secondary sexual characters.

Development of the Ovum in Drepanophorus borealis.

That the ovary of *Drepanophorus borealis* contains eggs in various stages has already been seen (p. 97). Throughout the greater portion of the intestinal region the ovaries are large and usually contain one almost or quite ripe ovum, and a number of

[1] Proc. Zool. Soc. 1892, p. 588.
[2] *Loc. cit.* p. 89.

others in stages fairly well advanced (Plate VI. fig. 5). Towards the hind end of the body, however, earlier stages in the formation of the ovary may be found. At certain spots within the copious gelatinous connective tissue surrounding the intestine may be seen a very young ovum (Plate VII. fig. 13), around which a space is commencing to appear. The connective-tissue nuclei around this space are somewhat more plentiful than in other parts. The ovum at this stage is surrounded by a small amount of yolk-material, though whether this represents its own protoplasm or has been derived from other cells which apply themselves to it, I am unable for certain to say. At a somewhat later stage the cavity in the connective tissue has become larger, with a more definite outline, whilst at the same time the ovum has increased in size and is seen to be surrounded by cells (Plate VII. fig. 14) composed mainly of yolk-material. In some of these cells is to be found a well-marked nucleus and a nucleolus of similar staining reactions to those of the ovum itself. In others the large nucleolus alone can be recognized, whilst in others again all traces of both nucleus and nucleolus have disappeared. It seems reasonable to suppose that these cells are in reality primitive ova which apply themselves to the functional ovum and become converted into yolk-material around it. The ovum now increases greatly in size, and the ovarian cavity becomes lined with a flattened epithelium derived from the cells of the gelatinous connective tissue. This epithelium may be traced passing over and covering the ovum (*vide* some of smallest ova in Plate VI. fig. 5), where it gives rise to a peculiar coat of follicle-cells. The follicular layer takes the form of a layer of irregular-shaped cells, with branched processes on the outer side, forming delicate strands connecting the ovum with the adjacent ovarian wall or other follicle-cells, whilst on the inner side are more regular processes like little waterspouts projecting through the delicate limiting membrane of the ovum into the sea of yolk beneath (Plate VII. figs. 15 & 16). As the ovum nears the ripe condition it becomes coated with a shell-like structure. On the ventral surface of the ovum (*i. e.* on the surface furthest from the dorsal opening of the ovary) the follicular layer degenerates into an undulating homogeneous deeply staining covering to the ovum (Plate VII. fig. 15). At the same time the surface of the ovum in this region takes on a similar appearance. This process gradually spreads round the ovum. Between the two layers are small spaces which subsequently disappear, though the two layers can still be recognized by the fact that the outer takes on a far deeper stain, owing probably to its containing more chromatin derived from the nuclei of the follicle-cells (Plate VII. fig. 17). The outer egg-covering is undoubtedly derived from the follicle-cells; the inner layer is formed within the fine limiting membrane of the ovum, though the material which composes it has probably been derived also from the follicle-cells. The largest ova observed were irregularly oval in shape, measuring about $700 \times 420\ \mu$.

The foregoing account differs in several points from that given by Burger[1] for two other species of the genus, viz. *D. crassus* and *D. cerinus*. In the former species, whilst the ova are still quite small, an oval deeply staining body is found lying in close proximity to each of them. These subsequently increase in number, surround the ovum, and later become metamorphosed into yolk. At a later stage, when the ova are already of considerable size, there is developed around them a delicate follicular tissue like a network, in the meshes of which the ova then lie. What the nature of the coverings of the ova are, and whether the follicular epithelium plays any part in their formation, Bürger does not state.

The process which occurs in *D. borealis* throws some light upon the peculiar nuclear-like little bodies which give rise to the yolk in *D. crassus*, and which have also been found by Hubrecht[2] in *Amphiporus marioni*. They are probably to be regarded as primitive ova in which the nucleolus has greatly increased in size at the expense of the rest of the cell, and it seems plausible to regard the enormous development of the nucleolus at the expense of the rest of such primitive ova as a stage in their conversion into yolk. The peculiar behaviour of the follicle-cells in *D. borealis* is probably correlated with the relatively great size attained by the ova in this species. Whilst in *D. crassus* the nearly ripe ova measure $144\ \mu \times 100\ \mu$, in *D. borealis* they attain the dimensions of $700\ \mu \times 420\ \mu$.

Gatty Marine Laboratory,
St. Andrews, N.B.

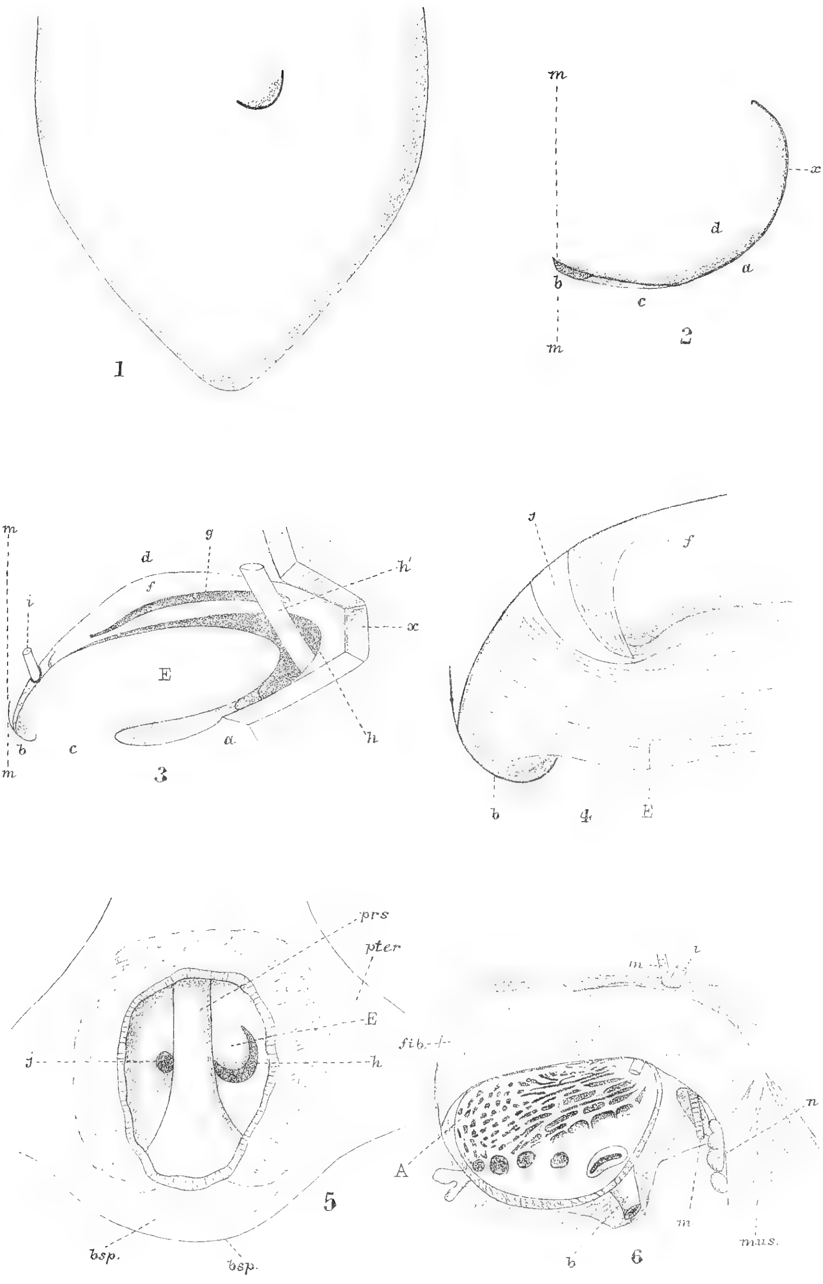
EXPLANATION OF THE PLATES.

Lettering in both Plates.

bm., basement-membrane.
cc., ciliated canal of cerebral organ.
cl., cephalic vascular loop.
cla., cephalic lacuna.
corg., cerebral organ.
cts., spaces in gelatinous connective tissue.
dbv., median dorsal blood-vessel.
dc., dorsal nervous commissure.
dg., dorsal ganglion.
ep., epithelium.
exd., excretory duct.
ext., excretory tubules.
fr., frontal organ.
gct., gelatinous connective tissue.
glcorg., glands of cerebral organ.
gll., lateral glands.
gs., gonidial sac.
hs., head-slit.
lbv., lateral blood-vessel.
ll., lateral blood-lacuna.
m., mouth.
mc., circular muscle-layer.
mcc., circular muscle-layer of cutis.
ml., longitudinal muscle-layer.
mlc., longitudinal muscle-layer of cutis.
mlo., outer longitudinal muscle-layer.
œs., œsophagus.
ps., proboscis-sheath.
rd., rhynchocœlomic diverticulum.
rde., expansions of rhynchocœlomic diverticula.
ss., nervous side-stem.
vc., ventral brain commissure.
vg., ventral ganglion.

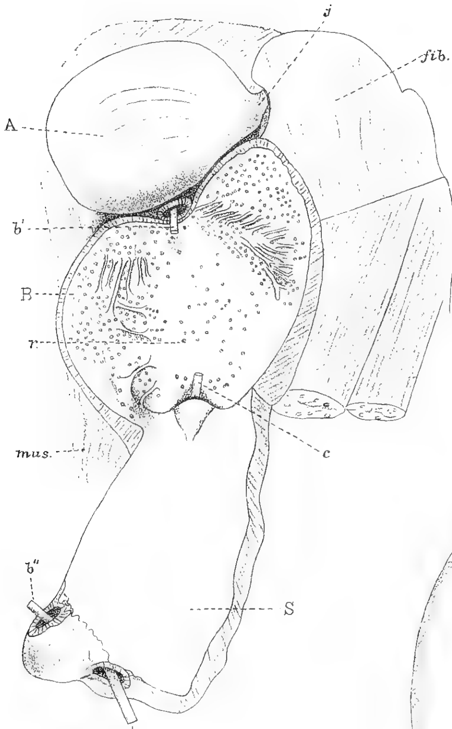
* marks point where the median blood-vessel leaves the proboscis-sheath.

[1] Zeitsch. für wiss. Zool. 50 Bd. 1890, p. 243, and pl. x.
[2] 'Challenger' Reports, vol. ix. (the Nemertea) p. 120.



M P. Parker lith. Parker & West imp.

ANATOMY OF COGIA.



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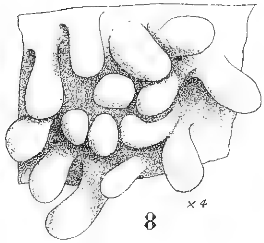

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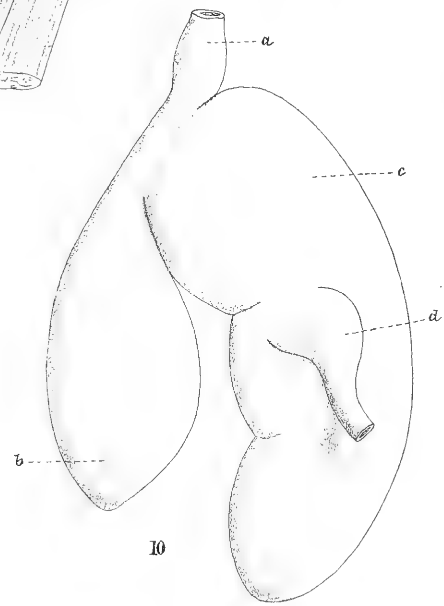

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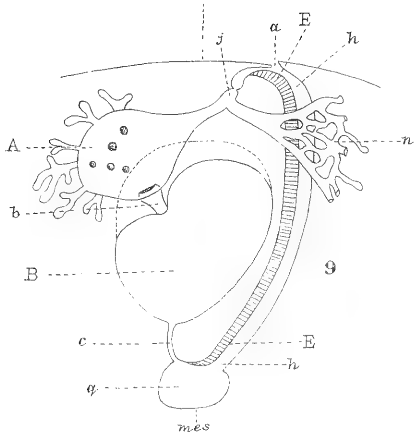

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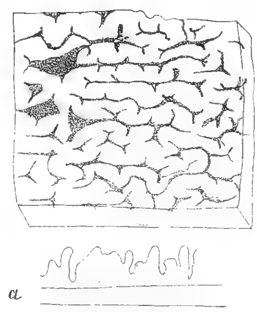

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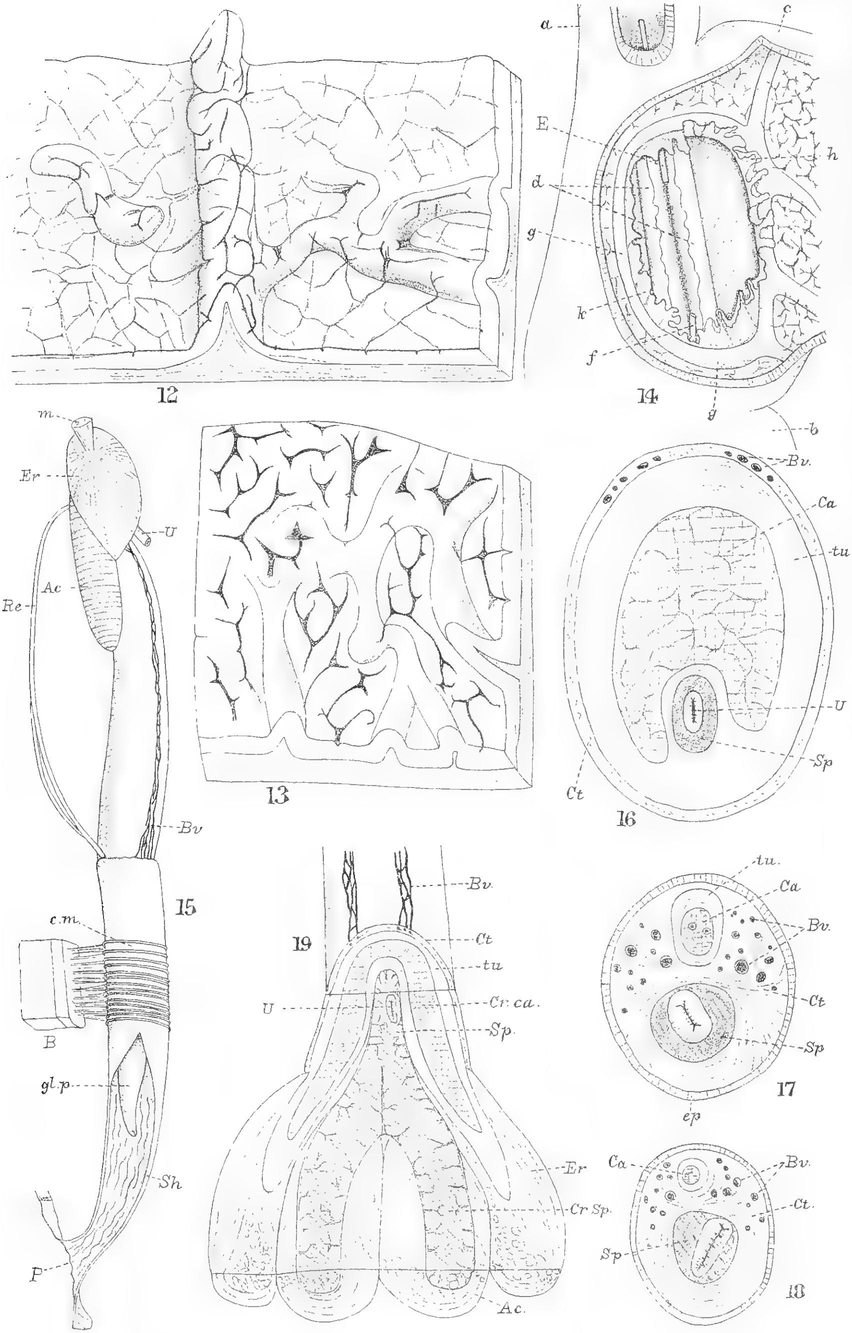
M. P. Parker lith. Parker & West imp.

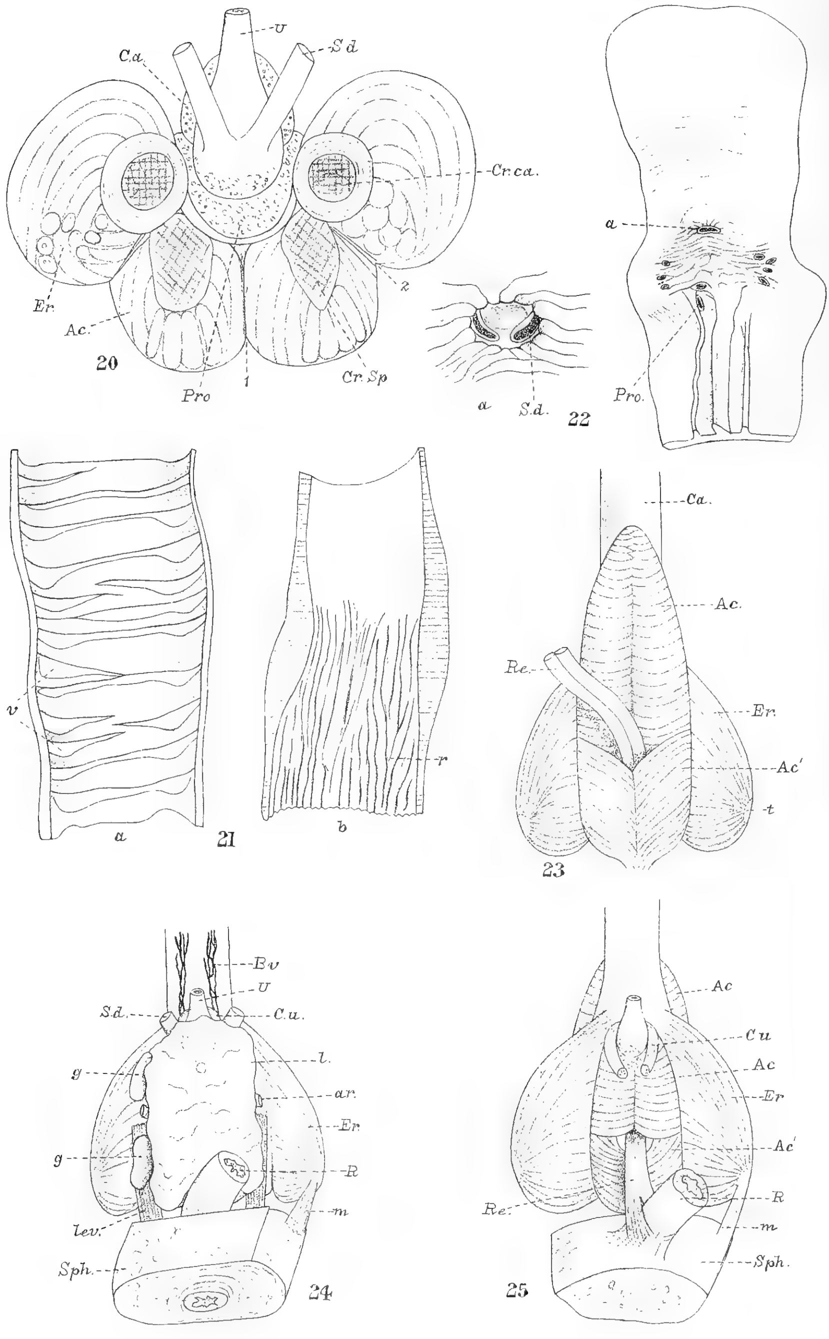
ANATOMY OF COGIA.



M P Parker lith.

Parker & West imp.

ANATOMY OF COGIA.



M. P. Parker lith.

Parker & West imp.

ANATOMY OF COGIA.

PLATE VI.

Figs. 1, 2, & 3. *Cerebratulus greenlandicus* (p. 99). Sections through cerebral organ and neighbouring parts, taken at intervals of about 50 μ. × 45.

Fig. 4. *Drepanophorus borealis* (p. 95). Section through rhynchocœlomic diverticulum at the point where it gives off an expansion. Enlarged view of * in text-fig. 3, p. 98. × 85.

The minute structure of the cerebral organ is not shown.

5. *D. borealis.* Section through a gonad. × 45.
6. *Amphiporus thompsoni* (p. 97). Dorsal view of anterior end. × $\frac{5}{2}$.
7. *D. borealis.* Dorsal view of anterior end. × 1.

PLATE VII.

Fig. 8. *Amphiporus thompsoni.* Schematic reconstruction of anterior end, showing the relations of the various systems. The alimentary canal, proboscis, and its sheath are omitted. The vascular system is more arched than shown here (*cf.* text-fig. 1, p. 91). × 10.

9. *A. arcticus* (p. 94). Similar to fig. 8. × 10.
10. *Cerebratulus greenlandicus.* Similar to fig. 8. × 5.
11. *A. paulinus.* Transverse section through œsophagus, just before the first appearance of the blind gut. × 45.
12. *C. greenlandicus.* Section through skin of œsophageal region. × 85.
13. *D. borealis.* Very young stage of ovum. × 410.
14. *D. borealis.* Slightly later stage than fig. 13. The functional ovum has become surrounded by several primitive ova, in one of which the nucleus and its contained nucleolus are seen, whilst in others the large nucleolus alone can be made out as a deeply staining body. × 410.
15. *D. borealis.* Older ovum, in which the greater part is surrounded by waterspout follicle-cells. At the lower pole the follicle-cells and the outer surface of the ovum are forming the egg-coverings. × 85.
16. *D. borealis.* Enlarged view of a few follicle-cells from the ovum shown in preceding figure. × 410.
17. *D. borealis.* Portion of the outer wall of a nearly ripe ovum, showing the two coverings of the egg enclosing the yolk (y). × 410.

3. On the Anatomy of *Cogia breviceps.* By W. BLAXLAND BENHAM, M.A., D.Sc., F.Z.S., Professor of Biology in the University of Otago, New Zealand.

[Received April 30, 1901.]

(Plates VIII.–XI.[1])

(Text-figures 7 & 8.)

At the end of August, 1900, I received information that a "young Sperm-Whale" had come ashore at Parakanui, a spot about 12 miles north-east of Dunedin. Next morning, accompanied by the museum taxidermist, I went down by train to the spot, where I ascertained that the whale had been thrown ashore just a week previously. We found the carcase at about high-water mark, nearly entirely covered by sand, which had preserved the animal from decomposition, so that the carcase did not present the unpleasant odour usual to deceased whales. Unfortunately, however, the animal had been much cut about; but I at once saw that

[1] For explanation of the Plates, see p. 132.

it was not a "young Sperm-Whale," but a full-grown "Small Cachalot," or *Cogia breviceps*. The head had been most skilfully disarticulated from the cervical vertebræ, and remained close to the body; the lower jaw had been cut away and was missing. I found, later, that it was in the possession of an old whaler, who intended to keep it as a curio, but who parted with it for a small consideration.

The "flukes," too, had been cut off and carried away by the finder of the whale; while much of the flesh of the head and trunk, including the dorsal fin, had also been removed for the purpose of extracting the oil. I subsequently obtained the flukes, but the damage done to the carcase prevented me making any observations of value on the contour of the body or its coloration, or accurate measurements. This is the more to be regretted, as I gather from Flower and Lydekker's 'Mammals' that some uncertainties exist as to these matters.

The abdominal wall had been cut through and the viscera were scattered about on the sand near the body; the thorax, also, had been opened and the lungs and heart abstracted.

Thus I obtained the entire skeleton, which together with some of the viscera were packed in barrels and taken to Dunedin. At the time I was unaware of the rarity of *Cogia*, otherwise I should have taken care to preserve all the viscera, and to have taken fuller measurements, even though these would have been imperfect. The only organs that I removed for study were the larynx, stomach, and penis, while the narial canals remained adherent to the skull.

An account of the larynx I have already presented to the Society, it agrees closely with that of other Odontocetes. The present contribution deals with the remaining organs.

I. *External Features.*

The general form of the body of *Cogia* has been described and figured by Owen [7] for specimens from India, and Von Haast [2] gave an account of a specimen from New Zealand seas. These are the only accounts accessible to me.

The dorsal surface of the Parakanui specimen was black; the under surface dirty white with a tinge of yellow in it, especially noticeable on the under surface of the pectoral fin. Von Haast says the "belly is greyish white"; Owen states (from Eliott's MS.) that the lower surface was "pinkish." Possibly these variations from pure white—which is usual in the Cetacea—are due to postmortem changes. In a young Rorqual that reached me in a perfectly fresh condition early in August, within 48 hours after its death, the belly was pure snow-white, but after exposure to the air for a couple of days the white took on a bluish tinge.

The total length of this specimen of *Cogia*, which is a full-grown male, was 8 feet 9 inches, measured in a straight line from the tip of the snout to the bottom of the notch in the flukes.

This total is obtained by adding together the measurements of the separated head (1 ft. 4 in.), trunk (5 ft. 10 in.), and tail (1 ft. 7 in.); it is, therefore, liable to a small error owing to shrinkage of the flesh, and to the fact that the tape would follow slightly different lines and curves in the three separate pieces, instead of one line; but the error cannot be greater than an inch or two one way or the other.

At any rate this specimen is considerably longer than the female described by Von Haast, which was 7 ft. 2 in. long, and much longer than Owen's Indian male, which was only 6 ft. 8 in. Flower and Lydekker state that the adult may attain a length of 10 feet, and the head is about one-sixth of the length of the body; from the above it is seen that the head is contained in the total length $6\frac{1}{2}$ times, or in body alone $5\frac{1}{2}$ times.

This was the only measurement I took, for naturally the circumference &c. could not be measured with anything approaching accuracy.

The *pectoral fin* measured 14 inches in a straight line from base to tip, or 15 inches along the curved anterior margin; it was 5 inches across the oblique base of attachment, $5\frac{1}{2}$ across the widest part.

The shape of the fin does not differ much from that usual in the Cetacea; its anterior margin is slightly convex; its posterior margin is angulate, the rounded angle being enclosed by a short proximal limb of 4 inches, and a longer distal limb of 8 inches, which is slightly excavated.

The colour of the fin was very dark grey on the upper surface —probably black in life; for in the young Rorqual the jet-black of the fresh animal gave place to a dark grey after exposure to air for a few days. The under surface of the flipper was yellowish white; but the dark tint of the upper surface passes round the margin and comes on to the lower surface, so that there is a narrow black margin nearly all the way round.

The "*flukes*" measured 2 ft. 3 in. from tip to tip; the notch was $5\frac{1}{2}$ in. deep, *i. e.* from a line joining the tips; and the distance from the base of origin of the flukes across the lobe, parallel to the long axis of the body, is 12 inches; the flukes are black below.

II. *The Nasal Passages.*

The top of the head had suffered like the other parts of the body, and much of the flesh anterior to the blowhole had been cut away. There is but a single blowhole as in other Odontocetes; it is not median in position nor symmetrical in shape.

It is a crescentic slit, situated just to the left of the median line, with the horns of the crescent directed backwards and slightly towards the middle line (Pl. VIII. fig. 1), so that its concavity is backwards[1].

[1] In the Porpoise, Grampus, and others, the blowhole, situated on the right side of the top of the head, has its concavity forwards. In *Physeter* it is on the left side, slightly sigmoid and near the anterior end of the snout.

It is situated about 12 inches from the tip of the snout; but as the measurement was made after the removal of skin and blubber, it is probable that the fissure containing the blowhole has shrunk backwards a little; for in Owen's 6-foot specimen the blowhole is only 5 inches from the tip of the snout.

The distance between the horns of the crescent is $2\frac{1}{2}$ inches; the inner horn terminates ($1\frac{1}{2}$ inch) further forwards than the outer.

The blowhole is the external opening of a "vestibule" into which open the two narial canals, of which the right is much the smaller. The anterior wall of the opening has a sharply marked edge or lip (Pl. VIII. fig. 2, *a*), especially well-marked towards the left, where it overlaps the posterior lip or "opercular fold" (*d*). The hinder limit of the blowhole is, however, quite ill-defined; the surface of the head slopes gradually downward and disappears behind the above lip, forming a kind of flap or operculum.

On a closer examination of this aperture, it is seen to be imperfectly divisible into two portions: a small portion on the right (*b*) just above the median line, and a much longer curved slit (*a*) forming the greater moiety of the crescent; the separation is indicated by an interruption in the lip, for over a short space (*c*) the anterior limit of the blowhole slopes gradually forwards to pass below the operculum (*d*).

On pressing apart the lip and operculum, or by cutting across the lip, the crescentic blowhole is found to open into a shallow, but wide chamber—the "spiracular sac" as Von Baer termed it in Dolphins, or the "vestibule" as I would term it here. This is lined by a black-pigmented epithelium continuous with that covering the head, and passing downwards into the narial canal on the left side.

The greater part of this vestibule is, in reality, the upper end of the large left narial canal, its floor is highly convex owing to the existence of a very prominent fleshy "valve" (Pl. VIII. fig. 3, *E*) which is developed on the mesial wall of the canal, but which, as it approaches the top of the head, assumes a transverse and nearly horizontal position. This valve becomes less convex as it approaches the surface of the head, with which it is continuous at the spot *c*, where the above-mentioned interruption in the lip of the spiracle occurs. This valve reduces the cavity of the vestibule to a horseshoe-shaped cleft, the limbs of which pass anteriorly and posteriorly towards the right; the bend lying towards the left, where the cleft deepens suddenly to form the left narial canal.

In the Delphinidæ this "spiracular sac" or vestibule is described by Murie [4] as possessing in its floor a pair of smooth, convex, obliquely transverse cushions; the above-mentioned "valve" appears to correspond with the left of these, but I find no mention, in either of the works consulted, of the continuance of this convexity down into, and along the wall of, the narial canal itself. Indeed, in these papers, more attention has been paid to the muscular arrangements than to details as to the dispositions of the sacs and canals.

Turning our attention to the posterior cleft on the floor of the vestibule, it is seen to be a groove between the convex floor (valve) and the hinder lip of the blowhole (*d*), which here bends suddenly downwards to form a vertical wall to the vestibule: on pressing it backwards, a horizontally disposed furrow (*g*) is seen about half-way down—a furrow which is about $\frac{1}{2}$ inch deep and nearly co-extensive with the length of the wall; it appears to be connected with the working of the lip itself. At the extreme right corner of the cleft is the small entrance to the right narial canal, having the form of a horizontal slit, about $\frac{1}{2}$ inch in length, bounded by smooth, inconspicuous lips (fig. 4). The "spiracular sac," or vestibule, then receives both right and left narial canals, which are extremely disproportionate in size and are very different in structure.

The *left* narial canal being the more conspicuous, and having a simple course, may be considered first. From the vestibule it passes outwards for a brief space, and then abruptly downwards with a slightly inward bend towards the median line, to reach the bones of the facial region of the skull; it passes through these to open into the naso-palatine canal. The "valve" which was seen in the vestibule is continued throughout the entire length of the canal as a well-marked convex, typhlosole-like ridge on its mesial wall, and is visible at the lower opening of the canal into the naso-palatine canal (Pl. VIII. fig. 5; Pl. IX. fig. 9).

This left narial canal, then, is quite simple; but it is otherwise with the right canal, which is complicated by the existence of a couple of dilatations to form "spiracular chambers," similar to those occurring in the Delphinidæ, from which, however, they differ in two or three particulars.

The right "nostril" is a small slit-like orifice bounded by thin muscular lips; it leads into a short canal which passes across the middle line, obliquely forwards, downwards, and to the right. It terminates in a considerable chamber, but on its way gives rise to branches that pass towards the left, and subdivide to form a number of narrow, anastomosing tubules, lying in front of the left narial canal (Pl. IX. fig. 9, *n*).

The chamber, or upper chamber (*A*) as it may be called to distinguish it from a second one lower down, is irregularly ovoid in shape, with its longer diameter transversely disposed; this longer axis measures about 5 inches; its shorter axis, or height, is 3 inches. The chamber is situated immediately below the fibro-muscular dermis, and is lined by a smooth, greyish membrane; its wall is not muscular, and relatively thin, though it is embedded in the muscles of this region.

Its roof is formed of a series of trabeculæ having, in general, a transverse direction; these, by lateral branches, connect with one another, so as to form a kind of network, leaving shallow pits between the trabeculæ. Some of these are deeper, and lead into short cæcal tubes projecting backwards; whilst lower down on the hinder wall are a few larger, circular apertures leading into similar tubes, most of which lie behind the chamber itself. These tubes, as well as those that are in connection with the canal itself, are similarly lined with a greyish membrane.

On the floor of the chamber, towards the median line, is a prominent aperture, somewhat curved, and provided with raised black lips. I took this, at first, for the true right nostril, but, for reasons given below, this is probably not the correct interpretation. This aperture leads into a short canal, curved towards the right, and then bending backwards towards the left, which in its turn opens into a lower and larger spiracular chamber [1]. This lower chamber (Pl. IX. fig. 7, *B*) rests, by its posterior wall and its sides, against the bones of the cranial region of the skull; its anterior wall (*S*), however, is soft, reddish, thick and muscular, and is evidently capable of considerable movement. The chamber is irregularly pyriform, the dorso-ventral diameter being much greater than its transverse diameter; it is, too, wider near the dorsal than at the ventral end. The longer axis is not truly dorso-ventral, but is somewhat oblique, the lower end being slightly more forwards than the upper, which is situated behind the upper chamber (see diagram, Pl. IX. fig. 9). The roof is concave and asymmetrical; the anterior and posterior walls meet below at an angle, where it is apparently closed; but in the middle of the angular furrow the reddish colour of the anterior wall becomes feebly pigmented with black, and here, by closer inspection, is to be found a very small aperture—about $\frac{1}{4}$ inch in diameter—which leads by a short canal into the nasopalatine canal (Pl. VIII. fig. 5, *j*; Pl. IX. fig. 9, *c*).

It is stated by Owen, in his 'Comparative Anatomy,' that the right bony canal in the skull does not transmit a narial canal: this is an error (which may probably have already been pointed out). The right narial canal is perfectly evident, though much smaller than the left one.

This lower chamber (Pl. IX. figs. 7, 9, *B*) is about twice the size of the upper chamber, or even greater; but I omitted to make a note of the dimensions. It is lined by a membrane that differs in character in the anterior and posterior walls. The former is lined by a smooth, reddish "mucous membrane," the latter and the sides and roof are covered by a shining, grey, tough membrane, covered with small closely-set papillæ, which I at first mistook for some kind of parasite.

These papillæ (Pl. IX. fig. 8) are vascular. Each is short and somewhat club-shaped, measuring $\frac{1}{8}$ inch in height by $\frac{1}{16}$ inch across. They are most numerous, and quite densely aggregated, on the roof, and the upper part of the hind wall and sides: lower down they become sparser (in the drawing they are not represented in their true abundance).

The junction of the side walls with the back of the chamber is crossed by a number of narrow tendinous strands, some of which are covered with papillæ. The *microscopic structure* of a

[1] This short canal has been severed, but no part appears to have been removed.

papilla is as follows:—it is more or less circular in transverse section; its epithelium consists of about three layers of cells, the most superficial of which are well-defined, refringent, and somewhat cuticular in aspect. The nuclei of these cells are not much more flattened than those of the deeper cells, which are arranged with the long axis parallel to the surface; the upper ones, however, are smaller and take the stain less deeply than the others. The bulk of the wall of the papilla is formed of concentric fibres of elastic connective tissue, which is somewhat looser externally than internally. Below this comes white fibrous tissue penetrated by numerous capillaries and small blood-vessels. The centre of the papilla is occupied by a cavity (? lymphatic) in which an unstainable coagulum was noted: it is lined by a layer of flat cells.

Towards the lower end of the papillæ the white fibrous tissue becomes more abundant, and passes gradually into that of the membrane lining the chamber, while the elastic tissue decreases.

I have no suggestions to make as to the functions of these peculiar structures.

The muscles that act upon these chambers in the Delphinidæ have been fully described by Sibson, Murie, and others: unfortunately the head of my specimen was too much injured to allow me to trace them out in *Cogia*.

Remarks.—A comparison of the foregoing account of the spiracular sacs in *Cogia* with that given by various authors for members of the family Delphinidæ brings out several differences which seem to be of importance.

In the Delphinidæ the single blowhole opens into a "vestibule" or spiracular cavity, which is in communication with (1) the two narial canals, and (2) from four to seven *diverticula*, that are known as "spiracular" pouches or sacs. (The nomenclature of the parts is in need of revision.)

In *Cogia* the "vestibule" is extremely reduced; indeed it seems rather to be represented by the upper, slightly dilated end of the left narial canal, into which the small right narial canal has come to open, having pushed its way across the middle line in order to reach it. The "spiracular chambers" are here *dilatations* in the course of the right narial canal: they are unpaired and are not diverticula.

This being the case, it seems impossible to homologise them with the functionally similar pouches in the Delphinidæ. At the same time I must confess that the only accounts to which I have access are those of Sibson [**10**], Murie [**4, 5, 6**], and Struthers [**12**], in addition to that by Huxley in his 'Manual.' Of these, the first gives a detailed description of the relations of the various sacs to the "spiracular vestibule" and to the narial canals; and he gives figures of actual dissections in illustration thereof. Murie deals chiefly with the muscular arrangements, and discusses the homologies of the apparatus with structures present in other mammals; while Struthers's account is in a footnote, and merely enumerates the pouches present in the White Whale. Huxley's account is descriptive but not illustrated; and, unfortunately, his account does not agree with Sibson's in regard to the point of origin of the sacs; so that I am in some doubt whether my conclusions as to the interpretation of the "upper chamber" (A) are correct or not. In the Porpoise there are five pouches, two pairs and an unpaired one; in the White Whale two pairs only; in the Grampus seven pouches in all.

According to Sibson the five pouches in the Porpoise all communicate with the "vestibule" above the openings of the narial canals into that cavity. He writes:—"Connected with the channel [*i. e.* vestibule] that leads from the external opening [blowhole] down to the two bony conduits [*i. e.* narial canals] is a series of pouches."

His figures indicate, but do not show quite clearly, that the pouches are outgrowths of the vestibule, with which they communicate above the entrance of the narial canals.

On the other hand, Huxley in his 'Manual' describes for the Porpoise the "spiracular chamber" (*i. e.* vestibule) as receiving the two nasal passages, the openings of which are guarded by valves; and then goes on to say that "Each nasal passage, after it ceases to be surrounded by bone, sends off two diverticula, one forward and one backward."

The accounts given by the other authors referred to do not aid us in deciding which of these two accounts is correct. But, apart from this point of disagreement, all accounts agree that the various pouches are, in the Delphinidæ, not dilatations of the canal but diverticula, either of the narial canal or of the "vestibule."

With regard to the "upper chamber" in the present Whale, it is a possible view that it is the "vestibule," asymmetrically expanded towards the right side, receiving the large left narial canal near the external "blowhole," and the small right narial canal deeper down: in other words, that the slit carried by the prominent papilla in the floor of the "upper chamber" is the true right nostril. The chief facts that seem to me to be opposed to this contention is that this "upper chamber" has a thin, grey wall, and is devoid of that black pigmentation that appears to characterize the "vestibule" in Delphinidæ; and, secondly, there is no convex valve on the floor of the "upper chamber," as we should expect if it were a "vestibule."

But, however this may be, there is no uncertainty about the lower one (B): it communicates below with the naso-palatine canal, while above it opens, by a canal, into the upper chamber: it is a dilatation in the course of the narial canal. So that, whichever view is taken as to the upper chamber, it is clear that in *Cogia* there are two asymmetrically placed sacs, which though physiologically, no doubt, corresponding with the series of paired spiracular sacs in the Delphinidæ, are morphologically different. I have therefore avoided the use of the descriptive terms "maxillary" and "premaxillary," that Murie uses in describing the analogous chambers in that family.

III. *The Buccal Cavity.*

The lower jaw having been removed, the skull disarticulated, and the larynx severed from its position, I am unable to make any remarks upon the tongue or pharynx.

The tough gum on each side was provided with 13 shallow pits for the reception of the 13 teeth borne by the corresponding ramus of the lower jaw. Further, each premaxilla bears a tooth: that on the right side was sufficiently long to project for $\frac{3}{16}$ inch beyond the gum; but the left tooth could only be felt; it had not been "cut." This premaxillary tooth was about $1\frac{1}{2}$ inches from the anterior end of the snout; it is conical and slightly curved, with the point directed backwards.

In the *lower jaw* there are thirteen teeth on each side, of the shape usual in the genus; that is, each is a rather slender cone, curved, and sharply pointed. They are all so arranged that the points are directed inwards, and, with the exception of the first, slope slightly outwards; those in the middle of the series having a greater slope than those at the ends.

The front tooth projects $\frac{3}{8}$ inch, and the last $\frac{1}{2}$ inch above the (dried) gum, (The lower jaw had been removed and was partially cleaned when I obtained it.) The series of teeth, or "dental area," measures $5\frac{1}{4}$ inches, and the individual teeth are separated by a space of $\frac{1}{4}$ inch, though the two hindmost are nearer together.

The dental formula, then, for the Parakanui specimen is $\frac{1-1}{13-13} = 28$, which is the same as that of von Haast's specimen.

In another skull in the Otago University Museum, obtained from Napier, on the East coast of the North Island, in 1892, the formula is $\frac{1-1}{15-15}$. It is true that the premaxillary teeth are absent in the specimen, and that there are only 14 teeth remaining on each side of the lower jaw, the tip of which has been broken across at the level of the sockets of the front teeth; the sockets are, however, quite visible at the fracture.

This skull is rather larger than that of the Parakanui specimen (which I hope to describe in the future), and the teeth are longer and stouter; the anterior teeth measuring $\frac{1}{2}$ inch, the hinder ones $\frac{5}{8}$ inch above the dried gum. The dental area measures $6\frac{3}{8}$ inches, allowing for the front teeth; and the dental interval is $\frac{1}{4}$ inch, except for the hinder 3 teeth, which are separated by a space of only $\frac{1}{8}$ inch; these last teeth have their points turned backwards, though whether this is due to the shrinkage and distortion of the gum in drying I am unable to say.

I have referred to this skull, since in Flower and Lydekker's 'Mammals' it is stated that *Cogia* has 9 to 12 teeth in the lower jaw. Owen gives 9 for the Indian specimen. I have not access to other accounts, but it is worthy of note that the three specimens described from New Zealand have each more than the above maximum. Moreover, Owen states (p. 41) that "the teeth are small, *straight*, conical, obtuse, not exceeding 8 lines in length," &c. It is, I understand, generally believed that there is but one species of this Small Cachalot; it is therefore worth noting these small differences.

The *soft palate* had been partially cut away, and the broad naso-palatal canal exposed. A short slit was all that was needed to exhibit the lower ends of the narial canals, which are shown in Pl. VIII. fig. 5.

IV. *Alimentary Tract.*

My observations are incomplete, as the gut had been cut across, close to the stomach, and indeed across the narrow chamber of this organ. When removing the viscera—which were buried in sand—this fact was overlooked, and the intestine with the rest of the stomach was left behind, so that I am unable to give measurements of the entire canal.

The hindmost portion (about 7 feet) of the intestine remained attached to the body; and at a point about 3 feet 6 inches from the anus the intestine suddenly dilates to form a sac, filled with a very dark-brown fluid, of considerable density, which, when smeared on the paper of my note-book, left a dark sepia-coloured mark.

Sir W. Turner [**15**] describes a similar rich brown fluid in the hind gut of Risso's Grampus, and suggests that it is derived from the sepia of the ink-sacs of the cuttles on which the cetacean had fed; and further explains the absence of the dark material in the stomach and anterior part of the intestine, by supposing that the ink-bags pass uninjured into the posterior region of the gut, where their walls become dissolved and the fluid released. This seems to be the case in *Cogia*, for the small intestine did not contain the dark fluid.

This specimen of *Cogia* contained in its stomach a great quantity of cuttle-beaks, lenses of eyes, and the remains of the pens of some Loligo-like species, probably *Ommastrephes sloanii*; also some partially digested red membranes which appear to have been cylindrical. Each bears, near one end, a thick, firm, white patch on which, and on the membrane, are horny, conical teeth-like structures, recalling gizzard-teeth of *Aplysia*, but no dark fluid.

Von Haast [**2**] states that in the specimen studied by him, "the contents of the stomach consisted of a dark slimy matter;" and noting the absence of cuttle-beaks, and the small size and the position of the mouth, he concluded that *Cogia* is "probably a ground-feeder, perhaps on the smaller hydroid polyps." This view is, evidently, negatived by the presence of beaks in the Parakanui specimen.

The *stomach* (Pl. IX. fig. 10), as I have said, is imperfect; but I will describe so much as remains, for in some respects it confirms

Turner's accounts (**13, 14**) of the organ in Odontocetes, though it differs from that of Porpoise or Dolphin, and appears to agree with that of the Sperm Whale. The œsophagus, which is 2 inches across (externally), is dilated below the entrance to the true stomach, to form a large ovoid pouch or "paunch" 7 inches in length and 5 in breadth [1].

The true stomach arises from the side of the œsophagus just above the commencement of the crop-like dilatation. It has the form of a long wide sac, somewhat like a curved sausage, extending beyond the end of the paunch, and measuring 15 inches in a straight line taken from its anterior margin to the hindmost end.

This sac may be termed the "cardiac chamber." It presents a "greater curvature" directed towards the right side, and a "lesser curvature," facing the paunch. Along the lesser curvature there are two slight constrictions, so that this chamber seems to be subdivided; but in reality it is one great sac. The constrictions are mere indentations of the wall, and there is no corresponding fold of the mucous membrane internally. On the dorsal surface of this cardiac chamber, at about midway along its length, and close to the lesser curvature, there arises a small sac, which soon becomes a distinct tube. Most unfortunately this had been cut across. It is the second chamber of the true stomach; and we are at present ignorant of how many chambers there are in *Cogia*, though probably only these two. For convenience I will term it the "pyloric chamber" for reasons that will become evident later.

This *pyloric chamber* commences as a depressed, subcircular, thin-walled swelling on the side of the cardiac chamber. It soon becomes tubular; but for about 4 inches remains adherent to the cardiac chamber, then leaves it as a free tube, one inch in diameter; but only about one inch of this tube remains in the specimen.

The hardened and distended stomach was opened by cutting windows, of convenient size, in the walls. The cardiac orifice is on the side wall of the œsophagus. It is usually stated that in Dolphins and other Cetacea in which a paunch is present, this and the cardiac chamber communicate with the œsophagus "at the same point," thereby inferring a sort of bifurcation of the œsophagus; but in *Cogia* the cardiac orifice (Pl. X. fig. 14) is a wide oval aperture, about 4 inches long, on the side wall of the œsophagus. It is surrounded by a very prominent rounded ridge (*g*), recalling a sphincter muscle, though it is a fold of the mucous membrane and the submucosa only, and the muscular coat is not involved. From the margin of this orifice the lining (*h*) of the œsophagus projects

[1] This and the following measurements were obtained from the preserved and not from the fresh specimen. The stomach and paunch having been emptied of their contents and thoroughly washed with water, were distended by filling them with strong alcohol, the ends being tightened; the alcohol was poured in through a funnel, not injected, so that the distension is not exaggerated. The whole was then laid in strong alcohol for about four months before I had time to examine them.

into the stomach as an irregular fringe, or, as Huxley describes it in the Porpoise, as a "prominent rugose lip."

The communication between œsophagus and paunch is by way of a deep groove bounded by a couple of high and thick folds (*d.d*) on the outer wall of the œsophagus. It is similar to the groove between the œsophagus and psalterium in the Cow's stomach. It is evident that the paunch is a blind, downward prolongation of the œsophagus, beyond the entrance of the latter to the stomach.

The passage from the cardiac to the pyloric chamber is between two stout curved folds of mucosa and submucosa, forming valves, which only incompletely circumscribe the aperture. One valve, the superior, is continuous with the surface of the cardiac chamber, and its free edge is concave backwards; the other, or inferior valve, is at a slightly different level, being the projection forwards of the adherent wall of the pyloric chamber; this fold is concave forwards, and its right end overlaps that of the superior valve. Further, as part probably of the apparatus, there is a strong rounded ridge (3 inches in length) in the ventral wall of the pyloric chamber, passing forwards and curving over the inferior valve.

The mucous membrane of these parts exhibit very characteristic differences, both macroscopic and microscopic; these have been described for some Cetacea by Sir W. Turner in some detail (**14**).

The lining of the œsophagus (Pl. IX. fig. 11), which in the preserved specimen is whitish and hard to the touch, is thrown into labyrinthine folds, the general trend of which is transverse.

In sections, the epithelium is seen to be "stratified," consisting of some 6 or 7 layers of cells: the nuclei of the deepest layer are oval and closely set; the upper ones are more or less flattened, and those on the free surface quite flat. These last take the stain (hæmatoxylin) much more faintly than the deeper ones. The surface of the epithelium is very ill-defined and irregular, due partly no doubt to the manipulation it had undergone; though, partly, this seems to be a natural character, for even in the deep pits formed by the above-mentioned foldings, where the tissue would be less liable to disturbance, the epithelium is comparatively thin. Moreover, it is everywhere of very irregular depth, as the subumucosa rises up into it at intervals in such a way that the epithelium seems to dip downwards in the form of solid columns; and I imagined that these were tangential sections of small pits; but I failed even in thin sections to determine the existence of anything of the kind. I find that Sir W. Turner notices the same thing in the Porpoise, and suggests that they are "in all probability slender folds of the mucous membrane, which when vertically divided look in sections as if separated by papillæ" of the underlying connective tissue.

There are no glands, either macroscopic or microscopic, in the wall of the œsophagus.

Opposite the entrance to the cardiac chamber, the mucous membrane is thrown into a few powerful longitudinal folds, two of which are more prominent than the rest, about one inch in height, and delimit the groove that leads to the paunch. Below the point there are 10 well marked ridges, which radiate from the groove, along the wall of the paunch ; some reach almost to the hinder end, others die out half-way along. In addition to these longitudinal folds, a few irregular ones originate from them and pass in a transverse direction.

The mucous membrane (Pl. X. fig. 12) is in the paunch distinctly yellow ; it is marked by irregularly arranged, straight, narrow, and shallow furrows, appearing as lines crossing one another at various angles, but there is nothing approaching the labyrinthine character seen in the œsophagus.

Sections show that the epithelium is stratified ; but it is much thicker than in the œsophagus, and more closely resembles the epidermis of a mammal than the epidermis of part of the gut. In fact, it is from the character of this epithelium that this region is recognized as being part of the œsophagus, and not part of the true stomach.

The epithelium consists of very well marked *stratum malpighii* and *st. corneum*, of about equal depth. The lowermost nuclei of the *st. malpighii* are oval, closely set, with the long axis vertical to the plane of the surface ; the others are rounder, till immediately below the *st. corneum* the nuclei undergo sudden degeneration, and are represented by small, horizontal, and almost linear groups of deeply stained granules ; two to four rows of such cells exist, evidently the *st. granulosum*. There is a very sharp line between them and the overlying *st. corneum*, which is coloured yellow (in the sections that were stained on the slide in Delafield's hæmatoxylin) except the outermost margin, which is faintly purple ; the whole stratum is distinctly "lamellate," with small linear groups of refringent, unstained granules interspersed here and there between the lamellæ.

The free surface is slightly irregular, the cells appear to be dropping away, and are somewhat swollen.

In short the lining of the paunch is a typical epidermis.

The mucous membrane of the cardiac chamber (Pl. X. fig. 13) is pinkish, even in the preserved stomach ; it is thrown into more or less pronounced and irregular folds, and the surface is furrowed, marking out rounded gyri of larger size than those of the œsophagus. Towards the hinder end the membrane is smoother. A few stray ridges start from the cardidc orifice, but soon die down, giving rise to the above-mentioned irregular folds. In sections, the epithelium is seen to be typically "gastric ;" it is many times thicker than that of the paunch, and consists of closely-set, long, tubular and branched "peptic glands." The cells at the surface had macerated off, but in the deeper parts of the glands they, though displaced, remain ; and the two kinds of cells—"chief" or "central" and oxyutic or parietal—are recognizable.

In the pyloric chamber "the mucous membrane is smooth, soft, and of a darker red than in the preceding chamber. Sections show that here, too, peptic glands occur; though of a different shape and length. From the ill-preserved state it is difficult to give an accurate detailed account, but it appears that the "duct" of each gland is much longer, and the branching takes place deeper in the epithelium than in the cardiac chamber. The mucous membrane is not uniformly thick, but in a given section the free surface describes undulations; in the thinner parts of the sections the glands consist of one kind of cell only, recalling the pyloric glands of ordinary mammals; but in the thicker parts patches of glands occur which show the oxyutic cells quite plainly, and even in greater numbers than in the cardiac chamber.

Although figures are apt to be misleading, yet the following afford an idea of the relative thickness of the mucous membrane in these different parts:—

In œsophagus it is 0·025 mm.
,, paunch it is 0·37 mm.
,, cardiac chamber it is 1·5 mm.
,, pyloric chamber it is from 0·4 to 0·75 mm.

Remarks.—It is well known that in the Cetacea the "stomach" consists of several chambers, and Sir W. Turner (**13**, **14**) has given an account of the arrangements met with in different families of the Order. It appears that in the majority of Odontocetes the "first chamber" is in reality a dilatation of the œsophagus; a fact that was recognized more than 200 years ago by Edward Tyson [**16**] who, according to Turner, recognized that this first compartment is "lined by a continuation of its inward tunic, which we now know to be of squamous epithelium," so that it seems to be a sac-like dilatation of that tube; or, in short, a "paunch." Only in the Ziphioids is this paunch absent; in them, notwithstanding the many chambers, all are true gastric chambers, lined by glandular epithelium. Although other authors, as for example Murie [**4**] for the Caa'ing Whale, compares this first chamber to a ruminant paunch, and Huxley in his Textbook (p. 395) also speaks of the first chamber as "a kind of paunch lined by a thick epithelium" (see also Wiedersheim), yet it appears that Turner was the first to investigate the character of the mucous membrane by means of microscopic sections; the literature at my disposal is sparse, but Turner gives no reference to anyone who had previously cut sections of the stomach-wall.

It seems necessary to insist on this fact that the first chamber is, in the majority of Cetacea, a "paunch" since in some English textbooks, even of recent years, the complex of chambers is still spoken of as "stomach." Turner has pointed out, and no doubt other workers on the group have done so, that this "paunch" serves not merely for receiving and holding food, in the way that the paunch of the Ruminant does, but that there is abundant evidence that the digestive juice is discharged from the true stomach into this chamber; for fish-bones, cuttle-beaks, and other indigestible remains of the food are found in the paunch, and never in the stomach: that, in fact, it is a "macerating chamber:" that these things are rejected through the mouth, just as owls reject the undigested parts of their food.

In view of his own insistence on the œsophageal nature of this first compartment, it is to be regretted that Turner does not, in his memoirs, speak more definitely of it as a "paunch" and thus draw attention to it more strongly; in his figures, for instance, he labels it "1" as he also does the first compartment of the ziphioid stomach. It may be objected that "paunch" is used for a particular part of the ruminant stomach; that in this no digestive juice is poured on to the food while it is retained there; that it is a mere reservoir, and not a macerating chamber. But according to Prof. Fleming (Chauveau's Comp. Anat. 1891) both the paunch and the reticulum are lined by "stratified epithelium," and therefore are as much œsophageal dilatations as the 1st chamber of the "stomach" in Cetacea; they are morphologically similar, even if physiologically dissimilar.

In these days of 'precise nomenclature,' it is strange that such a word as "stomach" is so very vaguely employed for all sorts of sacs: primarily used for the digestive chamber in man, the meaning of the word has been extended to include a variety of dilated portions of the alimentary system in different animals, *e.g.*, the gizzard of the Crayfish is not a "stomach," although frequently so termed, nor is the paunch of Cetacea or Ruminants.

Messieurs Pilliet and Boulart [8] have pointed out that the stomach of Cetacea cannot be compared in detail with that of Ruminants; but it seems that, so far as this first compartment is concerned, there is a morphological resemblance, and to some degree a physiological one [1].

The true "stomach" consists, as we know, of a "pars cardiaca" and a "pars pylorica"; and while both these are present in the Cetacea and Ruminant, there is in addition an œsophageal paunch. In the whales, the pars pylorica and perhaps the pars cardiaca may be further subdivided.

Returning, now, to *Cogia*; the mutilated condition of the organ prevents us comparing it in detail, as I should have wished to do, with that of other Odontocetes; but so much as remains indicates that it differs from the stomach of the Delphinidæ, in the fact that the "pyloric chamber" (=3rd chamber in the sense of other authors) soon becomes *free* from the wall of the cardiac (or 2nd chamber), and is evidently the commencement of a tubular region; whereas in Porpoise, Dolphin, &c., this "3rd chamber" is totally adherent to wall of the "2nd" (as in *Globicephalus*, where Murie calls it the "burrowing passage"), or it is globular in form, whilst additional chambers exist. Naturally one turns for elucidation to *Physeter macrocephalus*, of which but little seems to be known.

[1] I have been unable to consult either this or Max Weber's valuable work in the Morph. Jahrb. xiii. 1888, or Pouchet and Beauregard in the original.

I quote from Turner's memoir [**13**], who summarizes the account given by Dr. Jackson [**3**] of the stomach of the Sperm Whale. "The first cavity is nearly globular, and is lined by a continuation of the cuticle and cutis from the œsophagus. The 2nd cavity opens freely into both œsophagus and the first cavity. It is elongated, and the rugæ on its inner surface are nowhere strongly marked. The 3rd cavity is elongated, narrow at its commencement, but becomes dilated and curved upon itself. The mucous coat is less rugose than in the 2nd cavity. There is no small intermediate chamber between the 2nd and 3rd. The 3rd cavity opens into a dilatation by an orifice $\frac{1}{4}$ inch in diameter; this dilatation ends in the intestine."

Of course by "1st cavity" is meant what in his paper Turner speaks of as "paunch;" the "2nd cavity" is the cardiac chamber, and the 3rd cavity is the pyloric chamber. Unfortunately, this summary does not enable us to form a very vivid picture of the Sperm-whale's stomach, as we are not told where the 3rd chamber originates from the 2nd, nor the relative size of the parts; but, so far as it goes, it appears that *Cogia* has a stomach of the same kind. At any rate, we have the evidence, that Prof. Turner desired to have, that in the Physeteridæ the 1st chamber is a paunch.

According to the account of the Cachalot's stomach given by Pouchet and Beauregard [**9**] the "first chamber" is, in its upper part, lined by a mucous membrane similar to that of the œsophagus, while in the lower part a "gastric epithelium" exists. Thus this chamber is partly "paunch," partly cardiac region of stomach. It appears that though the boundary between the two kinds of mucous membrane is distinct, there is no constriction here.

The "pyloric chamber" is separated from the two following or "duodenal chambers" by a short definite duct.

Of the two "duodenal chambers," the first is lined by a smooth mucous membrane; while, in the second, *valvulæ conniventes* are present[1].

Without access to the original account, it is difficult to correlate this description with Jackson's with certainty. But it seems that the "narrow commencement" of the 3rd elongated chamber of his account corresponds to the "true duct" of Pouchet and Beauregard, and their "first duodenal chamber" with its smooth lining is Jackson's dilated part of the 3rd chamber.

There is one point in the above account that is of general importance, viz.: the absence of any constriction between the paunch and cardiac region of the stomach. Have we, here, a commencement of the process by which a part of the stomach becomes modified to serve as a receptacle for food, by the down-growth of the œsophageal membrane? or, is an original paunch being invaded by gastric epithelium?

[1] But it is not clear from the abstract in the *Zool. Jahresber.* whether the 2nd "cavité" is the pyloric, or whether a third "chambre" (pyloric) also exists.

No doubt this matter is dealt with by the French authors; but in view of the condition of the "stomach" in other Cetacea, that of the Cachalot is rather puzzling.

It appears, then, that in the family Physeteridæ the apparatus is simpler than in the Delphinidæ, and agrees with the Platanistidæ in having only three chambers, viz., a paunch, a cardiac chamber, and a pyloric chamber.

V. *The Penis.*

The body-wall between the anus and the aperture of the penial sheath had been cut about, so that the position of these apertures and their distance apart, with regard to the body-length, could not be ascertained.

In the arrangement of the muscles at the base of the organ, and some other matters, *Cogia* differs from the accounts given for the Dolphin and the Right Whale (by Professors Turner and Struthers respectively), so that it is worth while to put on record the arrangements in the present whale. The total length of the apparatus, in the fresh condition, was 28 inches, measured from the base of the "accelerator urinæ" muscles to the end of the penial sheath, but more detailed measurements of the preserved material show that a certain amount of shrinkage had occurrred.

In dealing with the penis, it will be convenient to distinguish three regions:—

(1) A basal portion consisting of the *crura penis*, surrounded by the muscles, which in *Cogia* are 4 in number, a pair of medial *acceleratores urinæ* and a pair of lateral *erectores penis*. This region measures, in the preserved specimen, 7 inches in length and about 5 inches at the broadest.

(2) The middle region or "body of the penis," rather more than 6 inches in length, formed almost wholly by the single *corpus cavernosum*.

And (3) the distal region of 12 inches, extending from the insertion of the sheath or prepuce into the penis, up to the external pore. The terminal region of the penis, enclosed within the sheath, is $8\frac{1}{2}$ inches in length: this region may be termed the '*glans*,' though it contains a continuation of the corpus cavernosum.

We will consider the middle region or body of the penis first. It consists of a single corpus cavernosum, having the usual strucure, with a thick tunic of fibrous tissue, and enveloped in a looser connective tissue carrying blood-vessels and nerves (Pl. X. fig. 16). The body is not quite cylindrical, but is slightly higher than broad ($1\frac{3}{4}$ inch by $1\frac{1}{4}$ inch, in the measured specimen); it was not straight, but somewhat undulating[1].

The upper surface is convex. There is no dorsal furrow, such as is described for *Balænoptera*, and the plexus of blood-vessels

[1] The only figure of transverse sections of a Cetacean penis that I have seen is that given by Murie (4) for *Balænoptera*, where it is broader than high.

destined for the glans is not in the mid-dorsal line, but consists of a right and left group of veins and arteries, lying on either side of the upper surface of the penis. Only for a short space, just behind the attachment of the penial sheath, do the two bunches of vessels widen out so as to meet dorsally, but almost immediately they separate again as the "glans" is entered, and take up a still more distinctly lateral position (Pl. X. fig. 17, *Bv*).

The ventral surface of the c. cavernosum embraces, as usual, the corpus spongiosum, in which the urethra is contained in a slightly asymmetrical position.

In transverse section the c. spongiosum is $\frac{7}{16}$ inch in height by $\frac{1}{4}$ inch across.

While the tunic of the c. cavernosum is very thick and dense, that of the c. spongiosum is quite thin, and to the naked eye is not distinguishable from the tissue of the spongy body itself.

As the distal region or glans is approached the relative sizes of the parts change. The glans is an elongated cylindrical cone, terminating in a blunt and slightly upturned point, the slit-like urinogenital pore, which is $\frac{1}{8}$ inch in length, being subterminal. In the preserved specimen the skin of the glans has a yellowish tint, is smooth but much wrinkled transversely, owing no doubt to shrinkage. Soon after the c. cavernosum has entered the glans, it undergoes a considerable reduction in size: thus, at a distance of 6 inches from the tip (Pl. X. fig. 17) it is, in transverse section, circular in outline, with a diameter of only $\frac{1}{2}$ inch, while the c. spongiosum has slightly increased in size. Further forwards, two inches from the tip (Pl. X. fig. 18), the cavernous body has almost disappeared. It is but $\frac{1}{8}$ inch in diameter, while the spongy body is now $\frac{3}{8}$ inch across, and is practically circular. The rest of the substance of the penis is now occupied by fibrous tissue with abundant vessels, chiefly laterally placed, derived from the previously mentioned dorso-lateral "plexus."

The urethra has enlarged, and here commences the usual dilatation to form the "fossa navicularis." Turning to the proximal region, we find a very interesting condition of affairs. After dissecting away the muscles—or rather by slicing them away—the usual *crura penis* (c. c. spongiosi) are exposed (Pl. X. fig. 19), each embedded in a muscle that appears to be the "erector penis" (or M. ischio-cavernosus). But the c. spongiosum instead of terminating posteriorly in the usual bulb at the angle of origin of the crura, *bifurcates*; and each limb or the *crus c. spongiosi* is enclosed in one of the "accelerator urinæ" muscles (or M. bulbo-cavernosus), within which it enlarges to several times its former size (Pl. XI. fig. 20). Each crus of the spongy body is $2\frac{3}{4}$ inches in length, and is as long as the crus penis: it is here irregularly oval in section, and measures $\frac{7}{8}$ by $\frac{5}{8}$ inch across.

The crus c. spongiosi lies ventrad and mediad of the crus c. cavernosi of its side, and the upper and external face rests against the tough tunic of the latter, while on the other three sides it is enveloped in muscle.

This forked character of the c. spongiosum in *Cogia* is readily seen both in transverse sections and horizontal sections. So far as I have been able to find out from textbooks, the Kangaroo (and perhaps some other Marsupials) presents a similar condition (according to Owen). In Cetacea no mention is made of the phenomena, and generally a " bulb " is described and figured, as in the majority of mammals.

It is, of course, in this basal region that the urethra enters the penis, and in the general disposition of parts *Cogia* is quite typical. The thick-walled, muscular urethra passes obliquely backwards and downwards towards the angle formed by the crura penis; it dilates to form the thin-walled *bulbus urethræ*, and here the angulation of the tube occurs: it then enters the c. spongiosum, through which it runs, slightly to the right side.

The *prostate* gland in *Cogia* agrees very closely with the account given by previous authors (*e. g.* Turner, **15**) for other Whales; it is a loose glandular and vascular tissue surrounding the lower half of the bulbus urethræ. Above the gland is a circular muscle, the "compressor prostatæ" or " comp. urethræ." (Pl. XI. figs. 24, 25, *C.u.*)

The *seminal ducts* deserve a few words. For a considerable part of their lower portion, each duct takes a straight course, as a wide, thin-walled tube; the internal lining of which is raised into a series of imperfectly transverse, thin membranous valves (Pl. XI. fig. 21). They do not form a continuous spiral, as they do in the Rorqual and the Dolphin, according to Beauregard and Boulart (**1**), who compare the arrangement to the well-known spiral valve of the Elasmobranch intestine.

Below the valves, for a distance of about an inch and a half, the mucous membrane is thrown into a number of very fine, lamellose, longitudinal ridges, which continue almost to the entrance of the sperm duct into the urethra.

The *verumontanum* (Pl. XI. fig. 22) is a long, narrow, but well-marked ridge, fading out anteriorly, and higher and broader posteriorly. At this point, on the posterior ventral wall of the " bulbus urethræ," is a transversely oval aperture (*a*) situated on a slight, rounded prominence. This aperture, which has a rounded margin, leads into a shallow, but well-marked pit, into which, right and left, the seminal ducts open by slightly curved slit-like pores, guarded by distinct and whitish lips. These pores are quite below the general level of the mucous membrane, and between them is a very slight recess, in the substance of the urethral wall, which no doubt represents the *uterus masculinus* (cf. Beauregard and Boulart).

The pores of the prostate gland (Pl. XI. fig. 22, *Pro.*) open behind this oval aperture; on each side of which, and behind it, a number of delicate transversely dispersed ridges or lamellæ occur. Most of the prostate pores are placed between the outer ends of neighbouring ridges: four on the left side, three on the right, but two others on this side are at a different level, and lie at the side of the longitudinal ridge of the verumontanum, between it and a smaller lateral ridge.

There appear, from the preliminary account by the above-named authors, to be various differences in this arrangement from the conditions in Dolphin and Rorqual.

The basal region of the penis is perhaps of the most interest, as we shall find striking differences in the arrangement of the muscles in *Cogia*, *Balæna*, and *Grampus*.

In the whale under consideration there are, as I have said, two pairs of muscles, to which I apply the older names "accelerator urinæ" and "erectores penis." The two accelerators lie side by side on each side of the middle line, and have a length of 7 inches on the ventral surface. (Pl. XI. figs. 20, 22, 24, 25, *Ac*, *Er*.)

The fascicles of which the muscle is composed are strikingly large, and have in general a transverse, *i. e.* circular, disposition. At the extreme anterior end, the fascicles of the right and left muscle interdigitate; but for the most part they are separated by a distinct median septum of connective tissue. (Fig. 20, *1*.)

By the passage of the retractor penis, the accelerators are divisible into a larger anterior moiety (*Ac*), and a smaller posterior moiety (*Ac'*), where the fascicles are oblique, with their mediad extremities directed slightly backwards.

The anterior moiety of the accelerator embraces and conceals the crus corporis spongiosi of its side, and the fascicles are arranged as follows. (See Pl. XI. fig. 20.)

Each muscle-fascicle is a broad band, thicker in the vertical than in the horizontal direction (with regard to the surface of the muscle), so that we may distinguish two faces and two edges, as well as two ends.

The faces are pressed against the faces of neighbouring fascicles; one edge is directed outwards and forms the surface of the muscle; the other edge is fixed to the thin connective tissue-sheath of the crus c. spongiosi. The ends are attached to the vertical longitudinal septa, one of which separates the right accelerator from the left (fig. 20, *1*); the other separates the accelerator from the erector of its side (fig. 20, *2*); and in part these outer ends are inserted in the crus corporis cavernosi, with which this septum is continuous.

It is evident that the contraction of these circularly disposed fibres must exert considerable pressure upon the spongy body.

The posterior moiety of the accelerator is marked off from the anterior, by the passage of the retractor penis (Pl. XI. fig. 23, *Re.*). On the ventral surface there appears to be a very marked break in the muscle at this point; but this is less marked on the dorsal surface (Pl. XI. fig. 25), where the transversely disposed fascicles of the anterior moiety only gradually take on an oblique direction; the mediad ends are directed backwards, and the last 3 or 4 fascicles enter the mass of muscle constituting the "sphincter ani," but do not mix with it. They are, here, inserted in a semicircular septum or sheath, concave anteriorly, which is continuous laterally with the longitudinal septa above referred to.

The fascicles in this region are, then, attached only to the septa, and are independent of the crus c. spongiosi.

The *erector penis* (*Er.*) is a plano-convex muscle, enclosing the crus corporis cavernosi of its side. It is shorter than the accelerator, being only 4 inches in length. It is made up of large fascicles, the direction of which varies in different parts of its extent; in fact, they radiate from a small circular tendinous patch on the outer surface near the hinder end of the muscle (*t.*).

From this area the most anterior fascicles pass directly forwards to be inserted in the corpus cavernosum; those in the middle of the series pass directly inwards, and the most posterior ones backwards and inwards. The opposite ends of these fascicles are attached to the fibrous tunic of the crus penis.

A small separate muscle (Pl. XI. figs. 24, 25, *m.*) arises from this tendinous patch, the fibres of which pass backwards and enter the *sphincter ani.* It seems probable that this represents the muscle marked "*a*" in Struthers's figures 13 & 14, arising from the hinder end of the pelvic bone, and which he terms the "caudal muscular mass."

Prof. Turner found no muscle attached to the hinder end of the pelvic bone in the Grampus.

The *retractor penis* (*Re.*) is, as usual, a double muscle, though the two are closely bound together. Each is band-like, and measured $\frac{5}{8}$ inch across and $\frac{3}{16}$ inch in thickness. They are attached at one end to the corpus cavernosum, immediately proximal to the insertion of the penial sheath; posteriorly they lie in the groove between the two accelerators, and finally burrow upwards between the anterior and posterior moieties of these muscles, to gain the dorsal surface. They then pass behind the posterior margin of the "pelvic fascia" and enter the muscle surrounding the rectum (Pl. XI. fig. 25).

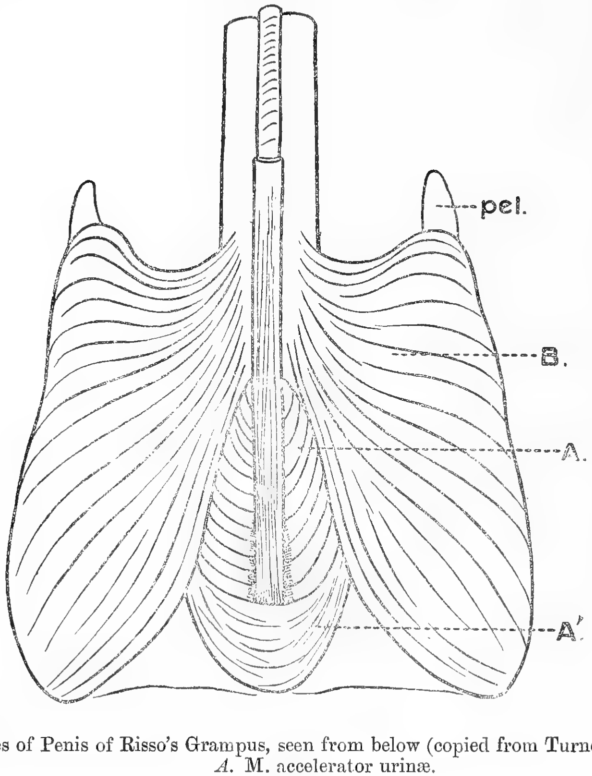
The retractors are 13 inches long, and they lie quite loosely separated from the penis, except at the two ends.

The upper surface of the accelerator muscles is covered by a tough, inextensible membrane, the margins of which had been cut. But from its relation to the muscles and other structures, it appears to be the "pelvic fascia" (Pl. XI. fig. 24, *l.*). Anteriorly, it bears on its under surface the two seminal ducts; on each side is seen an artery (*ar.*)—dipping downwards below it—the pudic artery, and posteriorly it is slightly reflected on to the rectum.

A short distance behind the anterior, cut edge is a depression caused by the origin, from its under surface, of a couple of muscles, which pass forwards, diverge, and embrace the urethra, just above the prostate gland. The muscle-fibres enter the muscular coat of the urethra on its anterior face (Pl. XI. fig. 25, *C.u.*). This almost circular muscle appears to be the "compressor urethræ" (=compressor prostatæ of Turner). In the Grampus, however, it is rather a sheet of muscle-fibres, covering the whole of the upper surface of the prostate, and encircling also the seminal ducts and the urethra; it arises, however, from the "interpelvic ligament" (which represents the "pelvic fascia"). I find that in *Cogia* some of the fibres of this muscle originate from the inner and upper faces of the crura penis.

Another muscle, though cut through, may be mentioned. On each side, and immediately below the cut edge of the pelvic fascia, is a fairly stout bundle of longitudinal fibres (Pl. XI. fig. 24, *lev.*), which, passing backwards, loses itself in the mass of muscle above referred to as "sphincter ani"; this pair of muscles appears to be the *levatores ani.*

Text-fig. 7.



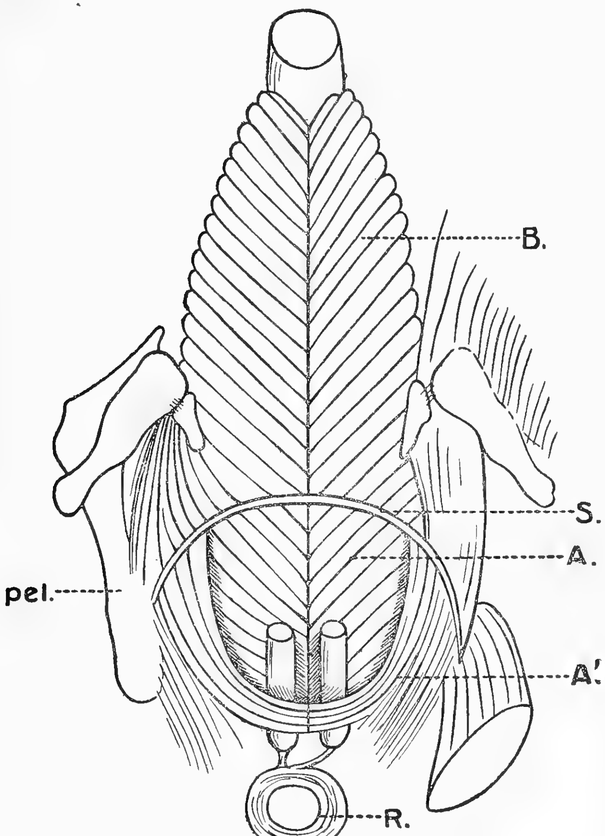
Muscles of Penis of Risso's Grampus, seen from below (copied from Turner).
A. M. accelerator urinæ.
A'. Its posterior moiety.
B. M. erector penis.
pel. Pelvic bone.

Remarks.—If we compare the penial muscles of *Cogia* with those in *Grampus* as described by Prof. Turner [**15**], and with those in the Greenland Right Whale as described by Prof. Struthers [**12**], we shall find an interesting series of stages in their arrangement.

For this purpose I reproduce the figures given by these authors (see text-figs. 7 and 8).

In the Grampus (text-fig. 7, p. 128) there are two pairs of distinct muscles; also a pair of accelerators (*A*), which only differ from those in *Cogia* by their smaller size, for in the Small Cachalot they extend much beyond the "erectores" and are, relatively, much more conspicuous. No doubt this is in relation to the much greater development of the posterior end of the corpus spongiosum and its bifurcation.

Text-fig. 8.



Muscles of Penis of Greenland Right Whale, seen from below (copied from Struthers).

S. Horseshoe-shaped septum; other letters as in text-fig. 7, p. 128.

Compare text-figs. 7 & 8 with the figure of these muscles in *Cogia* (Pl. XI. fig. 23).

The retractor penis (*B*) is seen to have precisely the same relation in both, and the hinder moiety of the accelerators (*A′*) presents the same modification described above. But the muscles for which I have used the name "erectores penis" are in the Grampus represented by a much larger pair (*B*), termed by Turner (and others) the "ischio-cavernosi." In this whale, each arises from, and almost entirely conceals, the pelvic bone (*pel.*). Apart from this, the relations are similar to those in *Cogia*.

When removing the viscera from *Cogia*, I sought for the pelvic bone, and not finding it in the neighbourhood, imagined that it would be concealed within the lateral erectores; but on dissecting these muscles I find no trace of it. I think, then, we may conclude that there is no pelvic bone in *Cogia*. I cannot speak with absolute certainty, since the body-wall was much cut about; but if it had been present it would have been connected with the penis; and there is no trace of any muscle, other than I have described, which would have been attached to it. We may take it, then, that the pelvic bone is absent, and that the "erectores" are homologous with the m. ischio-cavernosi.

At first sight, the account and figure given by Struthers from the Greenland Right Whale differs considerably from the other two Cetacea. On the ventral surface (text-fig. 8) there is a great muscular mass consisting of a right and left half, separated by a median raphe or septum. This mass is subdivided into an anterior (*B*) and a posterior (*A*) muscle by a "horseshoe-shaped septum" (*S*). To this great muscle he gives the name "compressor." The anterior compressor consists of fibres with various origins, but with in general an antero-external direction, as seen from below. The hindmost fibres arise from the inner surface of the hinder part of the pelvic bone (as in the case of the mus. ischio-cavernosus in the Grampus); they pass forwards to be inserted, on the dorsal surface, into the median septum or raphe: the deeper fibres are inserted in the outer surface of the crus penis. A second lot of fibres arise on the ventral surface from this septum and pass round the corpus cavernosum to be inserted in its dorsal surface: these, in fact, surround the base of the corpus cavernosum.

On p. 306, the author goes on to say:—"This vast muscle in *Mysticetus* corresponds to two muscles in human anatomy: the part from the inner slope on both aspects of the [pelvic] bone to the erector penis (ischio-cavernosus), enormously developed; the part from the mesial raphe, on the under surface, to the anterior part of the accelerator urinæ (bulbo-cavernosus)."

Before giving reasons for controverting this view, I will continue his account (p. 307) of the posterior part of the great compressor (*A*) behind the horseshoe-shaped septum.

Its fibres are only visible from the ventral aspect; they arise from the median raphe, pass forwards and outwards, towards the horseshoe-shaped septum, and "are inserted into the whole fibrous surface covered by this muscle: *the deeper into the fibrous coat* *of the bulb*[1]; the most superficial into the hinder surface of the horseshoe-shaped septum; the intervening and greater part into the hard fibrous coat of the crus."

Behind this muscle he represents a group of curved fibres (*A'*, fig. 2), the ends of which arise from the horseshoe-shaped septum in front; the right and left by a median raphe. These cross over behind the retractor penis. To this muscle he gives the name—with some hesitation owing to the mutilation—"*levator ani*" (p. 308).

This "horseshoe-shaped septum" is a vertical sheet of fibrous tissue, attached to the lower faces of the crura penis and of the bulbus spongiosi. "In sections the septum appears as a *prolongation of the special fibrous stratum which thickens the under surface of the crus*[1], and may be regarded as a continuation of that stratum, shelving to the surface in relation to the attachment and action of the posterior compressor muscle" (p. 306).

From the relations of the "anterior compressor" (*B*)—that part which lies in front of the horseshoe-shaped septum—it seems to me that, not merely one part of it, but the whole is homologous with the erector penis or ischio-cavernosus, while the "posterior compressor" (*A*) is nothing else than a much reduced "accelerator urinæ"; for, like it, it is related to the corp. spongiosum, and the account of its attachments agrees with that given by Sir W. Turner. Further, the so-called "levator ani" (*A'*) has relations practically identical with the "posterior moiety" of the accelerator.

As to the horseshoe-shaped septum, it seems to correspond with the longitudinal septum that, in *Cogia*, separates the acceleratores from the erectores (Pl. XI. fig. 20, *2*), which, owing to the shortening of the median muscle and the great development of the lateral ones, has assumed this curved form.

A comparison of the arrangement in the three genera shows the same two pairs of muscles in each, but an interesting disproportion in the relative sizes. At one end of the series, *Cogia*, we find the accelerators (*A*) relatively enormously developed, probably in relation to the bifurcation of the corp. spongiosum; at the other end of the series, in *B. mysticetus*, the accelerator is much reduced, while the erectores (*B*) are enormously developed—no doubt in relation to the great size of the pelvic bone and to the existence of a rudiment of the hind limb, both of which are absent in *Cogia*. The Grampus occupies a middle place in the series, in which a pelvic bone is present, but with neither a hind limb nor crura c. spongiosi.

List of Papers referred to in the text.

1. Beauregard & Boulart.—"Sur l'Utricule prostatique et les Canaux déférents des Cétacés." C.R. Ac. Sc. vol. 119, 1895, p. 596.

[1] *Note.*—The italics are mine.

2. v. Haast.—"On the Occurrence of a new Species of *Euphysetes* &c. on the N. Z. Coast." Tr. N. Z. Inst. vi. 1873, p. 97, and P. Z. S. 1874, p. 260.
3. Jackson, J. B. S., in Boston Journ. Nat. Hist. v. 1845.
4. Murie.—"Anatomy of the Caa'ing Whale, *Globicephalus melas*." Tr. Zool. Soc. viii. 1867.
5. Murie.—"Notes on the White-beaked Bottle-nose, *Lagenorynchus albirostris*." Journ. Linn. Soc. (Zool.) xi. 1870, p. 141.
6. Murie.—"On Risso's Grampus." Journ. Anat. Physiol. (ser. 2) iv. 1871, p. 118.
7. Owen.—"On some Indian Cetacea." Tr. Zool. Soc. vi. 1865, p. 17.
8. Pilliet & Boulart.—"L'Estomac des Cétacés." Journ. de l'Anat. et Physiol. xxxi. 1895, p. 250. [Abstract in Zool. Jahresber.]
9. Pouchet & Beauregard.—"Sur l'Estomac du Cachalot." C.R. Biol. Soc. ix. 1889, p. 92. [Abstract in Zool. Jahresber.]
10. Sibson.—"On the Blowhole of the Porpoise." Phil. Trans. 1848, p. 117.
11. Struthers.—"On the Bones, Articulations and Muscles of the Rudimentary Hind Limbs of the Right Whale (*B. mysticetus*)." Journ. Anat. Physiol. xv. 1881, p. 301.
12. Struthers.—"Anatomy of *Beluga*." Journ. Anat. Physiol. (3rd ser.), x. 1893.
13. Turner.—"Anatomy of Sowerby's Whale." Journ. Anat. Physiol. xx. 1886, p. 144.
14. Turner.—"Additional observations." Journ. Anat. Physiol. xxiii. 1889.
15. Turner.—"Notes on some of the Viscera of Risso's Grampus." Journ. Anat. Physiol. xxvi. 1892, p. 258.
16. Tyson. "*Phocæna*, or the Anatomy of the Porpoise." London, 1680.

Dunedin, March 8, 1901.

EXPLANATION OF PLATES VIII.-XI.

Anatomy of *Cogia breviceps*.

Plate VIII.

Figs. 1–9 illustrate the structure of the Nasal Passages.

Fig. 1. Outline of the head, to show the position of the blowhole (reduced). This is not absolutely correct, as the flesh of the head had been partially removed.

2. Enlarged view of the blowhole (nat. size). *a*, *b*, the anterior lip; *c*, the interruption in the lip, where the lip becomes continuous with the skin of the head; *d*, posterior lip. *mm*, the median line of head. *x* points to region that, in the next figure, has been cut across.

3. The spiracular vestibule, exposed by cutting across the anterior lip at *x*, and turning backwards the hinder lip *d* (nat. size). *b*, the right-hand

corner of the blowhole. *E*, the valve, which is continued down the left narial canal. *f*, vertical wall of the hind-lip of blowhole; *g*, the recess in this. *h*, left narial canal; *h'*, probe passed into it. *i*, probe passed into the right narial canal. *mm*, median line of head. *a, c*, as in fig. 2.

Fig. 4. The right-hand corner of the foregoing figure, enlarged, showing the right narial canal and its lips. Letters as in fig. 3.

5. The naso-palatine canal exposed by slitting open the soft palate, seen from behind. *h*, the lower end of left narial canal. *j*, the lower end of right narial canal. *E*, valve. *bsp.*, basisphenoid bone. *ptery.*, pterygoid. *prs.*, presphenoid.

6. Dissection of the head, exposing (*A*) the upper spiracular chamber, the front wall of which is laid open (nat. size). *b*, the narial canal passing to the lower spiracular chamber. *fib.*, fibro-muscular dermis. *i*, probe passes through the left nostril into the spiracular chamber. *m*, another probe passed into the nostril and issuing through the cut end of a branched canal similar to *n*. *mus.*, cut muscle.

Plate IX.

Fig. 7. Further dissection exposing lower spiracular chamber, the front wall of which is turned downwards ($\frac{1}{2}$ nat. size). *A*, posterior, inferior face of the upper chamber. *B*, the opened lower chamber; *r*, its posterior wall; *S*, its anterior wall. *mus.*, muscles. *fib.*, fibrous dermis. *j*, right narial canal disappearing behind the surrounding tissue. *b'*, the lower end of a probe passed through the inter-cavity canal (*b*) of the previous figure. *b''* and *b'''*, another probe passed through the dissevered part of this same canal; *b'''*, its entrance into the lower chamber. *c*, probe passed down into the naso-palatine canal.

8. A group of papillæ from the wall of the lower chamber ($\times$ 4).

9. Diagram of the nasal passages in the form of a projection seen from in front. *a*, blowhole. *b*, intercavitary portion of right narial canal. *c*, lower end of right narial canal. *E*, longitudinal valve in the left narial canal. *h*, left narial canal. *j*, upper end of right narial canal. *n*, branching outgrowths of this right narial canal. *q*, nasopalatine canal. *A*, upper spiracular chamber. *B*, lower spiracular chamber, the dotted outline indicates its dorsal extension behind *A*. *m.e.s.*, median line of the head.

Figs. 10–14 refer to the Alimentary Canal.

Fig. 10. View of the dorsal surface of the paunch and stomach ($\frac{1}{4}$ nat. size). *a*, œsophagus. *b*, paunch. *c*, cardiac chamber. *d*, commencement of pyloric chamber which had been cut short.

11. Surface view of the lining of the œsophagus (slightly enlarged). *a*, section through the same.

Plate X.

Fig. 12. Epithelial lining of the paunch (slightly enlarged).

13. Mucous membrane of the cardiac chamber (slightly enlarged).

14. A part of the wall of the cardiac chamber has been removed, and the cardiac orifice thus exposed ($\frac{1}{2}$ nat. size). *a*, œsophagus. *b*, paunch. *c*, cardiac chamber. *d*, the two ridges bounding the furrow leading from œsophagus to paunch. *E*, probe passing from œsophagus. *f*, probe passed along the furrow into the paunch. *g*, circular ridge of mucosa and submucosa surrounding the orifice. *h, k*, free fold of œsophageal mucosa projecting through the orifice.

Figures 15–25 refer to the Penis.

Fig. 15. View of the entire penis from the right side ($\frac{1}{2}$ nat. size): the penial sheath is opened to show the tip of the glans. A portion of the abdominal wall (B) is represented to show the connection of the muscles of the sheath.

16. Transverse section of the body of the penis (nat. size).
17. Transverse section of penis about 6 inches from the tip (nat. size).
18. Transverse section of penis two inches below the tip (nat. size).
19. A dissection of the base of the penis ($\frac{1}{2}$ nat. size): the upper half of the muscles and of the corp. cavernosum and corp. spongiosum has been sliced away so as to expose the crura of these two bodies.

Plate XI.

Fig. 20. Transverse section of the base of the penis at the point of bifurcation of the erectile tissues ($\frac{1}{2}$ nat. size, somewhat diagrammatic). It exhibits the relation of the muscles to the crura. *1, 2*, connective-tissue septa.

21. A sperm-duct opened. *a*, its upper region; *b*, its lower region.
22. Internal surface of the hind wall of the bulbus urethræ and the commencement of the penial region of the urethra. *a*, the mouth of shallow pit, which is drawn on an enlarged scale at the side to show the apertures of the two sperm-ducts.
23. Ventral view of the base of the penis ($\frac{1}{2}$ nat. size).
24. Dorsal view of the base of the penis ($\frac{1}{2}$ nat. size), with the pelvic fascia *in situ*, and a couple of lymphatic glands on the left. In the centre, forwards, the origin of the compressor urethræ (*C.u.*) in the under surface of the fascia is indicated.
25. Dorsal view of the base of the penis after removal of the pelvic fascia ($\frac{1}{2}$ nat. size). The "sphincter ani" has been turned backwards to show the compressor urethræ and termination of the retractor penis in the rectal muscles.

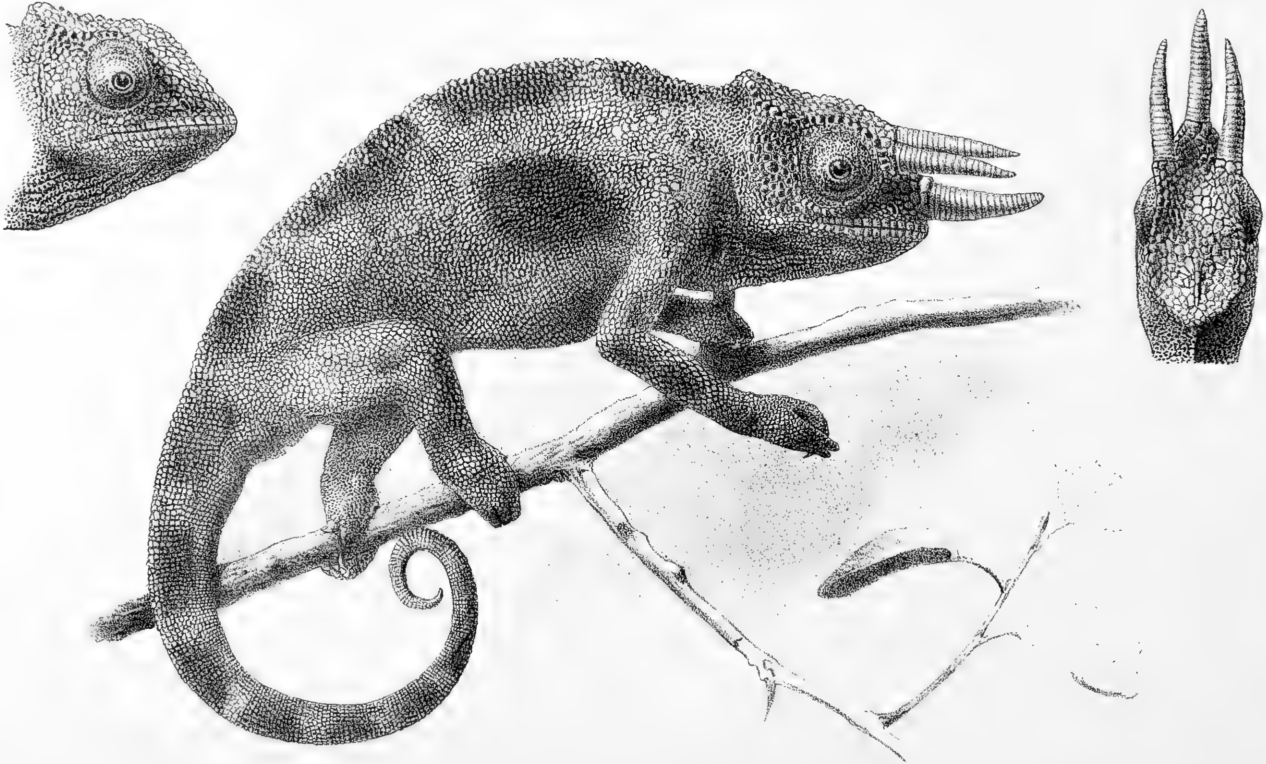
Explanation of the lettering.

Ac., accelerator urinæ muscle. *Ac.'*, its posterior division. *ar.*, pudic artery. *Bv.*, blood-vessels on penis. *Ca.*, corpus cavernosum. *Cr.ca.*, crus. corp. cavernosi. *Cr.Sp.*, crus corp. spongiosi. *c.m.*, circular muscles in sheath of penis. *Ct.*, connective-tissue coat of penis. *C.u.*, compressor urethræ muscle. *ep.*, epidermis of glans penis. *Er.*, erector penis muscle. *g*, lymphatic gland. *gl.p.*, glans penis. *l.*, pelvic ligament. *lev.*, levator ani muscle. *m.*, muscle of doubtful homology. *P.*, external aperture of penial sheath. *Pro.*, prostate gland or its pores. *R.*, rectum. *Re.*, retractor penis muscle. *r*, longitudinal ridges in sperm-duct. *S.d.*, sperm-duct, or its opening into urethra. *Sh.*, sheath of penis. *Sp.*, corpus spongiosum. *Sph.*, sphincter ani muscle. *t.*, tendinous patch on erector muscle. *tu.*, tunic of corp. cavernosum. *U.*, urethra. *v.*, valves in sperm-duct.

P.J.Smit del. et lith.

Mintern Bros. imp.

CHAMÆLEON XENORHINUS



P.J. Smit del. et lith.

Mintern Bros. imp.

CHAMÆLEON JOHNSTONI

4. Descriptions of two new Chameleons from Mount Ruwenzori, British East Africa. By G. A. Boulenger, F.R.S.

[Received May 6, 1901.]

(Plates XII. & XIII.[1])

The already long list of East-African Chameleons has recently been enriched by the discovery of two most strikingly new species represented in Sir Harry Johnston's collection, which I have been authorised to describe. Examples of these new species were obtained on Mount Ruwenzori at an altitude of 6000 feet, together with specimens of *C. ellioti*, Gthr.

Chamæleon xenorhinus. (Plate XII.)

Casque elevated posteriorly, very much in the male, with strong, curved parietal crest; the distance between the commissure of the mouth and the extremity of the casque equals the length of the buccal cleft in the male, a little less in the female; lateral crest distinct all round the head, strong and tubercular; upper head-scales large, unequal in size; interorbital region concave; the snout of the male terminating in two large compressed bony processes directed forward and slightly upward, closely appressed, fused together at the base, nearly twice as long as deep; in the female, the processes replaced by two very small tubercular knobs; no trace of occipital lobes. Body covered with rather coarse granules, intermixed with numerous feebly enlarged flat tubercles. A feeble dorsal crest in the male, barely indicated in the female; no gular or ventral crest; enlarged flat tubercles on the side of the throat. No tarsal process. Tail longer than head and body, not crested. Male uniform dark olive, the rostral appendage and part of the tail lighter. Female purplish brown, with a large blackish, light-edged blotch on each side of the body.

	♂. millim.	♀. millim.
Total length	240	197
From end of snout to extremity of mandible (rostral process excluded)	25	21
From end of snout to extremity of casque	38	25
Length of rostral appendage	14	—
Greatest width between lateral cranial crests	16	13
Depth of skull (mandible included)	26	16
Width of head	16·5	14
Body	75	66
Tibia	17	15
Tail	140	110

Two specimens, male and female.

This species stands nearest to *C. fischeri*, Reichen.

[1] For an explanation of the Plates, see p. 136.

CHAMÆLEON JOHNSTONI. (Plate XIII.)

Casque feebly raised posteriorly, with obtusely angular posterior contour, with a short, feeble parietal crest; the distance between the commissure of the mouth and the extremity of the casque equals the length of the buccal cleft; lateral crest strong and tubercular, but absent on the snout; no canthus rostralis; interorbital region concave; male with three long, conical, smooth, horn-like processes with circular striæ, directed forward and slightly upward, one in front of each orbit and the third on the snout; the rostral horn a little thicker, but not longer than the orbitals; no trace of such appendages in the female; scales on upper surface of head unequal, moderately large; no trace of occipital lobes. Body with angular spine, but without crest, coarsely granular, with scattered small flat tubercles; no gular or ventral crest. No tarsal process. Tail as long as head and body, not crested. Uniform dark olive; horns yellowish.

	♂. millim.	♀. millim.
Total length	224	220
From end of snout to extremity of mandible	24	24
From end of snout to extremity of casque	33	33
Rostral horn	16	—
Præorbital horn	17	—
Greatest width between lateral cranial crests	13	13
Depth of skull (mandible included)	21	21
Width of skull	17	17
Body	88	80
Tibia	22	20
Tail	112	115

Three male specimens, one female and one young.

The Chameleon which I have the pleasure of naming after Sir Harry Johnston, K.C.B., is most nearly related to the one described by me as *C. jacksoni*, from which it is easily distinguished by the more feeble occipital crest, the finer granulation of the body, and the absence of large tubercles on the spine, forming a dorsal crest.

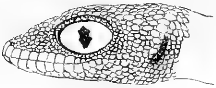
EXPLANATION OF THE PLATES.

PLATE XII.

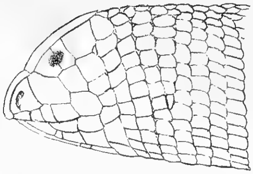
Chamæleon xenorhinus, male, with upper view of head, and side view of head of female.

PLATE XIII.

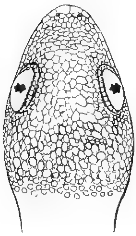
Chamæleon johnstoni, male, with upper view of head, and side view of head of female.



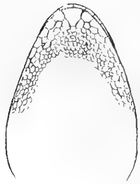
1b.



2b.



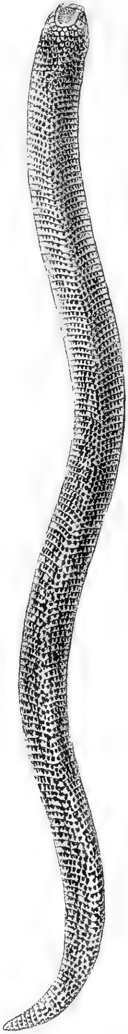
1a.



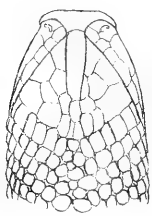
1c.

2a.

1.



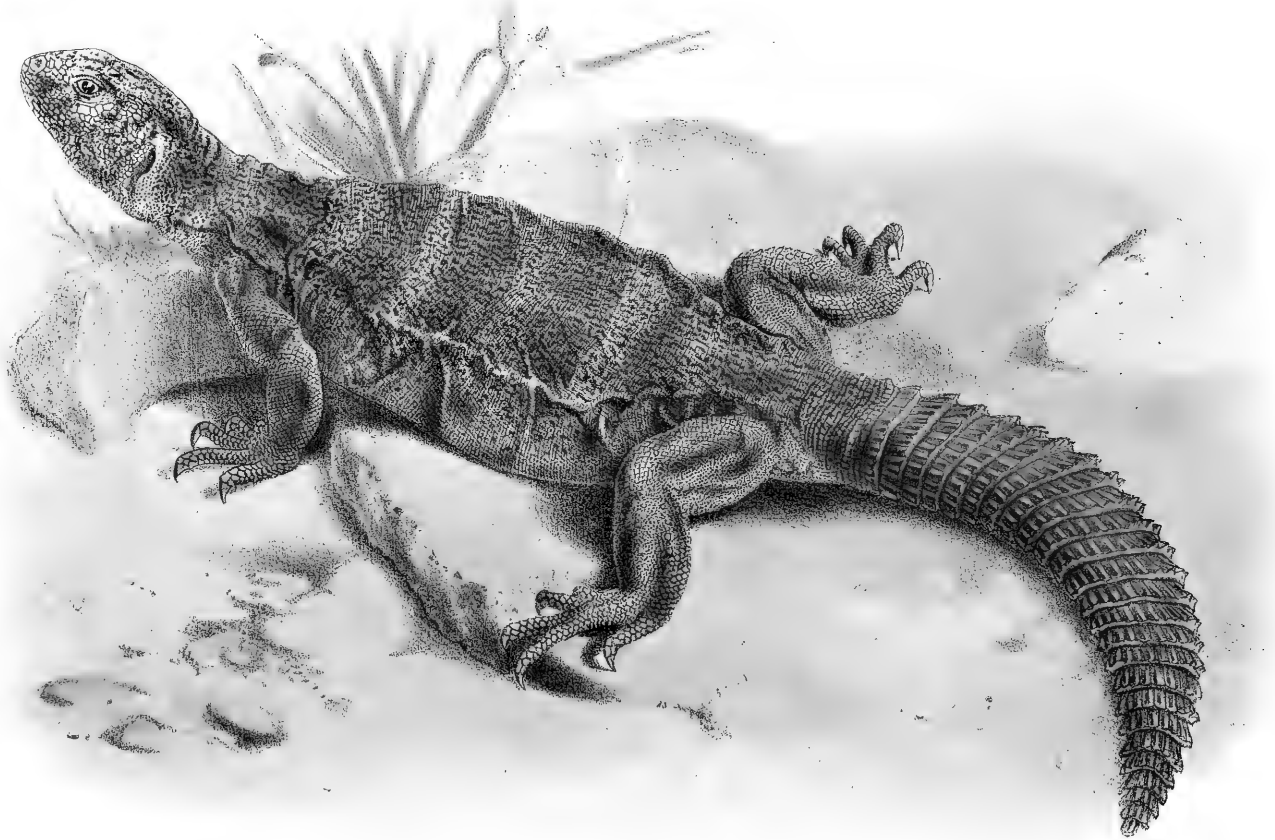
2.



2c.

P.J.Smit del.et lith. Mintern Bros.imp.

1. BUNOPUS SPATALURA. 2. AGAMODON ARABICUS.



P.J. Smit del. et lith.

UROMASTIX BENTI.

Mintern Bros. Chromo.

5. A List of the Reptiles and Batrachians obtained by Mr. A. Blayney Percival in Southern Arabia. By the late Dr. J. Anderson, LL.D., F.R.S. With Notes by the Collector.[1]

[Received May 14, 1901.]

(Plates XIV. & XV.[2])

REPTILIA.

LACERTILIA.

Geckonidæ.

1. Stenodactylus doriæ Blanf.

Three specimens from the Abian country. One, an adult female, the largest of the species I have seen, measures 60 mm. from the snout to the vent, and the tail 46 mm. The second female is about half-grown; the third is a male, also young. It has two well-developed preanal pores. All three were collected by Mr. Percival in the Abian country.

The adult female has well-defined large brown spots on the back and much smaller whitish ocelli, margined with brown, intermixed among the brown speckling. The other two individuals have no large brown dorsal spots, but the pale brownish of the back is marked by numerous round white spots, with a dark ring encircling each, intermixed among the dark rings and dark brown speckling. The coloration is much the same as that of the Egyptian *S. elegans*, from which this form differs chiefly by the divided character of the scales or plates on the under surface of the toes.

2. Bunopus spatalurus, sp. n. (Plate XIV. fig. 1.)

Head oval, flattened from between the eyes and backwards to the occiput. Snout short and somewhat broad, its length equalling once and a half the longitudinal diameter of the eye and one-third the total length of the head on the upper surface. Forehead convex; a short depression behind each nostril. Eye rather large, its longitudinal diameter equal to the distance between the hinder border of the ear and external canthus. Ear a narrow oval slit placed obliquely, from above downwards and forwards, about half the long diameter of the eye. Body not depressed but rather compressed, covered with somewhat imbricate or juxtaposed scales of irregular size, the larger more numerous than the

[1] This paper had been prepared shortly before his death by the author, whose MS., however, comprised no introduction. For an account of Mr. Percival's Expedition, see P. Z. S. 1900, p. 95.

[2] For an explanation of the Plates, see p. 152.

smaller scales, some of them on the middle of the back showing a tendency to carination. Scales of the upper surface of the head juxtaposed, flat, rounded, hexagonal. A few rounded tubercles on the temporal and occipital regions. Rostral once and nearly one half as broad as high, upper external angles rounded off, mesial line cleft in its upper half. Nostril defined by the rostral, first labial, and three nasals. Ten upper and lower labials. Mental nearly as broad as long, outer margin opposed to first labial, concave, with another shorter concave margin behind it, against which lies a small shield, the most anterior of the line of enlarged granules which lies below the lower labials. Gular scales granular. Ventral scales more or less pointed and feebly carinated. Tail verticillate throughout, cylindrical in its anterior half, and flattened from above downwards in its posterior moiety, with the tip slightly laterally expanded; no enlarged scales inferiorly. Limbs moderate; digits slender, with two or three of the distal phalanges forming an angle with the base as in *Gymnodactylus*, covered with transverse lamellæ more or less spiny or tubercular. Four preanal pores. General colour greyish, the head finely and obscurely speckled irregularly with black. A broad black band passing from side to side across the nape of the neck from behind the temporal region, succeeded by five similar broad bands on the trunk and eight on the tail, the intervening greyish areas being not quite so broad as the black bands. The dark bands are continued down on both sides of the trunk, but on the tail they form rings. Underparts whitish.

From snout to vent 35 millimetres; tail 23.

This species is of considerable interest, as it seems somewhat to connect the two genera *Bunopus* and *Gymnodactylus* together. Its flattened tail somewhat expanded at the tip and the character of the body-scales are its most striking features.

Only one specimen was collected by Mr. Percival, in the Wadi Jimil.

3. Pristurus flavipunctatus Rüpp.

Numerous examples from the hills north of Lahej, towards Jimil, and from the Jimil Valley.

4. Pristurus crucifer Val.

Numerous examples from the same localities as the preceding, and also from the hill-country east of Aden, from Wadis between Lahej and the mountains and below Mount Manif.

5. Pristurus collaris Steindachner.

Two specimens from the hills north of Lahej towards Jimil, and one from the Wadis between Lahej and the mountains. These specimens are exactly like those described from the Hadramut [1]. This is the first time it has been recorded from Aden.

[1] Herpetology of Arabia (Anderson), 1896, p. 34.

These specimens do not throw any additional light on the relation between this species and *P. carteri* (Gray)[1].

[We found these strange little beasts on the very hottest stony deserts near Manif, and again amongst the black volcanic rocks in the Abian country: they are extremely quick and are also very fragile, tails breaking off without any provocation. I obtained several with a pistol by shooting at the stone where they sat, the splashes of lead from bullet killing them. When sitting on a stone the tail is usually curled round, something like a chameleon's. They look almost white when alive. As I passed the stone on which they were, they would move round it so that their head was to be seen over the top.—*A. B. P.*]

6. Hemidactylus yerburyi Anderson.

2 ♂. From the Bungalow at Lahej.
1 ♂, 1 ♀. North of Lahej.

These specimens agree in all their details of structure and in their coloration with the types.

[Very common on walls and roof of the Bah Bungalow at Lahej; also about the Sultan's palace.—*A. B. P.*]

Agamidæ.

7. Agama sinaita Heyden.

1 ♂ & 1 ♀. Wadis between Lahej and the mountains.
1 ♂ & 1 ♀. Wadis below Mt. Manif, north of Lahej.
1 ♂ & 1 ♀. Lahej.

These specimens resemble the examples of this species from the Hadramut in their large dorsal scales. They consequently differ from the Sinaitic and Egyptian lizards; but as this is the only feature by which they can be distinguished, and as they have the third digit the longest, possess an enlarged plate under each claw, and have brown spines on the transverse plates of the digits, all of which are characteristic of this species, the enlargement of the dorsal scales is only a local variation which begins to show itself to the north at Medina, where the species is traced to the south from the Sinaitic Peninsula.

8. Uromastix (Aporoscelis) benti Anderson. (Plate XV.)

2 ♂ adnlt and 1 ♀. Between Mt. Manif and Jimil.
1 ♂. Abian Mountain.

This species, originally described from the Hadramut, was obtained by Captain Nurse about four years ago from the hills 50 miles to the north of Aden[2]. The present specimens differ in no

[1] Conf. Boulenger, Ann. Mus. Genov. (2) xvi. 1896, p. 549.
[2] Herpetology of Arabia (Anderson), 1896, p. 63.

respect from those obtained by Captain Nurse, nor from the Hadramut type.

Mr. Percival has added the accompanying note regarding this Lizard, which, as is well known, is a vegetable-feeder. He says it is much hunted by the Beduins, who eat it.

[This fine lizard is fairly numerous in the hills of Southern Arabia. It is a vegetable-feeder, and is much hunted by the Beduins, who eat it. The specimens now in spirit in my collections all contained small twigs and grass in stomach. The first specimen was brought me at J. Manif cut to pieces by a spear. I impressed upon the bringer that I did not want them in that state, and he promised to get some more alive: next day he brought one alive and in nice condition. Two days later at Jimil I got two more specimens; and on the last trip into the Abian country, to the east of Aden, I got two more specimens, the live one I brought home being one of them. It is a slow beast, and when seen is very easily captured, unless, as happened to me, they get into a crack in the rocks and so escape. There are, I think, one or two more species, as the Beduins say that in Dethina there is a larger species that is particularly good-eating. I did not try the lizard as an article of food, much as some of the men wished me to. I was told that they were particularly numerous along the sides of W. Yeramis, but I saw only one and that one escaped me into a crack in rocks; it was on the northern side.—*A. B. P.*]

The larger species referred to by the natives as occurring at Dethina may probably prove to be *U. ornatus*.

The figure here given of this beautiful lizard is taken from the living specimen brought home by Mr. Percival.

VARANIDÆ.

9. VARANUS GRISEUS Daud.

[Native name "Waral." I saw only one specimen of this fine Lizard. They are not uncommon, as we often saw their spoor. Seem to live in same holes as the large Jerboa Rats (Tuft-tail Rats).—*A. B. P.*]

AMPHISBÆNIDÆ.

10. AGAMODON ARABICUS, sp. n. (Plate XIV. fig. 2.)

Body much compressed, its transverse breadth at the middle being little more than one-half of its depth, whilst before the vent it is less than half of the depth. Head very short, higher than broad. Rostral considerably broader than long, triangular; the apex or labial border curved downwards and slightly backwards and nearly half the breadth of the base of the shield. Frontal more or less concave from side to side, the lateral margins of this shield, as well as of the rostral, projecting and raised above the shields on the sides of the head. Nostril elongated, parallel to the outer border of the rostral, in a single shield resting on the 1st, 2nd, and 3rd upper labials. Five upper labials, the fourth and fifth the largest, the first lying below and close to the nostril. A large quadrangular postnasal lying above the 3rd, 4th, and 5th labials and below the anterior half of the ocular shield. Ocular plate considerably longer than deep, partially divided about the middle of the eye; a large postocular with three shields between it and the hinder margin of the gape. A subocular, higher than broad, lying between the postnasal and the shield below the postocular. Three lower labials, the first only in contact with the mental; the last very large and elongated from above downwards, separated from its fellow of the opposite side by seven scales which are shut off from the posterior end of the chin-shield and from the first and second labials by seven other shields and scales, one or two of the shields being in contact with all the lower labials. Mental very elongate and ribbon-shaped, reaching as far back as the posterior border of the second labial. 161 annuli on the body, 18 on the tail. About 55 scales round the body, including the irregular scales of the vertebral and ventral lines, in the former of which there are about 7 and in the latter 3; each annulus containing about 45 quadrangular segments.

Salmon-coloured in life, the majority of the segments of the annuli being generally partially or wholly marked by a dark brown spot, absent, however, from the lower half of the sides and ventral aspect; head-plates yellowish.

A single specimen, from the Abian country, measuring 144 millimetres.

This species is the first of the Emphyodont group of Amphisbænidæ which has been recorded from the Asiatic Continent, but *Pachycalamus* is found in Socotra.

Three species of *Agamodon* are known, viz., *A. anguliceps* Peters [1], the type of the genus, *A. compressus* Mocquard [2], and *A. arabicus* Anders. The first was described from a specimen obtained at Barava, and the second also from Somaliland. They constitute three well-defined species distinguished from one another by the number of annuli round the body. In the first they do not exceed 133. In *A. compressus* there are as many as 147, and in *A. arabicus* there are over 160. *A. arabicus* has a greater number of upper labials than in the African forms, but it is quite possible that with further materials the supposed distinction will vanish. It also differs from the other species in the way in which the second lower labial is broadly excluded from the mental.

A. arabicus has the compressed form of *A. compressus,* from which it is at once distinguished by the shape of its fronto-parietal in addition to the other characters here enumerated.

[1] Peters, Sitz. Ak. Wiss. Berl. 1882, p. 579, pl. x.

[2] Mocquard, Mém. Cent. Soc. Philom. 1888, p. 121*, pl. xi. figs. 2, 2 *a* to 2 *c*.

	A. anguliceps. Barava, Somaliland. B. M. 96.9.24.16.	*A. anguliceps.* Somaliland. B. M. 89.12.16.32.	*A. anguliceps.* Somaliland. B. M. 88.1.12.1.	*A. arabicus.* Abian country, Arabia. B. M. 99.12.13.52.	*A. anguliceps.* Peters. Barava. Berlin Mus.	*A. compressus* Mocq. Somaliland.
Upper labials	4	L. 3. R 4.	4	5	3	3
Lower labials	3	3	3	3	3	3
Scales between last lower labials	9	14	11	14	12	6
Annuli round body	133	132	132	161	132	147
Annuli round tail	16	16	15	18	17	23
Segments and scales round body	50	50	50	55		
Preanal pores	0	4	2	0	4	2
Snout to vent	110	105	122	130	153	103
Tail	12	12	15	14	19	12·5
Length of head	9	9	11	8	11	
Head-shields, length of,	6	6	7	6		
Nasal in contact with upper labials	L. 1&2. R. 1,2,3.	L. 1,2,3. R. 1, 2, 3, 4.	L. 1,2,3. R. 1,2,3.	1, 2, 3.	1, 2, 3.	1 & 2.
Præocular in contact with	fronto-parietal, rostral, nasal, 3 & 4 labials and subocular and ocular, 2 labials on left side.	rostral, nasal, R. 4 labial, L. 3 & 4, subocular and ocular.	rostral, nasal, 3 & 4 labials, subocular and ocular.	fronto-parietal, rostral, nasal, 3, 4 & 5 labials, subocular and ocular.	fronto-parietal, rostral, nasal, 2 & 3 labials, subocular, ocular.	fronto-parietal, 2 & 3 labials, nasal, subocular, and ocular.
First upper labial and mental	broadly in contact.	broadly in contact.	broadly in contact.	broadly in contact.	broadly in contact.	broadly in contact.
Second upper labial and mental	broadly in contact.	R. contact, L. excluded.	broadly in contact.	broadly excluded.	L. contact.	broadly in contact.

Peters's definition of the genus is as follows :—" Dentes maxillarum tomiis innati. Caput superne scutis duobus, rostrali frontoparietalique, obtectum. Oculi distincti, superolaterales. Corpus subbreve; segmenta lateralia quadrangularia, dorsalia ventraliaque media minora, squamiformia; sulcus lateralis nullus, spinalis obsoletus, abdominalis medianus distinctus; pori præanales distincti. Cauda compressa, apice acuminato." In his further explanation of the generic characters he states that the nasal was sickle-formed, and in his account of the specific characters he states that there were three upper labials, but that in the type the first upper labial had united with the nasal, separating only two labials, the nasal entering the labial border, there, however, being in reality 3 upper labials.

Mocquard, who had 9 examples of *A. anguliceps* Peters under observation, viz., 7 males and 2 females, states that they all had 4 upper labials instead of 3 as described by Peters, so that in *A. anguliceps* these shields may vary from 2 to 4, the smaller of these numbers being due to the first labial amalgamating with the nasal. Four, however, would appear to be the prevalent number in this species.

In the specimen 88.1.12.1 there are two well-developed and prominent preanal pores, whereas in the individual 89.12.16.32 there are four small blackish orifices in the position of pores exactly as figured by Peters. If these pores are confined to the males, then the specimen 96.9.24.16 and the type of *A. arabicus* are females.

[This burrowing reptile I obtained at Al Khaur from a ploughed field, it being thrown out by the plough just as I passed. It was salmon-pink in colour when alive.—*A. B. P.*]

LACERTIDÆ.

11. ACANTHODACTYLUS CANTORIS Günther.

	Sex.	Snout to vent.	Tail.	Scales round body.	Ventrals.	Scales between thighs.	Femoral pores.	
							L.	R.
1...........	♂	62[1]	152	32	14	11	20	21
2...........	♂	60	?	34	14	14	21	20
3...........	juv. ♀	39	?	39	13	13	22	22
4...........	♀	53	?	32	14	12	21	20
5...........	juv. ♀	36	?	34	14	12	21	20
6...........	♀	46	107	39	14	10	17	20

[1] Measurements throughout in millimetres.

No. of specimens.

1 & 2. 2 ♂. Wadis between Lahej and the mountains.
3. 1 juv. Wadi below Mount Manif north of Lahej.
4. ♀. Hills north of Lahej towards Jimil.
5. Juv. Jimil Valley.
6. Abian hill-country east of Aden.

None of the examples of this species hitherto recorded from Aden and its neighbourhood have had fewer than 38 scales transversely and dorsally between the ventrals at the middle of the body, but in some of the foregoing examples there are as few as 32, so that now the range of variation in the number of dorsal scales in the region indicated is as much as 25, the highest number occurring in Baluchistan, and the lowest in the Aden district, where the variation may be as much as 13.

12. Acanthodactylus boskianus Daud.

	Sex.	Snout to vent.	Tail.	Scales round body.	Ventrals.	Scales between thighs.	Length of fourth toe.	Pores. L	Pores. R
1...........	♀	72	?	34	10	16	11·7	20	12
2...........	♀	60	128	36	10	17	11·4	21	21
3...........	♂	72	163	37	10	17	12	23	23

1. 1 ♀. Wadi between Lahej and the mountains.
2. 1 ♀. Wadis below Mt. Manif.
3. 1 ♂. Abian country.

These specimens belong to the variety *aspera*, as is shown by the small number of scales between the ventrals across the back. Thirty-four is a lower number than has hitherto been recorded.

13. Latastia longicaudata Reuss.

1 ♂. Shaikh Othman.

Snout to vent 98 mm., tail 320 mm.

The only distinction in which this male differs from African specimens is in the greater number of its femoral pores. The highest number yet recorded in Africa is 14, whereas in this South Arabian specimen there are as many as 16. The following are the numbers of plates and scales present in this individual:—

Ventrals from side to side 6. Ventrals between collar and preanal region 31. Collar-plates 9. Upper labials 9 (6th below eye). Scales round middle of body 58.

This is the second occasion on which this species has been recorded from Asia. In the first instance it was found at Tor on the Sinaitic Peninsula, and these specimens constituted the types of the species.

14. Latastia hardeggeri Steind.

Latastia hardeggeri, Steind. Ann. Hofmus. Wien, vi. 1891, p. 371, pl. xi.; Blgr. Zool. Rec. 1893, Rept. p. 23; id. Ann. & Mag. N. H. (7) v. 1898, p. 130.

Eremias heterolepis, Boettg. Zool. Anz. 1893, pp. 115 & 193.

Philochortus neumanni, Matschie, SB. Ges. naturf. Fr. Berl. 1893, p. 30.

Latastia neumanni, Anders. P. Z. S. 1895, p. 643, pl. xxxvii. fig. 1; id. Herpet. of Arabia, 1896, pp. 73, 80, 85, & 88.

1 ♂, 1 ♀, and 1 juv.

	♂.	♀.	Juv.	Berbera. Juv. ♂.
Snout to vent	74	82	51	43
Vent to tip of tail	205	190	?	122
Ventrals across body	6	6	6	6
Ventrals, collar to preanal region	32	31	31	30
Plates of collar	8	8	9	8
Upper labials	9—9	8—8	9—9	9—9
Upper labials under eye	6—7	5—5	6—6	6—6
Scales round middle of body	38	39	39	34
Femoral pores	16—15	15—14	16—15	12

The first specimen of this species from Aden which came under my observation had 42 and 47 rows of scales across the middle of the body between the ventrals. These recent specimens from practically the same locality have only 38 and 39 rows of scales. In an example in the British Museum from Berbera there are only 34 rows of scales. Mr. Boulenger, in identifying this example of *L. hardeggeri* in 1898 [1], remarked that in fact "nothing but a smaller number of scales across the body (about 30 exclusive of the ventrals) distinguishes it" from *L. neumanni*. The specimen, however, with which he dealt, he states had 34 rows. The circumstance that there is only a difference of 4 rows of scales between the recent acquisition from Aden and the Berbera lizard referable to *L. hardeggeri*, causes the supposed distinction to break down, and *L. neumanni* must be relegated as a synonym to *L. hardeggeri*. The range of scales exclusive of the ventrals has now been ascertained to be from 30 to 47.

15. Eremias guttulata Licht.

1 ♀. Jimil valley.

1 ♀. Abian country east of Aden.

The palpebral disk of these specimens consists of two semitrans-

[1] Ann. & Mag. N. H. (7) ii. 1898, p. 130.

parent plates, of about equal dimensions, as in Egyptian examples of this species. In both the interparietal is directly in contact with the occipital.

Snout to vent.	Tail.	Scales round body including ventrals.	Mesial longitudinal line of ventrals.	Position of subocular between labials.	Femoral pores.
46	73	49	30	L. 4, R. 5	13—13
38	?	56	30	L. 4 & 5 R. 5 & 6	12—13

Recently figured, see 'Symbolæ Physicæ, seu Icones adhuc ineditæ,' of Hemprich & Ehrenberg, Zool. i. Amph. pl. ii. fig. 1.

Scincidæ.

16. Mabuia brevicollis Wiegm.

1. Wadis between Lahej and the mountains.
2. " " " " "
3. ♀. Abian hill-country E. of Aden.
4. Juv. of foregoing specimen.
5. " " "
6. In membranes of foregoing specimen.
7. Abian country.
8. Jimil Valley.

Sex.	Snout to vent.	Tail.	Length of head.	Width of head.	Length of fore limb.	Length of hind limb.	Scales round body.	Ear-lobules.	Relation of anterior loreal to labials.	Position of post-nasal to labials.	Position of nostril to labials.	Axilla to groin.	Shoulder to anterior canthus of eye.
♀.	121	187	27	16	35	49	32	3	L. 1, 2, 3, R. 2 & 3	1	1	58	37
♀.	95	150	20	12	30	41	30	2	2 & 3 2 & 3	1 & 2 1	1	50	31
♀.	122	?	25	16	34	49	32	L. 3, R. 2	2 & 3	1&2 1&2	1	59	35
♂.	38	50	11	7	13	16	32	?	2 & 3	1 & 2	1	16	13
♂.	38	50	11	7	13	16	32	2	2 & 3	1 & 2	1	16	13
♂.	125	170	28	21	36	49	33	3	2 & 3	1 & 2	1	61	37
	48	?	13	8	15	21	32	2 3	2 & 3	1 & 2	1	24	15

This lizard and the specifically identical *Euprepes pyrrhocephalus* Wiegm. have been figured in the recently published work entitled 'Symbolæ Physicæ, seu Icones adhuc ineditæ &c.,' of Hemprich & Ehrenberg, Zool. i. Amph. pl. v. figs. 1 & 2.

The large female, the mother of the young ones, is completely devoid of white spots. The dark longitudinal lines are only feebly indicated, but the small dark brown spots by which they are marked are very distinct. The white lateral band is more or less distinct. The specimen No. 2 has much the same characters, but there are here and there faint traces of white spots. In the large female No. 1 the dark lines and dark brown spots are present, and white spots on the anterior part of the body. In the adult male the general colour is pale brown, each scale having a dark brown margin. A few white spots occur on the sides of the body. The pale lateral band is present, and below it is a broadish dark band extending back from the eye to the hind limb, blackish on the sides of the head and neck, but becoming pale brown behind the axilla. The sides of the body below the band are of a pale livid tint extending on to the throat, which is dark-spotted; white spots on the upper and lower labials.

The young is marked dorsally by two broad, very pale brown bands defined by a mesial and by a very narrow pale whitish band externally. These three lines converge on the base of the tail. There are six longitudinal lines, each consisting of 18 well-defined black spots from the head to the interfemoral region, but beyond that they are prolonged on to the tail. There are two transverse sets of spots to each of the broad brownish areas, and another somewhat more transversely elongated set of black spots along the side on a somewhat pale brownish lateral band from the eye to the hind limb, the sides of the body below it being also black-spotted. The upper surface of the fore limbs is pale brownish with obscure whitish spots, whereas the corresponding aspect of the hind limb is markedly black-and-white spotted. Underparts pure white. The mesial white longitudinal dorsal line disappears in the adult, but the white lateral line of each side is more or less persistent throughout life. In none of the very young which I have examined are white spots associated with the dark spots as occur in some adults. Young lizards with the foregoing coloration correspond to *M. pulchra* Matschie.

In two of the fœtuses the male generative organs are extruded.

17. Scincus hemprichii Wiegm.

1 ♂. Shaikh Othman.

1 ♂. Lahej and south to Shaikh Othman.

This lizard has been recently figured in the part of the 'Symbolæ Physicæ' entitled "Icones adhuc ineditæ &c.," 1899, Zool. i. Amph. pl. iv. figs. 1 & 1 *a*.

The Aden specimen described by me in 1895 differed from the type preserved in the Berlin Museum and from Professor

Bœttger's Aden example of the species in having 24 instead of 22 rows of scales round the body, whereas out of the three specimens now recorded 22 is the prevailing number.

In all of these specimens the frontoparietals and frontal are normal, also the supraorbitals.

Sex.	Snout to vent.	Tail.	Length of head.	Width of head.	Length of fore limb.	Length of hind limb.	Scales round body.	Locality.
♂.	101	48	27	18	29	33	22	Shaikh Othman.
♂.	140	82	42	29	41	44	22	Lahej to south of Shaikh Othman.
♀.	90	58	25	17	26	31	24	,, ,,

18. Chalcides ocellatus Forskål.

1. Wadis between Lahej and the mountains.
1. Wadis below Mount Manif north of Lahej.
1 juv. Abian country.

Snout to vent.	Tail.	Eye to snout.	Fore limb.	Axilla to eye.	Hind limb.	Position of nostril.	Position of postnasal.	Supranasals.	Upper and lower labials.	Labials entering orbit.	Scales round body.
102	107	7	19	21·5	27	over suture of rostral and 1st labial.	1 & 2 labials.	2	R. 8—6 L. 8—7	5	30
124	90	8	20	23	29		1 & 2	2	R. 8—7 L. 8—7	5	30
46	43	4	9·5	11	14·5		1 & 2	2	R. 7—6 L. 8—6	5	30

In both the adults, the broken, more or less oblique or transverse black dorsal bands, the breadth of a scale, are well-defined, each dorsal and lateral scale included in the black band being provided with the usual pure white narrow spot. In the smaller of the two, the black bands with the white spots constitute about 26 transverse dorsal bands, whereas in the larger specimen they are nearly obliterated. In the young there are no black bands, but many of the scales have a white spot margined with blackish, but on the tail there are feebly indicated pale brown dorsal bands with white spots, as in the last mentioned adult. The coloration of these lizards thus conforms to that distinctive of the typical form of this species.

The largest of the two adults is four millimetres longer than the largest male yet recorded by me[1].

[Not uncommon in desert between Lahej and Shaikh Othman: only obtained at night by going out with a lantern and looking for tracks in sand and by throwing the sand aside which indicated where the animals had gone down, until they were thrown or had come out again. *Chalcides ocellatus* was very common in and around Lahej, and in fact everywhere we went.—*A. B. P.*]

RHIPTOGLOSSA.

Chamæleontidæ.

19. Chamæleon calcarifer Peters.

1 ♂. Lahej.
2 ♂. Shaikh Othman.
1 juv. ♀. Abian country.

Sex.	Snout to end of casque.	Angle of mouth to summit of casque.	Snout to vent.	Vent to tip of tail.
♂	74	54	230	265
♂	71	50	195	220
♂	39	26	108	122
♀	25	17	74	80

In the adult and semiadult the anterior border of the casque is nearly straight, whereas in the other two much younger specimens it is decidedly concave in its curvature. The occipital lobes of the second specimen are somewhat more developed relatively than in the adult.

OPHIDIA.

Colubridæ.

20. Zamenis rhodorhachis Jan.

1. Abian country.

	Snout to vent.	Tail.	V.	A.	C.	Scales.	Upper labials.	Labials entering eye.
♀ ...	655	245	221	1/1	131	19	9+9	5 & 6.

This snake is of a uniform greyish-blue or slate-colour along two-thirds of the length of the trunk, whereas in the latter third and on the upper surface of the tail it passes into purplish brown.

[1] Herpet. Arabia, 1896, p. 50; Zool. of Egypt, Rept. & Batr. 1898 p. 219.

On the neck there is a narrow interrupted blackish mesial line, becoming more marked as it is traced backwards, and so broad at the anterior fourth as to cover the greater part of the back, ultimately extending over the whole of the dorsal surface and producing the purplish-brown colour already referred to. Externally to the dark area, about the middle of the body, there are a few black scales on the sides and on the angles of the ventrals. The upper surface of the head olive-greyish. Upper lips pale greyish-yellow. Under surface of neck anteriorly yellowish, passing into dusky, which is the general colour of the ventrals, which have darker borders, whereas the under surface of the terminal fourth of the body is dark purplish-brown.

It recalls in its coloration the snake from Ogaden in Somaliland described by Boettger[1] under the name of *Z. ladacensis* var. *subnigra*, but differs from it in some details, but of such little importance that the type of coloration first indicated by Boettger may be said to be common to individuals of *Z. rhodorhachis* from both sides of the Red Sea in the latitude of Aden.

The type of Boettger's var. *subnigra* had ventrals 213, anals 1/1, caudals 118, and scales 19.

21. Tarbophis guentheri Anderson.

1 ♀. Abian country.

Snout to vent.	Tail.	V.	A.	C.	Scales.	Upper labials.	Labials entering eye.
650	125	229	1	65	21	9+9	3, 4, & 5

Number of dark dorsal spots.	Præocular.	Relation of præocular to frontal.	Post-oculars.	Temporals.
Ill-defined, not sufficiently distinct to be counted.	1	In contact.	2	R. 2+3. L. 2+4.

The coloration of this specimen resembles that of the specimen already recorded from Lahej. The undivided anal, the number of the scales round the body being less than 23, and the arrangement of the labials entering the orbit, are all characters distinctive of this form, which, however, is very closely allied to *T. obtusus* Reuss.

22. Cœlopeltis moilensis Reuss.

1 ♀. Abian country.

Snout to vent.	Tail.	V.	A.	C.	Scales.	Upper labials.	Labials entering eye.
495	135	167	1/1	69	17	8	4 & 5

Præoculars.	Relation of præocular and frontal.	Post-oculars.	Temporals.	Nasal.	Loreal.
1	Widely separated.	2 + 2	2+3	1	1

[1] Zool. Anz. 1893, p. 118.

This species was first recorded from Arabia by Rüppell. In 1895 it was met with for the first time at Aden by Col. Yerbury [1], and in 1896 Bent brought it back with him from the Hadramut. In the smallness of the dark spots the present example corresponds to the Egyptian snakes. Those from Suakin are distinguished by large black spots and more vivid colouring.

23. Psammophis schokari Forskål.

1. Abian country.

Snout to vent.	Tail.	Ventrals.	Anals.	Caudals.	Scales.
228	155	181	1/1	154	17

Upper labials.	Labials entering eye.	Relation of præocular to frontal.	Temporals in contact with postoculars.	Number of nasals.
9	5 & 6	Broadly in contact.	2	2

A dusky band from the nostril through the eye to the temporal region. Upper parts pale greyish, under surface white, but with a minute black spot generally present in the angle of each ventral. The lineated form of this snake also occurs in the Aden district. 154 caudals is the highest number yet recorded in Arabia, in which the individuals of this species are distinguished from those found in Africa by the more numerous caudals.

Viperidæ.

24. Cerastes cornutus Hasselq.

1 ♀. Abian country.

Snout to vent.	Tail.	V.	A.	C.	Sc.	Upper labials.	Scales between labials and eye.	Horns.
335	42	139	1	37	28	L. 13, R. 12	5	None.

The two extremes, or nearly so, of the range of variation in the ventrals are met with in South-east Arabia, as this individual possesses 139 ventrals, whereas in the Hadramut the highest number of ventrals (164) hitherto recorded of the species is met with. An Aden specimen obtained by Colonel Yerbury in 1895 had as many as 159 ventrals.

25. Echis carinatus Schneider.

1 ♀. Lahej.

Snout to vent.	Tail.	Ventrals.	Anal.	Caudals.	Scales.
610	52	167	1	27	29

Nasals.	Nasals and supranasals.	Scales round eye.	Upper labials.
2	In contact with rostral. Left supranasal excluded.	L. 19. R. 21.	L. 12. R. 11.

[1] Proc. Zool. Soc. 1895, p. 656; Herpet. of Arabia, p. 52.

Hitherto the specimens from South-east Arabia have had never less than 30 subcaudals.

BATRACHIA.

1. Rana cyanophlyctis Schneider.

1 ♂. Abian country.

2. Bufo andersoni Blgr.

1. Shaikh Othman.

3. Bufo pentoni Anderson.

3. Wadis below Mount Manif north of Lahej.
2. Abian country.

EXPLANATION OF THE PLATES.

Plate XIV.

Fig. 1.	*Bunopus spatalurus*, p. 137.	
1*a*.	Upper view of head.	× 2.
1*b*.	Side ,, ,,	,,
1*c*.	Lower ,, ,,	,,
2.	*Agamodon arabicus*, p. 140.	
2*a*.	Upper view of head.	× 3.
2*b*.	Side ,, ,,	,,
2*c*.	Lower ,, ,,	,,

Plate XV.

Uromastix (*Aporoscelis*) *benti*, p. 139. $\frac{2}{3}$.

6. Description of a new Fish of the Genus *Gobius* obtained by Mr. A. Blayney Percival in South Arabia. By G. A. Boulenger, F.R.S.

[Received May 14, 1901.]

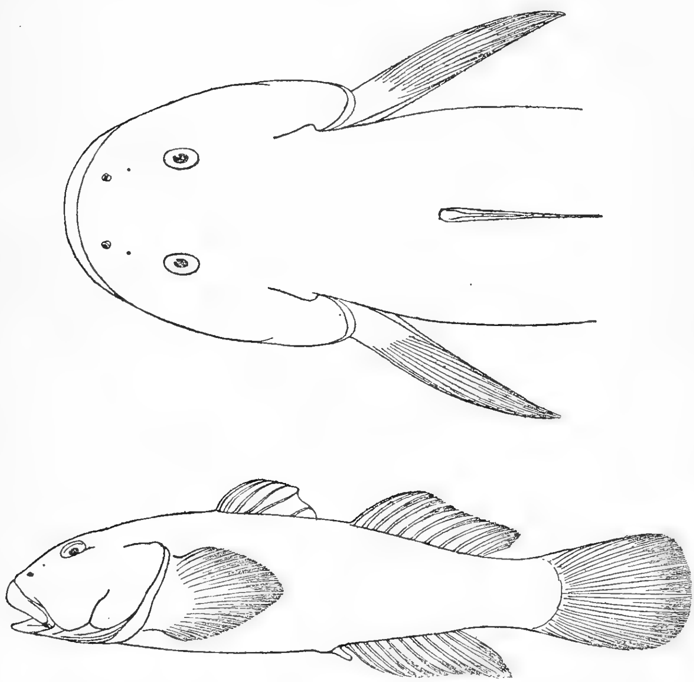
(Text-figure 9.)

The collection made by Mr. Percival, the Mammals, Birds, and Reptiles of which have been reported upon by Mr. O. Thomas, Mr. W. R. O. Grant, and the late Dr. Anderson, contained examples of only two species of Fishes, viz., the widely distributed Cyprinid *Discognathus lamta*, and a fine Goby which I propose to name

Gobius percivali, sp. n. (Text-fig. 9, p. 153.)

No canine teeth. Depth of body 4 times in total length, length of head $3\frac{1}{2}$ times. Head slightly longer than broad; diameter of eye $6\frac{1}{2}$ times in length of head, twice in interocular width; snout slightly shorter than postocular part of head; upper jaw extending somewhat beyond the lower; maxillary not extending to below anterior border of eye. First dorsal with 6 rays, the length of which is $\frac{2}{5}$ that of head; its base $\frac{3}{5}$ length of head; its distance from the eye nearly equal to that between the end of the snout and the border of the præoperculum. Second dorsal with 11 rays, $1\frac{1}{2}$ as long as and slightly deeper than the first. Anal as much

Text-fig. 9.



Gobius percivali.

developed as the second dorsal, with 11 rays. No silk-like filaments to the pectoral. The extremity of the ventral halfway between its base and the vent. Caudal rounded. Caudal peduncle slightly longer than deep. 60 scales in a longitudinal series, 28 in a transverse series. Pale olive-brown above, white beneath; dorsal and caudal fins with numerous dark dots.

Total length 165 millim.

A single specimen from a Wadi (= stream) near Lahej, coming down from the hills in the interior.

This *Gobius*, which I have much pleasure in naming after Mr. Percival, is closely allied to another large Arabian species, described by me from specimens obtained at Muscat by Dr. Jayakar, *G. jayakari* (P. Z. S. 1887, p. 663, pl. liv. fig. 2). It differs from *G. jayakari* in the shorter mouth, not extending to below the eye, in the broader interocular region, and in the shorter caudal peduncle.

June 4, 1901.

Dr. W. T. Blanford, F.R.S., Vice-President, in the Chair.

The following papers were read :—

1. Notes on the Type Specimen of *Rhinoceros lasiotis* Sclater; with Remarks on the Generic Position of the Living Species of Rhinoceros. By Oldfield Thomas.

[Received May 7, 1901.]

On August 31st, 1900, there died in the Gardens of the Society the famous female Rhinoceros from Chittagong which has so often been referred to in our 'Proceedings,' and the characters of which it is only fitting should be here noted, now that its skull and head-skin have passed into the possession of the National Museum.

As the animal was captured in January 1868, its age at death was more than 32 years.

The first reference to this specimen is an account of its external characters given by the late Dr. Anderson, the Superintendent of the Calcutta Museum (P. Z. S. 1872, p. 129). Then followed (*t. c.* p. 185) an announcement of its purchase for £1250. In March of the same year (*t. c.* p. 493, pl. xxiii.) our Secretary gave the history of the specimen's capture, and a figure of it, and in a footnote assigned to it the name of *R. lasiotis*, given after comparison with a Malaccan example of *R. sumatrensis* which arrived in August. In November (*t. c.* p. 790) he gave his full reasons for separating the two forms, accompanied by figures of the heads, and of the Malaccan specimen.

Dr. Gray, however (Ann. Mag. N. H. (4) x. p. 207, 1872), with a total disregard to the geography of the question, considered that it was the Chittagong animal that was the true *R. sumatrensis*, assigning the Malaccan animal first to his *R. crossii* (P. Z. S. 1854, p. 250) and afterwards (Ann. Mag. N. H. (4) xi. p. 357, 1873) giving it the special name of *Ceratorhinus niger* (nec *Rhinoceros niger*, Schinz, Syn. Mamm. ii. p. 335, 1845).

In the latter paper Gray, perceiving (as I think rightly) that the skulls figured in Blyth's valuable paper of 1863, quoted below, belonged to different forms, gave the name of *Ceratorhinus blythii* to some of them, but so worded his remarks that it is not easy to make out to which he applied the name. This point is, however, of but little importance, as the term *blythii* is antedated by names covering all the forms figured.

Other references bearing on the subject are as follows:—

Sclater, Ann. Mag. N. H. (4) x. p. 298 (1872).

Blyth, *t. c.* p. 399; also J. A. S. B. xxxi. p. 151 (1863), and xliv. Burmese Appx. p. 51 (1875).

Flower, P. Z. S. 1876, p. 443, and 1878, p. 634.

As might have been expected, after so many years in confinement, the animal had become very much diseased, and after its death it was found that the skull and the head-skin were alone worth preservation, and it is on these that my observations have been taken.

For comparison I have had before me 13 skulls belonging to the group of *R. sumatrensis*, four of them having been kindly lent me by Prof. Stewart from the College of Surgeons collection (Nos. 2142, 2143, 2145, and 2146 of the 1884 Catalogue), and the others being those belonging to the British Museum.

In the first place, with regard to the external characters of colour and hair development, a comparison of the head-skin of *R. lasiotis* with the two specimens in the Museum of "*Ceratorhinus niger*" leads me to the conclusion that the differences described were mainly due to age. For it will be remembered that the "*C. niger*" (that is to say the specimen determined by Sclater as *sumatrensis* and used by him for his comparison with *lasiotis*) was very old, while the type of *lasiotis* was then quite young. In its old age the latter has become practically quite like the former, for the tufts on the ears do not exceed $1\frac{1}{2}$–2 inches in length, and are in no way noticeably different from those of the Malaccan specimen. In fact Dr. Anderson's supposition (P. Z. S. 1872, p. 130) that the tufts on the ears might wear off with age, seems to me entirely confirmed by the evidence, so far as can be judged from a menagerie specimen.

Nor is there in colour any difference worthy of note, that described by Sclater having apparently disappeared with advancing age.

Turning to the skull, we find that in size the type of *R. lasiotis* surpasses all the other thirteen skulls examined, but differs in no other tangible character, so that the question of the validity of *R. lasiotis* as a special form seems to depend purely on the matter of size. The following are its measurements, given in inches for comparison with those published by Sir W. Flower in 1878:—

Length from occipital crest to end of nasals, in straight line $23\frac{5}{8}$, with tape over curve of nasals 24·5; greatest zygomatic breadth

$12\frac{7}{8}$; interorbital breadth 8. [Teeth and palate too much diseased for measurement.]

From these measurements it appears that *R. lasiotis* exceeds considerably the equally aged skull of "*C. niger*" (Flower's No. 2) from Malacca, and is only approached by No. 5 (R. C. S. No. 2142), said to be from Sumatra.

Allowing for its much more youthful condition, the latter skull is practically of the same size as the Chittagong one, and therefore, if it really came from Sumatra, disposes at once of the claim of *R. lasiotis* to distinction on the ground of size.

But I am not satisfied about the question of locality, for Sir Stamford Raffles, as a collector of Natural History objects, and a great Governor and Administrator, might easily have had brought to him a skull from any part of the East Indies; so that, merely on the evidence of this skull only, I do not like to dismiss the claims of *R. lasiotis* to distinction, since such dismissal would carry with it the assumption, otherwise unsupported, that the skulls of the Sumatran Rhinoceros vary in size to so considerable an extent.

The Pegu skull (Theobald, B.M. No. 68.4.15.1, Flower's No. 4) is intermediate in size, as in locality; while all the Malaccan and other Sumatran skulls are comparatively small, as are those from Borneo.

For the time being therefore, on the assumption that the Raffles skull referred to was not really from Sumatra, I should consider *R. lasiotis* as a tenable northern subspecies of *R. sumatrensis*, characterized mainly by its greater size. As noted by Flower in the case of the Pegu skull, and borne out by that from Chittagong, the post-glenoid processes appear to be longer in proportion than in the Malaccan and Sumatran Rhinoceros.

Of course it follows, from the tentative nature of this conclusion, that further material is badly wanted, both from the North, to see if the form found there is constantly larger, and from Sumatra, to see if any such skull as R. C. S. No. 2142 may really occur there.

Further material may also prove that the typical horn of Gray's "*Rhinoceros crossii*" belongs to the northern subspecies, in which case the name *crossii* will have to supersede *lasiotis*. But this identification is as yet too doubtful to be definitely accepted.

Now with regard to the general question of the nomenclature of Rhinoceroses and the genera in which the recent species should be placed, I would draw attention to the recent important paper by Prof. Osborn on the "Phylogeny of the Rhinoceroses of Europe" [1].

[1] Bull. Amer. Mus. N. H. xiii. p. 229 (1900). I should demur to the characterization of *R. bicornis* as a *dolichocephalic* form, for its short stumpy head is one of its most marked distinctions from its long-headed congener *R. simus*, but in all other respects Prof. Osborn's conclusions seem justified. In conjunction with Mr. Lydekker, I have compared the fine skull in the Museum of *R. platyrhinus*, hitherto usually considered related to the *simus* group, and after careful consideration we have come to the conclusion advocated by Osborn, that, in spite of its tooth characters, it is really most nearly allied to the *sumatrensis* group.

In this paper no less than six groups of the family are recognized, distinguished mainly by the characters of the skull, those of the teeth being considered to be of less phylogenetic value. Of these six groups, which are treated by the author as subfamilies, three are still existent, the "Ceratorhinæ" (*sumatrensis*), the "Atelodinæ" (*simus* and *bicornis*), and the "Rhinocerotinæ" (*unicornis* and *sondaicus*), groups which were also recognized by Flower as genera in his paper of 1876.

Now if there is to be any sort of uniformity in the value of genera as recognized among Mammals, it appears to me impossible to continue to include such essentially different animals in one genus *Rhinoceros*. Flower came to this conclusion in 1876, although he did not carry it out in his later works; and now that Osborn arrives at a like opinion from the palæontological side, I venture to think the generic groups should be accepted for ordinary use.

But in so doing it would be advisable to start with the names for them which have technical priority, so that no name-changing may hereafter become necessary. Both *Atelodus* and *Ceratorhinus*, used by Flower and Osborn, are antedated by earlier names, as the following synonymy will show:—

I. Rhinoceros.

	Type.
Rhinoceros, Linn. Syst. Nat. (10) i. p. 56 (1758)..	*R. unicornis.*
Eurhinoceros, Gray, P. Z. S. 1867, p. 1009......	*R. unicornis.*

One-horned. Occipital plane much slanted forward. Meatus closed in below by the junction of the post-tympanic and post-glenoid processes. Functional incisors present above, and canines below.

1. *Rhinoceros unicornis* L.

2. *R. sondaicus* Desm. Mamm. ii. p. 399 (1822).

II. Dicerorhinus.

	Type.
Dicerorhinus, Gloger, Naturg. p. 125 (1841) ..	*D. sumatrensis.*
Ceratorhinus, Gray, P. Z. S. 1867, p. 1021....	*D. sumatrensis.*

Two-horned. An open groove below the meatus. Incisors and canines as in *Rhinoceros*.

1. *Dicerorhinus sumatrensis* G. Cuv.

1*a*. *D. sumatrensis lasiotis* Sclater.

III. Diceros.

	Type.
Diceros, Gray, Med. Repos. xv. p. 306 (1821)..	*D. bicornis.*
Cœlodonta, Bronn, Jahrb. Min. Geol. 1831, p. 51	*D. antiquitatis.*
Opsiceros, Gloger, Naturg. p. 125 (1841)	*D. bicornis.*

	Type.
Atelodus, Pomel, Ann. Sci. Auvergne, xxvi. p. 114 (1853)	*D. bicornis.*
Rhinaster, Gerrard, Cat. Bones Mamm. B. M. p. 282 (1862)	*D. bicornis.*
Keitloa, Gray, *t. c.* p. 1025	*D. bicornis.*
Ceratotherium, id. *t. c.* p. 1027..............	*D. simus.*

Two-horned. Occipital plane slanted backward. Auditory region as in *Dicerorhinus*. Incisors and canines rudimentary or absent.

1. *D. bicornis* Linn.

2. *D. simus* Burch.

Should *D. simus*, on the ground of its much longer skull and the different structure of its molars, be separated generically or subgenerically from *D. bicornis*, it and its fossil allies would have to bear the name of *Cœlodonta*, Bronn.

These conclusions are practically identical with those to which Sir W. Flower came in his classical paper on the craniology of the group (P. Z. S. 1876, p. 443), but unfortunately his study of the nomenclature did not carry him back to the names now shown to have priority.

2. On a small Collection of Fishes from Lake Victoria made by order of Sir H. H. Johnston, K.C.B. By G. A. Boulenger, F.R.S.

[Received May 21, 1901.]

The Fishes which have reached the Natural History Museum from the Victoria Nyanza through Sir H. H. Johnston are referable to seven species only, four of which were previously unrepresented in the National Collection, two being besides new to science.

1. Protopterus æthiopicus Heck.

Three specimens, two adult measuring 1 m. 35 and 1 m. 10, and a young one measuring 160 millim. The latter was taken from the crop of a *Balœniceps*.

In the adult specimens the length of the head is contained $4\frac{2}{3}$ times in the length from snout to vent, the diameter of the eye is 15 or 20 times in the length of the head and $4\frac{1}{2}$ or $5\frac{1}{2}$ times in the interocular width; dorsal fin originating nearer the vent than the head; pectoral fin twice length of head, ventral fin $1\frac{3}{5}$; vent sinistral; 65 scales in a longitudinal series to above vent, 44 or 50 round middle of body; no traces of external gills. The scales show very distinctly the punctulations of *ganoine* already noticed by Kölliker.

In the young the length of the head is 4 times in the length from snout to vent, the diameter of the eye 8 times in the length of the head and twice in the interocular width; dorsal fin originating a little nearer the vent than the head; pectoral fin $2\frac{1}{2}$ length of head, ventral fin $1\frac{2}{3}$; vent dextral; about 65 scales in a longitudinal series to above vent and 40 round middle of body; no traces of external gills.

2. MORMYRUS KANNUME Forsk.

3. LABEO VICTORIANUS, sp. n.

Body compressed, its depth equal to length of head and contained $4\frac{1}{2}$ to $4\frac{2}{3}$ times in total length. Head $1\frac{1}{2}$ as long as broad; snout rounded, strongly projecting beyond the mouth, with small horny warts; eye perfectly lateral, in the middle or a little anterior to the middle of the head, its diameter 6 to $6\frac{1}{2}$ times in length of head, 3 to $3\frac{1}{2}$ times in width of interorbital region, which is slightly convex; width of mouth, with lips, not much more than half greatest width of head, $2\frac{1}{2}$ to $2\frac{3}{4}$ times in length of head; rostral flap and anterior border of lip not denticulated; posterior border of lip very indistinctly denticulated; inner surface of lip with numerous transverse plicæ, formed of closely-set obtuse papillæ; a minute barbel, hidden in the folds at the side of the mouth. Dorsal III 9–10, with notched upper border; the longest ray equals the length of head; fin equally distant from the end of the snout and the root of the caudal. Anal II 5; longest ray about $\frac{2}{3}$ length of head. Pectoral subfalciform, as long as head, not reaching base of ventral. Ventral not reaching vent, its first ray falling under the seventh (fourth branched) ray of the dorsal. Caudal deeply forked, with pointed lobes. Caudal peduncle about $1\frac{1}{2}$ as long as deep. Scales 38–39 $\frac{6\frac{1}{2}}{7\frac{1}{2}\text{–}8\frac{1}{2}}$; 4 or 5 series of scales between the lateral line and the root of the ventral. Olive above, whitish beneath; fins greyish.

Total length 285 millim.

Three specimens.

L. victorianus stands nearest to *L. forskalii*, from which the more perfectly lateral eyes and the smaller mouth easily distinguish it.

4. DISCOGNATHUS JOHNSTONI, sp. n.

Depth of body equal to length of head, 5 times in total length. Head moderately depressed, with nearly flat interorbital region; eye supero-lateral, in the second half of the head, its diameter $4\frac{1}{2}$ times in length of head, twice in interorbital width; two very short barbels on each side; width of mouth $\frac{1}{2}$ length of head; upper lip moderately developed, lower large, semicircular; no denticulate fringe to the lips. Dorsal II 7, equally distant from the nostrils and from the root of the caudal; first branched ray longest, $\frac{2}{3}$ length of head. Anal II 5; first branched ray longest, $\frac{3}{5}$ length of head. Pectoral $\frac{3}{4}$ length of head, widely separated from the ventral, which is situated below the posterior half of the dorsal. Caudal a little shorter than head, with deep crescentic emargination. Caudal peduncle $1\frac{1}{4}$ as long as deep. Scales 38 $\frac{5\frac{1}{2}}{7\frac{1}{2}}$; 4 series between lateral line and root of ventral. Upper parts and fins blackish olive; lips, gular and pectoral regions yellowish white, belly brown.

Total length 110 millim.

A single specimen.

In its very minute barbels, this species is intermediate between *D. lamta* and allies, in which they are well developed, and *D. imberbis*, in which they are altogether absent. A species from Syria, Transcaspia, the Tigris, and Persia, *D. variabilis* Heckel, to which I refer specimens from Kushk and the Helmand[1], agrees in the very small size of the posterior barbels, but differs in the total absence of the anterior and also in the more backward position of the dorsal, which is equally distant from the occiput and the root of the caudal, the position of the eyes, which are nearly perfectly lateral and occupy the middle of the length of the head, and the longer caudal fin. The scales number 33 to 37 in the lateral line, 4 or 5 between the latter and the ventral fin.

In the Abyssinian and Erythrean specimens which have been previously referred to *D. lamta*[2], and for which I propose the name *D. blanfordi*, the barbels are much longer, as in *D. lamta*, the eye is perfectly lateral and a little anterior to the middle of the head, the interorbital width is more than half the length of the head, the dorsal is equally distant from the eye and the root of the caudal, or a little nearer the latter, which is longer than the head, the scales number 33–35 $\frac{5\frac{1}{2}}{6\frac{1}{2}}$, 3 or 4 between the lateral line and ventral fin.

A third African species has been described by Vinciguerra[3] from Shoan specimens, under the name of *D. chiarinii*. It has two pairs of well-developed barbels, a larger eye (its diameter contained only $3\frac{1}{2}$ times in the length of the head), a little anterior to the middle of the head, and smaller scales (L. lat. 42).

I have recently received from Mr. Loat several small specimens, measuring from 38 to 45 millim., obtained on the Nile in a pond in the cataract country about 3 miles north of Kermeh, which approach *D. chiarinii* in the size of the eye ($3\frac{1}{2}$ diameters in length of head), the length and number of the barbels, and the position of the dorsal, but which may be distinguished from it by the larger scales, numbering 37 or 38 in the lateral line and 3 between the latter and the ventral. For this new species I propose the name *D. vinciguerræ*.

[1] Recorded by Günther, Tr. Linn. Soc. (2) v. 1889, p. 107, under the name of *D. lamta*. Recently described as *D. rossicus* by Nikolski, Ann. Mus. St. Petersb. v. 1900, p. 239.

[2] Blanford, Zool. Abyss. p. 460; Vinciguerra, Ann. Mus. Genova, xviii. 1883, p. 695, fig.

[3] *L. c.* p. 696, fig.

5. CLARIAS LAZERA C. et V.

6. SYNODONTIS AFRO-FISCHERI Hilgend.

Hilgendorf, Sitzb. Ges. nat. Fr. Berl. 1888, p. 77; Pfeffer, Thierw. O.-Afr., Fische, p. 37 (1896).

The following description is taken from the single specimen sent by Sir Harry Johnston:—

Body compressed, its depth equal to the length of the head and contained $3\frac{2}{3}$ times in the total length. Head little longer than broad, granulate above, the granulate area extending on the snout to half-way between nostrils and eyes; frontal fontanelle large; snout rounded, a little shorter than postocular part of head; interorbital region slightly convex, its width half length of head; eye supero-lateral, its diameter 5 times in length of head, twice in interorbital width; occipital region neither keeled nor tectiform, simply convex. Lips moderately developed; maxillary barbel simple, a little longer than the head, extending to anterior third of pectoral spine; mandibular barbels inserted on a straight transverse line, the outer $\frac{2}{3}$ length of head and with slender simple branches, the inner $\frac{1}{2}$ length of head and with shorter but ramified branches. Præmaxillary teeth small and numerous, forming a broad band; anterior mandibular teeth small, curved, $\frac{2}{5}$ the diameter of the eye, 44 in number. Gill-cleft not extending inferiorly beyond the base of the pectoral fin. Nuchal shield convex, not keeled, rugose and pitted, $1\frac{1}{2}$ as long as broad, ending in two sharp points, which extend a little beyond the base of the dorsal spine. Humeral process covered with granular asperities, about $1\frac{1}{2}$ as long as broad, sharply pointed, not extending quite so far back as the occipito-nuchal shield. Skin villose on the sides of the anterior part of the body. Dorsal I 7; spine strong, $1\frac{2}{3}$ as long as the base of the fin, nearly as long as head, striated and armed behind with 11 retrorse serræ. Adipose dorsal $3\frac{1}{2}$ times as long as deep, $1\frac{1}{3}$ as long as its distance from the rayed dorsal, $\frac{3}{4}$ the length of the head. Anal III 8. Pectoral spine very strong, as long as that of the dorsal, striated, with 31 to 33 strong teeth on the anterior border and 11 much stronger still and retrorse on the posterior border. Ventral not reaching anal. Caudal very deeply notched, crescentic. Dark brown above and beneath, with some lighter, yellowish-brown marblings; fins dark grey, with transverse series of blackish spots having a tendency to form cross-bars.

Total length 135 millim.

7. PARATILAPIA SERRANUS.

Hemichromis serranus, Pfeffer, Thierw. O.-Afr., Fische, p. 23 (1896).

Paratilapia serranus, Bouleng. Proc. Zool. Soc. 1898, p. 143.

Adult specimens, measuring 125 millim., agree well with Pfeffer's description, drawn up from an example obtained by Stuhlmann at Bukoba, a German station of L. Victoria at about

1° 21′ S. lat, except for the depth of the body, which is $4\frac{1}{2}$ to $4\frac{2}{3}$ times in the total length, the maxillary not extending quite to below the anterior border of the eye, the diameter of which is $4\frac{1}{2}$ times in the length of the head. 9 gill-rakers on lower part of anterior arch. D. XV–XVI 9; A. III 8–9; Sq. 30–32 $\frac{4-5}{12-13}$; Lat. l. 20–21/13–14. 6 or 7 scales between the first dorsal spine and the lateral line.

Smaller specimens (85–95 millim.) differ in the smaller head, the larger eye ($3\frac{1}{2}$–4 times in length of head), and the lower jaw not projecting beyond the upper. The dark longitudinal bands are very indistinct and are traversed by 7 or 8 ill-defined dark cross-bars.

In all the specimens the ventral fins are of a bright yellow.

3. On the Structure and Affinities of *Udenodon*. By R. Broom, M.D., B.Sc.[1]

[Received May 21, 1901.]

(Plates XVI.–XVIII.)[2]

(Text-figures 10 & 11.)

A considerable number of skulls of *Udenodon* and of the closely allied genus *Dicynodon* have long been known, and there have also been found many other bones of the skeletons; but as in almost all the specimens the association of the skull and other bones has been quite lost, it is at present impossible to refer limb-bones to their proper species of which the skulls are the types, and it is only with some doubt that they can be referred even to their proper genera. In a few cases some bones of the skeleton have been found in association with *Dicynodon*-skulls, but in the case of *Udenodon* the post-cranial skeleton is quite unknown.

The most important specimen in which the Dicynodont skull is in association with a considerable portion of this is the little form which has been described by Seeley (**1**) as "*Keirognathus cordylus*." In this specimen the skull, upper vertebræ and ribs, front limbs, shoulder-girdle, and sternum are shown, but all in a very bad state of preservation. There is scarcely a doubt that the skeleton is that of a young *Dicynodon*, and it is specially valuable as showing the relations of the shoulder-girdle, sternum, and interclavicle. Seeley's restoration is unsatisfactory.

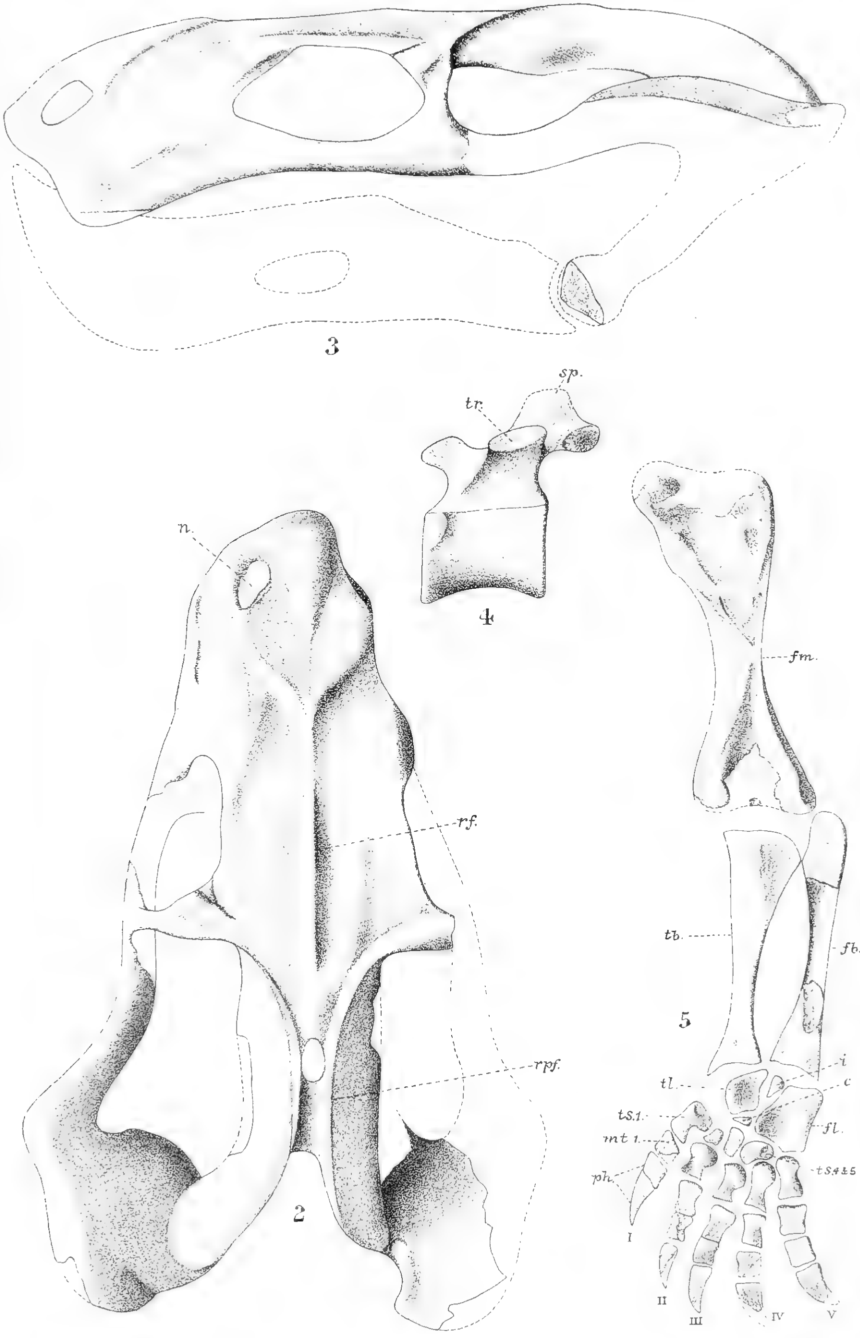
In the Lower Karroo beds of Pearston, S. Africa, while the remains of various species of *Dicynodon* are met with, the genus which most commonly occurs is *Udenodon* and from the specimens which I have recently discovered I am now in a position to give an almost complete account of its skeleton.

[1] Communicated by Prof. G. B. Howes, LL.D., F.R.S., F.Z.S.
[2] For an explanation of the Plates, see p. 190.

R.B del.
M P. Parker lith.

Parker & West imp.

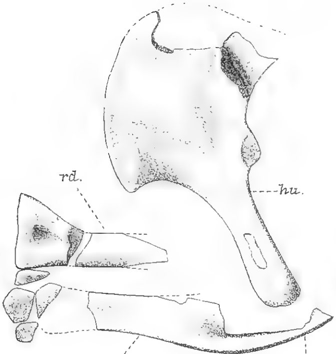
SKELETON OF UDENODON GRACILIS.



R B del
M P Parker lith

Parker & West imp.

SKULL, VERTEBRA, & HIND LIMB OF UDENODON.



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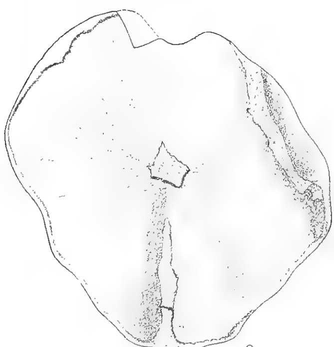

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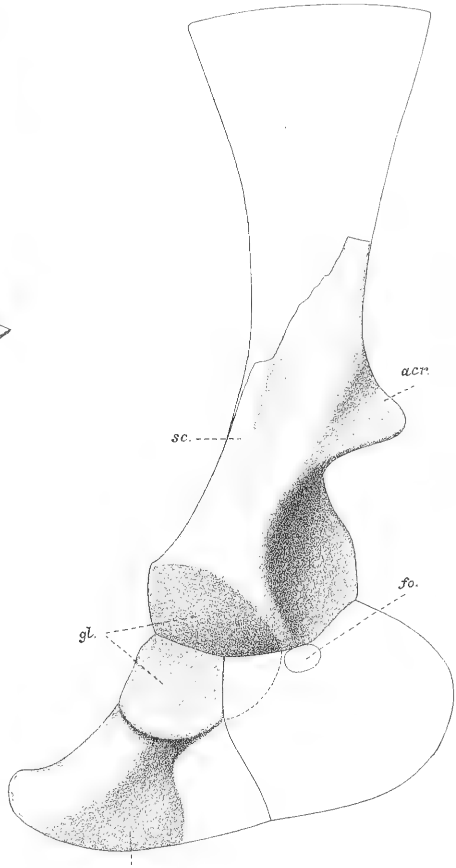

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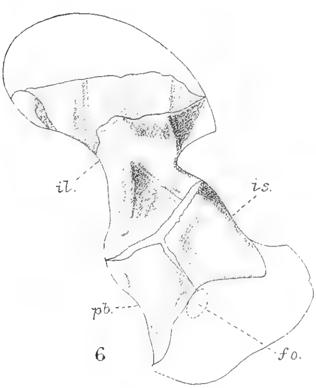

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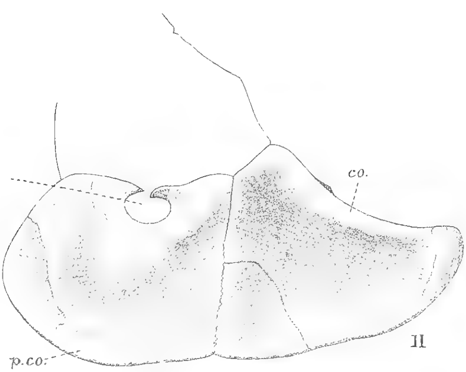


11

R.B del.
M.P. Parker lith.

Parker & West imp.

LIMB-BONES & STERNUM OF UDENODON.

When an endeavour is made to classify the specimens found, one is beset with a number of difficulties. Almost every specimen exhibits some degree of crushing; and when two skulls of the same species have been crushed in different directions, the appearances would readily make one believe that he was dealing with two species. One skull of *Udenodon baini* in my possession has the maxilla of one side so crushed as to give an appearance very like that in the specimen described by Owen (2) as "*Udenodon strigiceps.*" Another difficulty is due to our ignorance of the extent to which differences in specimens may be due to the sex and age. The identification of any specimen therefore must in the meantime be subject to some doubt.

The following is a list of the specimens which I have found and on which my researches are based:—

1. An almost complete skull of a small form, which I regard as new, and for which I propose the name of *Udenodon gracilis* (Pl. XVII. figs. 2 & 3).
2. An almost perfect skeleton of apparently the same species. The skull unfortunately has been so much weathered that it is impossible to decide the species with certainty (Pl. XVI.).
3. A lower jaw of possibly the same species.
4. A fairly good skeleton of *Udenodon baini*.
5. A second very imperfect skeleton of presumably the same species, but with the head missing.
6. A moderately complete skull of *Udenodon baini*, but much crushed on one side.
7. A second imperfect and much crushed skull of the same species.
8. A third imperfect skull, also probably of *U. baini*.
9. A moderately complete but somewhat crushed skull of a young animal, probably *U. megalops*. From a much higher stratum than the other specimens.
10. An imperfect skull of a young animal, apparantly *U. greyi*.
11. The posterior portion of a skull referred to *Udenodon*, but possibly belonging to a *Dicynodon*.
12. The mandible and front part of snout of a small *Udenodon*.
13. Imperfect middle region of a small *Udenodon*-skull.
14. A number of detached portions of mandibles, maxillæ, humeri, vertebræ, and other bones referred to *Udenodon*.

Of these specimens all have been discovered in the neighbourhood of Pearston, S. Africa, with the exception of specimen 10, which is from the Bedford district and was kindly presented to me by Mr. D. D. Frazer, Junr.

Before beginning an account of the general structure of *Udenodon*, I think it will be well to give a brief description of specimens 1 and 2.

The small skull which I take as the type of *Udenodon gracilis* (Pl. XVII. fig. 2) is somewhat crushed on the right side, and on the same side the temporal arch and the lower jaw are missing, but otherwise the skull is almost perfect. The skull is more elongated than is usual in *Udenodon*, and differs from most species in having the interorbital region very considerably wider than the parietal region. The eyes are moderately small and directed more outwards than upwards. The nostrils (*n.*) are placed far forwards and rather small. The nasal bones are prominent immediately behind the nostrils. The caniniform ridges are flat and slender and directed well forwards. The suborbital arch is moderately round and rather feeble. The frontal region is broad and moderately flat, and is characterized by a rather prominent median ridge (*r.f.*). Posteriorly, the frontals are considerably wider than in front. The postfrontals, where they join the frontals are flat and broad and to a considerable extent roof over the orbits. Externally they are rather slender. A distinct ridge runs from the posterior border of the postorbital portion of the postfrontal bone inwards, then backwards along the posterior part of the postfrontal. The parietal region is about two-thirds the width of the frontal region, and is characterized by the presence of two well-marked postfrontal ridges (*r.p.f.*), with an intervening depressed parietal portion. The squamosals are large, and the anterior portions which form the temporal arches are developed considerably, horizontally outwards.

The second specimen (Pl. XVI. fig. 1) referred to is an almost perfect skeleton of a small *Udenodon*, and it is especially valuable in that the bones are scarcely at all displaced. The specimen was found in an impure and fairly hard shale. The skull had evidently been long exposed, and is so badly weathered that very little now remains of the bones of the upper side of the head. The postorbital arches are quite lost, though evidences of their positions are given by the underlying matrix. The squamosal, so far as it is displayed, agrees very closely with that in *Udenodon gracilis*, and nothing in the other parts of the head seems to oppose this determination.

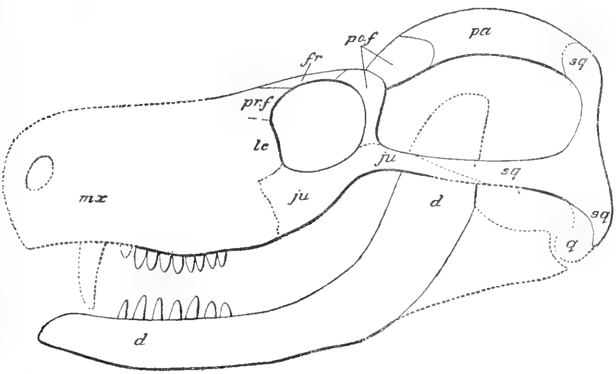
When the slab in which the skeleton lay was split, it was found that this had been so arranged that the remains were almost equally divided between the two sides. In the larger of the two portions, which may be looked upon as the main slab, are preserved the almost perfect left fore-limb, the impressions of a number of vertebræ, a large number of ribs and impressions of ribs, the sacrum and caudal region, the left ilium (*il.*), and the left hind-limb, which unfortunately is twisted and has not been fully displayed, and the right ischium (*is.*) and pubis (*pb.*). In the counterpart slab is seen the head, the right fore-limb, almost all the vertebræ and ribs, and the right ilium with the right hind-limb extended and almost perfectly displayed. In the drawing (Plate XVI.) the bones and impressions on the main slab are with the skull figured and shaded in true relative position, while the bones of the counterslab are in outline in proper relationship with those of the main slab.

In the following account of the structure of *Udenodon*, that part dealing with the skull is founded mainly on the skulls I have obtained at Pearston, while the account of the post-cranial skeleton is mainly based on the little skeleton of *Udenodon gracilis.*

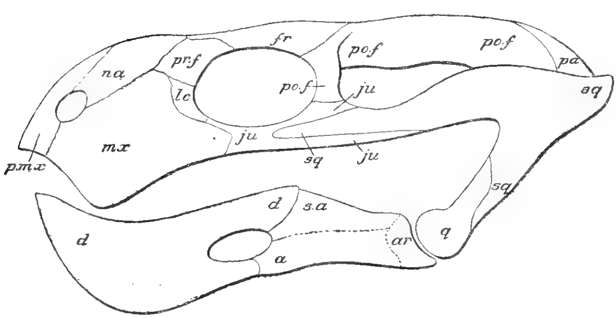
Skull.

The Dicynodont skull has been described by Owen (2), Cope (3), Huxley (4), and others, but the fullest description is that given by Seeley (5). Even Seeley's account, however, leaves many points in doubt, and a considerable number of his determinations are very questionable. I have therefore thought it well to give an independent description of the skull, dealing but briefly with those elements whose structure is well known, and more fully with the points open to dispute.

Text-fig. 10.



Text-fig. 11.



A composite figure of the skull of *Udenodon* (text-fig. 10) showing details from the left side, for comparison with the skull of a primitive Theriodont, *Ictidosuchus primævus* (text-fig. 11).

a., angulare; *ar.*, articulare; *d.*, dentary; *fr.*, frontal; *ju.*, jugal; *lc.*, lachrymal; *mx.*, maxilla; *na.*, nasal; *pa.*, parietal; *p.mx.*, premaxilla; *po.f.*, postfrontal; *pr.f.*, prefrontal; *q.*, quadrate; *sq.*, squamosal; *s.a.*, surangulare.

In *Udenodon* (text-fig. 10, p. 167) the whole beak has had a horny covering, which in some species at least covers not only the alveolar margin, but almost the whole of the facial surface of the maxilla (*mx.*); and in probably in all the species the horny layer was specially developed over the caniniform development of the maxilla.

The premaxilla in *Udenodon* and *Dicynodon* is better developed than in the majority of reptiles, having not only a well-developed facial portion passing up between the two nostrils, but also a large palatal portion. The two premaxillæ, as in the bird, must have very early united into a single bone (*cf.* Pl. XVII. fig. 2), as in even comparatively young specimens there is no trace of a suture between the two elements. As I have elsewhere shown (**6**), the premaxilla forms almost the whole of the bony palate, including by far the greater part of the median ridge, which has almost invariably been regarded as the vomer. In the paper referred to, a section through the posterior part of the hard palate of *Udenodon truncatus* is figured, and it is there shown that though the maxillæ have internal plates which form a sort of secondary palate, these are almost completely covered by the great palatal development of the premaxilla. From the palatal portion of the premaxilla there passes up internally a prominent median ridge which runs from the facial portion of the premaxilla backwards to articulate with the vomer, and to a considerable extent divides the nasal cavities.

The maxilla differs in shape greatly in different genera, and it is highly probable that there is considerable difference in shape in the two sexes of the same genus. In all, however, there is a more or less well-marked caniniform development. In some species a prominent external descending ridge gives the tusk-like development a triangular shape; in others the descending process is almost flat. The maxilla resembles that of man in having a large *antrum maxillare.* From the region of the antrum, which may be regarded as the centre of the bone, the maxilla is developed upwards, forming the greater part of the side of the snout (*cf.* text-fig. 10, p. 165) and bounded by the nostril and the nasal (*na.*), the prefrontal (*pr.f.*) and the lachrymal (*lc.*) inwards, forming part of the secondary palate; and backwards, meeting the jugal, are the palatine and the pterygoid bones. The caniniform ridge is continued back into the ridge formed by the anterior bar of the pterygoid and forms the border of the palate.

I can find no evidence of any ossified turbinal bones.

The nasals (*na.*) are moderate-sized bones irregularly triangular in shape. They are joined to each other by a fairly long median suture. Their anterior sides are formed by the premaxilla (*p.mx.*), the nostrils, and the maxillæ. The posterior and outer side of each nasal is bounded by the frontal (*fr.*), the prefrontal (*pr.f.*), and maxillary (*mx.*).

The lachrymal (*lc.*) is quite mammalian in structure. It forms a considerable part of the anterior wall of the orbit—fitting in between the prefrontal above and the jugal (*ju.*) below. It has a large lachrymal canal opening within the orbit.

The prefrontal (*pr.f.*) is a somewhat quadrate bone—three sides being formed by the orbit, the frontal, and nasal respectively, and the fourth side by the lachrymal and maxilla. It forms a considerable portion of the anterior and upper wall of the orbit.

The frontals (*fr.*) lie between the orbits and are usually well developed. In *Udenodon greyi* they are narrow; in *U. gracilis* almost exactly as broad as long. They usually form the borders of the upper sides of the orbits. Each frontal articulates with the nasal and prefrontal in front, and with the parietal and postfrontal behind.

The postfrontal (*po.f.*) forms, as in *Dicynodon* and many Theriodonts, an outer limb which forms the postorbital arch, and a posterior which runs backwards by the side of the parietal. The postorbital arch varies considerably in different species, but is usually rather broad above, forming a sort of roof to part of the orbit. In the middle it is generally narrow and round; while inferiorly it broadens out and articulates with the squamosal and the jugal. From the upper end of the postorbital portion the posterior part runs abruptly backwards, forming the greater part of the inner wall of the temporal fossa, and to a great extent hiding the parietal. Posteriorly it curves outwards a little and meets the squamosal (*cf.* text-fig. 10, p. 165).

The parietals early unite to form a single bone, which though of moderate size is very largely hidden by the postfrontals. Near the centre of the bone is a fairly large parietal foramen. Posteriorly the parietal articulates in the middle with the interparietal, and laterally with the squamosals (*sq.*).

The jugal is rather a small bone (*ju.*) which forms the greater part of the infraorbital arch. Anteriorly it forms a considerable part of the wall of the orbit at its anterior and lower side, meeting the lachrymal and being clasped by the maxilla. Internally, the anterior part meets the palatine. The squamosal (*sq.*), which lies on the outer side of the jugal in its middle and posterior regions, to a large extent hides it from view. Where the jugal meets the postfrontal it is fairly deep in some species, but in others only slightly increased in depth. Posteriorly it flattens out and lies on the inner side of the squamosal, forming with it the temporal arch.

The squamosal is by far the largest bone in the skull (*cf. sq.*, text-fig. 10, p. 165). It comprises a large broad posterior portion which descends from its union with the parietal and postfrontal, along the outer border of the supra- and exoccipitals, to give articulation to the quadrate, and an anterior branch, which springs from the upper half of the posterior portion and passes forwards to form with the jugal the temporal arch.

The quadrate (*q.*) consists of a broad flat part which lies against the front of the descending portion of the squamosal, and a large articular head. The articular face of the quadrate has a deep antero-posterior groove running across it, which divides it into an outer semicircular button-like portion and an inner very prominent antero-posterior ridge. Both the outer and inner portions of the articular face have an antero-posterior convexity of fairly wide radius.

The structure of the palate I have elsewhere dealt with (6), and I have little further so add to my previous description. The pterygoids, as in the other Dicynodonts, are greatly developed, meeting each other in the middle line and sending processes forwards to the maxillæ and backwards to the quadrates. Between the two anterior processes lie the palatines and the vomer. The vomer is quite mammalian in structure, and is present as a median plate, extending from the fork formed by the anterior branches of the pterygoids forwards to articulate with the palatal median and internal median ridges of the premaxilla. Superiorly the vomer articulates with the sphenoid, the mesethmoid, and the ethmoid cartilage. Towards the posterior and upper part it gives off a pair of small lateral wings which articulate with the palatines, and with them form the roofs of the nasal passages. The palatines pass outwards and downwards from the articulations with the vomer, by the side of the anterior branches of the pterygoids. Each palatine then sends a process forwards and inwards to form a sort of rudimentary secondary palate, and a second process outwards above the anterior lobe of the pterygoid to meet the jugal.

Where the two pterygoids meet in the middle line they rest on, and are articulated to, the basisphenoid. This latter bone shows on the under surface of the skull to a considerable extent, sending two plates backwards to clasp the large paroccipital processes. From the region where the pterygoids meet, the basisphenoid sends a comparatively narrow median plate upwards and forwards resting on the vomer, and probably in adult specimens articulating with the mesethmoid. This plate may be the presphenoid, but I have not seen any specimens in which it is distinct from the basisphenoid. The mesethmoid is a median plate which forms the greater part of the interorbital septum. Above it is clasped by the orbital plates of the frontals, and below it rests on the vomer.

Immediately behind the point where the pterygoids meet, there passes upwards from each pterygoid a slender *columella cranii*. In forms with a deep narrow skull, e. g. *U. greyi*, the columella is long and slender: in those species where the skull is broad and rather flat, the columella is comparatively short. In all forms, however, it is very slender. It appears to articulate with the parietal above.

The periotic bones appear to form the lateral walls of the braincase in a manner very similar to that seen in lizards; but I have not seen any specimens in which their exact limits could with certainty be determined.

The occiput has long been well known in a number of Dicynodonts, especially *Ptychosiagum*. A small occiput is figured by

Lydekker in the British Museum Catalogue of Fossil Reptiles, which is probably that of a species of *Udenodon*. The supra- and exoccipitals are bordered by the interparietal and the squamosals, while the lower corners of the large exoccipital processes also articulate with the quadrates.

Between the quadrate and the descending process formed by the exoccipital and basioccipital, there lies a remarkable little dumbbell-shaped bone, which with one end fits into a hollow of the occipital process and with the other supports the quadrate. As it is but loosely articulated, it is lost from the majority of *Dicynodon* and *Udenodon* skulls discovered. This bone differs so markedly from any bone found in the posterior region of the skull in known Reptiles or Mammals, that one hesitates in giving an interpretation. As, however, it forms with the notch in the lower border of the exoccipital an oval aperture, and as the columella auris lies in this same notch of the exoccipital, it seems to me most probable that it is the homologue of the mammalian tympanic.

Lower Jaw.

The lower jaw is almost typically reptilian in structure (*cf.* text-fig. 10, p. 165). In front, the two large toothless dentaries (*d.*) are anchylosed together as in the tortoise. Each dentary is considerably deeper than in the tortoise, and differs in forming a single edge above, instead of two ridges as in the Chelonian. In *U. greyi* the outer surface of the dentary is moderately flat; but in *U. gracilis* there passes outwards from the posterior part of the bone a very prominent horizontal ridge. On passing backwards the dentary divides into an upper and a lower lobe, which meeting respectively the surangular (*sa.*) and the angular (*a.*) encloses with these a fair-sized oval vacuity. The angular is a rather large flat element which articulates with the dentary in front, the surangular above, the splenial below, and the articular (*ar.*) behind. The surangular is a fairly strong bone which fits into a deep cavity in the posterior end of the upper part of the dentary. The splenial extends along almost the whole length of the jaw, from the articular behind to the symphysis in front. Posteriorly it is fairly stout, but on passing forwards it becomes a rather thin plate. The articular is a large thick bone, but, as in Chelonians, short.

I am unable to give any account of the hyoid apparatus, as though there are evidences of hyoid bones, they are disconnected and their interpretation is quite uncertain.

Vertebræ.

In the little skeleton of *Udenodon gracilis* (Pl. XVI.) most of the vertebræ are preserved, but none are well displayed. The atlas and axis are hidden by matrix, but from the 3rd cervical (4th?) there are indications of almost all the other vertebræ. The skeleton does not show where the division lies between the cervical and the thoracic series; and in *Udenodon*, as in most other Theromorphous reptiles, there is no division of the body vertebræ into thoracics and lumbars. Assuming that the first cervical vertebra displayed is the 3rd cervical, then it is moderately certain that in *U. gracilis* there are 27 presacral vertebræ.

The vertebræ which I take to be 3rd and 4th cervicals, so far as displayed, agree fairly closely with the 3rd and 4th cervicals of *Tropidostoma dunni* Seeley (5) [=according to Lydekker (7) *Ptychosiagum microtrema* Seeley]. The bodies of the vertebræ have well-marked lateral processes arising from the anterior and outer angles of the ventral surfaces, for articulation with the cervical ribs.

In the skeleton of *Udenodon gracilis*, though most of the vertebræ of the thoraco-lumbar series are shown, unfortunately only the bodies are displayed; but in the imperfect skeleton of *U. baini* (spec. 4) a number of presacral vertebræ are well preserved.

As has long been known in other Dicynodonts, the vertebræ consist of deeply cupped bodies to which are articulated arches closely resembling the arches in mammals. In the dorsal series (*cf.* Plate XVII. fig. 4) the bodies are considerably elongated and moderately constricted in the middle. On the body just below the neuro-central suture in front is the articular surface for the head of the rib. The pedicle is stout, and a ridge runs up obliquely from near the front of the neuro-central suture to the transverse process. The transverse processes (*tr.*) are short and strong, directed outwards and slightly upwards, and lie well above the level of the top of the neural canal. The spine (*sp.*) is quite short, and situated well backwards over the posterior zygapophyses. Both the anterior and posterior zygapophyses are situated fairly closely together, and the articular surfaces make approximately a right angle with each other. A large opening is formed between each pair of vertebræ for the exit of the spinal nerves.

The ribs in the thoracic region (*cf.* Plate XVI.) are long and slender; the anterior ones being, however, slightly stouter than the others. The upper end of the rib is expanded so as to form a distinct head for articulation with the centrum and a tubercle for attachment to the transverse process. As the border of the rib between the head and the tubercle is almost straight, and the ridge on the vertebra between the articular surface and the transverse process is only slightly concave, there must be but little of a foramen left between the rib and the vertebra. The ribs in the lumbar region have their upper ends less expanded and may possibly have been articulated to the transverse processes alone.

The sacrum is very badly preserved in the skeleton of *U. gracilis*, but appears to have been composed of 5 vertebræ.

The tail has evidently been short, but it is impossible to say of how many vertebræ it may have been composed. Those that are shown in the little skeleton have their centra about half the length of those in the thoracic series. The vertebræ are much crushed and fractured, so that it is difficult to be certain of the identification of the fragments. By the side of one of the vertebræ is a well-developed process, which may be a spine, but which I am rather inclined to believe to be an autogenous transverse process.

Shoulder-girdle and Sternum.

In the little skeleton of *Udenodon gracilis* the shoulder-girdle, though present, is almost completely hidden by matrix and could not be displayed without injury to other parts. In the skeleton of *U. baini* (spec. 4, Pl. XVIII. fig. 10) the scapula (*sc.*), precoracoid (*p.co.* fig. 11) and coracoid (*co.*) are well preserved, and also in the very imperfect skeleton (spec. 5), while in specimen 5 the sternum is also shown.

The scapula, precoracoid and coracoid agree pretty closely with the corresponding bones in the Dicynodont shoulder-girdle as figured by Owen (2), Seeley (1), and Lydekker (7). The scapula is somewhat stouter than that figured by Lydekker, but on the whole closely agrees with it. The upper part of the scapula is broad and flat and only moderately curved inwards. The anterior border is grooved for the lodgment of the cleithrum. A little below the middle of the scapula there is a well-marked acromion process (*ac.*, Pl. XVIII. fig. 10) which passes forwards, upwards, and slightly inwards as a fan-like expansion. The lower end of the scapula has a large glenoid surface (*gl.*) which looks downwards and a little outwards, and an anterior flattened continuation which articulates with the precoracoid.

The coracoid (*co.*) is comparatively small, but has a large glenoid surface (*gl.*) which looks mainly outwards, and which is separated from the outer surface of the bone by a very prominent bony border.

The precoracoid (*p.co.*) is a moderately flat bone, but slightly larger than the coracoid. On its upper border is a deep notch (*fo.*) which closed by the lower border of the scapula becomes a large oval foramen. The precoracoid articulates behind by a straight suture with the coracoid, and above with the scapula. It appears to furnish a small portion of the glenoid cavity.

I have failed to identify the interclavicle or cleithrum in any of the specimens in my possession, but in the skeleton of *U. gracilis* one of the clavicles is fairly complete (*cl.*, Pl. XVI. & Pl. XVIII. fig. 8). It is curved very much like the human clavicle. It appears to have articulated with its neighbour in the middle line, and to have rested on the anterior part of the interclavicle. The inner half of the bone is flattened antero-posteriorly, and the outer vertically.

The sternum, or perhaps more correctly præsternum (Pl. XVIII. fig. 9), is a moderately large four-sided median plate, with the angles pointing forwards, backwards, and to the sides. The anterior angle is notched, probably for the lodgment of the interclavicle; the outer angles are rounded and the posterior angle truncated as if to give attachment to a cartilaginous meso- or xiphisternum. For its lower two-thirds there is a well-marked median ridge for the attachment of the pectoral muscles. The bone is a little longer than broad.

Humerus.

In the little skeleton of *Udenodon gracilis* (Pl. XVI.) one of the humeri (*hu.*) is perfectly preserved and beautifully displayed; the other though less perfect has the opposite side showing. In specimen 4 one humerus is fairly well preserved, and of the other the lower half is almost perfect; while in specimen 5 one humerus is shown, but in bad condition. The difference between the humeri in *U. gracilis* and *U. baini* is very striking, and much greater than one could have expected to find in two species apparently so closely allied.

In *Udenodon gracilis* (Pl. XVI.), the humerus, while constructed on the well-known Dicynodont type, is characterized by a number of peculiarities. The delto-pectoral crest (*c.d.*) is greatly developed, its border curving forwards and downwards from the articular surface and ending, as in "*Platypodosaurus robustus*," in a somewhat hooked process. The ento-tuberosity is developed to a greater extent than is met with in the humerus of any S. African reptile hitherto discovered, and forms a long flattened tapering process which ends in a rather sharp point. Near the middle of the bone on its inner side is developed a very prominent tricipital ridge resembling more that seen in *Echidna* than the rounded prominence on the humerus of "*Platypodosaurus*." The articular surface of the head of the bone resembles greatly that in *Ornithorhynchus* and *Echidna* in being considerably developed transversely, while it is but very narrow. As in the Monotremes, a sharp ridge runs down from the articular head to the external condyle; and this is very peculiarly developed, in that while in the humeri hitherto discovered though it may be very prominent it is generally slender, it is here a markedly rounded boss (*c.e.*). The internal condyle is not very large. The entepicondylar foramen is only of moderate size, and is situated a little more distally than is usually the case in Dicynodonts. The ridge of bone which forms the bridge over the foramen runs up to the base of the delto-pectoral crest.

In *Udenodon baini* the humerus varies much less from the normal dicynodont type. The delto-pectoral crest is not developed downwards to form a hooked process in front; the tricipital ridge appears to have been small; while the external condyle is not more greatly developed than is the case in *Ornithorhynchus*.

Radius and Ulna.

The radius and ulna are very mammal-like in form (*cf.* Plate XVI.).

The radius (*rd.*) is considerably shorter than the humerus. Its upper half is moderately rounded, and from the head to a little below the middle of the bone it steadily decreases in thickness, so that at the middle the diameter is only about one-half that of the head. In its lower third the bone becomes flattened out to give a broad articulation to the radiale (*ra.*). The broad end of the bone has a deep depression on both its upper and under sides. Its articular surface looks downwards and slightly outwards.

The ulna (*ul.*) is very nearly twice as long as the radius, and considerably longer than the humerus; its great length being due to the greatly developed olecranon process (*ol.*; *cf.* also Plate XVIII. fig. 7). The upper half of the bone is very strongly developed, and the olecranon extends about as far beyond the sigmoid articulation as it does in such typical lowly mammals as the Wombat and the Porcupine. The point of the olecranon is directed slightly outwards, but it is not dilated like that of the Monotremes. On the outer side of the ulna a short prominent ridge is seen bordering the sigmoid articulation. On the inner side the upper part of the ulna is deeply excavated after the manner seen in that of *Echidna*, but to a much greater extent, as the border of the bone forms a much more prominent ridge. The lower half of the ulna is much flattened. Like the radius, the lower end is slightly expanded; while the articular surface looks slightly towards the radius.

Carpus (Plate XVI.).

In the skeleton of *Udenodon gracilis* the carpus is almost perfectly preserved, and the various bones composing it have scarcely been at all disturbed in position. In the proximal row are four bones—radiale (*ra.*) intermedium (*i.*), ulnare (*un.*), and pisiform (*pi.*); in the distal row are five carpals; while in the middle is a single centrale (*c.*).

The radiale or scaphoid (*ra.*) is a broad and considerably flattened bone which occupies the greater part of the articular end of the radius. Its dorsal surface shows a considerable depression towards its outer end. It articulates with the radius, with the 1st carpale, the centrale and the intermedium.

The intermedium or lunar (*i.*) lies between the end of the radius and the ulna and ulnare. On the upper side it has a fairly large surface, but on the under it is apparent as a slender plate fitting in between the radius and the ulnare.

The ulnare or cuneiform (*un.*) is considerably shorter in its transverse diameter than the radiale, but of much greater length antero-posteriorly. It articulates with the ulna, the intermedium, the 4th and 5th carpalia, the pisiform, and probably with the centrale. Bordering the side by which it articulates with the ulna there is a prominent little oblique ridge, and at the distal and inner corner of the bone is a little rounded eminence.

The pisiform (*pi.*) is a little bone which articulates with the outer side of the ulnare, and curves outwards and upwards, forming part of the articulation for the ulna.

The centrale (*c.*) is a rounded, moderate-sized element, which occupies the centre of the carpus. It articulates with the radiale, intermedium, and probably with ulnare of the proximal carpal bones, and with the 1st, 3rd, and 4th carpalia of the distal series. It is possible that a small second central element may have lain between the centrale and the ulnare, but I regard this as improbable.

The 1st carpale is a short flattened bone which fits in between the radiale and the 2nd carpale. On its outer end it gives an articulation to the pollex. Its inner end articulates with the 3rd carpale and the centrale.

The 2nd carpale is a very small bone which articulates with the 1st and 3rd carpalia, and supports the metacarpal of the 2nd digit, and possibly shares with the 1st carpale the support of the 1st metacarpal.

The 3rd carpale is a fair-sized element which fits in between the 2nd and 1st carpalia, the centrale, and the 4th carpale, and gives articulation to the 3rd metacarpal.

The 4th carpale is a large quadrangular element. Distally it gives articulation to the 4th metacarpal and to a slight extent to the 3rd and 5th metacarpals. Proximally it articulates with the centrale and the ulnare, and fits in between the 3rd and 5th carpalia.

The 5th carpale is very small, and is so closely articulated to the 4th carpale as to render it not improbable that the two elements may be anchylosed as age advances. In the little skeleton, which is probably immature but not very young, the two elements are quite distinct. The little 5th carpale articulates also with the ulnare, and gives articulation to the 5th metacarpal.

Metacarpals and Phalanges.

In the manus there are five well-formed digits, but I fail to detect any trace of a præpollex. The three median digits are somewhat stronger than the other two.

Of the pollex only the metacarpal and part of first phalanx are preserved. The metacarpal is a small rectangular bone about as broad as long. The 1st phalanx is probably very similar.

In the second digit, as in the first, only the metacarpal and a portion of the 1st phalanx are preserved. The metacarpal is a fair-sized element appreciably longer than broad. In the middle it is somewhat constricted, and at its distal end considerably expanded. The 1st phalanx was probably considerably smaller than the metacarpal.

The third digit is complete except the ungual phalanx. The metacarpal is very similar to that of the 2nd digit, but somewhat larger. Like the latter, it is constricted in the middle and expanded distally. The 1st phalanx is a quadrangular bone only slightly longer than broad, and slightly constricted in the middle. It is about one-half smaller than the metacarpal. The 2nd phalanx is very similar in shape to the 1st, but still smaller.

The fourth digit is almost perfect. The metacarpal is about equal in size to that of the 3rd digit, but is less constricted in the middle. The 1st phalanx is a quadrangular bone slightly broader than long and only slightly constricted in the middle. The 2nd phalanx is a small bone very distinctly broader than it is long. It gives articulation to a large claw. The terminal or ungual phalanx is narrow, slightly curved, and almost as long as the metacarpal and the other two phalanges together.

The fifth digit has a small metacarpal, about as broad as long, and but slightly narrowed in the middle. The 1st and 2nd phalanges are both small quadrangular bones, the 1st being considerably smaller than the metacarpal, and the 2nd than the 1st. The ungual phalanx is almost as large as that of the fourth digit, and like it but slightly curved.

In *Udenodon baini* the metacarpals and phalanges appear to be very like those in *U. gracilis*, but the ungual phalanges are much shorter and broader, and the whole digits appear proportionally stronger.

Pelvis.

In the skeleton of *Udenodon gracilis* (Plate XVI. and Plate XVII. fig. 6) the almost perfect ilium (*il.*) is displayed. On the right side the ischium (*is.*) and pubis (*pb.*), with a portion of the ilium, are shown attached to the main slab, while the greater portion of the right ilium remains adherent to the counter slab.

The ilium resembles considerably the ilium of *Ptychosiagum orientale* figured by Lydekker (7) in being directed upwards and forwards, and in being greatly expanded antero-posteriorly. As the acetabulum (*ac.*) is fairly large, the lower end of the ilium which articulates with the pubis and ischium is broad. On passing upwards it becomes somewhat constricted into a short neck, from which it again rapidly broadens into a large fan-like expansion. The anterior part of the blade of the ilium lies much in advance of the axis formed by the neck and the acetabulum, the anterior border of the bone forming a graceful gentle curve forwards. The posterior part of the blade is of much less size, and the posterior border curves almost abruptly backwards from the neck and at right angles to its axis. The iliac blades are moderately flat, being only slightly concave antero-posteriorly on their outer side and with some muscular ridges.

The pubis (*pb.*) is peculiarly twisted, so that while the upper part looks outward the lower looks mainly downward. The pubis forms a little more than a quarter of the acetabulum, and bounds the articular cavity by a prominent ridge. The outward facing portion of the pubis is triangular in shape. In front of the acetabulum is a little prominence—apparently the pectineal tubercle; while at the lower and anterior angle of the triangular portion is another small tubercle, which in position corresponds with the tubercle which in *Ornithorhynchus* assists in the articulation of the marsupial bone. A ridge runs obliquely from this lower tubercle towards the lower border of the acetabulum, and from it the pubis passes at first directly inwards and then downwards and inwards. The exact size of the obturator foramen (*f.ob.*) is not clearly shown in this skeleton, but it is situated immediately below the oblique ridge not far from the lower border of the acetabulum. The lower part of the pubis is moderately flat, and does not extend farther forward than the level of the lower tubercle. The anterior border between the lower tubercle and the symphysis is straight, as if for the articulation of a cartilaginous epipubic element. There is a long articulation between the pubis and the ischium below the obturator foramen.

The ischium (*is.*) in *Udenodon gracilis* is proportionally very considerably smaller than in the *Dicynodon* pelvis figured by Lydekker, and looks much less downwards than in that specimen. From the point where the ischium meets the ilium the posterior border curves downwards and then backwards, ending abruptly at the ischial tuberosity. From the tuberosity the lower border curves gently round to meet the pubis. The lower part of the ischium is flat except in being slightly concave in the neighbourhood of the obturator foramen. Round the posterior border of the acetabulum the ischium forms a prominent ridge, but the ridge formed by the ischium is not continuous with that formed by the pubis, a gap occurring at the ischio-pubic suture. From the acetabular border a prominent thickening or ridge runs backwards to the upper end of the ischial tuberosity.

There is no evidence of any marsupial bones, and from the condition of the skeleton this may almost be taken as conclusive proof that such bones did not exist in *Udenodon*. There is evidence, however, in favour of there having been a cartilaginous epipubis.

In *Udenodon baini* the ilium is very similar to that in *U. gracilis*, but the ischium is proportionally considerably larger though its general characters are very similar. The obturator foramen (*f.ob.*) is oval with the long axis directed antero-posteriorly and situated close under the border of the acetabulum. The long axis of the foramen measures about half the diameter of the neck of the ilium.

Femur.

In *Udenodon gracilis* the right femur has its posterior side well-displayed, and as its upper half has been broken loose its anterior side can also be examined with the exception of the head.

In its general proportions the femur (Plate XVII. fig. 5, *fm.*) agrees with that of the Monotremes, though in its characters it differs somewhat. It is much flattened throughout its whole length, and considerably broadened out both at its upper and lower ends. From the head to the greater trochanter the measurement is nearly three times as great as that across the middle of the shaft. From a little below the middle of the bone, the outer border forms an almost straight line to the top of the great trochanter. The inner border curves very markedly inwards to the head, and the curve is interrupted by the presence of the small trochanter, which forms a small but very distinct inwardly directed ridge. On the anterior surface of the bone so far as displayed is a small vertical groove a little to the outside of the middle line; while to the inside of the great trochanter is a distinct but shallow concavity. On the posterior side of the bone there is a fairly deep concavity below the head and on the inner side of the small trochanter. On the outer edge of the posterior side there runs down, from a little below the great trochanter to beyond the middle of the shaft, a small sharp backwardly directed ridge. In the middle of the shaft a section is almost oval, showing a small but distinct medullary cavity. The lower end of the femur resembles very considerably the lower part of the bone in *Echidna* or *Ornithorhynchus*. The condyles are small and rather widely apart, and, as in the Monotremes, the whole lower end of the femur is much flatter than in the Eutherians. From the neighbourhood of the inner condyle an oblique ridge runs upwards and outwards towards the outer side of the middle of the shaft, apparently corresponding to the oblique ridge on the back of the lower end of the femur of *Echidna*.

In the skeleton of *Udenodon baini* (spec. 4) both femora are shown but in rather bad preservation, having been much crushed. The chief differences in this species are in the bone being proportionally stronger, in the greater development of the great trochanter, and in the small trochanter being less marked.

Tibia and Fibula.

In the skeleton of *Udenodon gracilis* (Pl. XVI.) both tibiæ and fibulæ are shown, but those of the left leg are not well displayed, and those of the right only show the posterior surface and have been slightly injured in clearing off the matrix.

The tibia (*tb.* Plate XVII. fig. 5) is considerably shorter than the femur, and resembles closely the tibia in *Echidna*. It is a moderately straight bone with a large flat head, a shaft tapering down to between the middle and lower thirds, and a distal end moderately dilated and with an oblique articular surface. It has a distinct though small medullary cavity.

The fibula (*fb.*) is a longer though more slender bone. As in Monotremes and most Marsupials the head is large, giving an articulation to the femur and having a portion passing up beyond the head of the tibia to give attachment to some of the leg-muscles. On passing downwards the fibula is directed slightly upwards, and it then curves inwards so as to form a wide interosseous space. At its lower end the bone is dilated considerably, and its articular surface is directed slightly inwards.

In *Udenodon baini* the tibia, like the femur, is proportionally a much stronger bone than in *U. gracilis*, and it is also proportionally shorter. The head is very large, and from it there runs down the front of the bone a very prominent crest. The fibula, as if to compensate for the greater strength of the tibia, is proportionally more slender than in the small species. It gives an articulation to the femur, but the head is much smaller and is scarcely extended beyond the level of the head of the tibia. It is more curved than in *U. gracilis*, and there is thus formed a larger interosseous space.

There does not seem to have been an ossified patella in *Udenodon*.

Tarsus.

The tarsus of the right side (Pl. XVI.) has its under surface well shown, and though a dorsal view would have been more satisfactory, a good idea is obtained of the structure of the joint even though a little doubt may remain on one or two points. The tarsus of the left side is so twisted that it is difficult to be sure of some of the elements.

Articulating with the tibia and fibula respectively (Pl. XVII. fig. 5) are two large elements—manifestly the tibiale (*tl.*) and the fibulare (*fl.*), with a small bone lying between, doubtless the intermedium (*i.*). The distal row of the tarsus is formed by five tarsalia; while in the centre, between the distal row and the tibiale and fibulare, is a centrale (*c.*), small as displayed on the under surface, but probably of much larger size on the upper.

The tibiale, or astragalus, as displayed, is a fair-sized somewhat pentagonal bone with the upper and outer angle sharp and produced. By its proximal and probably its inner face it articulates with the tibia. On its outer face the little intermedium comes between it and the fibulare, but it is probable that an articulation between the two large elements takes place above and distally to the intermedium. On the distal border of the tibiale lies the small centrale. It is probable that the tibiale does not articulate with any other element. As the tarsus is displayed in the specimen, there appears to be no element between the 1st tarsale and the tibiale, and one might infer that the tarsale had articulated with the tibiale, and that these elements are slightly displaced; but it seems much more probable that what appears to be a very small centrale is merely a projection, showing on the under side, from a moderately large centrale which fits in between the 1st tarsale and the tibiale, as does the navicular in mammals.

The intermedium (*i.*) is a very small element, at least so far as displayed, fitting in between the tibiale and the fibulare, and articulating with these two elements and with the fibula. It is possible that the element may not be a true intermedium, but a small sesamoid bone; its being deeply implanted, however, between the other tarsal elements, and its occupying the exact position where an intermedium would be looked for, leads me to believe that I have rightly interpreted it as that.

The fibulare is a large, elongated, four-sided element, nearly as large as all the other tarsal elements together. Its proximal side, by which it articulates with the fibula, is the shortest of the four. The inner side, which is half as long again as the proximal, articulates with the intermedium, the tibiale, and the centrale. The distal end of the element, which is a little shorter than the inner side, but much broader than the proximal end, articulates with the fourth and fifth tarsalia and with the fifth metatarsal.

The centrale, as seen in the specimen, would appear to be a small element fitted in between the tibiale, the fibulare, and the third tarsale, but it seems probable that the dorsal view of the tarsus would show it to be a much larger element. This is rendered highly probable by the fact that there appears to be an unoccupied gap between the first tarsale and the tibiale. This must either have been occupied by the centrale or the 1st tarsale must have articulated with the tibiale, and in the specimen has been displaced. The positions occupied by the other tarsal elements lead me to favour the former alternative.

The 1st tarsale (*ts.* 1, Plate XVII. fig. 5) is a large element much resembling a metatarsal in shape. Its proximal end is expanded, and, assuming that it is in an undisturbed position in the specimen, the outer side of this end articulates with the 2nd tarsale. The proximal end must either articulate with the tibiale direct, or a portion of the centrale was interposed.

The 2nd tarsale is a very small element, articulating laterally with the 1st and 3rd tarsalia, and most probably with the centrale proximally. It gives support to the 2nd digit.

The 3rd tarsale is about twice as large as the 2nd. It articulates with the 2nd and 4th tarsalia and with the centrale, and gives support to the 3rd toe.

The 4th and 5th tarsalia (*ts.* 4, 5) are so closely united that there is some doubt as to whether the element present may not be entirely the 4th tarsale. The element is a somewhat oval-shaped bone with the distal side slightly concave. It fits in between the fibulare and the 3rd tarsale, and possibly articulates with the centrale. It gives support to the 3rd, 4th, and 5th metatarsals. Near its outer end there is an indication of a transverse suture, which seems to point to there being a small 5th tarsale closely united to, if not anchylosed with, the 4th. In dealing, however, with so small a structure, where the bones so closely resemble the matrix in colour that it is difficult at times to decide what is bone and what matrix, one cannot place much reliance on an indication so minute.

The hallux has a short quadrangular metatarsal (*mt.* 1) and a phalanx (*ph.*) almost exactly similar in shape and size, and a short ungual phalanx less than twice the length of the 1st phalanx.

The 2nd, 3rd, 4th, and 5th toes are so similar in all respects that a description of any one would suit, with very slight modifications, any of the others. In all four the metatarsals are elongated bones with rounded proximal ends, flattened distal ends, and with their shafts constricted in the middle. The first phalanx in all four toes is a quadrangular bone slightly longer than broad. In the fourth toe the phalanx is somewhat stouter than in the others. The second phalanx is a little shorter than the first, and very similar in all four toes. The ungual or terminal phalanx has in all five toes been provided with a short claw, only slightly curved.

Though the fore and hind limbs are fairly equal in length, the pes is very much smaller than the manus. All the digits are much more feeble, and the claws have been only about one-third the size of those in the manus.

"PLATYPODOSAURUS ROBUSTUS, Owen."

In 1880 and 1881 Owen (8, 9) described in two papers parts of the skeleton of a large Anomodont reptile to which he gave the name of *Platypodosaurus robustus*. The remains comprised a number of vertebræ, a scapula, a humerus, the sternum, the greater part of the pelvis with the sacrum, a portion of one femur, and some phalanges. Unfortunately the head was missing. Owen recognized a number of affinities between the bones and those of *Dicynodon*, but was chiefly impressed by the many Mammal-like characters displayed, and particularly by the striking resemblances many of the bones showed to those corresponding in the Monotremes; and he suggests that the Monotremes may be the descendants of reptiles closely resembling *Platypodosaurus*.

Lydekker (7), in the 'British Museum Catalogue of Fossil Reptiles,' places *Platypodosaurus* among the Dicynodontia as a doubtful species, and expresses his opinion that from the general Dicynodont character of the specimens, the remains "are referable either to *Udenodon* or *Eudothiodon*."

As nothing has hitherto been known for certain of any of the bones of either *Udenodon* or *Eudothiodon* except the skull, no advance beyond Lydekker's position has been possible. Now, however, that the limb-bones of at least two species of *Udenodon* are known, it is possible to come nearer a solution of the *Platypodosaurus*-problem.

The chief distinctive features of the *Platypodosaurus* specimens are the great development in the humerus of the delto-pectoral crest which forms a downward projection, and the presence of a marked tricipital prominence. In *Udenodon gracilis* both of these characters are found, and the general proportions of the humerus are strikingly similar to those in *Platypodosaurus*. The sternum of *Platypodosaurus* does not differ greatly from that of *Udenodon baini*. The scapula agrees so closely with that of *U. baini* that had that of the latter been found alone it would almost certainly have been referred to a young specimen of *Platypodosaurus*. The femur of *Platypodosaurus*, so far as is known, differs somewhat from that of *U. gracilis*, especially in the greater development of the great trochanter, and in the less development of the small trochanter; but it agrees closely with the femur of *U. baini*. The pelvis of the larger anomodont, so far as it is preserved, agrees very closely with that of *U. gracilis* in its general proportions, and, if allowance be made for imperfections, probably also in its contours. The vertebræ differ very considerably from those of *U. baini* which I have figured. This is probably due to their belonging to different regions of the column in the two species.

From the close agreement between the bones of *Platypodosaurus* and those of *Udenodon gracilis* and *U. baini*, there seems to be very little doubt that the *Platypodosaurus robustus* remains are the bones of a large species of *Udenodon*. The large skull figured by Owen (2) as *Udenodon magnus* bears almost the same proportion to the limb-bones of "*Platypodosaurus robustus*" that the skull of *Udenodon gracilis* does to its limb-bones. It seems, therefore, very probable that the bones described as *Platypodosaurus robustus* are parts of the post-cranial skeleton of *Udenodon magnus*, Owen. Lydekker (7), in his British Museum Catalogue, holds that *Udenodon magnus* is a synonym of *Udenodon prognathus* Owen. It is impossible for one away from the original specimens to offer an opinion on the subject, and though the figures seem to show a number of distinctive characters, Lydekker's work among the Anomodonts has been so carefully and conscientiously done, that any opinion expressed by him must always carry very great weight.

Affinities of Udenodon.

The genus most nearly allied to *Udenodon* is *Dicynodon*; in fact so great is the resemblance between the two genera that it has been suggested that *Udenodon* was the female of *Dicynodon*. The discovery of the limb-bones shows that the two genera are distinct though very closely related; and there seems to be very little doubt that *Udenodon* is merely a slightly modified *Dicynodon* in which the tusks have ceased to develop.

When the bones of *Udenodon* or *Dicynodon* are compared with those of other Vertebrates, we find that the group has many marked affinities with the Theriodonts and the Mammals; some affinities, but less marked, with the primitive reptilian types such as *Pariasaurus*, and even with the Rhynchocephalians, Plesiosaurs, and Chelonians; but that the relationships with the more highly specialized reptiles, such as the Crocodiles, Dinosaurs, and Pterodactyles, are rather remote.

In *Udenodon* the anterior half of the skull is so greatly modified in connection with the toothless beak that the affinities are masked. There is little doubt, however, that the beak is derived from that of a Theriodont type, intermediate stages being found in *Cryptocynodon* and *Dicynodon*.

In the structure of the posterior part of the skull *Udenodon* agrees closely with the Theriodonts and Mammals; and differs markedly from all the regular Reptilian types.

In the majority of typical reptiles the temporal region of the skull is protected by two bony arches—a supra-lateral arch formed by the postfrontal or postorbital and the squamosal or supratemporal, and an infra-lateral formed by the jugal and quadratojugal. This arrangement, or a modification of it, occurs in the Rhynchocephalians, Pelycosaurians, Crocodilians, Dinosaurs, and other groups. The more primitive lizards differ in having lost the lower arch. In the Dicynodonts, as in the Theriodonts and Mammals, there is but a single arch formed by the jugal and squamosal; and some difference of opinion has been held as to whether this single arch is the homologue of the upper or of the lower arch in the typical reptiles. As, however, the single arch in the Dicynodonts differs in structure from either of the normal reptilian arches, and as it is moderately certain that the reptiles with the two arches have been derived from the ancestral forms which had the temporal region completely roofed, by quite a different line from that by which the Dicynodonts have arisen, the single arch in the latter cannot be regarded as homologous with either of the arches in the more typical reptile. In the branch which gave rise to the majority of Reptilian orders the temporal roof became transformed on either side into a couple of arches by an upper fenestra formed between the parietal, squamosal, postorbital, and postfrontal, and a lower fenestra between the jugal, quadrato-jugal, supratemporal[1], and postorbital. In the other great Reptilian branch which gave rise to the Anomodonts, Theriodonts, and Mammals, a single fenestra only has been formed in the temporal roof, corresponding to the upper fenestra of the branch from which the Rhynchocephalians and allied forms have sprung. After the formation of the fenestra, or possibly before, the skull in the anomodont line became much simplified by the reduction and loss of a number of elements and the corresponding increase in size of others. The squamosal increased apparently early in relative size, and with its increase the supratemporal and the quadrato-jugal became first reduced and then lost. In a number of different lines of descent we find a similar process has gone on. Thus, in *Sphenodon* the squamosal by its increase has led to the complete loss of the supratemporal and the great reduction of the quadrato-jugal; in *Aëtosaurus* the increased development of the squamosal has led to the loss of both the supratemporal and the quadrato-jugal; and in the Plesiosauria, which are possibly an offshoot from the Anomodont stem, we find a very large squamosal with complete loss of the supratemporal and quadrato-jugal. The temporal region of *Udenodon* only differs from that in the Plesiosaur in that, whereas the latter has both a postfrontal and a postorbital, one of those elements is lost in the former; in my opinion it is the postorbital which is lost in the Anomodont.

The only essential difference between the structure of the postero-lateral region of the skull in the Mammals and that in the Anomodonts and Theriodonts is that the mammalian skull has become further simplified by the loss of the postfrontal and the almost complete loss of the quadrate. A number of years ago I advanced (**10**) the view that the reptilian quadrate had its

[1] Concerning the two bones found in the upper and posterior temporal region, opinions have differed as to which is to be regarded as the squamosal and which supratemporal. The opinion to which I have been led is that it is invariably the upper and inner which is the squamosal—an opinion which agrees with that of Baur, but differs from that of most British authorities, including Parker. When only the one element is found it appears to be always the squamosal.

homologue in the mammal in the interarticular cartilage of the lower jaw. If recent advances in palæontology have not fully confirmed this view, they have at least shown that practically all the alternative theories are untenable.

In the higher Theriodonts, e. g. *Cynognathus*, the zygomatic arch, though composed of the same elements as in *Udenodon*, differs very greatly in the relative proportions of the parts; but in the lower Theriodonts, i. e. *Ictidosuchus* (**11**), the zygomatic arch bears much resemblance to that in the Anomodonts.

The palate in *Dicynodon* and *Udenodon* differs considerably from the normal reptilian type, and agrees essentially with that in the Theriodonts and Mammals.

All known Reptiles have palates more or less modified from a primitive type such as is found in *Pariotichus* or *Procolophon*, and which consists of the following elements:—an anterior pair of bones which meet in the middle line, and which are usually regarded as "vomers"; a pair of large pterygoids, which have each a posterior and outer branch to the quadrate, an outer and anterior branch joining the transpalatine, and an anterior and inner branch which usually meets the so-called "vomer"; a pair of palatines lying on the outer side of the anterior and inner branches of the pterygoids; a pair of transpalatines; and a median element passing forwards from the basisphenoid between the two pterygoids, and usually referred to as the "parasphenoid." This arrangement we find with only slight modifications in all the early groups, including types so dissimilar as *Pareiasaurus*, *Procolophon*, *Ichthyosaurus*, *Plesiosaurus*, *Dimetrodon*, and *Sphenodon*.

The palates of the Theriodonts and Anomodonts are very considerably modified derivatives of the same type. Unfortunately in none of the primitive Theriodonts is the palate at all well known. We know, however, that a secondary palate was not formed in either *Gorgonops* or *Ictidosuchus*, nor apparently in *Ælurosaurus*. In *Udenodon* we have an imperfect secondary palate, and in the higher Theriodonts a secondary palate as well-developed as that in mammals, and essentially similar to that in mammals. As the general structure of the skeleton of *Udenodon* is essentially Theriodont, and as the palate only differs from that of the typical Theriodont in the specialization of the beak and in the secondary palate being imperfect, one is justified in concluding that the Anomodonts are a specialized offshoot from the earlier Theriodonts. In the evolution of the Theriodont palate from the primitive Reptilian type, the changes which have taken place appear to have been the following:—The anterior and internal branch of the pterygoid has become greatly reduced and finally lost, and its place and function to a large extent has been taken up by a great increase in the so-called "parasphenoid"; while the anterior and outer branch has become more developed, and with its increase the palatine has come to lie rather internal than external to the pterygoid. With the development of a secondary palate the anterior paired element—the so-called "vomer"—being no longer required as a bony floor for the nasal cartilages, has become reduced, and is only retained to give support to the cartilages of Jacobson's organ. This is the condition we find in *Gomphognathus* (**12**). The "parasphenoid," having now a new function—that of forming a support for the secondary palate—becomes greatly developed as a median plate, which is unquestionably the homologue of the mammalian vomer. From this it follows that the element called *Parasphenoid* in the Reptiles generally ought to be called the *Vomer*; while the anterior paired element, usually regarded as the "vomer," but which is the homologue of the dumbbell-shaped bone in *Ornithorhynchus*, may be called the "anterior vomer," or by the name I have elsewhere (**13**) proposed for convenience, the *Prevomer*.

In *Udenodon* the true vomer is greatly developed, but the anterior vomer or prevomer is lost—no doubt owing to the great palatal development of the premaxillary. The vomer in the Anomodonts agrees with the mammalian vomer even more closely than does the vomer in the higher Theriodonts.

In the Chelonians, probably as the result of a parallel development, the palate bears considerable resemblance to that in the Anomodonts, and it even appears that the median vomer is a true vomer, as in *Dicynodon* and its allies.

The lower jaw of *Udenodon* differs greatly in appearance from that in the Theriodonts, owing to its being toothless and to the absence of a well-developed coronoid process. As the elements are apparently the same, the difference is probably due largely to a degeneration in the Anomodont jaw, similar to that which has taken place in the toothless mandibles of such mammals as Echidna or the Whales.

The vertebræ appear to be essentially similar in structure in the Anomodont and in the Theriodont; but in the Anomodont the type is somewhat more primitive, in that the ribs of the lower trunk vertebræ are not specialized as they are in the higher Theriodont at least.

The shoulder-girdle in *Udenodon* belongs to the type which is found to persist with little variation from the lower forms such as *Pareiasaurus* up to the Monotremes. The cartilaginous elements consist of a scapula, a coracoid, and a distinct precoracoid, while the membrane-bone elements are a clavicle, a supra-clavicle or cleithrum, and a median interclavicle. In the Anomodonts the coracoid and the precoracoid are extremely like those in the Theriodonts, both the higher and the lower; but, curiously enough, the scapula agrees with that in the higher Theriodonts such as *Cynognathus*, and differs from that in the lower Theriodonts, e. g. *Ictidosuchus*, in having a moderately well-developed acromion.

The humerus closely resembles that in the Theriodonts, but whereas in the latter, as in the typical terrestrial mammals, the humerus is elongated, in the Anomodonts, as in the Monotremes, the humerus is short and broad. As pointed out by Owen in *Platypodosaurus*, the humerus bears a most remarkable resemblance to that in Echidna. There is little doubt, however, that the humeri in both the Monotremes and the Anomodonts have been derived by a parallel development from the more elongated Theriodont type.

The radius and ulna closely resemble these bones in both the Theriodonts and in the Mammals. The ulna is remarkable by its having a very well-developed olecranon, somewhat resembling that which Seeley has shown to occur in *Theriodesmus*, but developed to a much greater extent.

The carpus is strikingly like that of both the Theriodont and the Mammal. In *Theriodesmus* it is moderately certain that there are four bones in the proximal row as shown by von Bardeleben (**14**), and not three as according to Seeley's restoration (**15**). From the condition found in *Udenodon* it will be seen that Seeley's objection to placing four bones in the proximal row is of no weight. Bardeleben figures two centralia, but as these two are figured by Seeley as a single bone, there must still remain some doubt as to whether *Theriodesmus* has one or two centralia. The carpus of *Theriodesmus* resembles that of *Udenodon* in the small size of the 2nd carpale, but differs in the apparent absence of the 5th carpale. *Theriodesmus* further differs from *Udenodon* in having a small præpollex. In the structure of its carpus *Udenodon* seems to be more primitive than the Theriodont, and shows affinities with a number of the earlier reptilian types. In *Sphenodon* the carpus is very similar, but differs in having two centralia. The carpus of *Lacerta* as figured by Wiedersheim is almost similar to that of *Udenodon*, only differing slightly in the relative size of one or two of the elements. In *Proterosaurus* the carpus is again formed on the same type, though apparently with the absence of the pisiform; and in the Chelonians we have another slight modification of type.

In many mammals we find the carpus very closely agreeing with that of *Udenodon*, but with the 5th carpale invariably lost. It is remarkable that in the lowest mammalian orders—the Monotremata, the Marsupialia, and the Edentata—the os centrale is absent. It is, however, retained in many Rodents, most Insectivores, the Seals, in the Hyrax, and in the Primates. Even in Man in early fœtal life a distinct central element can be seen.

The manus agrees with that of the mammal, not only in the number of digits, but in the number of phalanges in each.

The pelvis belongs to that type with expanded ilium and small obturator foramen, which can be seen as far back as *Eryops* among the Labyrinthodonts, and which is still found in the mammals of to-day. As in the Pariasaurians, the ilium lies mainly in front of the acetabulum, and the ischium and pubis are well developed. The obturator foramen, however, is considerably larger than in these primitive forms. In *Cynognathus* the ilium is even more greatly expanded antero-posteriorly than in *Udenodon,* and the ischium is produced backwards to a greater extent, while the obturator foramen is considerably larger. The pelves in the two forms are, however, manifestly closely related, though the Theriodont pelvis comes nearer to the Mammalian type than does the Anomodont; while the latter retains more of the primitive characters.

The femur does not greatly resemble the femora of those few Theriodonts in which that bone is known. It shows hardly any of the remarkable features of the femur of *Ictidosuchus.* There is, however, a distinct depression immediately inside the great trochanter corresponding to the deep pit in the femur of that early Theriodont. It is probable, however, that in many Theriodonts the femur was as little specialized as in *Udenodon.* In *Cynodraco* the distal end of the femur is fairly like that in the Anomodont. On the whole it must be admitted that the Anomodont femur resembles the Mammalian type more than that of any other known Reptilian group.

The fibula agrees with that in the Monotremes and Marsupials, in having the upper end expanded and passing beyond the head of the tibia. A similar condition is seen in *Aristodesmus.*

The tarsus is especially interesting, in that while it shows close affinities with the primitive types, it also foreshadows the tarsus of the mammal. Assuming that my interpretation of the elements is correct, the tarsus would show some resemblance to that in the Pelycosauria, where, according to Cope (**16**), a distinct intermedium and centrale are present. In the large majority of Reptiles the intermedium and the centrale become early united with the tibiale. In the mammal it would appear that the astragulus is the tibiale, the calcaneum the fibulare, the navicular the centrale, and that the intermedium is missing. The condition of the elements in *Udenodon* would seem to favour this view. By Gegenbaur, Flower, and others the mammalian astragalus has been held to represent the united tibiale and intermedium; while according to Emery the astragalus represents a fusion of the intermedium and a paracentrale. When, in any form, a single cartilage or bone occupies the situation held by two elements in an ancestral type, many morphologists incline to regard the single element as morphologically equivalent to the two; but in the very large majority of cases there is good reason to believe that the single element is only functionally equivalent to the two, and that it is the homologue of only one, the other being completely lost. Thus, if we compare the human carpus with that of the Baboon, we might readily conclude that the scaphoid or radiale in Man was equivalent to the small scaphoid and centrale together of the lower form; but we know from development that a rudiment of the centrale is present and quite distinct in man in early fœtal life, and that as development advances it completely disappears. Very many similar instances might readily be given. Of course this rule does not apply to those cases where two elements distinct in early life coalesce or anchylose as development advances, but it appears to apply to membrane-bones as well as cartilage.

In *Udenodon* the small size of the intermedium seems to indicate that it is on the point of disappearing, and in mammals it is apparently quite lost. The centrale, though as displayed it is small, occupies the position of the navicular in the mammal, which has generally been regarded as the centrale of the tarsus.

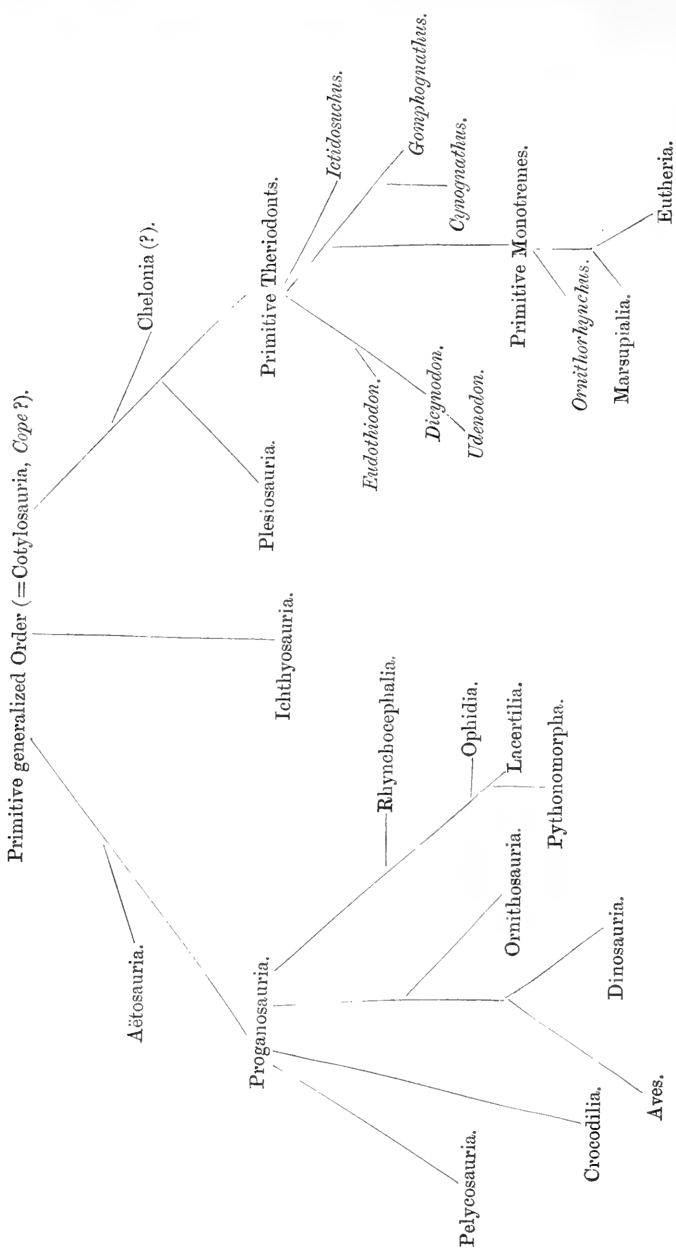
The digits and the phalanges agree in number with those of the Mammalia.

Conclusion.

From the structure of the skull and other parts of the skeleton, *Udenodon* is very manifestly closely related to both the Theriodonts and to the Mammals, and though the higher Theriodonts are too specialized to have been the ancestors of the Anomodonts, the lower Theriodonts may very well have been the ancestors not only of the Anomodonts but of the Mammals. The lower Theriodonts may have sprung from forms allied to *Pareiasaurus* with the temporal region completely roofed; and it seems probable that the bones forming the temporal roof have been reduced in number before the first formation of the fenestra. From the same line by which the Theriodonts have arisen, it is probable that the Plesiosaurs have sprung as an offshoot arising early and becoming greatly specialized, and it is also possible that the Chelonians have branched off from near the same point.

All the other reptilian groups appear to have arisen by a different branch or branches from the primitive forms. From forms with the temporal region completely roofed as in *Pariotichus*, it is probable that a group arose with the roof fenestrated at first in the supralateral region, and then later in the infralateral region as well, and giving rise to a group of which *Palæohatteria* may be regarded as the type. From this group it is highly probable that the Pelycosauria have arisen by one branch, the Crocodilia by another, the Dinosauria, and probably the Ornithosauria, by a third; while a fourth branch has given rise to the Rhynchocephalia and the Squamata. The Ichthyosauria appear to have either sprung directly from the primitive group, or to have branched off very early from the *Palæohatteria* stem. All the orders along this main branch have the palate directly derived from a *Sphenodon*-like type, and in most instances the modification from the type is slight.

What appear to be the mutual relationships of the principal Orders are best seen when an endeavour is made to arrange them phylogenetically, thus :—


Primitive generalized Order (=Cotylosauria, *Cope*?).
Ichthyosauria.
Chelonia (?).
Plesiosauria.
Primitive Theriodonts.
Ictidosuchus.
Gomphognathus.
Cynognathus.
Primitive Monotremes.
Eutheria.
Marsupialia.
Ornithorhynchus.
Dicynodon.
Udenodon.
Eudothiodon.
Aëtosauria.
Proganosauria.
Rhynchocephalia.
Ophidia.
Lacertilia.
Pythonomorpha.
Ornithosauria.
Dinosauria.
Aves.
Crocodilia.
Pelycosauria.

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EXPLANATION OF THE PLATES.

Plate XVI.

Fig. 1. Skeleton of a small *Udenodon*, presumably *U. gracilis*. The parts in outline are from the remains on the counter slab. × $\frac{9}{10}$.

Plate XVII.

Fig. 2. Upper view of skull of *Udenodon gracilis*. Nat. size.
3. Side view of skull of *Udenodon gracilis*. Nat. size.
4. Vertebra (probably lower thoracic) of *Udenodon bainii*. Nat. size.
5. Posterior view of right hind-limb of *Udenodon gracilis*. Nat. size.
6. Inner view of pelvic bones of right side of *Udenodon gracilis*. Nat. size.

Plate XVIII.

Fig. 7. Posterior or under side of right arm-bones of *Udenodon gracilis*. Nat. size.
8. Right clavicle of *Udenodon gracilis*. Nat. size.
9. Sternum of Anomodont—believed to be *Udenodon baini*. Nat. size.
10. Right shoulder-girdle of *Udenodon baini*. Nat. size.
11. Right coracoid and precoracoid of *Udenodon baini*, from within. Nat. size.

Reference Letters.

ac., acetabulum.
acr., acromion process.
c., centrale.
c.d., deltoid ridge.
c.e., external condyle.
cl., clavicle.
co., coracoid.
f., femur.
fb., fibula.
fl., fibulare.
fm., femur.
fo., precoracoid foramen.
f.ob., obturatur foramen.
gl., glenoid facet.
hu., humerus.
i., intermedium.
il., ilium.
is., ischium.
mt., metatarsals.
n., anterior nares.
na., nasal bone.
ol., olecranon process.
pb., pubis.
ph., phalanges.
pi., pisiform.
p.co., precoracoid.
ra., radiale.
rd., radius.
r.f., frontal ridge.
r.p.f., postfrontal ridge.
Sc., scapula.
Sp., neural spine.
tb., tibia.
tl., tibiale.
tr., transverse process.
ts., tarsalia (1 & 4–5).
ul., ulna.
un., ulnare.

4. On some Species of Earthworms of the Genus *Benhamia* from Tropical Africa. By Frank E. Beddard, F.R.S. &c.

[Received May 20, 1901.]

(Text-figures 12–19.)

The genus *Benhamia* was originally instituted by Dr. Michaelsen[1] and withdrawn from *Acanthodrilus*, in which it had been formerly included. Quite recently[2] the same authority has proposed to drop this generic name, and has placed the species which belong to it in

[1] JB. Hamb. wiss. Anst. vi. p. 6.
[2] Oligochæta in 'Das Tierreich,' 1900, p. 334.

the genus *Dichogaster* (originally instituted by myself [1]), which has priority. This genus *Dichogaster* was also extended so as to include *Microdrilus*, *Millsonia*, and *Balanta*. The extended genus will contain therefore at the present moment no less than 70 species. If it can be avoided, it appears to me to be undesirable to divide families into such large genera. I do not for a moment deny that the difference between the several types, which were distinct enough at the time of their creation as genera, are through further discovery rendered small. Nevertheless it appears to me to be still possible to retain the genus *Benhamia* (which perhaps must include *Trigaster*) for those Acanthodrilid worms in which the male pores are quite independent at their orifice from the spermiducal glands, and which in all cases (save only in *Benhamia viridis*) open on to a segment (the xviiith) lying between those upon which open the two pairs of spermiducal glands. But *B. viridis* is not exceptional in the fact that the sperm-ducts are quite independent at their orifice of the spermiducal glands. *Benhamia* is, at least mainly, an African genus—tropical African. Some 38 species are confined to that continent, and two others have been found in the Malay Archipelago as well, while a third has been met with in many parts of the world. Four are, so far as we know at present, confined to the Oriental region, while 9 (exclusive of the species of the genus *Trigaster*) are Central-American and West-Indian. It is held, and as I think rightly held, by Michaelsen that the real home of the genus is tropical Africa, and that there is a great possibility that the species not found within that area have been accidentally transferred. As to the ease with which this may have occurred there is plenty of evidence which I need not recapitulate here. There are, as it appears to me, two strong pieces of evidence in favour of the view that it has occurred in the case of this particular genus, which are these :—firstly, three species are common to Africa and to some other part or parts of the globe ; secondly, the species of the genus *Benhamia* of Western Africa are different from those of Central and Eastern Africa. Now migration across the continent must surely be an easier matter than migration so far as the Malay archipelago ; we thus are forced to conclude that if so trifling a barrier, comparatively speaking, as the breadth of equatorial Africa has prevented the intermingling of western and eastern species, the enormous tracts of land and sea which intervene between *Benhamia bolaui* in Africa and the same species in other parts of the world must have been traversed by some other means than unaided effort.

(1) Benhamia moorii, n. sp.

Mr. Moore has very kindly placed in my hands two specimens of earthworms collected by him in Africa. One of these is well preserved, and is a large and, as I believe, new species of *Benhamia*.

[1] Quart. Journ. Micr. Sci. xxix. p. 251.

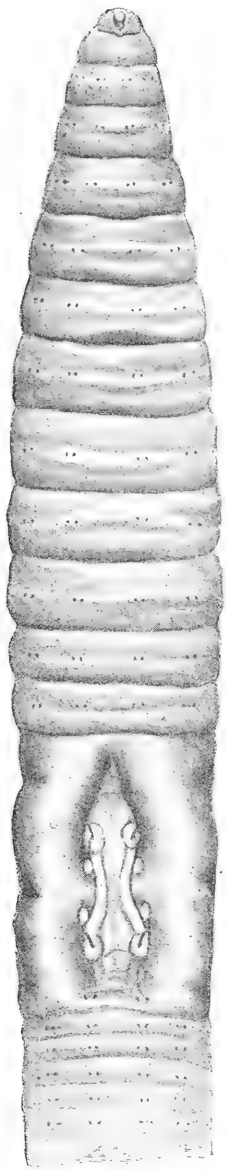
The worm was found upon the Kurungu mountains north of Lake Kivu.

This *Benhamia* is of a leaden colour with a distinct tinge of pink. It is also, on account of its darkly pigmented body, beautifully iridescent. It measures some 280 mm. in length, and is thus one of the larger species of the genus; the extreme diameter (behind the clitellum) is 15 mm.; it is thus a stoutly built worm. Towards both ends of the body it tapers somewhat. As will be seen from the drawing exhibited (text-fig. 12), many of the preclitellar segments are biannulate. The *prostomium* is quite small and entirely retracted within the buccal cavity. It is continued back by a slender prolongation a short distance over the buccal segment. The *dorsal pores* of this worm are apparently rather remarkable in one matter. They commence between segments v./vi., as in many species of the genus. Four plainly obvious pores follow the first one, which is not so pronounced as they are. Then there is a gap where two pores ought to be. It might be imagined that this gap was apparent and not real, due simply to the greater contraction of the body at this part. On dissection, however, the pores were exceedingly plain. And I observed that on the border-line of the three segments, where the dorsal pores were apparently absent, the longitudinal muscle which acts as an expansor muscle of the pore was carried right across the place where the pore should be, instead of ending at its margin as is the case when the pore is present. There seems to be thus no doubt as to the real absence of these pores from the segments mentioned, a curious circumstance which I do not recollect having seen referred to in any other species. Between segments xii./xiii. the pores recommence and continue in an unbroken line to the very end of the body. On the clitellum a median groove partly obliterates the actual pores; it runs from pore to pore and on the anterior part of the clitellum is continuous for some distance; there are traces of it also elswhere upon the clitellum. It is not a furrowing of the integument, but a slight folding which may of course be due to contraction; and yet this is not certain, since it is the ventral side of this worm which was most contracted, a circumstance which ought to have resulted in a tauter condition of the opposite side of the body.

The *setæ*, as is universal in this genus, are strictly paired, and lie entirely upon the ventral surface of the body.

The *clitellum* is fairly extensive. It begins with the xiiith and ends with the xxiiird segment, thus occupying eleven segments. The middle region of the clitellum, including segments xiv.–xxi., is more compacted, owing to a reduction in the depth of the intersegmental furrows. The ventral surface of a considerable portion of this is deeply depressed, as in other species of *Benhamia*, and thus forms a sucker-like structure, extending from about the fifteenth to the twentieth segment. This area surrounds of course the male pores. The arrangement of these will be apparent from an inspection of the drawing exhibited (text-fig. 12). The species shows no great differences from the conditions which have been observed

Text-fig. 12.



Ventral view of the anterior segments of *Benhamia moorei*. × $\frac{3}{2}$.

and described in other species of *Benhamia*. The four *pores of the spermiducal glands* lie as usual upon the xviith and xixth segments. Their position corresponds to that of the ventralmost setæ; from each protrudes a single penial seta, whose structure will be dealt with immediately in connection with that of the male efferent apparatus. A nearly circular fold of integument surrounds each pore, and is continuous with a fold which demarcates a groove putting the two pores of each side of the body into communication. This seminal gutter has a curvature which is not usual in the genus. As a rule it is absolutely straight, or, if curved, the convexity of the curve is to the outside. In the present species the curvature is, as may be seen in the figure, in the reverse direction, the concavity of the curve being directed outwards. Between the two gutters the integument is traversed by a regular series of grooves which subdivide its surface as I have shown (text-fig. 12). I presume that the orifices of the sperm-ducts lie in the groove on each side of the body. But the groove was so deep that I was unable to detect them. Moreover I am unable to assert definitely whether or not the ventral pair of setæ are present upon the xviiith segment. It was thought for a time that the absence of these setæ was distinctive of the genus *Benhamia* (*sensu stricto*); but, as Michaelsen has found that this is not always the case, the character must be dropped: still it remains true that in the majority of species which have been carefully examined these setæ are really absent. On the clitellum generally of this worm, large though it is, the setæ are not at all conspicuous. Just behind each of the anterior penial setæ and just before each of the posterior penial setæ there is, to the side, an isolated and smallish tract of integument which I regard as a *genital papilla*. The two pairs of genital papillæ would thus appear to be situated on the border lines of segments xvii./xviii. and xviii./xix. Although the appearance of the integument which forms these structures does not differ markedly from the appearance of the surrounding integument, yet the groove which surrounds them seems to mark them out as something distinct; and they are, as I think, to be looked upon as genital papillæ, which are sometimes, though not very generally, present in the species of this genus. I could not find either the pores of the oviducts or those of the spermathecæ. As to the latter, a dissection assured me that they are ventral in position and correspond fairly closely to the position of the pores of the spermiducal glands.

Internal Anatomy.

When the worm was cut open, the relative thickness of various regions of the integument was found to vary considerably. Anteriorly to the clitellum the body-wall was much thinner than in the clitellar region and behind it I may remark that a difference of colour distinguished the two layers of the clitellar epithelium.

Intersegmental Septa.—The considerable deficiency of septa in the anterior region of the body may perhaps account for the thinness of the integument already referred to. It is very unusual to find so few—and those such thin—septa dividing the anterior segments. Their arrangement, moreover, is very puzzling when taken in relation with the external segmentation and with the location of organs internally. The first recognizable septum is fairly thick and separates segments v. and vi. Its insertion on the body-wall corresponds quite accurately to the external furrow separating those segments. There is then an apparent gap of considerable extent in which there are no septa at all, though the œsophagus and the gizzards are bound to the parietes by a few muscular threads. The next actual septum is very thin; it is inserted behind the last of the two gizzards on to the alimentary canal, but to the body-wall at about the middle of the ixth segment, as mapped by the dorsal pores which are quite conspicuous from the inside of the body. It might therefore be held that the few muscular strands, already referred to, represented the otherwise missing septa vi./vii. and vii./viii., and perhaps viii./ix. Obvious though this determination seems on a dissection, it is apparently not correct. If we count the septa from a fixed point such as the segment lodging, and containing the external orifice of, the anterior spermiducal gland, we find that up to as far forwards as the xivth segment there is a correspondence between the insertion of the septa and the segments which they demarcate. Between the septum which defines the fifteenth segment anteriorly and the second recognizable septum just described, I find six septa crowded together. It seems to follow therefore that that septum, in spite of the place of its attachment to the body-wall, is really septum vii./viii. and that the only really missing septum is vi./vii.

As this latter septum would if present lie between the two gizzards, it is not surprising to find it absent, a state of affairs which is very characteristic of the gizzard segments of *Perichæta* (syn. *Amyntas* and *Pheretima*).

None of the septa as already mentioned are particularly thick; those dividing segments xii./xvii. are the most developed.

Alimentary Canal.—The *pharynx* occupies the first five segments of the body. The two *gizzards* are separated by a very short tract of thin-walled œsophagus. The anterior of the two gizzards is really preceded by a third rather rudimentary gizzard, for the walls of the end of the œsophagus are nearly as thick as those of the gizzard and are divided from it by a brief thin-walled region. From what has been said with regard to the septa of this part of the body, it should be clear that the two fully developed gizzards lie in segments vi. and vii., a quite reasonable determination of their situation. Segments v. and vi., however, are more usually occupied by the gizzards in this genus. The *calciferous glands* are in segments xv., xvi., and xvii. The first pair differ from the rest in being whiter in colour. Each gland is somewhat kidney-shaped but with a number of transverse depressions dividing it into lobules. The glands open separately into the œsophagus, by wide and easily visible ducts.

Generative organs.—The *testes* I did not detect. The *ovaries* were very small, though easily recognizable in their usual segment (the xiiith). There are two pairs of *funnels*, which seem at first sight to be situated farther forward than is the rule; they lie in fact beneath, and are quite concealed by, the large gizzards. The shifting of the septa, however, already referred to, accounts for this appearance; and I have little doubt but that the funnels lie in segments x. and xi. They are large, much folded, and of an opaque white colour as is usual with the funnels of the terrestrial Oligochæta. The *sperm-sacs* are apparently but slightly developed, that is if I am right in my identification of these structures. In segment xii. and attached just behind the posterior pair of funnels to the septum near to the ventral body-wall, is a pair of small pear-shaped bodies which I took at first for *testes*, so small are they, and of so unusual a form for sperm-sacs. Nevertheless I imagine that they must be sperm-sacs, though I could make out nothing decisive in their structure when teased in glycerine. A second pair of apparently similar sacs lie above them and protrude into their segment through an obviously natural foramen in the septum. A series of sections enable me to state definitely that these are sperm-sacs. The *spermiducal glands* are large and much coiled, so that they occupy only two or three segments. They appear, however, above the gut in this region. The muscular duct in which they end is thinnish and of some extent.

This *Benhamia* has the usual two pairs of *spermathecæ*, which are large and completely hidden by the gizzards; their external orifices are, however, between segments vii./viii. and viii./ix. Each sac (text-fig. 13, p. 197) consists of a thin-walled receptacle of somewhat irregular form owing to its being not very full of secreted matter, and to unequal pressure by the other viscera in the preserved worm. Leading from this pouch is the thick-walled and more muscular duct, which is quite of equal length to the pouch. Attached to the duct nearer to its external opening than to the pouch is a single diverticulum, which is composed of a rosette of flattened seminal chambers which are chalk-white from the enclosed semen.

Penial Setæ.—It is rather extraordinary that the very fragile penial setæ were absolutely intact. Protruding from each of the four spermiducal gland-apertures was a single long penial seta of a brown horn-colour, and some four or five millimetres long. That they were protected by the deep depression in which the male orifices lie is possibly the cause of their preservation; for I found them very brittle. These four setæ stand up perfectly straight without a bend, except at the very tip, which is hooked. It is a curious fact that they were symmetrically disposed; each pair stood as it were back to back, with the hooks directed outward. I do not think that this regularity in the position of the penial setæ has been commented upon before.

The appearance of these setæ under the microscope (see text-fig. 16, p. 205) is characteristic. Very nearly the whole of that part of the seta which is exposed at the surface of the body is marked by complete rings of a different texture, or at least appearance, to the interspaces. It can be readily seen that these rings are not superficial markings upon the seta, as they have been—perhaps wrongly—stated to be in the case of similar seta in other worms. They are, as was correctly stated by Michaelsen in another species of earthworm, caused by some differentiation of the material of the

Text-fig. 13.

Spermatheca of *Benhamia moorei*. × 3.

seta below the outermost layer. Towards the hooked end of the seta these rings get to be closer together and at the same time of less diameter. In addition to these markings the extremity of the seta is pitted—this time quite superficially—with minute excavations. The tip is strongly hooked, and before this the seta regularly but rapidly decreases in calibre, not suddenly as Michaelsen has figured and described in *Benhamia itiolensis*.

Spermatophore.—I found a spermatophore in this species ; but I do not give a full account of it, and as the existence of spermatophores in this genus is not my discovery, I do not give a special section to an elaborate description of it. It is curious how rarely spermatophores have been met with in the enormous number of species (some 550) belonging to the family Megascolicidæ (from which I exclude the Eudrilidæ). Indeed I am only acquainted with their description in two forms belonging to the same genus as the subject of the present communication. Dr. Michaelsen has in fact figured and briefly noticed a spermatophore in *Benhamia monticola* and *B. itiolensis* [1]. The spermatophore of the species described here is apparently slightly different in form. I may remark first of all that it lay entirely in the muscular duct of the spermatheca, and

[1] Regenwürmer in Deutsch-Ost-Afrika, p. 28, pl. i. fig. 4.

that it is too large to have been moulded in the narrow muscular part of the spermiducal gland. The end turned towards the spermatheca was oval in form, and this region gradually narrowed and then terminated abruptly in a large roughly rounded mass, of greater diameter than the oval end of the spermatophore. The structure was very hard, and a little brittle, and of the usual chitin yellow. When viewed with the naked eye, or with a lens, the distal end of the spermatophore was white from the enclosed sperm. The finer middle region was of a golden yellow, since the canal here within the spermatophore was narrow. The walls are thick, especially of course those of the rather irregularly shaped terminal swelling. Whether there is a terminal pore I do not know.

I conclude with a brief definition of this new species, which I propose to name after Mr. Moore:—

Benhamia moorei, n. sp.

Length 280 *mm., diameter* 10–15 *mm. Prostomium very small, prolonged for a short way on to the buccal segment. Dorsal pores commence v./vi. Clitellum xiii.–xxii. Male pores on deep depression; seminal gutter convex inwards. Two pairs of genital papillæ on xvii./xviii. and xviii./xix. Gizzards in vi. and vii.; calciferous glands in xv., xvi., xvii., opening separately into œsophagus. No septa very thick; septum vi./vii. wanting. Dorsal vessel single; last heart in xii. Two pairs of sperm-duct funnels. Spermiducal glands large and coiled. Penial setæ one to each gland, hooked at the tip and marked throughout the greater part with fine rings; at the very tip very slightly pitted. Spermathecæ with long muscular duct as long as the pouch. Near to the beginning of the muscular duct a rosette of four or five diverticula. Spermatophores present.*

Hab. Kurungu Mts., East Central Africa.

(2) **Benhamia johnstoni**, n. sp.

Sir Harry Johnston, K.C.B., has sent to the Natural History Museum three Earthworms which prove to be all of the same species, and are closely allied to *B. moorei* which has just been described. I am indebted to the kindness of Sir Harry Johnston as well as to Dr. Lankester for allowing me the opportunity of examining these worms. The species, which I propose to name after their collector, is in many respects so near to *B. moorei*, that at first I thought that I had before me some larger examples of that species. Nevertheless, as I shall show, there are a number of points of structure in which the two differ.

B. johnstoni is a larger worm, though its actual length is less than that of *B. moorei*; the largest of the three specimens was 250 mm. in length, but quite 20 mm. in breadth, indeed a millimetre or two more in places. It is thus an exceptionally stout species. The colour during life must have been very marked; even in the preserved worms the contrasts of colours are striking. The general colour above is of a red-brown, which pales into a yellowish upon the ventral surface. The dorsal pores are surrounded by a small pale area and the clitellum is yellowish.

The *prostomium* is larger than that of *B. moorei*; it is retracted within the buccal cavity, and is divided off from the buccal segment by a complete groove which dips faintly into the segment. The arrangement of the prostomium is that denominated "pro-epilobisch" by Dr. Michaelsen. It is convenient to have terms for the varying condition of the prostomium which is so frequently of use in the discrimination of species or genera, as in the present instance. But it would be as well perhaps to convert Michaelsen's terms into more purely Greek compounds. I would suggest that the terms should be epicheilous, &c. The *dorsal pores* have an interesting arrangement in this species. In one of the three examples no pores were missing from the intersegmental groove v./vi. onwards. In another, one was not visible externally and internally, the muscles, which are present in every case, running from margin to margin of the successive pores, were exceedingly feeble at this point. In the third example, which I did not open, there was no doubt of the fact that the dorsal pores between segments x./xi. and xi./xii. were absent; for in that worm the other pores happened to be particularly conspicuously distended. There is thus in the present species a series of stages which culminates in the loss of the two dorsal pores immediately preceding the clitellum. In *B. moorei*, as has been stated, the same pores are absent; but it may be of course that other examples would show some trace of their presence. I should observe that the muscles whose function it is to distend the pores are exceptionally well developed in this species, and that the feeble muscles running from the places which should be occupied by the missing dorsal pores ended where the pores should be, and did not, as in *B. moorei*, continue their course over this spot without a break.

The *setæ* have the usual strictly paired and ventral position. The individual setæ are very plainly ornamented, as is the case with other species; the ornamentation is in the form of slight ridges over the distal end of the seta. The seta as a whole is rather straight, and has often a somewhat peculiar ending in its epidermic sac, which is illustrated in the accompanying drawing (text-fig. 14, p. 200). The setæ cannot be considered to be small except proportionately, the worm being exceptionally large.

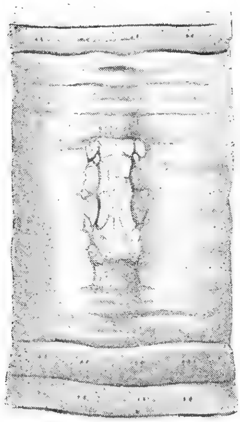
The *clitellum* is largely composed of segments whose mutual demarcations have been to a great extent obliterated; but in front of, and behind, this region are two segments which belong to the clitellum, though they are not so thoroughly amalgamated with the middle segments as the latter are with each other. The clitellum extends from segment xii. to xxiii. inclusive, and is thus longer than that of *B. moorei*. The ventral surface which bears the several male pores is deeply depressed as shown in the drawing (text-fig. 15, p. 200).

The figure of *B. moorei* shows the tesselated appearance of the integument in the region of the male pores; this appearance is

Text-fig. 14.

Two setæ of *Benhamia johnstoni* (highly magnified).

Text-fig. 15.



Ventral surface of clitellar segments of *Benhamia johnstoni*. × $\frac{3}{2}$.

exaggerated in the present species (text-fig. 15, p. 200), the condition of the integument somewhat obscuring the actual orifices of the spermiducal glands. The penial setæ projected from the latter precisely as in *B. moorei*. The groove which connects the two spermiducal gland-pores of each side is straighter than in *B. moorei*, and in the two not fully mature examples was perfectly straight. The groove itself is a little difficult to see owing to the numerous lines which divide up the ventral area into detached tracts.

The internal structure of this worm also shows a few small differences from both *B. moorei* and *B. itiolensis*. The two *gizzards* are so close together that it is difficult to note their line of division. Moreover strands of muscle pass over this line of division. I am disposed to believe that the gizzards lie respectively in segments vii. and viii. It is rather hard to be certain upon this point; but in any case I counted six septa in front of that which divides segments xiv./xv. In front of the last of these six septa lies the posterior of the two gizzards. It cannot therefore be behind the viiith segment, though it is possible that the gizzard really lies in vii. as in *B. moorei*. The *calciferous glands* are in segments xv., xvi., xvii. They differ slightly from those of *B. moorei*, in that the first and the third pairs are equal, while the middle pair are rather the smallest. I observed no difference of colour such as distinguishes the first pair of these glands in *B. moorei*. The *intestine* in this species commences in segment xix. There is apparently no difference from *B. moorei*, as far as I can see, in this particular.

The *organs of reproduction* are, moreover, much the same. I found, as in *B. moorei*, masses of sperm in segments xi., xii. I could find no wall to these masses, which seemed to be merely freely floating and agglomerated heaps of developing spermatozoa freed from the testes. I have adverted to the very small size of the sperm-sacs in *B. moorei*. In the present species I could not discover them at all; they must therefore be small if present. It is remarkable that in mature examples of both species the sperm-sacs are so small, and that both concur in having large and freely floating masses of sperm. In *B. itiolensis*, Michaelsen was unable to record the position and appearance of the sperm-sacs; while in *Benhamia viridis* and *Trigaster lankesteri* the sperm-sacs, dwindling as it appears in the former three species, have entirely disappeared. The *spermiducal glands* are very large and massive. Each of them occupies two segments, the connection between the two masses being by a single loop of the tube which perforates the septum; thus the appearance of four pairs of glands is produced. The arrangement is obviously not quite the same as has been figured by Michaelsen in *B. itiolensis*. But in the so-called variety *cœrulea*, the same arrangement as that characteristic of *B. johnstoni* appears to occur. The *penial setæ* of the present species are quite different in form from those of *B. moorei*, as will be seen from a comparison of the accompanying drawings (text-fig. 16, p. 205). The general form and the remarkable straightness is the same in both, as is the series of transverse bars which mark the setæ throughout. At the distal end, however, there are plain differences. In *B. johnstoni* the seta swells ovally just before its termination, and on the ventral side of this there is a sharply marked ridge; the actual extremity is bent almost like a crozier, the end lying parallel with the main shaft; the very tip is slightly bifid. It is clear that this does not agree with the figure given by Michaelsen of *Benhamia itiolensis*. Nor does his description of the penial setæ of the variety *cœrulea* fit itself to what I have observed. Of the seta in *B. itiolensis* var. *cœrulea*, he remarks that it has a much narrower distal extremity (as in *B. johnstoni*), and that there is also an oval swelling which precedes this terminal hook (also as in *B. johnstoni*); but the tip is apparently not so much hooked as in *B. johnstoni*, and no mention is made of the bifid extremity.

The two species *Benhamia johnstoni* and *B. moorei* evidently come near to *B. itiolensis*[1]. But they both differ in a number of recognizable features from that large and also Eastern African *Benhamia*. To begin with, *B. itiolensis* is distinctly larger, it measures 380 mm. Its colour seems to be somewhat different. The anterior segments are some of them triannulate instead of biannulate, as is the case with the species described in the present paper. Nothing is said by Michaelsen of the missing dorsal pores; but in a variety of the type named by him var. *cœrulea*, the pores are stated not to begin until the intersegment xii./xiii. The clitellum of *B. itiolensis* is more limited than in its allies; but the seminal gutter is convex inwards as in those two species. At least that is not the case with the type itself, but with the form *cœrulea*. The spermiducal glands of *B. itiolensis* are very much smaller than those of *B. johnstoni* or *B. moorei*, though their size appears to be increased in the var. *cœrulea*. The penial setæ as figured by Michaelsen are more like those of *B. johnstoni*, but the hooking of the extremity is more marked in the latter form; moreover, no ornamentation is described. In var. *cœrulea* the extremity of the seta is more hooked, and therefore more like that of *B. johnstoni*. Finally, *B. itiolensis* has no free diverticula to the spermathecæ, a feature which is so obvious in the species described by myself that Michaelsen would hardly have overlooked it did it exist in his *Benhamia itiolensis*. The differences between many species of this genus (which requires revision) are often so small, that a very careful and detailed statement of the characters is necessary. For this reason I have not hesitated to deal with my supposed new species at considerable length.

It may be convenient to contrast the characteristics of the four species in a tabular fashion. I shall consider the variety *cœrulea* to rank as a species; its differences from *B. itiolensis* are quite as great as those which divide many other recognized species of the genus.

[1] Michaelsen, "Beschreibung der von Herrn Dr. Fr. Stuhlmann am Victoria Nyanza geasammelten Terricolen," JB. Hamb. wiss. Anst. ix. p. 3; ibid., xvi. p. 116; Regenwürmer in Deutsch-Ost-Afrika, iv. p. 25; Oligochæta in Thierreich, 1900, p. 360.

	B. itiolensis.	B. cœrulea.	B. moorei.	B. johnstoni.
Prostomium	*Proepicheilous.*	*Epicheilous.*	*Epicheilous.*	*Proepicheilous.*
Anterior segments	*Triannulate.*	....	*Biannulate.*	*Biannulate.*
Dorsal pores	*v./vi.*	*xii./xiii.*	*v./vi.*	*v./vi.*
Clitellum	*xiv.–xxii.*	(?)	*xiii.–xxiii.*	*xii.–xxiii.*
Seminal gutter	*Straight.*	*Convex inwards.*	*Convex inwards.*	*Convex inwards.*
Gizzards	(?)	*viii. & ix.* (?).	*vi., vii.*	*vii., viii.*
Calciferous glands.	*xv. smallest.*	*xv. smallest.*	*xv. smallest.*	*xvi. smallest.*
Spermathecæ	*No extern. div.*	*No extern. div.*	*Extern. div.*	*Extern. div.*
Penial setæ	*Suddenly diminish into slightly curved hook.*	*Suddenly diminish into slightly curved hook.*	*Gradually diminish into slightly curved hook.*	*Suddenly diminish into very curved hook.*

From the above account of its structure I can abstract the following definition of the species which, I may remark, contains certain statements not described in any further detail in the foregoing.

Benhamia johnstoni, n. sp.

Length about 250 *mm.; diameter* 15–20 *mm. Prostomium rather large, retracted within mouth-cavity, not prolonged over buccal segment, but with slight median projection. Dorsal pores commence v./vi. Clitellum xi.–xxiii. Male pores on deep depression; seminal gutter slightly convex inwards. Integument surrounding male pores markedly tesselate. Gizzards in vii., viii.; calciferous glands xv., xvi., xvii., opening separately into œsophagus; middle pair the smallest. No septa very thick. Dorsal vessel single; last hearts in xii. Spermiducal glands lie in two masses in two segments each. Penial setæ, one to each gland, slightly swollen before strongly hooked tip, which is bifid at extremity, marked throughout with fine rings. Spermathecæ with strong muscular duct longer than pouch, into the duct opens a rosette of five or six diverticula.*

Hab. Ruwenzori, 6500 *ft.*

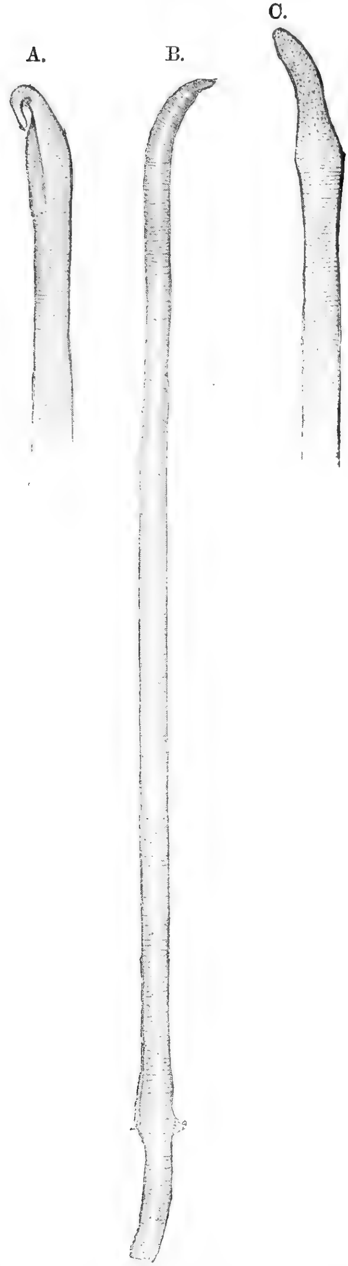
(3) Benhamia mollis, n. sp.

In the above table of the specific distinctions between the species *B. johnstoni*, *B. moorei*, *B. itiolensis*, and *B. cœrulea*, I have not included the characters of a second species of *Benhamia* placed in my hands by Mr. Moore. This worm is of a very dark brown colour and is very soft. I naturally put down this softening to inferior preservation; but Mr. Moore informs me that the living worm was exceeding soft and that the specimen which I have examined is in reality as well preserved as is the type of *B. moorei*. I have not compared its characters in a tabular form with those of the other species for the reason that, although I believe it to be a distinct form, it is not easy to define by marked characters as can be made use of in such a table, and indeed it comes very near to *B. johnstoni.*

It is, however, a smaller and more slender species than is the last named. My example measured some 205 mm. in length by a diameter of about 7 mm. There is the same curious absence of two *dorsal pores* from the preclitellar series that is so noticeable in *B. moorei* and *B. johnstoni.*

The *genital area* is a deep excavation; and the integument in this region is tesselated in appearance, being divided up into numerous small areas by grooves. The seminal gutters are nearly straight, only slightly bulging inwards. The single *penial seta*, as in the other species, projects from the apertures on segments xvii. and xix. The *clitellum* is a little less extensive, and seems to occupy only segments xiv.–xxii. I am sure that the ventral setæ of segment xviii. are wanting, and this adds probability to their apparent absence in the other two species of which the present memoir treats. As in *B. johnstoni*, the middle pair of *calciferous glands* are the smallest of the three pairs. The glands are somewhat flattened from side to side, more so than in *B. johnstoni*, and much more so than in *B. moorei*. The *intestine* begins in segment xix. The two *gizzards* are certainly in vii. and viii.; the same segments apparently are occupied by the gizzards in *B. johnstoni.* The *last heart* is in xii. The *sperm-sacs* in this species were more in evidence than in the other two species of *Benhamia* dealt with here. They lie in segments xi., xii., and are somewhat elongated transversely, curving up in a somewhat horn-like fashion. The *penial setæ* of *B. mollis* are recognizable as different from those of the other two species. The setæ of all three species are figured in the accompanying drawing (text-fig. 16, p. 205). It will be noticed that their structure is intermediate between that of the penial setæ of *B. moorei* and *B. johnstoni.* As in the former, the distal end of the seta is not very strongly curved; as in the latter, the shaft of the seta is swollen before the terminal hook. But the swelling is not so marked a feature of the setæ of the present species. Nor is the difference in diameter between the hook and the rest of the seta so suddenly changed. Moreover, the markings upon the end of the seta which appear to be of the nature of pits are much more pronounced in *B. mollis* than in its allies. No one, after inspecting the figures referred to, can doubt the difference of the penial setæ in the three species. The *spermiducal glands* are, as in *B. johnstoni*, contained each in two segments, one half or thereabouts of the gland lying in each segment. The junction between the two is a single tube, *i. e.* the gland only perforates the intersegmental septum once. The *spermathecæ* are most like those of *B. johnstoni.* The muscular duct of the spermatheca is humped on one side, where a series of five or six inconspicuous diverticula debouch into the duct. The diverticula are less separated from the tube into which they open than they are in *B. moorei.*

Text-fig. 16.



Penial setæ of *Benhamia* (highly magnified).
A, distal extremity of that of *B. johnstoni*; *B*, seta of *B. moorei*;
C, distal extremity of that of *B. mollis*.

It must be admitted that the principal reason for separating this species from *B. johnstoni* is the character of the penial setæ. It is, however, a smaller species, with a different coloration. As to the clitellum, it is possible that other specimens would show an extension equal to that of *B. johnstoni.*

(4) **Benhamia austeni**, n. sp.

I am indebted to the kindness of Mr. Austen for kindly collecting for me a considerable number of specimens of a species of *Benhamia*, which I believe to be new. The worms were collected about forty miles from Blantyre in Nyassa-land.

The species is not a large one, but I cannot give accurate measurements of length as the worms were rather softened. I should say that a length of 150 mm. by a diameter of 5 mm. was a fair statement of their dimensions.

The *setæ* have the usual strictly paired and ventral arrangement. Those of the three or four anterior segments are smaller than those which follow; they gradually increase in size, and the larger ones show a distinct ornamentation in the form of ridges which produce a scale-like appearence—a form of ornamentation found in other species of the genus. On segments vi.–ix. or so the setæ are especially enlarged; it will be noted that these segments are in the neighbourhood of the spermathecal pores, and the strong pairs of setæ on the segments between which those pouches open are particularly noteworthy. It is only the ventral setæ which are thus specially enlarged. Now it will be remembered that in *Benhamia liberiensis* [1] there is a similar enlargement of the ventral pair of setæ of segment vii. But in this species the setæ when extracted are seen to be quite as much modified as are the genital setæ of segments xvii. & xix. in the same and other species of *Benhamia*. This is not the case with *Benhamia austeni*; but the enlargement and increase of the ornamentation upon the setæ is a step in that direction. The circumstances are exactly paralleled by the slightly modified setæ in the neighbourhood of the male pores in certain species of *Perionyx* [2], which in the allied genus *Megascolex* become the much more modified penial setæ.

There are no ventral setæ upon segment xviii.

The *dorsal pores* commence between segments v./vi. They appear to go on without intermission to the end of the body. No such break as I have described in *Benhamia moorei* seems to exist.

The *oviducal pores* are paired. Each pore lies on the fourteenth segment to the inside of, and quite in line with, the ventralmost seta; it looks, on an inspection by a lens, precisely like a third seta in this position, by reason of its dark appearance.

It is important to note the position of the oviducal pores, which vary in the genus, and would appear to offer characters of specific

[1] Horst, "Descriptions of Earthworms: IX. On two new *Benhamia*-species from Liberia." Notes Leyd. Mus. xvii. p. 21.

[2] Beddard, "On some new Species of Earthworms from various Parts of the World." P. Z. S. 1892, p. 688.

value by this variation in position. For example, in *Benhamia crassa* the pores lie in front, though also slightly to the inside, of the ventralmost seta.

The *clitellum* extends from segments xiii.–xx. and leaves only the area which is occupied by the male pores free. The latter lie upon the segments which they universally occupy in this genus. The seminal groove which connects the two successive pores of each side of the body is quite straight.

The internal anatomy is like that of the genus, and only shows some slight differences from other species. The *septa* which divide segments x./xiv., *i. e.* four septa, are specially thickened.

The *gizzards* occupy segments v. & vi. The *calciferous glands* are in segments xv., xvi., xvii. The glands are bean-shaped, and the upper surface is traversed by a few longitudinal furrows, which divide the glands into segments.

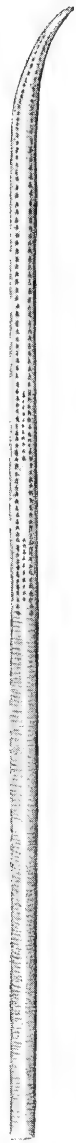
The last pair of *hearts* are in the twelfth segment, and the *dorsal vessel* is throughout a single tube.

The *sperm-sacs* are in the same segments as those of the last species described, *i. e.* xi. & xii. They are large and racemose. There is no doubt that this species, like at any rate some others, has sperm-reservoirs also which enwrap the funnels and testes. I cannot attempt an accurate description of them, but can assert that a pair project forwards, just as these pouches generally do when they are present, into the xth segment.

The *spermiducal glands* are fairly long and coiled; I occasionally observed the posterior pair to be the smaller. The muscular terminal duct is longish. The glands lie in two segments. The shape of the *penial setæ* of this species is quite peculiar for the genus, and would serve at once to distinguish it, if there were no other characteristics. One of the setæ is shown in the drawing exhibited (text-fig. 17, p. 208). Its shape is, as will be seen, straight in the shaft like that of the other East-African species already dealt with here. The end imbedded in the body-wall is curved slightly and thicker. The opposite extremity of the seta is also curved and in the same direction: it does not end in a very fine point but diminishes gradually and not very much in width. The termination is therefore a blunt point. It is the ornamentation of the genital seta which is so characteristic. This consists of two rows of spines which commence about half-way down the seta or a little less. They appear to be much like the penial setæ of *Stuhlmannia variabilis* [1] figured by Michaelsen. In two setæ which I examined I found slight differences in the arrangement of these spinelets; in one which I have selected for figuring the two rows ran to the end of the seta, and between them not far from their origin are indications of a third row consisting of two separated tracts of spinelets. In another example this middle row ran to the end of the seta, and the lateral row of one side ceased a little way from

[1] "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar, &c." JB. Hamb. wiss. Anst. ix. 1891, pl. ii. fig. 12.

Text-fig. 17.



Penial seta of *Benhamia austeni* (highly magnified).

its commencement. I may add that each seta-sac contained only one seta, as in the other East-African species.

The *spermathecæ* of this species lie in segments viii. and ix. Each consists of a thin-walled sac and of a duct. Into the commencement of the latter opens a single diverticulum. The thin-walled sac is divided by a constriction into two unequally sized chambers, of which the upper is the larger. Its diameter exceeds that of the duct. The smaller division is of about the same diameter as the duct, and without a microscopical examination might therefore be confounded with the duct. The great thickness of the muscular walls of the latter serve to distinguish it easily. Also the character of the lining epithelium. The duct of the spermatheca is of about the same length as the pouch; its walls are, as already said, very muscular, which gives to them a nacreous appearance. The muscles are disposed in two layers of which the thicker and internal layer consists of circular fibres. The outer thinner layer is made up of longitudinally running fibres. The diverticulum is an oval, almost spherical, pouch, which is appended to the spermatheca by a short and slender duct. This opens into the spermatheca just at the junction of the thin-walled pouch with the thick-walled duct. It might appear from my figure of the spermatheca of *Benhamia moorei* (text-fig. 13, p. 197), that this species differs from *Benhamia austeni* by the fact that the diverticula open into the muscular duct itself, and at some little distance from the union of the duct with the pouch; this is, however, not the case, as I have assured myself by microscopic sections of the spermatheca of *B. moorei*. In that worm the diverticula are certainly appended to the muscular duct itself; but the tubes which put them into communication with the interior of the spermatheca run upwards (*i. e.* away from the external pore) and open into the commencement of the thin-walled portion of the spermatheca, which, however, in this species is rather thicker-walled (in correspondence with its larger size) than the corresponding portion of the spermatheca of *Benhamia austeni*.

I may extract from the foregoing the following definition of

Benhamia austeni, n. sp.

Length about 150 *mm., diameter* 5 *mm. Dorsal pores commence v./vi. Clitellum xiii.–xx. Male pores on a deep depression connected by a straight seminal gutter. No genital papillæ. Gizzards in v., vi., ; calciferous glands in xv.–xvii. Septa x./xiv. thickened. Dorsal vessel single; last hearts in xii. Two pairs of sperm-duct funnels. Spermiducal glands large and coiled. Penial setæ with two rows of spinelets, one to each sac. Spermathecæ with long muscular duct and a single stalked spherical to oval diverticulum. Spermatophores*[1] *present.*

Hab. Near Blantyre, East Africa.

[1] I intend to describe these structures, which differ from those of *Benhamia moorei*, later.

I am indebted to Mr. Budgett, of Trinity College, Cambridge, for a number of specimens of Earthworms from McCarthy Island in the Gambia, which he collected during a recent visit. The specimens were at first put aside under the impression that they belonged to a species recently characterized by myself as *Benhamia budgetti*[1]. A further examination has, however, shown that they are not of that species, but represent two other species of the same genus upon which I propose to offer some notes. The preponderance of the known species of this genus are of West-African habitat, some 25 having been described from that part of the continent; there are some 18 East and Central African forms.

The species of this genus are not at all easy to identify, and there is a group of West-African forms to which the specimens described in the present paper belong which are all characterized by the calciferous pouches usually lying in the xivth to the xvith segments, and of a form like the "quarter" of an orange; by spermathecæ unprovided with an externally visible diverticulum, the anterior pair being often the smaller; and often by genital papillæ in the neighbourhood of the male pores. This group contains the species *B. buettikoferi*, *B. horsti*, *B. beddardi*, *B. stampflii*, *B. schlegelii*, *B. liberiensis*, and *B. budgetti*. To the first of the new forms described here I shall give the name of

(5) **Benhamia gambiana**, sp. n.

I have examined three examples all of which were sexually mature. The length of the worms, which were somewhat softened in condition, was about 170 mm.; the diameter not more than 5 mm. except in the more swollen clitellar region.

The *prostomium* is rather broad and does not notch the buccal segment; it belongs to the type termed "prolobisch" by Dr. Michaelsen, but which I prefer to call "procheilous."

The *setæ* are in closely approximated pairs, and, as is the case in this genus, lie upon the ventral surface of the worm.

The *clitellum* occupies segments xiii.–xx., and is not developed upon the ventral area which bears the genital orifices of the male system. The latter part was to be distinguished from the yellow clitellum by its grey colour.

The *seminal gutters* uniting the two orifices of the spermiducal glands of each side of the body are bracket-shaped, the main portion of each being perfectly straight and only bending inwards and that at right angles at each end, where it becomes confluent with the aperture of the spermiducal gland. This species has a number of very conspicuous *genital papillæ* in the neighbourhood of the male pores. These lie intersegmentally, and in the intersegments xv./xvi., xvi./xvii., xviii./xix., xix./xx. One pair of papillæ therefore lie within the genital area. A remarkable fact about these papillæ is that although paired their mutual distance (of each pair) increases gradually in successive papillæ commencing with the

[1] Proc. Zool. Soc. 1900, p. 653.

earliest. Thus those of xv./xvi. are quite in contact, and finally the last pair, those on the intersegment xix./xx., are farther apart than are the ventralmost setæ of the neighbouring segments. Papillæ with the arrangement just described were only found in one example; in another the intersegment xv./xvi. bore but a single median papilla which was followed by only two pairs, *i. e.* intersegments xvi./xvii. and xix/xx. A third example had still fewer papillæ, the anterior pair or single papilla, as the case may be, having disappeared. In this specimen there are, therefore, only two pairs of papillæ.

I observed that the *oviducal pores* lie on a level with and to the inside of the ventralmost seta of each side. The *male pores* and the *spermathecal pores* correspond in position to the ventral pair of setæ.

In a third individual, which was rather more contracted in the clitellar region, the papillæ have become also contracted and look like half-closed eyes lying between segments xv./xvi., xvi./xvii., and xix./xx. They are not obvious, and might be missed by any-one who had not seen them in a more fully expanded worm.

The *dorsal pores* of this species, as of *B. budgetti*, are by no means plain. They appear to be quite absent in front of the clitellum, and behind the clitellum I could only see them by examining microscopically pieces of stripped-off cuticle. The condition of the dorsal pores in this species shows how careful one should be in stating the absence of these structures. The internal anatomy of this species shows very few characters of difference from its allies. The two *gizzards* are separated from each other by a considerable tract of soft-walled œsophagus; there is not that close connection between the two gizzards that obtains in some other species—for instance in *Benhamia johnstoni.* The position of these gizzards is perfectly plain in one specimen; they lie in the vth and vith segments. In others it appeared to me that the vith and viith segments were those occupied by the gizzards; but in view of the very clear appearances shown in the individual (that with a contracted clitellum) where they were to be relegated to segments v. and vi., I imagine that the thin septum dividing segments vi. and vii. had escaped my attention. The *calciferous glands* lie in segments xiv., xv., xvi., as in many of these West-African species of the genus. The anterior pair were smooth and smaller than the others, whose superior surface is broken up by a few transverse grooves; the shape of the glands is that of a segment of an orange, the top being flat. I have not ascertained whether they open separately into the œsophagus or by a common duct. The *intestine* begins in segment xix. It is noticeable that when the calciferous glands are in segments xv., xvi., xvii., the commencement of the intestine is at least sometimes not thrown a segment farther back.

The *dorsal vessel* is single, and the last *hearts* lie in segment xii. The *sperm-sacs* are large and lie in segments xi. and xii. There are also two pairs of sperm-duct funnels which are in x. and xi.

The *spermiducal glands* are confined each to its segment (the xviith and xixth). These glands have a rather short muscular duct which is not half the diameter of the glandular tube. The latter is only bent upon itself once or twice; there is no complicated coiling such as occurs in many species. The anterior spermiducal glands are rather the smaller. The *penial setæ* are about 1·25 mm. in length. Each sac contains two of these setæ equally developed. The two setæ are of precisely the same form, there being no differentiation of the penial setæ such as characterizes many species. Each seta is gracefully curved in an elongated S. It

Text-fig. 18.

Extremity of penial seta of *Benhamia gambiana* (highly magnified).

diminishes in breadth at the free end, but not suddenly or markedly. For a little distance before the end it is covered with fine spinelets. The actual end of the seta seems to be excavated on one surface, as is shown in the accompanying drawing (text-fig. 18); the outlines of this terminal excavation are plainly to be seen. The tip of the seta is somewhat expanded in a way reminiscent of the "cap" which covers the penial seta of *Benhamia horsti*[1]. This region has a granular appearance.

[1] "Ueber eine neue Gattung und vier neuen Arten der Unterfamilie Benhamini," Mitth. Naturh. Museum, Hamburg, xv. p. 11, fig. 3.

The two pairs of *spermathecæ* occupy the usual position that characterize this genus. The anterior pair of pouches are rather the smaller. Each consists of a roughly spherical pouch which is almost sessile upon the body-wall; external diverticula are not visible. But a microscopical examination shows a cavity filled with sperm within the walls of the organ.

(6) **Benhamia michaelseni**, n. sp.

Of this species, also new, which comes from the same locality as the last, I have had but a single specimen for examination, which proves, however, to be fully mature. It measured 200 mm. in length by 5 mm. in diameter. It is thus of much the same size as the last, and has *B. budgetti*, *B. beddardi*, and *B. horsti* among its nearest allies.

The *setæ*, which show the usual paired arrangement, are smaller upon the first few setigerous segments and gradually increase in size up to the fifth (setigerous) segment. A distinct ornamention can often be traced in the form of transverse rings.

The *genital area* is much more deeply sunken than in the last species. The arrangement of the *genital papillæ* is also different. But in *B. michaelseni*, as in *B. gambiana*, the *seminal gutter* is straight. The only two *genital papillæ* that I could find are situated respectively on the border-lines of segments xxi./xxii. and xxii./xxiii.; each papilla is small and round and perfectly obvious; it lies exactly in the middle ventral line of the body. In the neighbourhood of the male pores the integument is swollen here and there into papilla-like outgrowths; but I do not put these down under the category of papillæ, since they are not so plain and unmistakeable as are those which I have just described. Where the area surrounding the male pores is depressed, there are usually such inequalities in the surface of the integument. These naturally produce, as they do in the present species, a chequered surface upon the cuticle when this is viewed after having been stripped off from the body.

In its internal structure this species does not offer many differences from *B. gambiana* or *B. budgetti*, except in the sculpturing of the penial setæ. The *gizzards*, however, seem to me to be in vi. and vii. instead of v. and vi. The *calciferous glands* are in xiv., xv., and xvi., and, as in other species, the first pair are smaller and of a smoother contour than those which follow. The large *sperm-sacs* are in xi. and xii. There are two pairs of funnels. The *spermiducal glands* are decidedly larger and more coiled than in *B. gambiana*. The *penial setæ* are of quite a different pattern, as may be seen from a comparison of the drawings (text-figs. 16–19, pp. 205–214) exhibited. In the present species, as in the last, each sac contains two setæ which are curved in form. They are nearly twice the size of those of *B. gambiana* and measure 2 mm. The end is not much hooked and ends in a rather blunt termination. A large part of the distal portion of these setæ is beset with

Text-fig. 19.

Penial seta of *Benhamia michaelseni* (highly magnified).

numerous fine spinelets which are four or five rows in the optical diameter of the seta. The arrangement, however, is not a regular one. These spinelets are precisely those of *B. gambiana*, but a much larger part of the seta is beset with them.

The *spermathecæ*, again, are very like those of the last species. The specimen being, however, in a rather better state of preservation as regards these organs, their form could be more accurately ascertained. Each pouch is roughly globular and is nearly sessile upon the body-wall, a short and thick duct putting it into communication with the exterior. There were no visible diverticula.

It will be, I trust, obvious from the foregoing descriptions that the two species with which I am concerned in the present communication are distinct from any of those which have been previously described by myself or others. As, however, the seven West-African species to which I have referred on p. 210 are so extremely like each other and like *B. gambiana* and *B. michaelseni*, I append a brief series of statements of the chief characters in which they diverge from those treated of in the present paper. I have not been anxious to emphasize the differences which the seven species show from each other, since their distinctness will be generally allowed. The points used serve to discriminate *B. budgetti*, *B. gambiana*, and *B. michaelseni* from any of those.

(1) *Benhamia buttikoferi.* A larger and thicker worm. 230–320 mm. by 10 mm. Clitellum xiii.–xix. Last hearts in xiii. Sperm-sacs in xii. only.
(2) *Benhamia horsti.* Of similar size, but seminal gutter strongly convex outwards. Papillæ more numerous. Penial setæ with fine spinelets arranged in transverse rings and covered by a cap-like structure.
(3) *Benhamia beddardi.* Of similar size, but seminal gutter convex outwards. Calciferous glands in xv.–xvii. No papillæ. Sexual setæ on vii. and viii. Duct of spermatheca long.
(4) *Benhamia stampflii.* A larger worm, 330 mm. by diameter of 10 mm. No papillæ.
(5) *Benhamia schlegeli.* Larger worm, 350–750 mm.; diameter 15 mm. No papillæ, Calciferous glands in xv.–xvii. Last hearts in xiii. Penial setæ "like an elephant's tusk" in form, 4 mm. long.
(6) *Benhamia liberiensis.* Larger worm, 350 mm., diameter 10 mm. Papillæ different in arrangement. Calciferous glands in xv.–xvii. Penial setæ dilated at end.
(7) *Benhamia budgetti.* Of similar size, but genital papillæ different. Penial setæ with few spinelets distally.

The characters of these seven species may be compared with those of the two new species *Benhamia gambiana* and *Benhamia michaelseni.*

(1) *Benhamia gambiana.* 170 mm. by 5 mm. Clitellum xiii.–xx. Seminal gutters straight. Genital papillæ in pairs, intersegmental xv./xvii., xviii./xx. Calciferous glands in xiv.–xvi. Last hearts in xii. Penial setæ 1·25 mm., with not very many spinelets at end which is scooped out on one side.

(2) *Benhamia michaelseni.* 200 mm. by 5 mm. Seminal gutter straight. Genital papillæ unpaired, intersegmental xxi./xxiii. Calciferous glands in xiv.–xvi. Penial setæ with very numerous spinelets covering a large part of seta; end bluntish.

5. On the Second Occurrence of Bechstein's Bat (*Vespertilio bechsteini*) in Great Britain. By J. G. Millais, F.Z.S.

[Received May 31, 1901.]

(Text-figure 20.)

On the 10th of March, 1901, whilst exploring a chalk cave in the neighbuorhood of Henley-on-Thames, Mr. Heatley Noble and I captured six Bats. There were 2 Natterer's Bats, 2 Daubenton's Bats, 1 Long-eared Bat, and an unknown stranger, the identity of which we were quite unable to determine.

The peculiar features of this last-named creature differed so materially from every other British Bat, that it was easy to see that it belonged to some rare species of which the written and figured descriptions were inadequate. After carefully examining Mr. Harting's and Mr. Hall's excellent collections of British Bats, I was still in doubt as to my specimen, though I thought, from Bell's description, the animal must be *V. bechsteini*; and it was only after a close examination by Mr. W. De Winton (who kindly took it to the British Museum, consulted with Mr. Oldfield Thomas, and compared it with others there), that all doubt as to its identity was set at rest.

A few words of description of this rare Bat as it appeared in life may be of interest to the student of small mammals. In general appearance this species resembles *V. nattereri*: in colour it is identical, and the tragus and formula of dentition are the same; but, on the other hand, it differs in possessing an entire and simple margin of the interfemoral membrame, and in the fact that the adult animal is of greater size and the ears much larger and quite different in shape. The gape, too, is unusually wide, extending to the base of the ears, and the wings are different in form.

However, by far the most striking feature, and one which even the most superficial observer cannot fail to notice, is the great size and peculiar shape of the ears of *V. bechsteini*. These first bend outwards at an angle of 75 degrees, and then turn upwards to the perpendicular, coming to a rounded point as shown in the illustration (text-fig. 20), which is a woodcut made direct from a photograph taken soon after death. This proves how misleading are the pictures on pp. 40, 41 of 'Bell,' whose artist evidently drew his examples from dried skins, and that naturalist himself describes the ears as "oval" which they certainly are not.

Text-fig. 20.

Vespertilio bechsteini.

The Bat, when captured, showed itself to be very wide awake; it resented disturbance in the usual bat-fashion by biting and uttering a series of querulous screeches not unlike that emitted by a young child.

This second occurrence of Bechstein's Bat in the British Islands should now set at rest any doubts that have been expressed as to its claim to be a British mammal; for even so eminent an authority as Mr. Lydekker has expressed his opinion that the species has "a very doubtful claim to rank in our fauna." The first examples of this Bat which occurred in England were taken many years ago in the New Forest by Mr. Millard, and are now in the British Museum.

6. On Australian and New Zealand Spiders of the Suborder Mygalomorphæ[1]. By H. R. Hogg, M.A., F.Z.S.

[Received May 21, 1901.]

(Text-figures 21–41.)

The suborder now dealt with is synonymous with M. Eugène Simon's family Aviculariidæ[2]. Mr. R. I. Pocock, in arranging the Indian genera of the same[3], raised the family to a suborder, and its subfamilies to families, which, as remanets of an older era, is without doubt their proper position relatively to most of the other families of the Araneæ.

I will, however, in the present paper, for the sake of convenience of reference, retain M. Simon's nomenclature.

Owing to the imperfect state and small number of any fossil remains, the line of descent of our various families of Arachnida has as yet been by no means clearly established.

With the single exception of the genus *Liphistius* Schiödte, a curious remanet in South-eastern Asia, the Mygalomorphæ are believed to contain the oldest forms of all known Spiders.

The representatives of the suborder in Australasia are especially interesting from the fact that, being of a simple form, they are probably indicative, like much of the rest of the fauna of the continent, of early types.

Of the seven subfamilies into which M. Simon divides the Aviculariidæ of the world, six are represented, the absentee Paratropidinæ comprising two species only, from the Upper Amazon in S. America and the Island of St. Vincent respectively.

Those we have to deal with may be roughly distinguished as follows :—

A. No projecting claw-tufts. Three tarsal claws.
- *a.* A rastellum, or digging apparatus, consisting of hard teeth on the frontal portion of the upper mandibular joint[4] (falx).
  - *α.* The cephalic part of the cephalothorax rising abruptly from the thoracic part and very highly arched. The eyes spread out across nearly the whole frontal region. The mandibles projecting horizontally from the front of and as large as the whole cephalic region .... ACTINOPODINÆ.

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[1] I have not included Tasmanian species because, many as are the gaps to be filled in our knowledge of what I am now describing, we know still less of the Tasmanian region, and I am unhappily not in a position to supplement that knowledge. As we find to be the case in other orders, Tasmania will no doubt contain some forms which have disappeared on the mainland. Its northern and western ranges have been scarcely investigated at all.

[2] Histoire Naturelle des Araignées, 1892, vol. i. p. 65.

[3] Fauna of British India—Arachnida, 1900, p. 157.

[4] These teeth, though of somewhat the same nature, must not be confounded with those on the margin of the falx-*sheath* underneath, used for preventing the escape of prey.

β. The cephalic part still arched, but not so highly. The eyes collected in a more or less compact group slightly raised in the centre of the cephalothorax. Mandibles less formidable	CTENIZINÆ.
b. No rastellum, or only slight hardened bristles on the lower front part of the falx.	
a. The mandibles normally long and reaching out in front horizontally	DIPLURINÆ.
β. The mandibles very short, convex and horizontal near the base only, thence inclined almost vertically.	MIGINÆ.
B. Tufts of bristles projecting beyond the anterior end of the tarsi; the 3rd, or lower, claw absent.	
a. A rastellum, though in some cases not strongly developed (*Idiommata*). The superior spinnerets short and stout, the 3rd joint almost hemispherical	BARYCHELINÆ.
b. No rastellum. The superior spinnerets long; the 2nd and 3rd joints being about the same length as the 1st .	AVICULARIINÆ.

Subfamily ACTINOPODINÆ.

This is represented by one genus only.

Genus ERIODON Latreille.

Eriodon Latreille, Dict. Nouv. d'Hist. Nat. appliquée aux Arts, tom. xxiv. 1804, p. 134.

Missulena C. A. Walckenaer, Tableaux des Araneides, 1805, p. 8.

Pachiloscelis H. Lucas, Ann. Soc. Ent. Fr. vol. iii. 1834 (ad part. *nigripes*, *rufipes*), pp. 362–4.

Sphodros Walck. Ins. Apt. vol. i. 1837, p. 246.

Eriodon H. Lucas, Ann. Soc. Ent. Fr. ser. 4, vol. v. 1865, p. 309, pl. 8. fig.

Closterochilus A. Ausserer, Verh. zool.-bot. Ges. Wien, vol. xxi. 1871, p. 141.

Theragretes Auss. ibid. p. 142.

Eriodon Latr., Auss. ibid. p. 142.

Eriodon L. Koch, Die Arachn. Austr. 1873, p. 454.

Eriodon E. Simon, Hist. Nat. d. Araign. vol. i. 1892, p. 81.

The specimen on which Latreille founded this genus was probably the first spider brought from Australia to Europe.

The genus has not so far been recorded outside the continent of Australia.

The males are generally smaller than the females, and often of much more brilliant colouring about the head and falces.

Eleven species have been described, in every case from either the male only or female only. The evidence connecting species of opposite sex either by locality or similarity of some feature is rather slight, but I think they can be reduced to eight at most.

Synopsis of Species.

1. Eyes all small and of about the same size. Bodies whole-coloured black-brown (in females at least)	2.
Eyes of clearly very unequal size	3.

2.	Eyes sessile, front middle very minute, at least 4 diameters apart	*E. formidabile* Cambr. ♀.
	Side eyes protuberant, front middle eyes about 1 diameter apart (*sec.* Lucas)	*E. occatorium* Walck. ♀.
3.	Cephalothorax and mandibles whole-coloured brown or black-brown in male as well as female	4.
	Cephalic part or mandibles bright scarlet (in male at least)	5.
4.	Front middle eyes upright, oval, larger than rear side. 2nd and 3rd pairs of legs of equal length	*E. rugosum* Auss. ♂.
	Front side eyes largest, middle eyes small and round. 3rd pair of legs longer than 2nd in female (*sec.* Cambr.)	*E. crassum* Cambr. ♀.
	Eyes as in preceding. Cephalic part of cephalothorax deeply pitted in male (*sec.* Cambr.) (? Same as above.)	*E. granulosum* Cambr. ♂.
5.	Cephalic part dark reddish black. No spines on lip or maxillæ	*E. incertum* Cambr. ♂.
	Cephalic part bright scarlet	6.
6.	Spines on lip and maxillæ. 4th pair of legs longest	*E. insigne* Cambr. ♂.
	No spines on lip or maxillæ. 1st pair of legs longest	7.
7.	Front middle eyes upright, oval, black centre on pale yellow iris, or (*sec.* Rainbow) brown. Stigma of palp in male about twice the length of bulb	[♂, ?♀. *E. rubrocapitatum* Auss.
	Stigma of palp "very long" (*sec.* Simon). (? Same as above).........'.	*E. semicoccineum* Simon.
	Thoracic part of cephalothorax black, cephalic part bluish black. Abdomen yellow above, or yellow hairs only, black beneath. Characteristics doubtful (*sec.* Simon) . . ? Same. Male and Female	*E. nigripes* Lucas. *E. rufipes* Lucas.

Eriodon occatorium Walck.

Missulena occatoria C. A. Walckenaer, Tableau des Araneides, p. 8, pl. 2. figs. 11–14 (1805); id. Ins. Apt. 1837, vol. i. p. 252.

Eriodon occatorium Walck., Lucas, Ann. Soc. Ent. Fr. sér. 4, vol. v. 1865, p. 309, pl. 8.

Eriodon occatorium Walck., L. Koch, Die Arachn. Austr. 1873, p. 457.

The original specimen, female, from which Walckenaer described this type-species (*sec.* Lucas), was the same as that from which Latreille formed the genus, the previous year, having been brought from New Holland by M. F. Péron[1], naturalist to Capt. Baudin's expedition with the French ships 'La Géographe' and 'La Naturaliste,' in 1802. They passed several months refitting in Port Jackson, so probably the spider was from New South Wales. In colour it was brown all over.

Walckenaer gives two drawings of the eyes, in one of which the front middle pair are quite small, about three diameters apart;

[1] Voyage de découvertes aux Terres Australes, redigé par M. F. Péron. Paris, 1807.

in the other, somewhat larger, one and a half diameters apart. In the former also the rear side-eyes are nearer together than the front side, and in the other drawing both distances are the same. The first is from above, the second from in front. M. H. Lucas in a long paper on the genus (*loc. cit.*), in 1865, says that the front middle eyes are close together; he gives a drawing in which they are small and about a diameter apart. His specimen was purchased by the Paris Museum in 1859, and came from 'les environs de Melbourne'; he was able to compare it with the original type-specimen, then 60 years old; still his identification should be correct. It was 20 mm. long—whether including mandibles or not does not appear. It is to be hoped some fresh specimens may be forthcoming from Melbourne or Sydney.

In the British Museum are two specimens from Hunter River, N.S.W., and Western Australia labelled *E. occatorium*, females also, old dried specimens; but they are different from one another, and do not agree with M. Lucas's description.

In these the rear row of eyes is shorter than the front. The two front middle are small, about three diameters apart, but stand on larger round, slightly raised bases, which may or may not have been originally part of the eyes, but in the dried state are now clearly separable from the seeing part. This probably accounts for the discrepancies above mentioned. The side-eyes are all slightly raised.

The colour is a uniform rich dark brown, the mandibles black-brown, and the cephalothorax smooth and shiny.

In the largest there are 11 teeth on the inner margin of the falx-sheath, 9 on the outer, and about 13 smaller in two intermediate rows.

On the superior tarsal claws are 2 or 3 rather long pectinations about the middle of the shaft and 1 on the inferior. There are numerous spines on lip and base of maxillæ.

The measurements of the largest of the above in millimetres are as follows:—

	Long.	Broad.
Cephalothorax ..	9	$9\frac{1}{2}$
Abdomen	6	6
Mandibles	7	5

		Coxa.	Trochanter & femur.	Patella & tibia.	Metatarsus & tarsus.		
Legs ..	1.	4	7	6	$5\frac{1}{2}$	=	$22\frac{1}{2}$
	2.	4	7	6	5	=	22
	3.	4	7	$5\frac{1}{2}$	$5\frac{1}{2}$	=	22
	4.	4	8	$7\frac{1}{2}$	6	=	$25\frac{1}{2}$
Palpi		3	6	5	3	=	17

In this specimen the teeth on the falx-sheath are numerous, pectinations on tarsal claws few, posterior legs relatively longer, and spines on lip and maxillæ numerous.

These two are more likely the female (unknown) of *E. rubrocapitatum* Auss. and of *E. crassum* Cambr. respectively.

ERIODON FORMIDABILE Cambr.

Eriodon formidabile Rev. O. P. Cambridge, Journ. Linn. Soc., Zool. vol. x. 1868, p. 266; L. Koch, Die Arachn. Austr. 1873, p. 454.

This was described by Mr. Cambridge from an old dried specimen in the Hope Museum at Oxford, which had lost its palpi and hind legs. He gives its length as $12\frac{1}{2}$ lines (or 26 mm.).

There is a mutilated specimen in the National Museum of Victoria, Melbourne, which I attribute to the same.

It is very similar to *E. occatorium* both in colouring (dark chocolate) and eyes. The front middle pair are very minute, about four diameters apart. The eyes, which are all small, seem more sessile, the front and rear rows about equal in length, and the middle eyes of rear row nearer to the side-eyes of same than to the front middle. Front row in a straight line. The whole creature is larger than the foregoing, and the species are probably distinct.

Mr. Cambridge says his specimen had six spinnerets, which, if correct, would make it differ from the rest of the genus. But old dry specimens are very difficult to handle and apt to be deceptive. In the female I examined the rear half of the abdomen was destroyed.

Locality. Swan Hill (River Murray), Victoria.

ERIODON CRASSUM Cambr.

Eriodon crassum Rev. O. P. Cambridge, Journ. Linn. Soc., Zool. vol. x. 1868, p. 269; L. Koch, Die Arachn. Austr. 1873, p. 456.

This again is very like *E. occatorium* (sec. Cambr.), but smaller, $7\frac{1}{2}$ lines. The front side-eyes twice the diameter of front middle. Legs 4, 3, 2, 1. Female from Swan River, W. Austr. (Hope Mus., Oxford).

The specimen in Brit. Mus. labelled as *E. occatorium*?, mentioned above, has the 1st, 2nd, and 3rd pairs of legs all about equal length, but, coming from the same locality and in other respects agreeing with the description of this species, I think it must be taken to be the same.

ERIODON GRANULOSUM Cambr.

Eriodon granulosum Rev. O. P. Cambridge, Journ. Linn. Soc., Zool. vol. x. 1868, p. 268; L. Koch, Die Arachn. Austr. 1873, p. 455.

Male. Length 7 lines. Swan River, W. Austr. (Hope Mus., Oxford), *sec.* Cambridge.

Cephalothorax black above and below, as also legs and palpi. Eyes, as drawn, very similar to those of *E. crassum*. Falces as long as cephalothorax, strong black spines at upper extremity. Legs long, 4, 3, 2, 1, with black hairs; black spines on underside of metatarsi and tibiæ. Margin of cephalothorax and caput rough and granulose (a common feature in males of this genus). Male palp with a double bulb and stigma of about the same length.

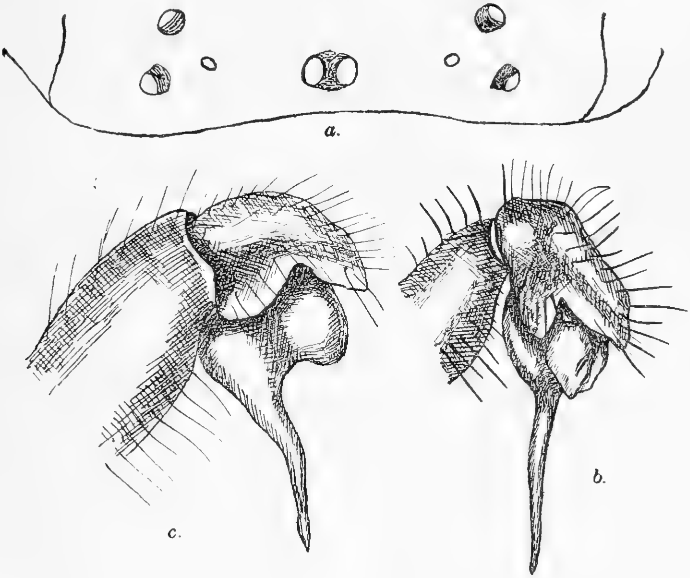
This reads very much like the male of the preceding.

Eriodon insigne Cambr. (Text-fig. 21, figs. *a*, *b*.)

Eriodon insigne Rev. O. P. Cambridge, Ann. Mag. Nat. Hist. ser. 4, vol. xix. 1877, p. 29.

Cephalic part of cephalothorax and mandibles bright scarlet; thoracic part black. Abdomen black. Thoracic fovea deep and strongly procurved. Front middle eyes largest, oval, upright, close together. Rear middle eyes nearer to rear side than to front middle. Scopula on tarsus and two-thirds of metatarsus of 3rd and 4th pairs of legs. Superior claws lightly pectinated, 5 or 6 on inner, 3 on outer; 2 on inferior. 8 teeth on inner falx-edge,

Text-fig. 21.



Eriodon rugosum. *c*. Male palp.
E. insigne. *a*. Eyes. *b*. Male palp.

4 on lower part of outer, and 5 very small intermediate at lower end. Club-shaped spines on lip and lower inner edge of maxillæ. A rather large protuberance on the inner fore corner of maxilla. Trochantal joint of maxillæ long and cylindrical. Posterior sternal sigillæ large and removed from margin. Forehead slightly granulated, not so much as *E. incertum*.

I have several of these males from Dimboola, Victoria, but no females that I can attribute as cospecific with them.

The males of *E. insigne* Cambr., *E. incertum* Cambr., *E. rubrocapitatum* Auss., and apparently *E. semicoccineum* Simon, are all very much alike, with their black thoracic part, abdomen, and legs, and scarlet head and mandibles. No scarlet-coloured females have been found; probably they are of the normal black-brown or chocolate colour, and may not differ even so much as the males.

Of the four species known to me I have figured the palps, the bulb and stigma of which will be seen to be of a somewhat similar type, the latter nearly straight, from once and a half to twice the length of the bulb.

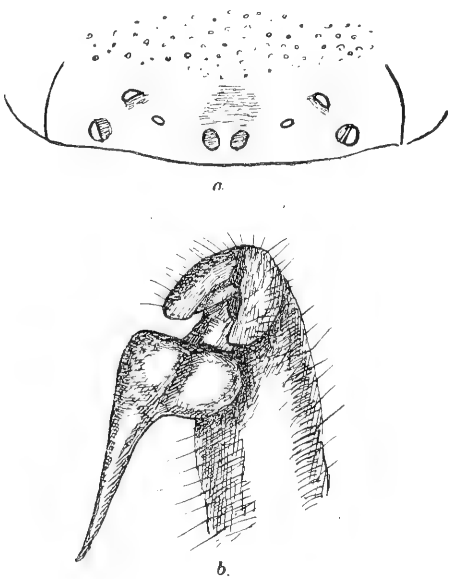
Measurements in millimetres.

		Long.	Broad.				
Cephalothorax		$4\frac{1}{2}$	5				
Abdomen..........		4	$3\frac{1}{2}$				
		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$2\frac{1}{2}$	6	$4\frac{1}{2}$	$4\frac{1}{2}$	=	$17\frac{1}{2}$
	2.	$2\frac{1}{4}$	5	4	4	=	$15\frac{1}{4}$
	3.	$2\frac{1}{2}$	5	4	$4\frac{1}{2}$	=	16
Or 4, 1, 3, 2.	4.	$2\frac{1}{2}$	6	$4\frac{1}{2}$	5	=	18
Palpi		$1\frac{3}{4}$	2 & 4	5	1	=	$13\frac{3}{4}$

ERIODON INCERTUM Cambr. (Text-fig. 22.)

Eriodon incertum Rev. O. P. Cambridge, Ann. Mag. Nat. Hist. ser. 4, vol. xix. 1877, p. 30.

Text-fig. 22.



Eriodon incertum. *a.* Eyes. *b.* Male palp.

Described from a male from Swan River.

Cephalic part of cephalothorax dark reddish black; mandibles bright scarlet; thoracic part black. Abdomen black-brown.

Thoracic fovea very deep and procurved. 8 teeth on inner falx-edge; 5 teeth on outer falx-edge, and bunch of about 7 small intermediate at lower end, away from fang. There are no spines on lip or maxillæ.

Eyes: the front middle are the largest, oval, inclined to one another, bases half their short diameter apart. Side-eyes about equal in size, in length equal the short diameter of front middle eyes. The cephalic part above the eyes is deeply pitted with numerous coarse indentations.

The rastellum is on a pad on the inner side of the falx. The sternal sigillæ are large, away from margin, and the same as in *E. insigne* and *E. rubrocapitatum.*

A thick low undivided scopula on tarsus and metatarsus iii. and iv. reaches nearly to the base of the latter. There are 5 pectinations on superior inner tarsal claw, 3 on outer, and 3 short on inferior.

These particulars are from a male from Perth (H. W. J. Turner) in the British Museum.

Measurements in millimetres.

		Long.	Broad.				
Cephalothorax		5	6				
Abdomen ..		5½	5				
		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	2½	5¾	5	4½	=	17¾
	2.	2½	5	4½	4	=	16
	3.	2½	5	4	4	=	15½
Or 1, 4, 2, 3.	4.	2½	5	4½	4½	=	16½
Palpi		1¾	2 & 4	5¾	1	=	14½

Eriodon rugosum Auss. (Text-fig. 21 *c*, p. 223.)

Eriodon rugosum Auss., Verh. der k.k. zool.-bot. Ges. Wien, Band xxv. 1875, p. 141, Taf. v. figs. 5 & 6. A male from Australia.

One male, Keyserling Coll., British Museum. Total length 14 mm.

The front side-eyes are largest and oval. The front middle are likewise oval, long diameter vertical, slightly smaller; their short diameter apart.

The whole cephalothorax and mandibles are deep black, the legs and palpi inclining to reddish brown—the colour of *E. occatorium*, from which however the eyes differ entirely. The abdomen considerably overhangs the cephalothorax.

Measurements in millimetres.

	Long.	Broad.
Ceph. (without mandibles) ..	7	7
Abdomen	6½	5
Mandibles	4	

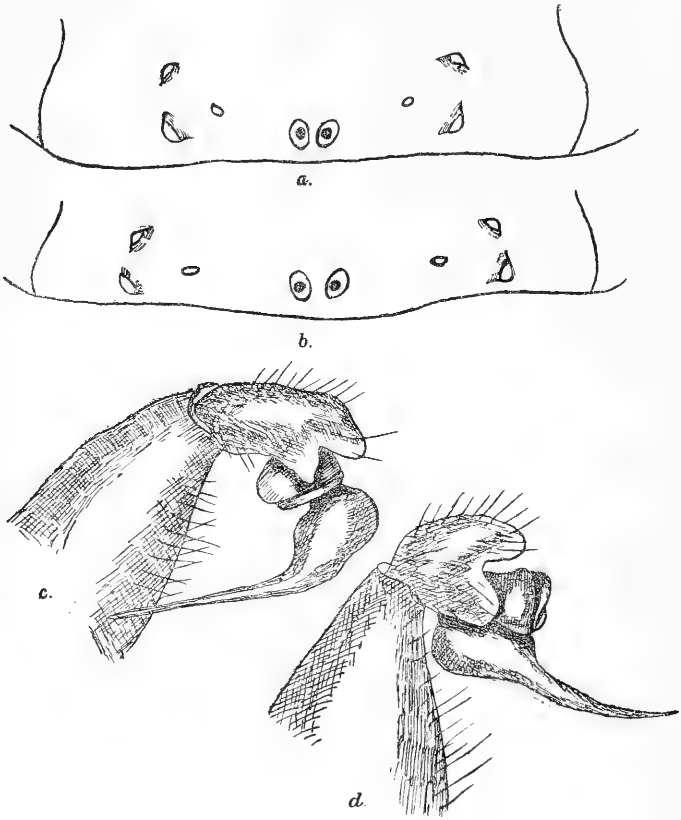
		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	2½	5½	4½	4½	=	17
	2.	2½	5	4	4	=	15½
	3.	2½	5	4	4	=	15½
Or 4, 1, 2, 3.	4.	2½	6	5	5	=	18½
Palpi		2½	5	5	1½	=	14

Eriodon rubrocapitatum Auss. (Text-fig. 23.)

From the specimen in Keyserling Coll., Brit. Mus., I take the following particulars.

Cephalic part of cephalothorax and mandibles rather brownish red; thoracic part black. Legs and palpi lighter brown than

Text-fig. 23.



Eriodon rubrocapitatum. *a.* Eyes of male. *b.* Eyes of female (labelled *E. occatorium*), probably female of this. *c, d.* Left and right male palps.

latter (not so bright as *E. insigne*), but the specimen is old and may have lost its colour somewhat. Thoracic fovea deep and procurved. Sternal sigillæ removed from margin; posterior pair very large; anterior pair small and on sternum below lip-fold. Scopula on tarsus and lower two-thirds of metatarsus iii and iv. 3 large and 5 small teeth on inner edge of falx-sheath, 2 large and

2 small near lower part of outer edge; intermediate row of 4 very small at lower end of same. About 5 or 6 pectinations on outer superior tarsal claws, 3 on inferior; 4 or 6 pectinations on inner superior tarsal claws. No club-shaped spines on lip or maxillæ. Female below has spines on both. The front middle eyes are small, on pale yellow prominences (Mr. Rainbow says brown). The tibial joint of palp is unusually long and swollen in the middle. The trochantal joint of same is also unusually long (as in *E. insigne* and *E. incertum*).

Mr. Rainbow, of Sydney, describes a male from Menindie, N.S.W., which is the same as this one labelled Australia only.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	5	6
Abdomen	4	4

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	2	6	5½	5	=	18½
	2.	2	5½	5	5	=	17½
	3.	2	4½	4	4	=	14½
	4.	2	5½	5	5	=	17½
Palpi		1½	2 & 4½	7	1	=	16

A female in British Museum, with eyes the same, dark centre on pale yellowish brown, measures:—

	Long.	Broad.
Cephalothorax ..	7½	9
Abdomen	11	10
Mandibles	5	4 each.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	3	7	5½	4½	=	20
	2.	3	6	5½	4½	=	19
	3.	3	7	5½	5	=	20½
	4.	3½	8	6½	5½	=	23½
Palpi		3	5¼	5	3	=	16¼

ERIODON NIGRIPES Lucas (*sec.* Simon).

Pachyloscelis nigripes Lucas, Ann. Soc. Ent. Fr. vol. iii. 1834, p. 364, pl. vii. figs. 1 & 2.

Sphodros abboti Walck. Ins. Apt. vol. i. 1837, p. 243.

Eriodon nigripes E. Simon, Hist. Nat. d. Araign. vol. i. 1892, p. 81 note.

Described as from Brazil. M. Simon, however, thinks that this is probably a mistake, as on examination of Lucas's type of the above-named species, he finds it to be a male *Eriodon*.

He further ascertained that *Sphodros abboti* Walck. (*loc. cit.*) was described from the same specimen.

The cephalothorax is described as black, the cephalic part blue-black, the abdomen yellow above and black underneath.

M. Lucas at the same time described a female as *P. rufipes* (*loc. cit.*), which from the colouring (black all over, bluish head-part, yellow hairs on abdomen) would appear to be the female of the above.

The rear middle eyes are depicted in this female as close up to the rear side, while in the male they are about half-way, which may doubtless have led M. Simon to reject it as cospecific; the drawings given of details of other parts, however, are clearly not to be taken too literally. Of course there is the doubt as to its locality, and it has not been recognized since.

ERIODON SEMICOCCINEUM Simon.

Eriodon semicoccineum Simon, Liste der Arachn. der Semon'schen Sammlung in Australien und dem Malayischen Archipel (E. Simon, 1896).

Black, with cephalic part and mandibles red; 9 mm. long. From Burnett River, Queensland.

From M. Simon's description (*loc. cit.*) it is not clear that this differs from *E. rubrocapitatum* Auss., unless the "very long, straight, thin" palpal stigma mentioned means something more than about twice the length of the bulb.

Subfamily MIGINÆ.

This subfamily is represented only by the genus *Migas* L. Koch, which is confined to New Zealand. Unlike the other members of the family, the mandibles are short, convex, kneed at the base and thence almost vertical. The thoracic fovea is recurved, and the front row of eyes (*sec.* Koch) straight or (*sec.* Goyen) procurved. The New Zealand species are unknown to me. I recorded a mutilated specimen from Central Australia (Horn Expedition, Zool. vol. ii. p. 334) as probably *M. paradoxus* L. K.; but on reconsidering my notes I feel sure that it must be a new genus—to be described when more material is available.

Genus MIGAS L. Koch.

Migas L. Koch, Die Arachn. Austr. 1873, p. 467; E. Simon, Hist. Nat. d. Araign. vol. i. 1892, p. 84.

Type, *M. paradoxus* L. Koch.

MIGAS PARADOXUS L. Koch (*loc. cit.*).

Front row of eyes straight; a remarkable double row of spines on metatarsus iv.

Female from Auckland.

MIGAS DISTINCTUS Cambr.

(Female.) Rev. O. P. Cambridge, Proc. Zool. Soc. Lond. 1879, p. 783.

(Male.) P. Goyen, Proc. New Zealand Inst. vol. xix. 1886, p. 210.

(*Sec.* Goyen). Both rows of eyes procurved. No spines on lip or maxillæ. Length 9 mm.

Locality. At the back of the sea-beach between Dunedin and Oamaru, Otago.

MIGAS SANDAGERI Goyen.

Migas sandageri Goyen, Proc. N. Z. Inst. vol. xxiii. 1890, p. 123.

(*Sec.* Goyen.) Both rows of eyes procurved. Lip and maxillæ studded with spines. Length 9 mm.

Weaves a nest on trunks of trees.

Locality. Mokohinou Islands.

Subfamily CTENIZINÆ.

Three claws and a rastellum. Eyes on a more or less raised prominence in the centre of the frontal area.

Of the six groups into which M. Simon divides this subfamily we have only three into which any of our genera can fall. *Idiopeæ*—in which the front side-eyes are brought so far forward as to be separated from the others; *Cyrtauchenieæ* and *Nemesieæ*, which M. Simon separates on the procurvedness or straightness of the thoracic fovea, and these so overlap the borders that no satisfactory dividing line between the groups can be drawn.

Synopsis of Genera.

1.	Rear middle eyes at least two of their longer diameters distant from the rear side-eyes	2.
	Rear middle eyes not more than their longer diameter from the rear side-eyes	3.
2.	Abdomen coriaceous, wrinkled, short spines on back. Anterior lateral eyes brought forward to margin of clypeus (as in *Idiops*) and not more than their diameter apart	*Idiosoma* Auss.
	Abdomen clothed with rather thick and long hair ...	4.
4.	Rear row of eyes procurved; long spines on the upper side of the abdomen	*Anidiops* Pocock.
	Rear row of eyes recurved	5.
5.	Cephalothorax only very slightly longer than broad	*Eucyrtops* Pocock.
	Cephalothorax one third longer than broad	*Aganippe* Cambr.

3. Lip broader than long. Thoracic fovea deep and strongly procurved. Posterior sternal sigillæ large and removed from margin. Long thin spines on upper and under side of abdomen ...	*Maoriana*, nov. gen.
Lip nearly square. Thoracic fovea straight or only slightly divergent therefrom. Sternal sigillæ moderate in size and marginal	*Arbanitis* L. Koch.

Genus Idiosoma Ausserer.

Idiosoma Ausserer, Verh. z.-b. Ges. Wien, 1871, p. 150.

Acanthodon Guérin, E. Simon, Hist. Nat. d. Araign. vol. i. 1892, p. 91.

Idiosoma Auss., R. I. Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xix. 1897, p. 109.

Attached by M. Simon to the genus *Acanthodon* and group *Idiopeæ*, to which the position of its front side-eyes entitles it. The rear side-eyes are, however, at least twice the diameter of the front middle instead of nearly equal, and the lip broader than long, instead of equally so. No spines on lip, instead of a row of a few large ones. I think, therefore, that Mr. Pocock is right in restoring Ausserer's genus.

Type, *I. sigillatum.*

Idiosoma sigillatum Cambr.

Idiosoma sigillatum Cambr., R. I. Pocock, *loc. cit.*

Idiops sigillatus Cambr. Proc. Zool. Soc. 1870, p. 105, pl. viii. fig. 2.

This, the only species of the genus, was described originally from a male from Perth, W.A. However, a female was received by the British Museum from the same neighbourhood a few years since, from which I have taken the following few points in addition to those published by Mr. Pocock.

Teeth on inner falx-edge 7
„ outer „ 4
3 smaller intermediate at lower end.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	8	6
Abdomen	11	9
Mandibles	4	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	3	6	$5\frac{1}{2}$	4	=	$18\frac{1}{2}$
	2.	3	$5\frac{1}{2}$	5	4	=	$17\frac{1}{2}$
	3.	3	5	$4\frac{1}{2}$	4	=	$16\frac{1}{2}$
Or 4, 1, 2, 3.	4.	3	6	7	$5\frac{1}{2}$	=	$21\frac{1}{2}$
Palpi		$3\frac{3}{4}$	5	5	$3\frac{1}{2}$	=	$17\frac{1}{4}$

Genus Aganippe Cambr.

Aganippe Cambr. Ann. & Mag. Nat. Hist. ser. 4, vol. xix. 1877, p. 28; Simon, Hist. Nat. d. Araign. vol. i. p. 106 (1892); Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. 1895, p. 223; id. ibid. vol. xix. 1897, p. 112.

Type, Aganippe subtristis Cambr., *loc. cit.*

Described from a dried specimen in the British Museum received from Adelaide (S. Australia), and not recorded since.

The cephalothorax and legs are bright chestnut-brown; the eye-space and mandibles darker reddish brown; abdomen reddish brown, rough and hairy. The sternum is pyriform, broadest behind. The posterior sternal sigillæ large and removed from the margin; a smaller pair between these and the anterior margin of sternum. The sternum and coxæ are copiously pitted.

The lip is small, as long as broad. Club-shaped spines on base of maxillæ, none visible on lip.

In this the rastellum extends in three rows of teeth right across the lower end of falx.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	12	9
Abdomen	11	9½
Mandibles	8 falx.	
	5 fang.	

		Coxa.	Tr. & fem.	Tib. & pat.	Metat. & tars.		
Legs	1.	5	9½	8½	5½	=	28½
	2.	4	8	8	5½	=	25½
	3.	4	7½	7	6	=	24½
Or 4, 1, 2, 3.	4.	5	10	9½	8½	=	33
Palpi		5½	6½	6½	4½	=	23

Genus Anidiops Pocock.

Anidiops Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xix. 1897, p. 114.

Type, Anidiops manstridgei Pocock, *loc. cit.*

Described from a dried female specimen from Lawlers, East Murchison, W.A., and not since recorded.

The front middle eyes are yellow with black centres, their diameter apart. The rear side-eyes are largest, two thirds diameter of front middle. The rear row strongly procurved. The front side-eyes project beyond the margin of the carapace, and are their diameter apart, one third more than front middle.

Rastellum along inner front of falx and over rather large area behind same.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	9	7
Abdomen	8	6½
Mandibles	6	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	4	6½	6½	5½	=	22½
	2.	3½	6	6	4½	=	20
	3	3	6	5	5	=	19
	4.	3½	7½	7½	7½	=	26
Palpi		5	6½	6½	4	=	22

Genus Eucyrtops Pocock.

Aganippe Cambr. (*ad partem, latior*), Ann. & Mag. Nat. Hist. ser. 4, vol. xix. 1877, p. 29, pl. vi. fig. 4.

Eucyrtops Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xix. 1897, p. 113.

Eucyrtops latior Cambr., *loc. cit.*

Removed by Mr. Pocock from *Aganippe* in consequence of a difference, which he considers sufficient, in the arrangement of the eyes in the type, and only, species from that of *Aganippe subtristis* Cambr.

There does not appear to me much difference beyond that the rear row is rather more recurved, and the front middle eyes equal in size to the rear middle, instead of larger. The four side-eyes are also equal, 1½ diameter of the medians, and they are all slightly raised on low tubercles. However, in *Eucyrtops* the cephalothorax is broad er, apparently the reason of its specific name.

Type (in British Museum), one dried female from Perth, W. A. Not recorded since.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	9½	9
Abdomen	7	5½
Mandibles	5	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	4	5½	6	5½	=	21
	2.	3½	5½	6	5½	=	20½
	3.	3½	5	5½	5	=	19
	4.	4	7½	7	6	=	24½
Or 4, 1, 2, 3.							
Palpi		4½	5½	5½	4½	=	20

Genus ARBANITIS L. Koch.

Pholeuon L. Koch (*nom. præocc.*), Arachn. Austr. 1873, p. 472.
Arbanitis L. Koch, Arachn. Austr. 1874, p. 491.
Arbanitis E. Simon, Hist. Nat. d. Araign. vol. i. p. 115 (1892).

Arbanitis differs primarily from *Nemesia* (*sec.* Simon) in having the pectinations on the tarsal claws in one row instead of two. Judged by this standard, all the species from Australia and New Zealand described under the two genera must be included in the former.

M. Simon has already removed *N. gilliesii*; and as Mr. Urquhart's description of his *N. kirkii* is apparently clear on the point, though he does not state it directly, that must also follow suit.

Type, *A. longipes* L. Koch.

Synopsis of Species.

1. Middle eyes of front row about ½ diameter apart (*sec.* L. Koch)	*A. longipes* L. Koch.
Middle eyes of front row more nearly 1½ diameter apart	2.
2. Cephalothorax of adult (♂ or ♀) not exceeding about 6 mm. in length (*sec.* Cambr. & Goyen).	*A. huttonii* Cambr.
Cephalothorax of adult (♂ or ♀) 8–14 mm. in length	3.
3. No club-shaped spines on lip	*A. gilliesii* Cambr.
Lip covered with small papillæ, or club-shaped spines (*sec.* Urq.)...*if coming within subfamily*...	*A. kirkii* Urq.

ARBANITIS GILLIESII Cambr. (Text-fig. 24, *a*, *b*.)

Arbanitis gilliesii Cambr., Simon, Hist. Nat. d. Araign. vol. i. p. 115 (1892).

Nemesia gilliesii Cambr. Trans. N. Z. Inst. vol. x. (1877) p. 284, plate x.

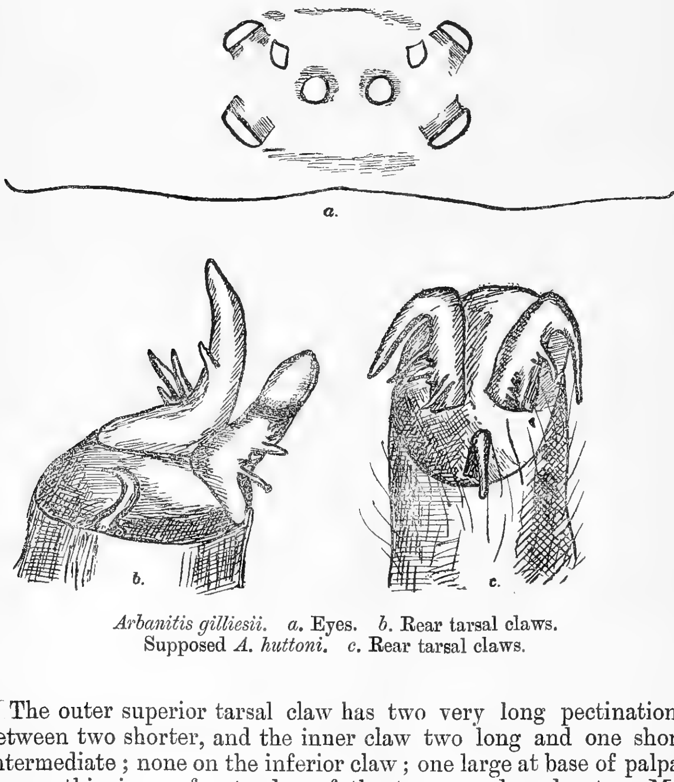
Nemesia gilliesii Cambr., A. T. Urquhart, Trans. N. Z. Inst. vol. xxiv. (1891) p. 221.

A female sent me by Prof. Dendy from Christchurch, N.Z., I attribute to this species, the colouring and pattern agreeing. Mr. Cambridge described his species from one male and two females sent by Captain Hutton from Oamaru, Otago.

The thoracic fovea is straight, or slightly recurved. Mr. Cambridge draws his procurved, but does not mention the point. The scopulæ on tarsus and metatarsus of two front pairs of legs are thick and undivided. With three long single spines in the scopulæ of the metatarsus; none on tarsus. On the two posterior pairs there are a good many short spines on the underside of the tarsus, and a row on the anterior end of metatarsus. There are very long bristles on the anterior end and sides of the sternum; bristles, but no club-shaped spines, on the lip, which is as broad as long, square in front, and sunk below the maxillæ. There is a bunch of club-shaped spines on inner side of base of the latter.

The front middle eyes are $1\frac{1}{2}$ diameter apart, they are wholly above the highest point of the side-eyes, which are twice their diameter, and the same distance away from both front middle and rear side-eyes. The rear row is recurved, the side-eyes being $1\frac{1}{2}$ diameter of front middle. The whole eye-space is twice as long as broad, the sides being parallel, and the front side-eyes are their long diameter removed from the margin of the clypeus.

Text-fig. 24.



Arbanitis gilliesii. *a.* Eyes. *b.* Rear tarsal claws.
Supposed *A. huttoni.* *c.* Rear tarsal claws.

The outer superior tarsal claw has two very long pectinations between two shorter, and the inner claw two long and one short intermediate; none on the inferior claw; one large at base of palpal claw: this is on front edge of the tarsus-end, and not, as Mr. Cambridge draws it, close up to the other claws.

The inferior mammillæ are one diameter apart. The superior have the first joint longest and stoutest, the second one fourth its length, the third conical, rounded at the end, the same length as the second.

There are fine spines on both upper and under side of the abdomen.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	14	11
Abdomen	15	10
Mandibles	$3\frac{1}{2}$	

		Coxa.	Tr. & fem.	Tib. & pat.	Metat. & tars.		
Legs	1.	6	11	$10\frac{1}{2}$	$8\frac{1}{2}$	=	36
	2.	$5\frac{1}{2}$	10	$9\frac{1}{2}$	8	=	33
	3.	5	$8\frac{1}{2}$	8	$7\frac{1}{2}$	=	29
	4.	$5\frac{1}{2}$	$11\frac{1}{2}$	13	$11\frac{1}{2}$	=	$41\frac{1}{2}$
Palpi		6	8	7	5	=	26

One female in British Museum from J. V. Jennings, Otago, 1891, differs slightly in the following particulars.

Eyes the same as the foregoing (supposed *A. gilliesii*), but distance between the front side pair and the margin of the clypeus rather narrower. Thoracic fovea deeper and slightly procurved. The Rev. O. P. Cambridge draws his recurved, but does not mention it in his description. No spines on the back of the abdomen, and only a few light bristly ones in two of the folds on the underside. Anterior abdominal (genital) fold double—the same in both species. Sternal sigillæ about the same size and marginal. The two rear coxæ not quite contiguous. Spinnerets about the same as foregoing.

Three small spines at front end of tarsus i. & ii. One larger pair at anterior end of metatarsus i. & ii., and two single in the middle and at the posterior end. A single row of large teeth (about eight) on inner falx-edge. The inner superior claw of tarsus iv. has about the middle one very long pectination, with another a good deal shorter nearer to the base, and a very small one between. On the outer claw is a long one near the base, followed by two short, and on the other side higher up one very long and one short—a sort of rudimentary double pectination. This might, however, almost equally well be a rudimental row crossing the claw, as in the *Diplurinæ*. On the other claws the pectinations are all single.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	11	$8\frac{1}{2}$
Abdomen	13	8
Mandibles	4	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	$9\frac{1}{2}$	9	$7\frac{1}{2}$	=	31
	2.	$4\frac{1}{2}$	9	8	$6\frac{1}{2}$	=	28
	3.	4	8	$7\frac{1}{2}$	$6\frac{1}{2}$	=	26
	4.	$4\frac{1}{2}$	$9\frac{1}{2}$	11	10	=	35
Palpi		$4\frac{3}{4}$	$7\frac{1}{2}$	7	5	=	$24\frac{1}{4}$

Arbanitis huttonii Cambr. (Text-fig. 24 *c*, p. 234.)

Arbanitis huttonii Rev. O. P. Cambridge, Proc. Zool. Soc. Lond. (24 Sept.) 1879, p. 682, plate lii. fig. 1 (male).

Arbanitis huttonii Cambr., A. T. Urquhart, Tr. N. Z. Inst. vol. xxiv. 1891, p. 221; P. Goyen, ibid. p. 255.

Described from an adult male sent by Captain Hutton from Dunedin in 1879; female by Mr. Goyen in 1891.

Arbanitis kirkii Urquhart.

Nemesia kirkii A. T. Urquhart, Trans. N. Z. Inst. vol. xxvi. 1893, p. 204.

One female from Wellington.

Mr. Urquhart says:—

Eyes. Posterior row moderately procurved, anterior row slightly recurved (unless this is a misprint it is of course quite different from anything else in the group).

The cephalic fovea is circular. (In the other species it is long.) The superior tarsal claws have 12 teeth, and the inferior 4. The palpal claw 7 stout open pectinations. In *A. huttoni* and *A. gilliesii* the superior claws have 4 pectinations, the inferior none, and the palpal claw one.

The position of the species must, therefore, be considered very doubtful.

Arbanitis longipes L. Koch.

Arbanitis longipes, L. Koch, Die Arachn. Austr. 1874, pp. 472 (*Pholeuon*), 491 (*Arbanitis*).

Maoriana, nov. gen.

This genus, though near *Arbanitis*, differs from it in several essential particulars. The line joining the centres of the front row of eyes is only slightly procurved, the upper margins of the laterals being in a line with the centres of the median. The front lateral eyes are twice the diameter of the median, and are close to the margin of the clypeus, so that the clypeus is very much narrower. The line joining the centres of the rear row is about straight. The thoracic fovea is deep and procurved. The lip is broader than long and hollowed in the front margin. The posterior sternal sigillæ are large, lying half-way between the margin and the central line of sternum, and the others are away from the side-margin.

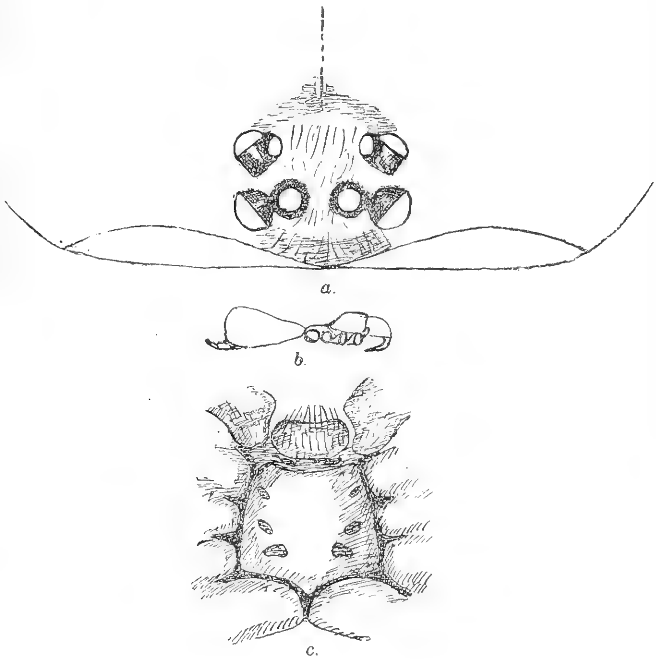
Maoriana agrees with *Arbanitis* in having thick scopula on the two front pairs of tarsi; none on the two rear pairs. Long thin spines on both upper and under side of abdomen. Superior tarsal claws pectinated in one row, but with not many in number. Row of teeth on inner side of falx-sheath only. Eye-space much broader than long; sides parallel. Eyes well apart. Superior spinnerets short, stout and tapering; first joint longest, third quite short and hemispherical.

Type, *Maoriana dendyi.*

MAORIANA DENDYI, n. sp. (Text-fig. 25.)

Cephalothorax, mandibles, legs, and palpi bright yellow-brown, with a few pale yellowish hairs on the cephalothorax, trochanter, and femur, darkening into brown and thicker on the remainder of the leg. Two longitudinal belts of yellowish-brown bristles on the face of the falx are separated by bare spaces. The teeth of the rastellum are black. The sternum, coxæ, lip, and maxillæ are dull orange, furnished with brown bristles springing from round

Text-fig. 25.



Maoriana dendyi. *a.* Eyes. *b.* Profile (nat. size).
c. Lip and sternum, showing sigillæ.

roots; the fringes are pinkish yellow. The fangs dark red, almost black at base. The abdomen is black above with yellow spots in transverse bands; underneath black irregularly mottled with yellow. Spinnerets, gill-covers, and anterior section above genital aperture yellow-brown; a few long thin spines on both upper and under side of abdomen, and short yellow hairs.

The thoracic part of the cephalothorax is flat, rounded at sides and narrowed at rear; the cephalic part rises rather abruptly from the deep and strongly-procurved fovea to about half its length, whence it slightly slopes downward to the anterior margin. The side striations are broad, shallow and straight, making the cephalic part almost triangular.

The front row of eyes is slightly procurved, the median pair $1\frac{1}{2}$ diameter apart on a common black oval prominence; the laterals are twice their diameter, the same distance away as the median from one another. The rear row is recurved. Side-eyes $1\frac{1}{2}$ diameter of front median, and that distance from the front laterals. The rear median are narrow pear-shaped, the length of the front middle, and just clearly separated at their apex from the side-eyes.

The sternum is broadest posteriorly, and very convex, hollowed in front opposite the lip, and slightly pointed between the rear coxæ, covered with long upstanding bristles on round roots. The posterior sigillæ are transversely oval, once and a half of their long diameter from the margin and the same distance from the central line.

The lip is broader than long, hollowed in front, and curved posteriorly with the sternum. It is very convex, and clothed with bristles on roots, but no small club-shaped spines.

The maxillæ are rather long, straight in front, a rounded protuberance at the heel and thence hollowed over the lip. A few club-shaped spines are sprinkled from the inner corner to half-way up.

Legs short and stout. Scopulæ on tarsi and metatarsi of front two pairs. A few short stout spines on all tarsi and metatarsi, and longer ones on underside of tibia.

The superior tarsal claws have one very long tooth near the base; the inferior claw is bare. One row of teeth only on falx-sheath. On the outside of patella iii. and iv. is an area covered with short stout spines very similar to those forming the rastellum.

The inferior spinnerets are one diameter apart. The superior are short, thick and tapering, the first joint longest and thickest, the third is hemispherical and only visible above the second from the underside.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax	8	7
Abdomen	10	6
Mandibles (horizontally)	3	
Superior spinnerets	$2\frac{1}{2}$	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$3\frac{1}{2}$	6	5	4	=	$18\frac{1}{2}$
	2.	$3\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	4	=	$17\frac{1}{2}$
	3.	3	5	4	4	=	16
	4.	$3\frac{1}{2}$	7	6	6	=	$22\frac{1}{2}$
Palpi		$3\frac{1}{2}$	$4\frac{1}{2}$	4	3	=	15

One female from Christchurch, N.Z., sent me by Prof. Dendy.

Subfamily Barychelinæ.

Group Barycheleæ.

In this subfamily we find the tarsal scopulæ projecting in strong bristly tufts beyond the claws at the end of the foot, and from consequent disuse the third claw has disappeared. Although the members of this group make their home in burrows in the soil which has to be dug out, the rastellum has not been developed into the strong teeth which are so typical in the previously described families; but in most cases the bristles on the front edge of the mandibles are simply hardened, retaining their bristly form. The spinnerets, as the name of the group implies, are short and stout; the first joint is longer than the remaining two together, the third shortest and nearly hemispherical.

The genera of which we have representatives in Australia all fall into the one group of *Barycheleæ*, distinguished by the strongly procurved front row of eyes; the front laterals being brought down to a position on the margin of the clypeus, where they are near together, forming a pattern of which the extreme form is seen in *Idiops* Perty, the whole group being at least not broader than long.

Genus Idiommata Auss.

Idiommata Auss., R. I. Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. 1895, p. 225.

Idiommata Auss., Rev. O. P. Cambridge, Proc. Zool. Soc. Lond. 1870, p. 154.

Idiommata Auss. Verh. zool.-bot. Ges. Wien, 1871, p. 183.

Idiommata Auss., L. Koch, Arachn. Austr. 1874, p. 474.

Encyocrypta E. Simon, Ann. Soc. Ent. Fr. 1888, p. 247.

Idiommata Auss., E. Simon, Hist. Nat. d. Araign. vol. i. 1892, p. 121.

Type, *Idiommata blackwalli* Cambr.

In the year 1895 Mr. Pocock, on re-examining Mr. Cambridge's type specimen, discovered (*loc. cit.*) that (in the male at least, the female not being known to him) *Id. blackwalli* is furnished with a Wood-Mason's stridulating organ, which the females, at any rate those in the British Museum, identified as *Id. reticulata* L. Koch, had not. *I. blackwalli* being the type of the genus *Idiommata* Auss., it is clear that the other species, until proved to have the stridulating organs, cannot be included in the same genus; and Mr. Pocock therefore re-characterized the genus *Encyocrypta* Simon, for the non-stridulated species. I record them as such, as it is necessary to obtain and examine more specimens before it can be seen how far the males and females agree respectively with those of *I. blackwalli.*

Idiommata blackwalli Cambr.

Idiommata blackwalli Rev. O. P. Cambridge, *loc. cit.*; L. Koch, *loc. cit.*; R. I. Pocock, *loc. cit.*; Ausserer, Verh. zool.-bot. Ges. Wien, Band xxv. 1875, p. 164.

Described from male only.

Herr Ausserer states (*loc. cit.*) that the cephalothorax and back of abdomen are thickly clothed with silver hair. Legs and palpi dark, nearly black.

Genus Encyocrypta Simon.

Encyocrypta Simon, R. I. Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. 1895, p. 225.

Encyocrypta E. Simon, Ann. Soc. Ent. Fr. 1888, p. 247.

Idiommata Auss., E. Simon, Hist. Nat. d. Araign. vol. i. (1892) p. 121.

Type, *E. meleagris*.

This genus was created by M. Simon for a New Caledonian member of the group (*meleagris*), but was subsequently merged by him in the genus *Idiommata* Auss., from which, under the circumstances above detailed, it was again resuscitated by Mr. Pocock.

From Herr Ausserer's synopsis of species (Verh. k.k. zool.-bot. Ges. Wien, Band xxv. 1875, p. 164) I translate the following:—

1.	Cephalothorax and upper side of abdomen not clothed with silver hair	2.
2.	Front middle eyes of second group at least their diameter apart; cephalic fovea deep half-moon shape with the opening in front	*E. fusca* L. K.
	Front middle eyes of second group less than their diameter apart; thoracic fovea straight	3.
3.	Abdomen brownish yellow, with a dark reddish-brown network spread on it	*E. reticulata* L. K.
	Abdomen black-brown, with yellowish-brown hairs without any network marking	*E. ausereri* L. K.

Encyocrypta reticulata L. Koch.

Encyocrypta reticulata R. I. Pocock (*loc. cit.*).

Idiommata reticulata L. Koch, Arachn. Austr. 1874, p. 47.

From British Museum specimens (three females from Rockhampton) labelled *E. reticulata*, I take the following particulars:—

The colour is chestnut-brown to lighter yellow-brown all over. The abdomen is clothed with thick short brown hair, intermingled with bristles and some spines. The six rear eyes yellow, the two front black.

A light rastellum of spinous bristles. 8 large teeth on inner margin of falx-sheath; 12 quite small intermediate at lower end; 1 large at lower end of outer edge. Thoracic fovea procurved (?).

Sternum a broad oval. Of the sternal sigillæ the three posterior pairs are moderate in size and marginal; the anterior pair under the lip very large.

The lip broader than long, strongly convex; no club-shaped bristles; it is somewhat rounded anteriorly, with a thick bunch of bristly hairs. On the lower end of the maxillæ is a distinct heel with 7 or 8 club-shaped spines. There is a thick divided scopula on all tarsi, the metatarsi of the front two pairs, and at the anterior end of the rear two pairs. All the tarsi are without spines; the front two pairs of metatarsi are without them; the other two pairs of metatarsi have a good many spines on both upper and under side. The inferior mammillæ are very minute and close together; in the superior pair the second joint is nearly as long as the first, the third short and hemispherical.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	11	7½
Abdomen	10	6
Mandibles	4	

		Coxa.	Tr. & fem.	Tib. & pat.	Metat. & tars.		
Legs	1.	4	8	8	5½	=	25½
	2.	4	7½	7½	5	=	24
	3.	3½	6½	6½	6½	=	23
	4.	4	8½	8½	10	=	31
Palpi		3½	6	5	2½	=	17

ENCYOCRYPTA FUSCA L. Koch (R. I. Pocock, *loc. cit.*).

Idiommata fusca L. Koch, Arachn. Austr. (1874) p. 475.

ENCYOCRYPTA AUSSERERI L. Koch (R. I. Pocock, *loc. cit.*).

Idiommata ausereri L. Koch, Arachn. Austr. (1874) p. 476.

ENCYOCRYPTA FULIGINATA Thor.

Idiommata fuliginata Thor. Ann. Mus. Gen. xvii. 1881, p. 243.
Male from Cape York.

Genus TRITTAME L. Koch, Arachn. Austr. (1874) p. 482.

Trittame L. Koch, E. Simon, Hist. Nat. d. Araign. (1892) p. 124.

The type species, *Trittame gracilis* L. Koch. No specimen recorded since.

Genus IDIOCTIS L. Koch.

Idioctis L. Koch, Die Arachn. Austr. (1874) p. 483.
Idioctis L. Koch, Simon, *loc. cit.* p. 125.

Type, *Idioctis helva* L. Koch, from Ovalau, Fiji.

Idioctis (Koch) has the eyes in one group (*Idiommata* in two). According to Simon, it only differs from *Idiommata* in having the lip longer than broad, an exceptional character in this group.

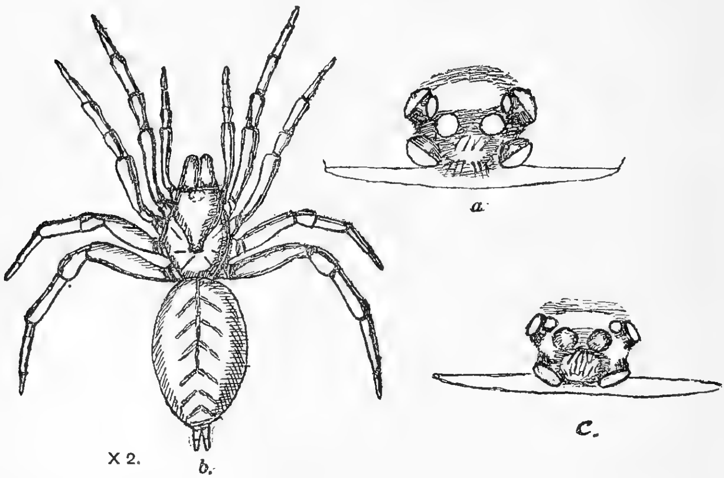
This statement will be seen to be only a printer's error in the description of the genus, as in that of the type species it is the other way—the lip is broader than long, and no exception to the rest. However, the eye-space is certainly much shorter than in *Idiommata* or *Encyocrypta* (at any rate than in *E. reticulata* L. K.); and I think the genus should stand.

I recorded specimens of *Idioctis helva* L. Koch as having come from Central Australia (Horn Expedition, vol. ii. p. 335). On comparing my notes with specimens of *I. helva* in the British Museum, this must clearly be a new species, which I describe below under the name of *I. palmarum*.

Genus Idioctis L. Koch.

Idioctis palmarum, n. sp. (Text-fig. 26.)

Text-fig. 26.



a. Eyes of *Idioctis helva* (Keyserling Collection). *b. I. palmarum.* *c.* Eyes of *I. palmarum.*

Cephalothorax, mandibles, legs, and palpi walnut-brown; sternum, lip, and maxillæ rather paler. Abdomen—upperside yellowish brown with dark-brown median line, six dark lines on either side, thence sloping towards the rear; underside rather paler without distinct markings, posteriorly the yellow shading into grey.

Cephalothorax ovate, truncate anteriorly, rounded at rear; cephalic part distinctly separated by lateral furrow. Thoracic fovea transverse, straight.

Front side-eyes rather less than their diameter apart; front median two-thirds diameter of latter, half their diameter apart;

rear side-eyes about the same diameter as front middle. Whole eye-space broader than long; an oval tubercle between the median and side pairs of front row of eyes has long bristles curling backwards.

The lip is broader than long, almost triangular, with a small triangular process at the apex, but without spines. The maxillæ are divergent, hollowed at base round the lip; rather thickly bespined at the basal part. The falx-sheath has six large teeth on the inner edge. Patella iii. has a thick row of spines on the anterior side.

The abdomen is oval, rounded at the sides.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	6	3 in front 5 in middle.
Abdomen	$2\frac{1}{2}$	$6\frac{1}{4}$

		Coxa.	Tr. & fem.	Tib. & pat.	Metat. & tars.		
Legs	1.	2	5	5	4	=	16
	2.	2	$4\frac{1}{2}$	$4\frac{1}{2}$	4	=	15
	3.	2	$4\frac{1}{2}$	4	4	=	$14\frac{1}{2}$
	4.	$2\frac{1}{2}$	6	6	6	=	$20\frac{1}{2}$

Locality. Palm Creek, Central Australia.

Besides its larger size, this differs from L. Koch's *I. helva*, from Ovalau, in having the sides of the lip more sloping, the second, third, and fourth pairs of legs longer in proportion, and both median pair and laterals of front row of eyes respectively nearer together.

Subfamily Aviculariinæ.

This subfamily, which contains all the largest members of the Mygalomorphæ, is characterized by being without both the third claw and rastellum. Of the ten groups into which M. Simon divides it, we are only concerned with two, the *Ischnocoleæ* and *Selenocosmieæ*; and if Mr. Pocock's supposition be found correct, that after examination of more specimens of the former, they may possibly all prove to be the young of other genera, we shall have only about two genera, both falling into the latter group. So far no specimens have been recorded from New Zealand.

The groups may be characterized as follows:—

Having no stridulating organs. Scopulæ of all tarsi divided. (Simon, Nat. Hist. des Araign. vol. i. 1892, p. 132.)...... Ischnocoleæ.

Having a Wood-Mason's stridulating organ, consisting of spiniform setæ on mandible and an oval cluster of bacilli; without fringe of hairs on maxillæ. Tarsal scopulæ of 1st, 2nd, and 3rd legs undivided. (Fauna of Brit. India, Arachn., R. I. Pocock, 1900.) .... Selenocosmieæ.

Group Ischnocoleæ.

This group has been formed on the distinction of the tarsal scopulæ being divided by a line of setæ; but, as shown by Mr. Pocock (Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. (1895) pp. 225–230), among those species which in an adult state have an integral scopula, it is always more or less divided in its earlier stages, and also that a considerable number of types of described species of *Ischnocolus* Auss. are certainly the young of members of other genera; so that it is possible that this may be the case with the only one recorded in Australia.

Genus Ischnocolus Auss.

Ischnocolus Auss. Verh. zool.-bot. Ges. Wien, Bd. xxi. (1871) p. 184.

Type, *I. holosericeus* Auss.

Ischnocolus lucubrans L. Koch.

Ischnocolus lucubrans L. Koch, Die Arachn. Austr. (1874) p. 487; Auss. Verh. zool.-bot. Ges. Wien, Bd. xxv. (1875) p. 173.

This species is unknown to me. It is distinguished (*sec.* Auss.) by the underside of metatarsus ii. having no spines at the fore end, and by the rear-side and middle eyes being equally large—points also applicable to *Selenocosmia crassipes* L. Koch. *Selenocosmia* is, of course, easily distinguishable by its stridulating organs, which Mr. Pocock has shown (*loc. cit.*) that several so-called *Ischnocoli* possess.

Herr Koch's type of this species is not available. I leave the record as it stands, but the presence of the genus in Australia requires confirmation.

Group Selenocosmieæ.

Synopsis of Australian Genera.

Rear legs less stout and not longer than front legs. Front row of eyes straight or procurved .... *Selenocosmia* Auss.
Rear legs longer and stouter than front pair. Front row of eyes recurved .... *Selenotypus* Pocock.

Genus Selenocosmia Auss.

Selenocosmia A. Ausserer, Verh. zool.-bot. Ges. Wien, Band xx. (1871) p. 204.

Phrictus L. Koch, Arachn. Austr. (1874) p. 488 (*nom. præocc.*).

Phlogius E. Simon, Bull. Soc. Ent. Fr. (6) vol. vii. (1887) p. cxcv; Hist. Nat. d. Araign. vol. i. (1892) p. 146.

Selenocosmia Auss., R. I. Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xv. (1895) p. 170; ibid. vol. xvi. (1895) p. 229.

Type, *S. javanensis* Walck.

Synopsis of Species.

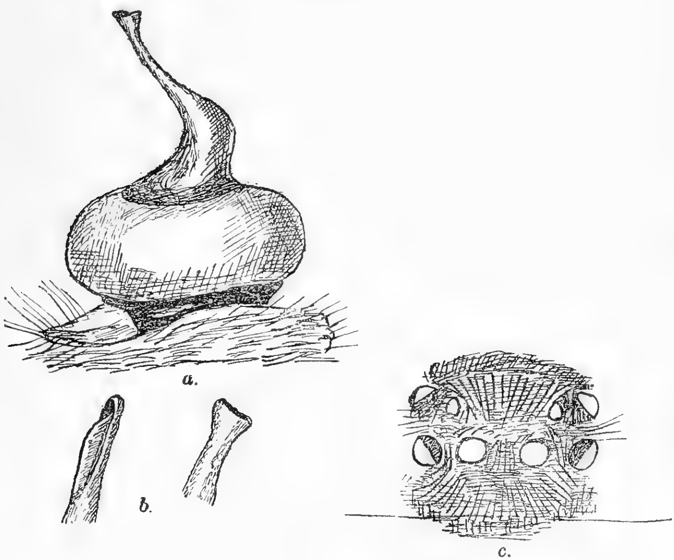
1.	Line joining centres of front row of eyes straight. Eyes in same about equal in size. Legs whole-coloured throughout	*S. stirlingi*, n. sp.
	Line joining centres of front row of eyes procurved.	2.
2.	(Male.) First and fourth pairs of legs about equal in length. In the front row of eyes a line touching the lower part of the middle pair passes through the centres of the laterals. Femur i. & ii. chocolate-brown underneath	{ *S. vulpina*, n. sp. / ? *S. crassipes* L. Koch.
	(Female.) First pair of legs distinctly longer than the fourth. Front row of eyes so far procurved that a line touching the lower points of the middle pair passes above the side-eyes (*sec.* Thor.)	*S. strenua* Thor.

SELENOCOSMIA CRASSIPES L. Koch.

Phrictus crassipes L. Koch, Die Arachn. Austr. (1874) p. 490.
Phlogius crassipes E. Simon, *loc. cit.*

SELENOCOSMIA STIRLINGI, n. sp. (Text-fig. 27.)

Text-fig. 27.



Selenocosmia stirlingi. *a.* Male palpal organ; *b*, extremity, enlarged from upper and under sides. *c.* Eyes.

This species has a wider range over Australia apparently than any other of the group. I have met with specimens from New Guinea through Queensland to about the northern border of New South Wales, through Central and South Australia, to lat. 25° 30′, and in Western Australia from the latitude of Perth. Until the male was known it was supposed to be L. Koch's *S. crassipes*, from which it differs in the coloration of the legs.

To many female specimens I have only seen one male, sent to the British Museum from Crown Point Station, S. Australia.

The measurements (in millimetres) compare as follows:—

Female.

	Long.	Broad.
Cephalothorax ..	18	11 in front. 16
Abdomen	28	20
Mandibles	$6\frac{1}{2}$	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	9	17	17	15	=	58
	2.	8	14	14	14	=	50
	3.	7	12	12	14	=	45
	4.	8	16	16	18	=	58
Palpi		9	12	12	7	=	40

Male.

	Long.	Broad.	
Cephalothorax ..	16	14	
Abdomen	$17\frac{1}{2}$	14	Spinnerets 8.
Mandibles	6		

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$8\frac{1}{2}$	18	19	18	=	$63\frac{1}{2}$
	2.	7	16	$17\frac{1}{2}$	16	=	$56\frac{1}{2}$
	3.	6	14	15	19	=	54
	4.	7	17	18	22	=	64
Palpi		$6\frac{1}{2}$	13	14	4	=	$37\frac{1}{2}$

The point of the stigma of palpal bulb of male is broadened into a flattened scoop, but not to the same extent as in *S. vulpina*, n. sp., below.

SELENOCOSMIA STRENUA Thor.

Selenocosmia strenua Thor. Ann. Mus. Genova, vol. xvii. (1881) p. 253.

Described from an adult female from Somerset, Cape York (Gulf of Carpentaria).

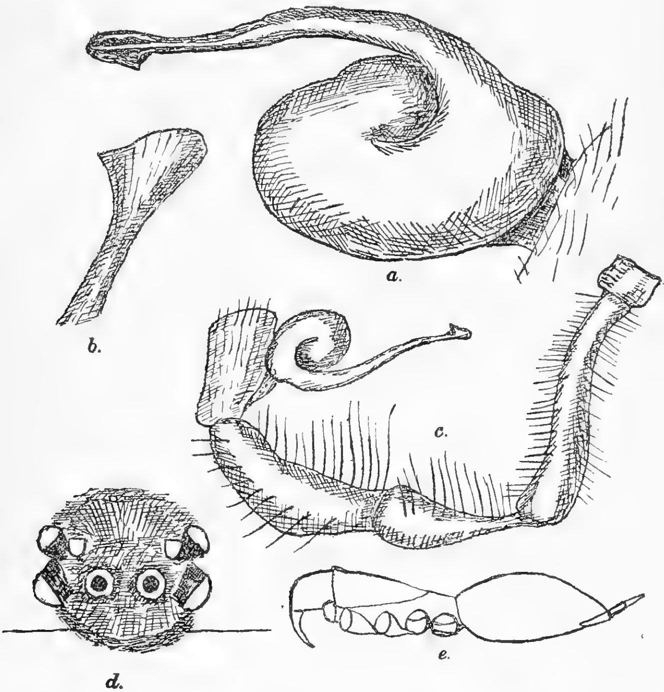
This species is unknown to me; but the Australian Museum at Sydney possesses specimens from New Guinea, identified by Mr. W. J. Rainbow, F.L.S.

SELENOCOSMIA VULPINA, n. sp. (Text-fig. 28, p. 247.)

Male.—Colour. The cephalothorax is black-brown, covered with short matted yellowish-brown hair which extends over the whole of the falces but is longer on the lower half. The sheath-fringe is darker reddish brown. Lip and maxillæ bright red; sternum dark brown. The legs and palpi yellowish brown above, darker and redder on tarsi and metatarsi. The coxæ of all legs, and the underside of the femur and trochanter of 1st and 2nd pairs are a rich chocolate-brown. Scopulæ a dirty dark brown. Abdomen above is a rather pale reddish brown, yellower underneath; spinnerets darker.

The *cephalothorax* is a tenth part longer than broad, tapering at front and rear to little more than half its greatest breadth. Thoracic fovea procurved.

Text-fig. 28.



Selenocosmia vulpina. *a.* Palpal bulb from above; *b*, ditto from beneath. *c.* Whole of palp. *d.* Eyes. *e.* Profile.

The eye-space is about twice as wide as long, a good deal raised, the prominence extending $1\frac{1}{2}$ times the diameter of the front middle eyes beyond them, to over the margin of the clypeus.

The front row of *eyes* is rather procurved; the middle pair being three-fourths of their diameter apart. The oval side-eyes obliquely-set, once and a half the diameter of middle and once and a half their diameter away from middle. (A line across the top of the middle eyes passes quite clear of the laterals, across the bottom about through their centre.) The rear side-eyes, oval, have their long diameter equal to that of the front middle. The rear middle eyes are truncate posteriorly, half the diameter of the rear side therefrom, the line joining the centres of the four being slightly recurved. Front and rear laterals clearly separated. The front middle eyes have yellow rims with black centres.

The *mandibles* are as long as the front patella, thickly clothed with short down-lying hair merging into longer at the front end and on the inner side of the falx. Fangs rather long.

The *maxillæ* are divergent, the base being curved round the lip to a narrowish heel at the outer corner. There is a bunch of numerous club-shaped spines about the middle of the base. The upper inner corner alongside the insertion of the trochanter is moulded into a small rounded protuberance.

The *lip* is unfortunately broken and its form not distinguishable.

The *abdomen* is oval, long and narrow, thickly covered with a mat of rather long bristly hair, but no spines. The superior spinnerets straight and tapering, one half the length of femur and trochanter iv.

The *palpi* are comparatively short. The femoral joint incurved, the patellar and tibial joints covered with long bushy hair; metatarsal quite short. The bulb is rather large and well rounded, twisting at the top so that the stigma, which in length equals twice the diameter of the bulb, proceeds from the inner side of the basal portion. The apex of the stigma is much dilated (as in *S. lanipes* Auss. Arachn. Austr. 1875, p. 187 & plate), but the bulb is much more globular.

The *legs* are powerful, the front pair being thicker than the rear, and thickly covered with long bushy hair. The scopula on the fourth metatarsi reach slightly beyond half-way up the joint, but merges into bristles. There are no spines or marks of them visible on any of the legs.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	$16\frac{1}{2}$	8 front. / 15 middle.
Abdomen	18	10

Spinnerets 4, 3, $2\frac{1}{2} = 9\frac{1}{2}$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	8	19	24	19	=	70
	2.	8	17	18	17	=	60
	3.	7	14	15	17	=	53
	4.	7	$18\frac{1}{2}$	21	23	=	$69\frac{1}{2}$
Palpi		7	13	14	4	=	38

This species (a single male from Cape Upstart, near Bowen, Queensland, dried specimen in Brit. Mus. N. H. received in 1873) is very much smaller than *S. lanipes* Auss., which it somewhat resembles, the cephalothorax being only two-thirds the length. The colouring is apparently lighter, no bare streaks on patellæ and femora nor on inner side of rear femora.

The 1st and 4th pairs of legs are about equal in length, instead of 4th much longer, and 3rd shorter than 2nd instead of slightly longer. The process of the palp is not so much curled though the end is about the same in shape.

Coming from the same neighbourhood, this may prove to be the male (unknown) of L. Koch's *S. crassipes.*

Genus Selenotypus R. I. Pocock.

Ann. & Mag. Nat. Hist. ser. 6, vol. xv. p. 176 (Feb. 1895).

For a Spider, a female, from Major's Creek, Townsville, Queensland, Mr. Pocock rightly constituted a new genus.

It differs from *Selenocosmia* Auss. in having the cephalic part not so much convex, the fovea deeper and more procurved, the front row of eyes recurved, the oval laterals of same not more than three-fourths the diameter of the median, the rear median nearly as large as the front lateral and larger than the rear, the whole of the clearly recurved rear row rather widely separated one from the other, and the 4th pair of legs much longer as well as stouter than the 1st.

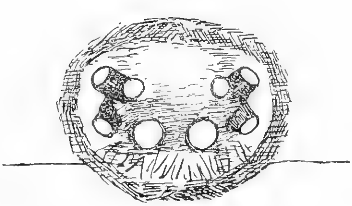
Type, *S. plumipes* Pocock.

Selenotypus plumipes Pocock. (Text-fig. 29.)

Selenotypus plumipes Pocock, *loc. cit.*

This fine species is the largest of all our Australian Spiders, having a total length of 59 mm. It is much more thickly covered

Text-fig. 29.



Selenotypus plumipes. Eyes.

with hair than is *Selenocosmia crassipes* L. Koch, or indeed than any others of the group.

I make the measurements as follows, but from a dried specimen it is difficult to take them with perfect accuracy.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	$22\frac{1}{2}$	{ 12 front. $17\frac{1}{2}$ middle.
Abdomen	30	20
Mandibles	7	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	10	$17\frac{1}{2}$	$19\frac{1}{2}$	15	=	62
	2.	8	15	16	$14\frac{1}{2}$	=	$53\frac{1}{2}$
	3.	7	15	14	16	=	52
	4.	9	19	22	24	=	74
Palpi		10	13	15	$7\frac{1}{2}$	=	$45\frac{1}{2}$

Subfamily Diplurinæ.

This subfamily is distinguished by having three claws, no rastellum, and the lip free. The superior mammillæ vary from less than one-third the length of the cephalothorax (*Hadronyche* L. Koch) to more than the whole length (*Cethegus* Thorell). The group *Masterieæ*, though represented in New Guinea and the Pacific Islands, has not been found in Australia or New Zealand.

The genera resolve themselves into fairly definite groups as follows:—

1. Six spinnerets .... Hexatheleæ.
   Four spinnerets only .... 2.
2. Tarsal claws with two rows of pectinations. Inferior mammillæ near together (not more than 2 diameters apart). Tarsi unbespined. Scopulæ on front two pairs of tarsi and at least partially on same metatarsi. No teeth on the outer margin of the falx-sheath. Sternal sigillæ of moderate size and marginal. Front row of eyes procurved. Superior spinnerets generally not exceeding half the length of the cephalothorax...... Brachytheleæ.
   Tarsal claws with one row only of pectinations............ 3.
3. Inferior mammillæ widely separated, about 4 of their diameters apart. No scopulæ on any legs. No row of teeth on outer margin of falx-sheath. Sternal sigillæ of moderate size and marginal. Superior mammillæ at least not much shorter than the cephalothorax .... Macrotheleæ.
   Inferior mammillæ close together, about 1 diameter apart. Tarsi of all legs thickly bristled and bespined. Two rows (besides an intermediate at lower end) of teeth on falx-sheath. Sternal sigillæ large and removed from margin. Superior mammillæ short, hardly exceeding two-fifths the length of the cephalothorax .... Atraceæ.

Group Brachytheleæ.

The group into which the genera hereunder collected fall is associated by M. Simon with the genus *Diplura* under the name of *Diplureæ*. In the first place, however, we have no genera to record following the *Diplura* side of it. Secondly, as shown by Mr. F. O. Pickard-Cambridge (Proc. Zool. Soc. Lond. 1896,

p. 716), at least some of the species hitherto attributed to that genus (*Trechona* C. Koch, and those for which he has constituted the genera *Harmonicon* F. O. P.-C., and *Melodeus* F. O. P.-C., *loc. cit.*) are furnished with stridulating organs; and it is not impossible that the type species itself, *D. macrura* L. Koch, may on examination prove to have them also, in which case the whole group would require remodelling. Thirdly, the genera centring around *Brachythele* Auss. seem to form a better antithesis to M. Simon's other well distinguished group of *Macrotheleæ.*

In spite of the fact, therefore, that none of the Australian species examined by me really conform exactly to the genus itself, the characters represented by *Brachythele* Auss. seem to form the better natural group round which to collect them, and I have adopted it as the type genus.

Synopsis of Genera.

1.	Thoracic fovea procurved. Tarsi and metatarsi of front two pairs scopulated but not to full length of latter. 3rd joint of superior spinnerets not longer than the 1st joint. Front row of eyes procurved though in some cases very slightly ...	*Aname* L. Koch.
	Thoracic fovea straight	2.
2.	Tarsi only of front two pairs with scopula. None on metatarsi. 3rd joint of superior spinnerets longer than 1st (or 2nd), thin and tapering	*Ixamatus* E. Sim.
	Metatarsi of front two pairs of legs at least partially scopulated	3.
3.	Front row of eyes procurved, side larger than middle. Tibia i. of male furnished with a single spur springing from an enlargement in the middle of the joint	*Chenistonia,* n. gen
	Front row of eyes straight. Tibia i. of male furnished with an apical spur. (*Sec.* Auss. ad partem *B. platipus.*)	*Brachythele* Auss.

Genus ANAME L. Koch.

Brachythele Ausserer, Verh. zool.-bot. Ges. Wien, 1871, p. 174.
Aname L. Koch, Die Arachn. Austr. (1873) p. 469.
Brachythele Auss., E. Simon, Hist. Nat. d. Araign. i. p. 180 (1892).
Type, *Aname pallida* L. Koch.

M. Simon apparently considered (*loc. cit.*) Herr Koch's genus *Aname* to be synonymous with Ausserer's older genus *Brachythele* (type, *B. icterica* C. Koch). While, however, we have a group of several species agreeing with the genus formed for *A. pallida*, they differ in the following important respects from *Brachythele.*

The thoracic fovea is procurved instead of straight. (M. Simon forgives this.)

The front middle eyes (in *A. arborea* and *pellucida*, n. sp.) range up to 2 diameters apart, instead of being (*parum disjuncti*) near together. In general the row is procurved and not straight. The rear middle eyes are, except in *A. pellucida*, smaller than the rear side, instead of nearly equal, nor are the latter (except in that species) smaller than the front side-eyes.

The two front metatarsi are scopulated only two-thirds up the joint instead of to the base; and lastly, but most important, the male has no apical spur on tibia i.

The species may be distinguished as follows :—

1.	The middle eyes of front row less than or about their diameter apart	2.
	The middle eyes of front row more than (more nearly two) their diameter apart	3.
2.	On the upperside of the abdomen a black median longitudinal stripe with side stripes depending therefrom on a yellowish ground. (*Sec.* L. Koch.)	*A. pallida.*
	Dark grey above with no recognizable pattern	*A. grisea*, n. sp.
3.	On back of abdomen two longitudinal rows of large yellow spots on black ground. Front and rear side-eyes the same length, rear middle shorter; front row procurved	*A. arborea*, n. sp.
	Black median and side stripes on yellowish ground on back of abdomen. Front side-eyes longer than rear side; rear side and middle eyes of equal length; front row nearly straight	*A. pellucida*, n. sp.

ANAME PALLIDA L. Koch.

Aname pallida L. Koch, Die Arachn. Austr. (1873) p. 469.

This species was unfortunately described by Herr Koch from a newly moulted specimen, at which time the whole of the cephalothorax, mandibles, fangs, mouth-parts, sternum, &c., are of a pale yellow colour, quite different from the normal dark brown or yellowish brown; and consequently the description is deceptive to the student. The yellow-brown hair of the cephalothorax looks almost black or dark grey in consequence. The dark median and side stripes on abdomen, and front middle eyes only half a diameter apart, serve to distinguish it.

I have seen no specimen, however, which I can recognize as being the same.

ANAME GRISEA, n. sp. (Text-fig. 30, p. 253.)

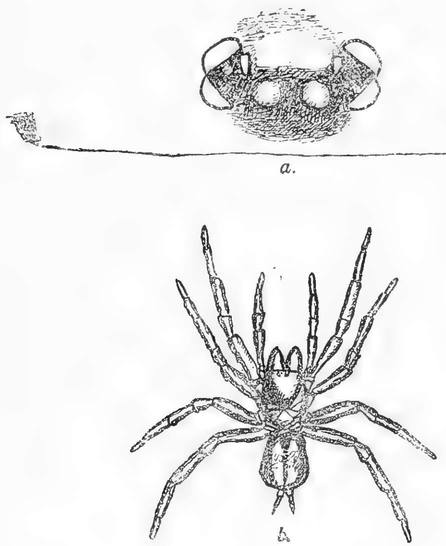
Cephalothorax and mandibles a dull yellowish brown, with dark brown hairs and black bristles on the latter. Legs and palpi yellow shaded with brown, with lighter brown hairs. Lip and maxillæ brownish yellow; sternum and rear coxæ bright golden yellow with brown bristles. Abdomen above black, mottled with irregular yellow spots, with long upstanding hairs medium to pale brown; underneath yellow, with small black mottlings and long dark brown hairs. Spinnerets pale yellow, with pale brown hairs.

Cephalothorax rather oblong, truncate both anteriorly and posteriorly, sides curving slightly towards the rear. Cephalic part rather high, sloping to its highest point behind the eyes, thence rather downwards to the margin; clearly separated by a long, deep, straight thoracic fovea and deep side striations from the thoracic part, on each side of which are three somewhat oval depressions.

Eyes. The front row is only slightly procurved; the two median three fourths their diameter apart; the side-eyes farther away, about one third longer in diameter than the median. The front and rear side are equal in diameter and almost contiguous. The middle eyes of rear row touch the laterals with their upper corner.

Sternum broad, shield-shaped, very convex. Sigillæ quite marginal, the posterior pair rather large.

Text-fig. 30.



Aname grisea. *a.* Eyes.

Lip convex, cup-shaped, broader than long, sides rounded, the front and rear edges both recurved and parallel; one or two club-shaped spines. Maxillæ rather broad, straight in front, a deep rounded heel at the outer posterior corner, thence curving inwards round the lip. Above this incurved part a thick group of club-shaped spines.

On inner margin of falx-sheath 8 large teeth and a few small intermediate at the lower end.

The superior tarsal claws have two rows of pectinations of 4 or 5 each, the 3rd claw without teeth. The tarsi are all unbespined. Scopulæ on the two front pairs reach two-thirds up the metatarsi also. The tibiæ and metatarsi are all bespined, and there are three short ones on the anterior side of patella iii.

The inferior spinnerets are their diameter apart. The superior tapering, the 1st and 3rd joints equally long, the 2nd shorter.

Measurements in millimetres.

		Long.	Broad.				
Cephalothorax ..		4	$3\frac{1}{4}$				
Abdomen		4	3				
Superior spinnerets		$2\frac{1}{4}$					

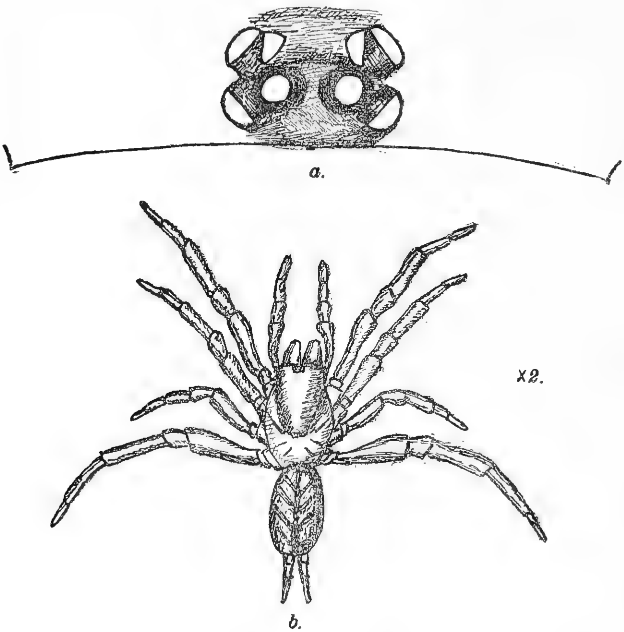
		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$1\frac{3}{4}$	$3\frac{1}{2}$	4	$3\frac{1}{2}$	=	$12\frac{3}{4}$
	2.	$1\frac{3}{4}$	3	$3\frac{1}{2}$	3	=	$11\frac{1}{4}$
	3.	$1\frac{1}{2}$	$2\frac{3}{4}$	3	$2\frac{3}{4}$	=	10
	4.	$1\frac{3}{4}$	$3\frac{1}{2}$	4	4	=	$13\frac{1}{4}$
Palpi		$1\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{1}{2}$	=	$7\frac{3}{4}$

Three females from Macedon, Victoria.

ANAME ARBOREA, n. sp. (Text-fig. 31.)

Cephalothorax deep yellow, thinly covered with down-lying pale yellow hairs and a darker belt of longer hairs round the margin.

Text-fig. 31.



Aname arborea. *a.* Eyes.

Mandibles yellow-brown, with a longitudinal belt of brown hair beginning one-fourth their length from the base, thence widening and thickening to the lower end of the falx, where the bristles lengthen and harden into a light rastellum. Sternum, lip and maxillæ, legs and palpi a bright golden yellow, with dark brown hairs and bristles. The abdomen has a black ground on the upper side, with a double longitudinal row of large yellow spots joined anteriorly and reaching to the spinnerets; beyond these on the side slopes smaller irregular yellow spots; underneath a yellow ground with a few black mottlings.

The eye-space is black, twice as wide as long. The front middle eyes are green, the remainder yellow.

The front row of eyes is clearly procurved. On a common protuberance of their own the median are 1½ diameter apart but only one half their diameter from the laterals, whose long diameter is 1½ times that of the median. The rear row is slightly recurved, its laterals the same size as the front laterals, are half their diameter away. The rear middle eyes are smaller than the laterals, and touch them with their upper corner.

The falx-sheath has 7 large teeth on inner margin and 2 small off the row to the outside.

The patella and tibia of all legs have two bare long streaks with an intervening row of hairs.

The superior spinnerets have the 3rd joint but slightly longer than the 2nd, both being shorter than the 1st.

In other respects this agrees with the foregoing (*A. grisea*). It differs from *A. pallida* L. Koch in coloration of abdomen, and in the front middle eyes being 1½ diameter instead of only ½ diameter apart.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	6	4½
Abdomen	6	3½
Superior spinnerets	3½	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	2½	5¼	5½	4	=	17¼
	2.	2½	4½	4½	3½	=	15
	3.	2	4	3	3	=	12
	4.	2½	5¼	6	6	=	19¾
Palpi		2	3	2½	1½	=	9

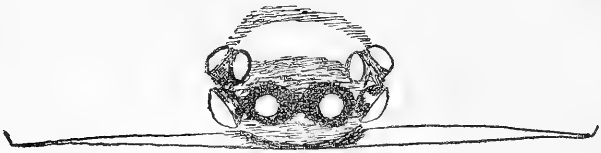
Two females from Macedon, Victoria.

ANAME PELLUCIDA, n. sp. (Text-fig. 32, p. 256.)

Cephalothorax, legs, and mandibles rather bright pale yellow; hairs brownish grey. Cephalic part not so much raised up as in *A. grisea*. Abdomen black above, with yellow side-streaks 5 in number. (The other parts are pale cream-colour, probably from recent moulting.)

The eyes are all pale yellow. The front median, each on a round black tubercle, are 2 diameters apart. The front side-eyes are longer than the rear side 1½ of their diameter. The long diameter of the rear middle eyes is the same as that of their laterals, from which they are just clearly separated. The front middle are the same distance (their diameter) from the rear middle and the front side. The centres of the front row are in a straight line, those of the rear row recurved.

Text-fig. 32.



Aname pellucida. Eyes.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax ..	$8\frac{1}{2}$	$6\frac{1}{2}$
Abdomen	9	$5\frac{1}{2}$
Mandibles	3	

Superior spinnerets $2\frac{1}{2}$, 1, $1\frac{1}{4} = 4\frac{3}{4}$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	4	7	$7\frac{1}{2}$	$6\frac{1}{2}$	=	25
	2.	$3\frac{1}{2}$	$6\frac{1}{2}$	7	6	=	23
	3.	3	$5\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	=	$20\frac{1}{2}$
	4.	$3\frac{1}{2}$	7	8	8	=	$26\frac{1}{2}$
Palpi		$3\frac{1}{2}$	$5\frac{1}{2}$	5	3	=	17

In other points the same as the foregoing (*A. arborea*).

Besides its much greater size, this differs from *A. pallida* L. Koch in the greater distance and colour of its front middle eyes, the equality in size of its middle and side eyes of rear row, the straighter front row; the 1st and 4th pairs of legs being more nearly equal in length.

One female from Macedon.

Genus Brachythele Auss.

This genus should have the front row of eyes straight. Thoracic fovea straight. Front tibia of male furnished with an apical spur. Tarsus and metatarsus of front two pairs fully scopulated.

Type, *B. icterica* C. Koch.

On comparing the Australian with some S.-American specimens of *Brachytheleæ* recently to hand, they certainly agree in many points. In eyes, spines of lip, shape of maxillæ and sternum, and type of superior mammillæ they agree. In the Australian the cephalic part is rather more raised up and the fovea deeper; the inferior mammillæ are nearer together. In the S.-American all the tarsi are scopulated instead of only the front two pairs, and are more flexuous instead of straight and firm.

The generic differences of *Aname* Koch and *Ixamatus* Sim. are very slight, and they might well be combined, though they can be clearly distinguished from *Brachythele* Auss., and *Hapalothele* Lenz.

BRACHYTHELE PLATIPUS Auss.

Brachythele platipus Auss. Verh. zool.-bot. Ges. Wien, 1875, p. 159.

Described by Ausserer from a cephalothorax only, from Herr L. Koch's collection and marked New Holland, without further description.

The length of cephalothorax is 7·5 mm. = tibia + patella iv., as in all the species of *Aname* L. Koch. Breadth of cephalothorax 5·8 mm.

The front middle eyes are somewhat more than their diameter apart; and the hair-covering of the cephalothorax is dingy yellow-brown.

The description is inadequate to show in what it differs from the species of *Aname* above described, to which genus it probably belongs; but I leave it as given until proof can be shown, from more material, of the genus to which it should really be attached.

Genus IXAMATUS Simon.

Ixalus L. Koch, Die Arachn. Austr. 1873, p. 469 (*nom. præocc.*).
Hapalothele H. Lenz, Zool. Jahrb. 1886, Band i. pp. 396–7.
Ixamatus E. Simon, Ann. Soc. Ent. Fr. 1887, Bull. (note).
Hapalothele Lenz, E. Simon, Hist. Nat. d. Araign. vol. i. p. 180.

Type, *I. varius* L. Koch.

M. Simon gave the above name to Herr Koch's genus *Ixalus*, which name had been used before, for a group of mammals. He subsequently, however, referred it to Lenz's *Hapalothele*, type *H. reuteri*, from the island of Nossi-bé off N.W. coast of Madagascar.

In Lenz's genus the male has an apical spur on tibia i., which is not the case in either of the species below, which follow exactly *Ixamatus* Simon. Further, the front row of eyes is straight or recurved, instead of procurved as in *Ixamatus*, and its members have *no scopula*, instead of having tarsi i. & ii. thickly scopulated; moreover the tarsal claws have only one row of pectinations apparently crossing them, as in the *Macrotheleæ* and *Atraceæ* groups, whilst in the Australian species of *Ixamatus* they are strongly biseriated.

The superior spinnerets are slender, the last joint tapering and longer than either of the others.

The thoracic fovea is straight, and the metatarsi are not scopulated on any of the legs.

The species may be distinguished as follows :—

The front row of eyes about equally large	1.
Side-eyes of front row nearly twice the diameter of middle	2.
1. Front row clearly procurved. Palpal stigma in male twisted and dilated at apex	*I. gregorii*, n. sp.
— Front row straight. Palpal stigma in male tapering to a point and about the length of the bulb (*sec.* L. Koch)	*I. varius* L. Koch.
2. Palpal stigma in male very long and attenuated (twice the length of bulb)..............................	*I. broomi*, n. sp.

Ixamatus varius L. Koch.

Ixamatus varius L. Koch, Die Arachn. Austr. (1873) p. 469.

Described from a male from Bowen, Queensland: the species is unknown to me.

According to L. Koch, the legs are much shorter in proportion to the cephalothorax and abdomen than either of the other two species described below; his measurements being: ceph. 7 mm., abd. 8, palpi 10; legs 16, 15, 13, and 18 mm. respectively.

Ixamatus gregorii, n. sp. (Text-fig. 33, p. 259.)

The cephalothorax and mandibles are dark yellowish brown, with down-lying yellow hair and a belt of upstanding brown bristles round the margin of the former and on the front of the latter. A straight deep fovea and bare side-streaks separate the long and rather narrow cephalic part from the thoracic.

The legs and palpi are the same, yellowish brown shaded in places with darker brown; the tibiæ and metatarsi wholly dark brown. They are thickly covered with a mixture of long yellow, grey, and brown bristly hairs. The tarsi of the front two pairs have pale yellow, almost white scopulæ which extend half-way up the corresponding metatarsi.

The lip, maxillæ, sternum, and coxæ are yellow shaded with brown, and furnished with upstanding bristly brown hair, paler on the coxæ.

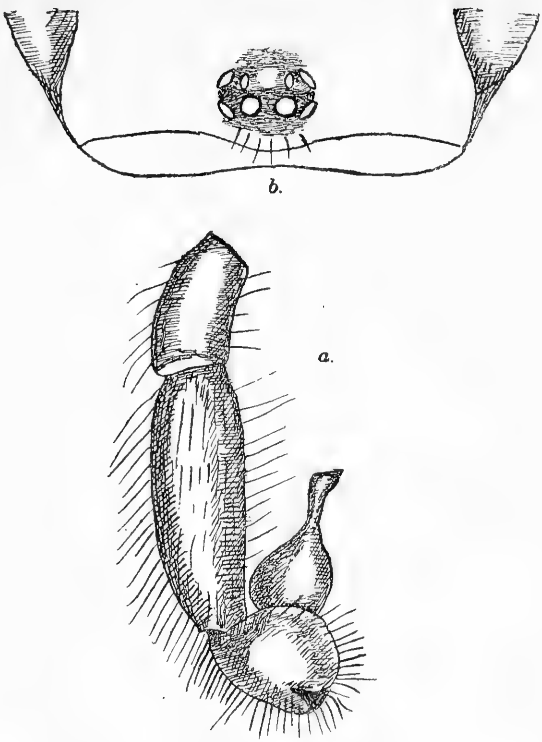
The abdomen above is dark grey mottled with large yellow spots; below yellow, with smaller black mottlings.

The superior spinnerets are pale yellow above, greyer underneath, with yellowish-grey hairs.

This differs from *I. broomi* in having the front and rear side-eyes equal in diameter to the front middle, which are half their diameter apart; in having the last joint of the superior spinnerets equal in length to the second and shorter than the first. The legs much more bristly; the thoracic fovea straighter; a few spines on the front of the lip; the style of the male palp short and curling, the length only of the bulb.

The tarsi also are weak and sinuous, the front two metatarsi partially scopulated, and on the anterior side of patella iii. are three short stout spines as in *Aname grisea* described above (p. 253).

Text-fig. 33.



Ixamatus gregorii. a. Male palp. *b.* Eyes.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax....	$4\frac{1}{2}$	$3\frac{1}{2}$
Abdomen	$4\frac{1}{2}$	3

Superior spinnerets $1\frac{1}{4}$, 1, 1 = $3\frac{1}{4}$.

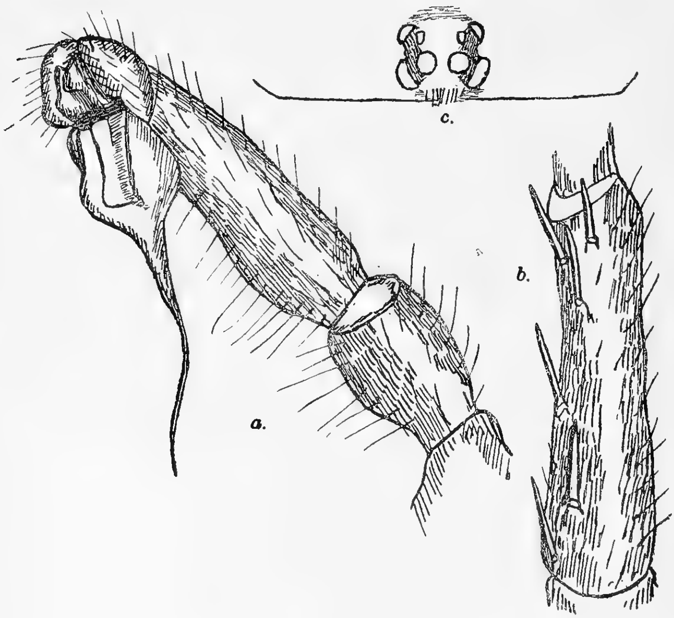
		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$2\frac{1}{4}$	$4\frac{1}{2}$	5	$5\frac{1}{4}$	=	17
	2.	2	$4\frac{1}{2}$	$4\frac{3}{4}$	5	=	$16\frac{1}{4}$
	3.	$1\frac{3}{4}$	$3\frac{3}{4}$	$3\frac{3}{4}$	$4\frac{1}{2}$	=	$13\frac{3}{4}$
	4.	2	$4\frac{1}{2}$	5	6	=	$17\frac{1}{2}$
Palpi		$1\frac{3}{4}$	$2\frac{1}{2}$	$4\frac{1}{2}$	1	=	$9\frac{3}{4}$

This specimen (a male) from Macedon, Victoria, I have named after my friend Prof. Gregory, of Melbourne University.

IXAMATUS BROOMI, n. sp. (Text-fig. 34.)

The cephalothorax is dull reddish brown; the mandibles, which are paler and more yellow-brown, have a bare streak along the outer edge and long brown bristles over the remainder. The legs and palpi are reddish brown above, deep yellow underneath, with brown hair, bristles and spines. The lip, maxillæ, sternum, and coxæ are bright golden yellow.

Text-fig. 34.



Ixamatus broomi. *a.* Male palp. *b.* Tibial joint of first pair of legs. *c.* Eyes.

On the underside of the abdomen the chitinous shield forward of the breathing-slits is bright golden yellow, the gill-coverings and the spinnerets are the same colour, behind the breathing-slits pale yellow mottled with black. Along the back is a dark median stripe, on each side of which large yellow spots are irregularly distributed on a black ground.

The cephalothorax is a short oval, the cephalic part only slightly higher than the thoracic. The fovea is rather long and deep, and clearly recurved.

The front row of eyes, seen from the front, is slightly procurved; the median pair half their diameter apart, and rather less from the laterals, of which the long diameter is once and a half that of the median. The rear row is recurved. The laterals in length equal the diameters of the front middle eyes. They are clearly separated from the still smaller rear middle eyes.

The whole eye-space is well raised up, the eyes yellow on a black ground.

The sternum is ovate, rather convex, covered with short stiff bristles ; the sigillæ are nearly marginal and moderately large.

The lip is without spines, broader than long, rather straight at the sides and hollowed in front. The maxillæ are only slightly hollowed round the lip, with a bunch of quite small spines above that portion.

The falx-sheath has one row of 7 medium-sized teeth and no intermediate.

The legs and palpi are rather long and slight, thickly clothed with stout upstanding bristly hair; the tibiæ and metatarsi well bespined, the front two pairs of tarsi have a light scopula which does not extend along the metatarsi.

The tarsal claws are large and have 7 or 8 pectinations on the inner edge, one less on the outer.

On the underside of tibia i. of the male are 10 irregularly placed spines, but no spur.

The thin, finely curved style of the male palp is $2\frac{1}{2}$ times the length of the genital bulb.

The abdomen is oval, sparsely covered with fine upstanding bristles on round roots. The inferior mammillæ are two diameters apart. The superior pair have the third joint cylindrical and longest, the second shortest.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax	6	5
Abdomen	$4\frac{1}{2}$	4

Superior spinnerets 1, $\frac{3}{4}$, $1\frac{1}{4}$ = 3.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	3	6	$5\frac{1}{2}$	$6\frac{1}{2}$	=	21
	2.	$2\frac{1}{2}$	$5\frac{1}{2}$	5	$5\frac{1}{2}$	=	$18\frac{1}{2}$
	3.	2	5	4	5	=	16
	4.	$2\frac{1}{2}$	6	$5\frac{1}{2}$	7	=	21
Palpi		$2\frac{1}{2}$	4	4	1	=	$11\frac{1}{2}$

A single male in the British Museum, sent by Dr. Broom from Hill Grove, New South Wales. I have named the species after that industrious collector.

Chenistonia, nov. gen.

Differs from *Aname* L. Koch in that tibia i. of the male is furnished with a powerful single spur springing from an enlargement in the centre of the joint. The front row of eyes is slightly procurved, the side-eyes being larger than the middle. The front and rear side-eyes are distinctly separated. The thoracic fovea is straight.

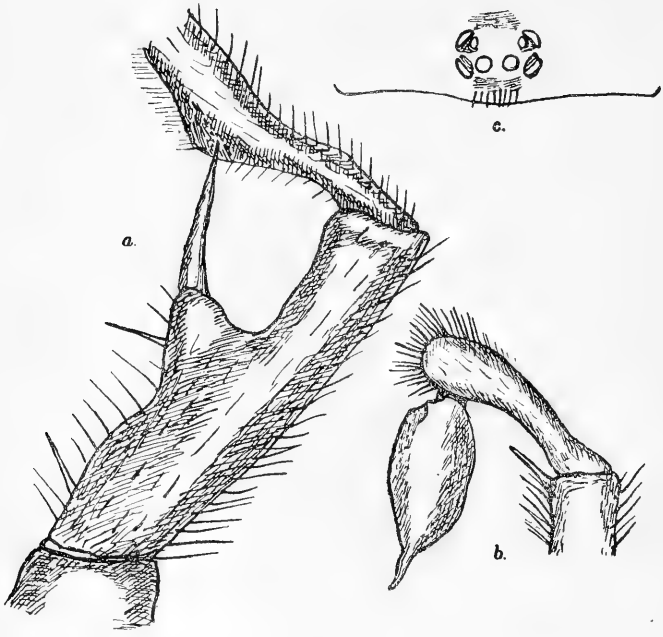
Type, *C. maculata*, n. sp.

Chenistonia maculata, n. sp. (Text-fig. 35.)

Cephalothorax and mandibles rich red-brown. Palpi and legs somewhat paler, with fine down-lying yellow hair and brown upstanding bristles. Coxæ, sternum, lip, and maxillæ deep orange, with upstanding brown bristly hair.

Abdomen, above, black ground with transverse rows of medium-sized yellow spots, rather thick short yellow hair; on the under-

Text-fig. 35.



Chenistonia maculata. *a.* Tibial and metatarsal joints of first pair of legs of male. *b.* End of palp. *c.* Eyes.

side, a yellow chitinous shield in front, behind it black and yellow mottlings with brown hair. Spinnerets yellowish with yellow hair.

The cephalothorax is oblong, only slightly narrower in front and rear; thoracic fovea straight; cephalic part not much higher than the thoracic.

Front row of eyes slightly procurved, median pair their diameter apart; laterals $1\frac{1}{2}$ diameter of former, $\frac{1}{2}$ diameter distant. Rear row recurved, laterals, the diameters of, or very slightly longer than front middle, rear middle nearly as large. Front and rear laterals clearly separated.

Sternum nearly round, convex, furnished with upstanding bristles; sigillæ rather round, marginal, and moderate in size.

Lip small, only slightly broader than long, hollowed in front; no spines. Maxillæ straight in front, round at heel, thence hollowed round lip, the whole base covered with thick club-shaped spines.

The falx-sheath has 8 large teeth on the inner side and 5 small intermediate at the lower end.

The male has a powerful lateral spur springing from an enlargement in the middle of tibia i., but none at the apex.

The genital bulb is a long pear-shape, with a short stylus not more than one-fourth of its length. The bulb springs from the end of a specially long metatarsal joint of the palp.

Measurements in millimetres.

Female.

	Long.	Broad.
Cephalothorax	6	$4\frac{1}{2}$
Abdomen	7	4

Superior spinnerets $1\frac{1}{2}$, 1, $1\frac{1}{4}=3\frac{3}{4}$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$2\frac{1}{4}$	$4\frac{1}{2}$	5	4	=	$15\frac{3}{4}$
	2.	2	4	4	$3\frac{1}{2}$	=	$13\frac{1}{2}$
	3.	$1\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$3\frac{1}{2}$	=	$12\frac{1}{4}$
	4.	$2\frac{1}{4}$	$4\frac{1}{2}$	5	5	=	$16\frac{3}{4}$
Palpi		$1\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{1}{2}$	$1\frac{3}{4}$	=	$10\frac{1}{2}$

Male.

	Long.	Broad.
Cephalothorax	6	$4\frac{1}{2}$
Abdomen	6	$3\frac{1}{2}$

Superior spinnerets $1\frac{1}{2}$, 1, $1\frac{1}{2}=4$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$2\frac{1}{2}$	$5\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{2}$	=	20
	2.	$2\frac{1}{4}$	$4\frac{1}{4}$	5	5	=	$16\frac{1}{2}$
	3.	2	$4\frac{1}{4}$	$4\frac{1}{2}$	5	=	$15\frac{3}{4}$
	4.	$2\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{3}{4}$	=	$20\frac{1}{2}$
Palpi		2	$4\frac{1}{2}$	$4\frac{1}{2}$	$1\frac{1}{2}$	=	$12\frac{1}{2}$

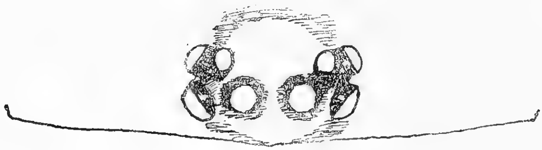
Locality. Macedon, Victoria.

CHENISTONIA MAJOR, n. sp. (Text-fig. 36.)

Besides its much larger size, though similar in colouring, this differs from *C. maculata* in the pattern of the upper part of the abdomen having a black median stripe with about 5 pairs of mottly diagonal side stripes on a buff ground; underneath all yellow.

The front middle eyes are nearer together, $\frac{3}{4}$ diameter apart, and the front side only slightly larger, about $1\frac{1}{4}$ diameter. The rear side are the same diameter as the front middle, the rear middle broad and truncate at the top.

Text-fig. 36.



Chenistonia major. Eyes

The mandibles are much more heavily clothed with hair and bristles.

The superior maxillæ are shorter in comparison, stout and tapering and darker in colour.

Also tarsi are scopulated and a portion of metatarsi i. & ii.

Lip rather round, with 3 or 4 spines in one row in front.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax	11	8
Abdomen	14	10
Mandibles	$4\frac{1}{2}$	

Superior spinnerets 2, $1\frac{1}{2}$, $2=5\frac{1}{2}$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	9	9	8	=	31
	2.	4	$8\frac{1}{2}$	$8\frac{1}{2}$	8	=	29
	3.	$3\frac{1}{2}$	7	7	$7\frac{1}{2}$	=	25
	4.	4	$9\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	=	$32\frac{1}{2}$
Palpi		4	$6\frac{1}{2}$	6	3	=	$19\frac{1}{2}$

Among a good many females I have not found a male.

Another female :—

	Long.	Broad.
Cephalothorax	11	9
Abdomen	17	11

Superior spinnerets $2\frac{1}{4}$, $1\frac{1}{4}$, $1\frac{3}{4}=5\frac{1}{4}$. Sternum $5\frac{1}{2}\times 4$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	10	10	9	=	34
	2.	$4\frac{1}{2}$	9	10	$8\frac{1}{2}$	=	32
	3.	4	8	8	9	=	29
	4.	$4\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$	$10\frac{1}{2}$	=	35
Palpi		4	7	7	4	=	22

Locality. Upper Macedon, Victoria.

Group Macrotheleæ.

This group is very clearly distinguished from the foregoing by the greater length of the superior mammillæ, which are not much, if any, shorter than the cephalothorax, by the distance between the inferior mammillæ, which are some four diameters at least apart; the tarsi and metatarsi of all the legs being without scopulæ, and the tarsal claws having the pectinations in a single row only, crossing the claw diagonally from one side to the other. They resemble one another in the sternal sigillæ, which are of moderate size and marginal, and in having the teeth on the falx-sheath in one row only on the inner side, or one row and a small intermediate at the lower end.

The genera may be distinguished as follows:—

1.	Mandibles protruding horizontally and normal...	2.
	Mandibles short, strongly kneed at base and nearly perpendicular (as in *Migas* L. Koch, *sec.* Thor.)........	*Cethegus* Thor.
2.	Front row of eyes procurved. Lip smooth or only bespined at apex; all tarsi generally bespined; all legs the same thickness; last joint of spinnerets not longer than the middle, but finer, smooth and straight	*Stenygrocercus* E. Sim.
	Front row of eyes straight or lightly procurved. Lip profusely bespined nearly to base; last joint of spinnerets as long as, or longer than second	3.
3.	No spines on tarsi. Front pair of legs stouter than others	*Porrhothele* Sim.
	All tarsi bespined. First and fourth pairs of legs the same thickness	*Macrothele* Auss.

Genus Cethegus Thorell.

Cethegus Thorell, Ann. Mus. Genova, 1881, p. 241.

This genus, formed for a specimen brought from Cape York by d'Albertis, I only connect provisionally with this group. It is unknown to me; and although (*sec.* Thor.) it has very long spinnerets, the form of the mandibles would seem to make it doubtful whether it should not rather be joined to the *Miginæ*.

Cethegus lugubris Thor., *loc. cit.*

Genus Porrhothele Simon.

Mygale Walck. Ins. Apt. vol. i. 1837 (ad part. *antipodiana*).

Cteniza White, Proc. Zool. Soc. 1849, p. 3 (ad part. *hexops* and *antipodum*).

Hexops Auss. 1871 (ad part. *whitei*).

Macrothele Cambr. 1873 (ad part. *huttoni*).

Macrothele Simon, Ann. Soc. Ent. Fr. 1891, p. 307 (ad part. *insignipes*).

Porrhothele Simon, Hist. Nat. d. Araign. vol. i. (1892) p. 185.

Type, *P. antipodiana* Walck.

This is evidently the New Zealand form of the genus *Macrothele* Auss.; but the only real difference between the two is that, whereas in the latter (*sec.* Auss.) the tarsi are all bespined, in the corresponding species of New Zealand they are without spines and the front pair of legs is somewhat stouter than the others.

M. Simon makes the lip in *Macrothele* only bespined at the apex, but in comparing the type species *M. calpetana* Walck. with the New Zealand specimens, I find no difference in this respect, the lip of both being profusely bespined to nearly the base. The front row of eyes in *Porrhothele* is straight or slightly procurved according to the point of view.

M. Simon says (*loc. cit.* & Ann. Soc. Ent. Fr. 1891, p. 307) that in *P. antipodiana* the eyes of the front row are slightly recurved. He has seen the type specimen, while I have not; but I would point out that Baron Walckenaer, though he is not quite clear in his original description, rather suggests the contrary [1], that no specimen has been since described with the row in question recurved, and the type specimen, I think a dried one, is between 60 and 70 years old, under which circumstances examination is difficult and likely to be deceptive through shrinkage.

Amongst some Spiders sent me by Prof. Dendy from Canterbury, N.Z., unfortunately all females, there are two distinguishable species of this genus, and I have little doubt that this includes all therefrom. It has not so far been met with on the mainland of Australia, but Mr. Urquhart has described a species from Tasmania (*M. aculeata*, Proc. R. Soc. Tasm. 1893, p. 94), so it is not unlikely that it may be found somewhere on the mainland.

I distinguish the species as follows:—

Front middle eyes not quite their diameter apart; thoracic fovea deep and round. Cephalothorax bright orange or light red, with dark median stripe from eyes to fovea; mandibles black-brown	*P. antipodiana* Walck.
Front middle eyes their full diameter apart (at least in female); thoracic fovea long and transversely straight. Cephalothorax and mandibles rich chocolate-brown	*P. simoni*, n. sp.

PORRHOTHELE ANTIPODIANA Walck.

Mygale antipodiana Walck. Hist. Nat. des Ins. Apt. vol. i. (1837) p. 230.

Mygale quoyi Lucas, in d'Orbigny, Dict. d'Hist. nat. vol. viii. p. 503.

Cteniza hexops White, Proc. Zool. Soc. 1849, p. 3.

[1] "Les yeux intermédiaires antérieurs . . . . sont sur la même ligne que les latéraux extérieurs."

Cteniza antipodum White, Proc. Zool. Soc. 1849, p. 3.

Hexops whitei Auss. Verh. zool.-bot. Ges. Wien, 1871, p. 155.

Macrothele huttonii Cambr. Trans. & Proc. N. Z. Inst. vol. vi. (1873) p. 200.

Macrothele huttonii Cambr., A. T. Urquhart, ibid. vol. xxiv. (1891) p. 221.

Macrothele insignipes Simon, Ann. Soc. Ent. Fr. 1891, p. 308.

Macrothele (or *Hexops*) Auss., R. I. Pocock, Ann. & Mag. Nat. Hist. ser. 6, vol. xvi. (1895) p. 224.

Porrhothele antipodiana Walck., E. Simon, Hist. Nat. d. Araign. vol. i. (1892) p. 185.

This species was originally described by Baron Walckenaer in 1837, from a specimen collected in New Zealand and brought to Paris by Messrs. Quoy & Gaimard. It would appear to be fairly common in New Zealand, and has certainly been the subject of several descriptions since, but some so vaguely drawn as to leave the characteristics of their types a matter of considerable doubt.

The 'Erebus' and 'Terror' Expedition brought home several specimens in 1847, in various stages of growth, from which Mr. Adam White described two species under the names of *Cteniza antipodum* and *Cteniza hexops* respectively.

Fortunately the types of these (two each) are preserved in the British Museum, and Mr. Pocock (*loc. cit.*) has shown that they are both the same. They are certainly also the same as two larger specimens of mine (from Canterbury as aforesaid, p. 266).

Baron Walckenaer's original description of his type specimen of *antipodiana* further agrees with these. (One of the names chosen by Mr. White rather suggests that he had himself a suspicion that he might be dealing with this species.)

M. Simon says that his *Macrothele insignipes* differs from *M. antipodiana*, but the only difference he quotes is the difference in size, which goes for very little in the females; and also he says that the front row of eyes of *antipodiana* is recurved, which I think, from reasons given above, must be taken as doubtful. His very careful description applies word for word to my specimens.

Mr. Cambridge's description of his *P. huttoni* has no points which disagree with these or by which a different species can be established.

I therefore conclude that, at least until some difference is shown between the males, the whole of these species with pale red or orange cephalothorax are really the same, and, moreover, the same as Walckenaer's type-specimen of *antipodiana*.

The unusually bright colour of the cephalothorax, with darker area about the eye-space, dark line from eye-space to the thoracic fovea, which is deep and round; front middle eyes as large as side-eyes and less than their diameter apart; black-brown mandibles; black or dark abdomen, with large round bronchial opercula yellow at the margins and brown inside, are features common to all the descriptions. The measurements of the largest specimen I have are as follows (in millimetres):—

	Long.	Broad.
Cephalothorax	12	10
Abdomen	13½	11
Superior spinnerets	10½	

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	9½	9	7½	=	31
	2.	5	9½	9	7½	=	31
	3.	4	8½	8½	8	=	29
	4.	4½	9½	9	9½	=	32½
Palpi		4½	6½	5	4	=	20

The superior tarsal claws have about 7 pectinations (in one row crossing the claw).

Tibia iv. above has 1 pair of spines in front, 2 pairs in middle close together, and 1 spine on outer side between.

Metatarsus i. has 1 pair of spines in front and 1 spine in middle of underside.

On the inner margin of the falx-sheath are about 11 irregularly sized teeth, with 8 smaller in a row at the lower end intermediate between the two edges.

As is well known, Mr. White, after his description of *Cteniza hexops*, mentions (casually in a postscript) that it has only six eyes, on which statement Herr Ausserer constituted a new genus. Hence arose the discussion (Pocock, *loc. cit.*) as to whether, on the discovery that the supposed type specimen had eight eyes, the generic name *Hexops* Auss. should or should not stand in place of the later named genera.

The eyes of this species are so particularly large and distinct, that it is difficult to believe that anyone looking at it sufficiently closely to describe a new species could possibly have made such a mistake as that attributed to Mr. White.

I happen to have a specimen (of *P. simoni*, n. sp.) with one side-eye missing from the front row, without the faintest mark of its ever having been there, and have had similar experience in other genera. Now if Mr. White's specimen had similarly lost two corresponding eyes, he may well have made the observation he did; and afterwards substituted for the type duplicate specimens, instead of the one he had pulled about and perhaps broken. In that case the type specimen of Ausserer's genus would simply have been unwittingly destroyed, and when a similar one reappears the genus, out of respect to its founder, can come back into our lists. Apart from this there must surely be an implied authority to rectify any obvious mistake, as when a name intended to be descriptive through an error (or carelessness) becomes misdescriptive.

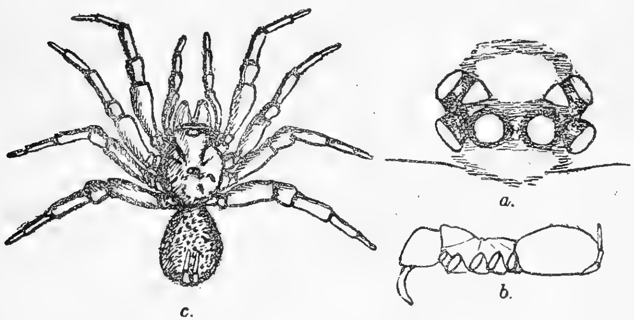
PORRHOTHELE SIMONI, n. sp. (Text-fig. 37.)

Mandibles black. Cephalothorax and sternum rich shining dark brown. Coxæ, lip, and maxillæ rather lighter brown. Legs and palpi medium reddish brown, with brown hairs, bristles, and spines. Abdomen dull black-brown, with small yellow spots here and there and rather rough corrugations; hair yellow-brown. Gill-covers brown, edged with yellow. Spinnerets dark brown. The cephalic part is only moderately raised; fovea deep and straight or slightly procurved.

The front row of eyes is slightly procurved, the median pair their diameter apart. Laterals scarcely, if any, larger, and half that distance away. The rear row is recurved, the laterals the same size as the front and three-quarters of the diameter away. The rear median are two-thirds the diameter of the others, rather square, half as far from the rear side as the front middle.

The falx-sheath has 10 large and 2 small (1st and 6th) teeth on its inner margin, with a median row of 8 small teeth at the lower end.

Text-fig. 37.



Porrhothele simoni. *a.* Eyes. *b.* Profile.

The sternum is a broad oval, flat, with thin upstanding brown hair. The sternal sigillæ are moderately large and quite marginal.

The lip is rather square, straight in front, and very convex. It is profusely covered with club-shaped spines from front nearly to base. The maxillæ are broad, with a protuberant inner front corner, a thick group of club-shaped spines reaches to two-thirds the length.

The superior tarsal claws are large, with one row of 11 pectinations, longest in the middle, running diagonally across the claws. The inferior tarsal claw is smooth. The female palp-claw has six pectinations. The inferior spinnerets are long, and about four of their diameters apart. The superior pair have the first and third joints equal and longer than the second.

The abdomen is oval, high, and rounded at the sides.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax	$11\frac{1}{2}$	7 in front.
		10 in middle.
Abdomen	14	11
Sternum	5	$4\frac{1}{4}$

Superior spinnerets $3\frac{1}{4}$, $2\frac{1}{4}$, $3\frac{1}{4}=8\frac{3}{4}$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	9	9	8	=	31
	2.	5	9	9	8	=	31
	3.	4	8	8	9	=	29
	4.	4	$9\frac{1}{2}$	10	10	=	$33\frac{1}{2}$
Palpi		4	$6\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{1}{2}$	=	$19\frac{1}{2}$

Two females from Christchurch, N.Z.

Genus Stenygrocercus E. Simon.

Macrothele E. Simon, Ann. Soc. Ent. Fr. 1888, p. 245 (ad part. *silvicola*).

Stenygrocercus E. Simon, Hist. Nat. des Araign. vol. i. (1892) p. 185.

Type, *S. silvicola* Simon.

M. Simon has constituted the genus *Stenygrocercus*, with a New Caledonian species as type, in which the lip is rather square, both that and the maxillæ free from spines. The superior mammillæ have the first and second joints of about equal length, the last joint being not longer than middle, and the whole slim, the first two joints about four times as long as wide. In many cases, if not always, the second joint of the superior mammillæ all through this family is certainly retractile, and its comparative length therefore difficult to establish unless fully extended. Apart from this, however, the great difference between the unbespined lip and maxillæ in this genus, and the profuse bespining of both in the two genera *Macrothele* and *Porrhothele*, is a good generic characteristic. There is no obvious thickening of the first pair of legs as in *Porrhothele*.

The front middle eyes are much smaller than the side, thus greatly differing from those of *Porrhothele*.

Stenygrocercus broomi, n. sp. (Text-fig. 38, p. 271.)

Cephalothorax, mandibles, sternum, and coxæ deep chocolate-brown; eye-space and mandibular fangs black. Legs and palpi, lip and maxillæ rather lighter, edges of the latter paler and ruddier. Front median eyes greenish, remainder bright yellow. Hairs on cephalothorax yellowish, on legs, palpi, and sternum dark brown. Abdomen dark grey ground, with small paler yellow-brown pit-marks over the upper surface.

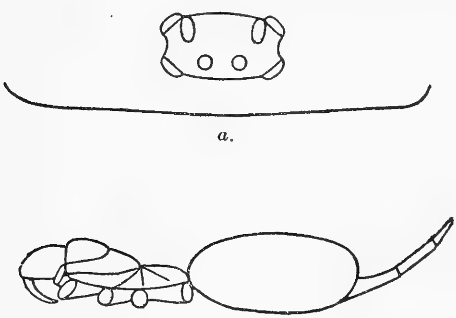
The cephalothorax is $1\frac{1}{2}$ mm. longer than broad, only slightly narrowing in front and rear. A deep round fovea and four well-marked depressions on either side.

The raised eye-space twice as long as broad and half its breadth from the edge of the carapace. The front row of eyes is procurved. Laterals $2\frac{1}{2}$ times the diameter of the median, the latter one diameter apart, and the same distance from the lowest point of the side-eyes. The side-eyes of rear row are smaller than front laterals, $\frac{1}{2}$ their diameter away. Rear median $1\frac{1}{2}$ diameter of front median, their apex is close up to the side-eyes.

The mandibles set rather divergently, are the length of the front patellæ, and are furnished with long stout bristles on the lower half. Falx-teeth about 8 of irregular size on inner margin, with a few small in an intermediate row at lower end of falx-sheath.

The sternum, a broad oval, and the coxæ are covered with long stout upstanding bristles each springing from a raised round radical. The anterior sigillæ are very large and situated in a broad shallow

Text-fig. 38.



a.

b.

Stenygrocercus broomi. *a.* Eyes. *b.* Profile.

depression behind the lip, which is widest at base, slightly wider than long and narrowing to a straight front edge. This is altogether without spines, as are also the maxillæ, which are square with a small rounded protuberance at front inner corner.

The metatarsi and tarsi are all bespined, the latter rather weakly; two small pairs underneath only on the front two pairs. 6 or 7 pectinations in a single row cross the superior tarsal claws. 5 or 6 short teeth on the female palp-claw.

The abdomen is oval, rounded at the sides. It has a little light-coloured down-lying hair and long spinous bristles with bases.

The anterior mammillæ are well developed, more than four times their width apart. The superior pair are about as long as the cephalothorax, the last joint tapering, the others cylindrical.

Two females were sent to the British Museum by Dr. Broom from Hill Grove, N.S.W.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax	$8\frac{1}{2}$	7
Abdomen	11	8
Mandibles	3	

Superior mammillæ 4, 3, $2\frac{1}{2}=9\frac{1}{2}$.

		Coxæ.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$3\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	6	=	$22\frac{1}{2}$
	2.	$3\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	6	=	$22\frac{1}{2}$
	3.	$3\frac{1}{2}$	$6\frac{1}{2}$	$6\frac{1}{2}$	$7\frac{1}{2}$	=	24
Or 4, 3, 2, 1.	4.	$3\frac{1}{2}$	$7\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	=	29
Palpi		3	$5\frac{1}{2}$	$5\frac{1}{2}$	3	=	17

Group ATRACEÆ.

The two genera *Atrax* Cambr. and *Hadronyche* L. Koch, which I have detached to this group, differ considerably from either of the two previous genera.

The sternal sigillæ are large and removed from the margin, and the teeth on the falx-sheath are in two rows on interior and exterior margins, with an intermediate row of small ones at the lower end.

The superior spinnerets are short and the inferior even closer together than in *Brachythele*; while the tarsal claws are pectinated in one row across the claw as in *Macrothele*, and the lip very thickly bespined.

Synopsis of Genera.

Last joint of superior spinnerets longer than second, cylindrical and smooth	*Atrax* Cambr.
Last joint of superior spinnerets short and conical........	*Hadronyche* L. Koch.

Genus ATRAX Cambr.

Atrax Rev. O. P. Cambridge, Ann. & Mag. Nat. Hist. ser. 4, vol. xix. (1877) p. 26; E. Simon, Ann. Soc. Ent. Fr. 1891, p. 302; id. Hist. Nat. d. Araign. vol. i. (1892) p. 186.

Type, *A. robustus* Cambr.

Synopsis of Species.

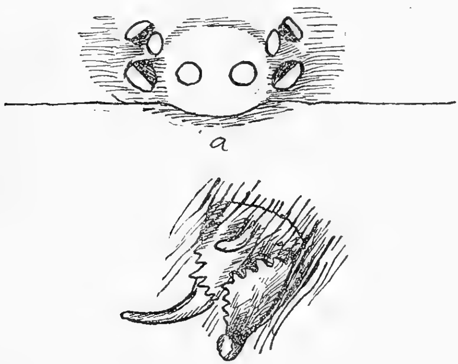
Front middle eyes more than their diameter apart, and distinctly less in their diameter than side-eyes of same row; patellæ of two rear pairs furnished with one or two spines; all four pairs of tibiæ bespined...	*A. robustus* Cambr.
Front middle eyes less than their diameter apart, and about the same in diameter as the front side-eyes; patellæ of third pair furnished with numerous spines, fourth pair none; and the front four tibiæ without any..	*A. modesta* Simon.

Atrax robustus Cambr. (Text-fig. 39.)

Atrax robustus Cambr. Ann. & Mag. Nat. Hist. ser. 4, vol. xix. 1877, p. 26, pl. vi. fig. 1; E. Simon, Ann. Soc. Ent. Fr. vol. lx. 1891, p. 301.

This rather powerful-looking spider varies in the colour of the cephalothorax, from a rich red-brown to a black-brown. Abdomen yellowish grey to darker grey, with fine dark brown hairs. The front middle eyes stand on raised shiny black rims which make them look larger and nearer together than they really are, and these again are raised on a common protuberance outside of which lie the side-eyes and rear middle. The front row only looks in any way procurved when seen from right in front.

Text-fig. 39.



Atrax robustus. *a.* Eyes. *b.* Tarsal claws.

There are seven pectinations in a curved row across the superior tarsal claws, the inferior tarsal claw being smooth.

There are 13 large teeth on the outer margin of the falx-sheath, 11 on the inner, and 9 rather large in an intermediate row.

The metatarsi and tarsi of all legs are thickly bristled and bespined, but have no real scopula. There are three or four short spines at anterior end of tibia i. and ii., and the same with more in the middle of tibia iii. and iv.

There are female specimens from Queensland and New South Wales in the British Museum, and from New South Wales in that of Paris, but no male recorded.

I give the following measurements in millimetres of about the largest.

	Long.	Broad.
Cephalothorax..	15	12
Abdomen	$12\frac{1}{2}$	11

Superior spinnerets $2\frac{1}{2}, 1, 2\frac{1}{2} = 6$.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	7	12	$12\frac{1}{2}$	11	=	$42\frac{1}{2}$
	2.	6	11	$11\frac{1}{2}$	10	=	$38\frac{1}{2}$
	3.	5	10	10	10	=	35
	4.	6	12	$11\frac{1}{2}$	$11\frac{1}{2}$	=	41
Palpi		6	9	8	5	=	28

ATRAX MODESTA Simon.

Atrax modesta E. Simon, Ann. Soc. Ent. France, vol. lx. 1891, p. 302.

Described by M. Simon from a female in the Paris Museum from Melbourne. I have not seen it, but it is apparently smaller and darker in colour. I have given (above, p. 272) the differences deduced from M. Simon's description.

Genus HADRONYCHE L. Koch.

Hadronyche L. Koch, Die Arachn. Austr. 1873, p. 463; E. Simon, Hist. Nat. d. Araign. i. 1892, p. 186.

This genus differs from *Atrax* in having the pars cephalica of the cephalothorax more raised up and rounder, but not so much so as in *Eriodon*. The superior mammillæ are short and tapering; the first joint, divided at the back but not all round, is equal in length to the remaining two, the second being slightly longer than the third. The inferior mammillæ are near together, cylindrical, and truncate at end. The lip is square in front but not nearly so long as broad, unless the whole distance from the sternum is included.

Type, *H. cerberea* L. Koch.

HADRONYCHE CERBEREA L. Koch. (Text-fig. 40, p. 275.)

Hadronyche cerberea L. Koch, *loc. cit.*

Herr Koch's description is from two female specimens from Sydney, for which he gives measurements:—Ceph. 11 mm. long; abd. 14; legs (without coxæ) 26, 24, 22, $27\frac{1}{2}$ mm. respectively.

I have a fully developed male from Macedon, Victoria, a good deal smaller, but in which I can distinguish no specific difference from his description. Still of course the question is doubtful.

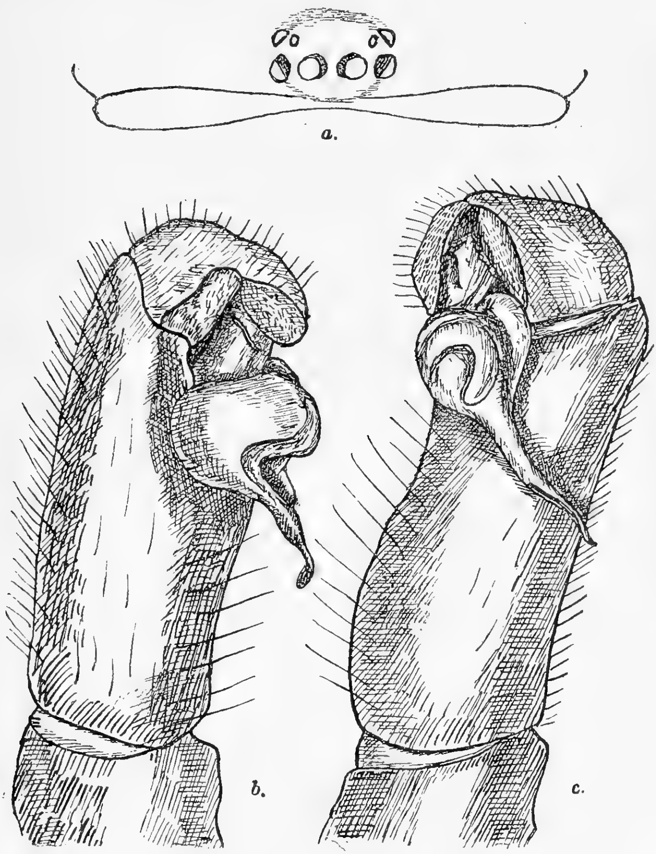
Male. Cephalothorax chocolate-brown, with paler marginal edging. Abdomen yellowish grey.

Front row of eyes straight and equal in size; middle their diameter apart, half that distance from nearest point of side-eyes; rear side-eyes smaller than front and rear median rather close up to them, smaller still.

Lip broader than long, straight in front, round at sides and rear, much bespined. The maxillæ have a short rounded projection at upper inner corner. There are 11 teeth on outer edge of falx-sheath, 9 larger on inner, and 5 or 6 very small in intermediate row at lower end.

The superior tarsal claws have one row of pectinations with about 6 teeth apparently crossing the claw. The lower claw

Text-fig. 40.



Hadronyche cerberea. *a.* Eyes. *b.* Right, and *c*, left male palp.

smooth. There are two rows of stout spines on metatarsus i. and ii. Scopulæ and numerous spines on all four pairs of tarsi. Thoracic fovea deep and procurved.

The stigma of the male palp is about as long as the bulb, the apex is somewhat flattened but not dilated; the bulb is divided by a deep long fovea underneath, but round and undivided above; metatarsal joint short.

Measurements in millimetres.

	Long.	Broad.
Cephalothorax	$6\frac{1}{2}$	5
Abdomen ..	6	4

Superior spinnerets 2 mm.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	$2\frac{3}{4}$	6	6	6	=	$20\frac{3}{4}$
	2.	$2\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{1}{2}$	=	$18\frac{3}{4}$
	3.	$2\frac{1}{4}$	5	5	5	=	$17\frac{1}{4}$
	4.	$2\frac{1}{4}$	$6\frac{1}{2}$	$6\frac{1}{2}$	7	=	$22\frac{1}{4}$
Palpi		2	3	3	1	=	9

Group HEXATHELEÆ.

Genus HEXATHELE Auss.

Hexathele Ausserer, Verh. zool.-bot. Ges. Wien, 1871, p. 171; L. Koch, Arachn. Austr. 1873, p. 459; E. Simon, Hist. Nat. d. Araign. i. 1892, p. 188.

The genus (*sec.* Auss.) hardly differs from *Macrothele* except in the addition of two small spinnerets to the usual group of four, but with no scopulæ on tarsal joint or spines on front two pairs. The known species, of which two only have been described, are confined to N. Zealand.

Type, *H. hochstetteri* Auss.

HEXATHELE HOCHSTETTERI Auss. (Text-fig. 41, p. 277.)

Hexathele hochstetteri Auss. *loc. cit.* p. 172; L. Koch, *loc. cit.*

Since the above was written, two specimens, a male and a female, have fortunately arrived at the British Museum. They were collected from Pahiatua, Wellington, N.Z., and forwarded by Capt. Hutton. They are larger than the specimens previously described by Ausserer and L. Koch, in both cases females, but fairly well conform to the descriptions of *H. hochstetteri* Auss. I am therefore able to give the following particulars of this previously imperfectly known species.

Cephalothorax and legs bright reddish brown; mandibles dark red-brown.

Abdomen dark grey-brown above, dark but rather yellower below, no pattern distinguishable.

Front middle eyes half their diameter apart. Front and rear side-eyes of equal size, their long diameter $1\frac{1}{2}$ of front middle and $\frac{1}{2}$ of same apart. The long diameter of the rear middle eyes equal to that of the front middle.

Thoracic fovea straight and deep.

Sternum ovate, broadest posteriorly; sigillæ moderate in size and nearly marginal.

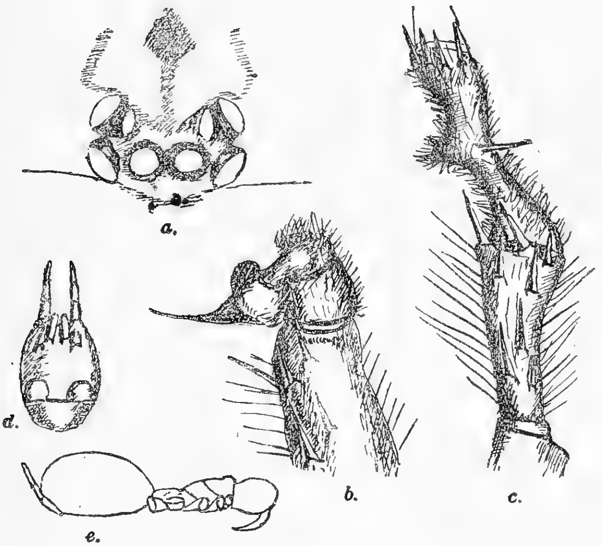
Numerous rather large club-shaped spines on both lip and maxillæ. The latter has a rounded prominence at the inner fore corner and a pronounced heel at the lower outer.

On the inner margin of falx-sheath is a row of about 15 teeth, and a thick fringe of orange-coloured hair on the outer.

The first and third joints of the superior spinnerets are equal and longer than the second; the last cylindrical, the others tapering. The second pair are about three diameters apart, and the small third pair below and outside these.

The tarsi of the female are all without scopulæ.

Text-fig. 41.



Hexathele hochstetteri. *a.* Eyes. *b.* Male palp. *c.* Tibia and metatarsus of male. *d.* Underside of abdomen. *e.* Profile.

The front two pairs of tarsi in the male have a divided scopula but without setæ, and a small pair of spines near the anterior end; only the posterior two pairs have a double row of setæ in the division of the scopula and a row of spines on each side.

One row of about 8 pectinations crosses the superior tarsal claws. The inferior claw is bare.

The palpal stigma of the male is about twice the length of the bulb, the first half flattened but tapering into a very fine point.

Measurements in millimetres.

Female.

	Long.	Broad.
Cephalothorax	$10\frac{1}{2}$	9
Abdomen ..	14	11

Superior spinnerets 3, 2, 3=8.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	9	$8\frac{1}{2}$	$8\frac{1}{2}$	=	31
	2.	$4\frac{1}{2}$	$8\frac{1}{2}$	8	8	=	29
	3.	$4\frac{1}{2}$	7	7	8	=	$26\frac{1}{2}$
	4.	$4\frac{1}{2}$	9	9	10	=	$32\frac{1}{2}$
Palpi		$4\frac{1}{2}$	6	6	4	=	$20\frac{1}{2}$

Male.

	Long.	Broad.
Cephalothorax	$10\frac{1}{2}$	9
Abdomen ..	$11\frac{1}{2}$	$7\frac{1}{2}$

Spinnerets 1st pair 3, 2, 3=8; 2nd pair 2; 3rd pair 1.
Distance apart ,, 3; ,, 2; ,, 4.

		Coxa.	Tr. & fem.	Pat. & tib.	Metat. & tars.		
Legs	1.	5	$9\frac{1}{2}$	$9\frac{1}{2}$	$9\frac{1}{2}$	=	$33\frac{1}{2}$
	2.	4	9	9	$9\frac{1}{2}$	=	$31\frac{1}{2}$
	3.	4	$8\frac{1}{2}$	$8\frac{1}{2}$	11	=	32
	4.	4	$9\frac{1}{2}$	$9\frac{1}{2}$	12	=	35
Palpi		4	7	7	2	=	20

HEXATHELE PETREII Goyen.

H. petreii P. Goyen, Proc. N. Z. Inst. vol. xix. (1886) p. 207.
H. petrerii, A. T. Urquhart, ibid. vol. xxiv. (1891) p. 221.

Female found by and named after D. Petrie, Esq.; locality Otago.
Total length 20 mm. (*sec.* Goyen).
Abdomen (overhanging ceph.) 12 mm. long.

Mr. Goyen makes no mention of how his species differs from the type species. Except a discrepancy in the eyes I can find no difference in the descriptions of these two species.

Ausserer says of the genus, "eyes as in *Nemesia*," *i.e.* front row procurved, rear row recurved. Lateral eyes oval.

Mr. Goyen says, "anterior row bent backward and the posterior forward." If this is meant in the German sense, his description tallies with *H. hochstetteri*; if he means recurved and procurved respectively, it must be something very different from the genus *Hexathele* of Dr. Ausserer.

Note.—In a former paper (Proceedings Royal Society of Victoria, August 1900), I gave the name *Hylobius* to a new genus of the family Dictynidæ. I now find that it has been previously applied to a genus of Coleoptera. I therefore change it to *Taurongia*, after the locality where the type specimens described were obtained.

In conclusion, I cannot too gratefully express my thanks to Mr. R. I. Pocock, of the British Museum Natural History Department, for kindly advice and ready assistance always at my service, and in allowing me access to the Collections under his charge; without which it would have been impossible fcr me to have investigated many points of interest and doubt, some of which I trust I have been able to make clear.

June 18, 1901.

Prof. G. B. Howes, LL.D., F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May, 1901:—

The total number of registered additions to the Society's Menagerie during the month of May was 226, of which 23 were by presentation, 7 by birth, 16 by purchase, and 180 were received on deposit. The total number of departures during the same period, by death and removals, was 150.

Amongst the additions attention may be called to:—

1. Four hybrid Macaws bred at Milan, in Italy, between a male Red-and-Blue Macaw (*Ara macao*) and a female Military Macaw (*Ara militaris*). These birds have been deposited under our care by the Hon. W. Rothschild, M.P., F.Z.S. This is, so far as I know, the only instance on record of hybridism between two species of Macaw in captivity.

2. A young male African Elephant (*Elephas africanus*), purchased on May 21st. This animal was imported from Massowah, and is said to have been captured in the Italian colony of Eritrea. It is about four feet high, and is presumed to be about four years old.

3. A Guilding's Amazon (*Chrysotis guildingi*) from St. Vincent, presented by the Earl of Crawford, F.Z.S., on May 25th. This addition renders our series of the peculiar Amazons of the Lesser Antilles complete. We have now in the Parrot House specimens of four species of these Amazons, viz., *Chrysotis guildingi* from St. Vincent, *C. augusta* and *bouqueti* from Dominica, and *C. versicolor* from St. Lucia.

4. A male Red-flanked Duiker (*Cephalophus rufilatus*) from West Africa, presented by M. Th. Leportier on May 28th. We have received no specimen of this Antelope since 1880.

Two skulls and the skin of the new Mammal, the Okapi, discovered by Sir Harry Johnston, K.C.B., F.Z.S., which had been sent to the Natural History Museum, were exhibited, and the following remarks, by Prof. E. Ray Lankester, F.R.S., F.Z.S., were read:—

The skin and two skulls of the Okapi, sent by Sir Harry Johnston, arrived at the Museum on June 17th. The larger of the two skulls is stated by Sir Harry Johnston to belong to the skin. It is not adult, and probably not more than two-thirds grown. There are traces of external male genital organs in the skin, which is probably, though by no means certainly, that of a male. The paired ungual phalanges are preserved in both fore and hind feet, but not the horny hoofs. My attention was immediately given to the skulls, the larger of which is exhibited to the Society this evening. It at once showed itself to be that of a Giraffine animal, and not that of a Bovine. The characters thus indicating Giraffine affinity are the almost complete absence of the angle between the basicranial and basifacial axes; the great relative length of the postorbital or true cranial portion of the skull; the large lacrymal vacuity bounded anteriorly by the maxillary bones; the swollen frontal margin of the orbit; the widely expanded and laterally depressed form of the hinder part of the nasal bones; the brachydont molars with rugose enamel; and the excessive length of the diastema between the præmolar teeth and the anterior group of canine and incisor teeth in the lower jaw.

The "Okapi" differs from the genus *Giraffa* not only in the relative shortness of the neck, the greater equality in the length of the limbs, and the colour-marking of the hair as shown by the skin, but in the absence, in both male and female, of the bony outgrowths of the frontal region which form the "horns" of *Giraffa*. These are represented in the Okapi by a posteriorly placed dome-like upgrowth of each frontal and a knob-like thickening in the skin.

The Okapi cannot, in my opinion, be associated generically with any of the described extinct genera of hornless forms allied to *Giraffa*, such as *Helladotherium* and *Libytherium*, though it has similar relations to *Giraffa* and is undoubtedly allied to those extinct forms. It differs essentially from *Helladotherium* in the presence of a large lacrymal vacuity. This is present in Lydekker's *Hydaspitherium*, which, however, had horns. It differs also from *Helladotherium* in the form of the orbit, which is oblong and depressed in that genus, whereas it is equal in height and breadth in the Okapi. It differs further from *Helladotherium* in the absence of the frontal bosses in the case of that genus. I have been able to compare the Okapi's skull with that of a *Helladotherium* from India, preserved in the Natural History Museum, and with the drawings of Gaudry, the founder of the genus.

I propose to establish the genus *Okapia* for Sir Harry Johnston's new animal, and provisionally characterize it as follows:—

OKAPIA, nov. gen.

A genus of Giraffine animals allied to the short-necked, hornless, extinct forms known as *Helladotherium*, &c. Distinguished from *Giraffa* by its short neck, absence of horns, and the uniform reddish-brown coloration of the hair of the body, neck, and head, accompanied by a striping in dark brown and white of the fore and hind limbs.

Distinguished from *Helladotherium* by the presence of large præ-lacrymal vacuities in the skull as in *Giraffa*, by the presence of a pair of lateral posterior dome-like prominences on the frontals (representing the bony outgrowths of *Giraffa*), and, lastly, by the presence of a minute accessory tubercle on the mediad face of the first upper true molar, which exists sometimes in *Giraffa* but is absent in *Helladotherium*.

Species. OKAPIA JOHNSTONI.

(=*Equus johnstoni* Sclater, P. Z. S. 1901, vol. i. p. 50.)

The only species known, now represented by two skulls and a complete skin, was originally described as *Equus johnstoni* by Dr. P. L. Sclater, from two pieces of skin which it appears were cut from the striped region of the hind limbs.

Sir Harry Johnston, who was himself present, gave an account of the facts connected with his discovery of the Okapi.

Sir Harry also stated that during his last excursion to the north of Mount Elgon he had found large herds of a Giraffe in that country which appeared to be distinct from previously known forms of this mammal in having five horns, four placed in pairs and one anterior in the middle line. Four examples of this animal were now on their way home, and would soon be here to settle the validity of this presumed new species.

The Hon. Walter Rothschild, M.P., F.Z.S., exhibited specimens of a mounted male and two unmounted males and a female of the Ibex of Abyssinia (*Capra walie* Rüppell), and made the following remarks:—

When Mr. R. Lydekker wrote his great work 'The Wild Oxen, Sheep, and Goats of All Lands,' in 1898, this fine species was only known from the type specimens in the Senckenberg Museum at Frankfort. Since then a few pairs of horns have been unearthed, collected at various times by Herr Menges, the wild-beast trapper, but it has remained for Captain Powell-Cotton to clear up the history of *Capra walie* by the fine series he has collected of this fast-vanishing form.

Rüppell's original description is as follows:—"Front and upper-side of head, neck, and back beautiful chestnut-brown; muzzle, a curved streak between eye and ear, sides of neck, body, and rump reddish umber-brown. Region under the eye and ear, the chin, throat, chest, and inner surface of the thighs and belly dirty white. Outer side of thighs and legs and sides of belly dirty grey. Feet whitish, with a large spot at the fetlock and a stripe down the legs black. Root of tail chestnut-brown, tip black. Inner side of ears white, with a reddish border, outer surface red-brown. Iris of eye pale brown, pupil dark blue."

The specimen of the female exhibited to-night is the first known female collected and brought to Europe.

The following notes were given me by Captain Powell-Cotton:—

"This Ibex is called Wālā by the Abyssinians and is said to exist only in the mountains of Simien.

"I shot these specimens at the commencement of autumn (end of June), just at the beginning of the rutting-season.

"There were slight falls of snow and hail, and it was very cold at night. There are said to be two feet of snow on the hilltops in August.

"On 25th June I saw two males and one female; later on, on same day, I saw a larger male by itself and shot it.

"On the 26th, I saw two large males feeding by themselves, and later on found them with thirteen females.

"On the 27th, I found the same herd and shot the two large males and one female.

"These were the only three large males on the ground. I searched a good deal of country round but only saw old tracks.

"The natives hunt these animals persistently for their flesh, skins, and horns (which they use for tumblers), and now that they are so much better armed, I believe in a very few years the animals will be extinct.

"I was told of some other hunting-ground farther to the N.E., but had not time to visit it.

"The three specimens shot and the head picked up all have the points of the horns turned inwards, but a pair of horns, which were said to have been obtained on Mount Hay, had the points turned outwards.

"I found them on the eastern slope of Mount Buiheat, one of the highest in the Simien range—in the French maps it is marked as 4510 m. in elevation. The top is undulating grass-land, with a much-frequented path running along close to the edge of the cliffs, at the foot of which is the Ibex-ground.

"The cliffs being too high for a shot, and, so far as I could discover, there being no direct path down, it seemed to be a favourite amusement of passing caravans to roll over stones in the hope of seeing a herd disturbed. At the foot of the first line of cliffs, and below several lesser ill-defined lines lower down, are the runs and lying-up places of the Ibex and Klipspringer.

"The earth and stones dropping from above have formed banks some little distance from the face of the cliffs, while here and there an overhanging rock forms a roomy shelter under it.

"The Ibex appear to regularly use these partly concealed runs in moving from one part of the ground to another, and it was in them that I found numerous traces of where native shikarees had lain up to get a shot at them, generally overlooking a drinking-place or a favourite shelter.

"The steep ground between the different lines of cliffs is covered with long coarse grass, among which the curious Tree-Lobelia (*Lobelia rhynchopetalum*) grows, besides firs, birch, and many scrubby bushes, the whole reminding me very much of where I have shot Thar in Kistowar, Kashmir, and being quite unlike any ground where I had previously seen Ibex.

"Even when the animals were feeding in the early morning and late afternoon, it was by no means easy to make them out amongst the undergrowth.

"At the foot of the mountain large flocks of sheep and goats were grazing, being sheltered at night in caves, the openings of which were protected by stone walls and wattles.

"Lower down there was a large stretch of cultivated land, and several groups of huts forming the village of Lourey.

"Although I had a special letter from the Emperor Menelik to the Governor of Simien, and from the latter to the different headmen, they placed every sort of passive obstacle in the way of my shooting Ibex, and one and all seemed most anxious to get me out of the country as quickly as possible, in spite of their receiving all the meat killed, besides presents and liberal rewards."

Mr. Rothschild pointed out that the principal differences separating this Ibex from *Capra nubiana* were the shorter beard and the horns, which are thick and stout and more like those of *Capra sibirica*. It differed from all the other Ibexes in the bony protuberance on the forehead.

Rüppell's type had the horns only 25 inches long, measured over the curve; but Captain Powell-Cotton's largest adult male had horns $43\frac{1}{4}$ and $43\frac{5}{8}$ in., while his smallest had them $41\frac{1}{2}$ and 41 in.

The Hon. Walter Rothschild also exhibited a mounted specimen of the Abyssinian Wolf (*Canis simensis* Rüppell), and made the following remarks:—

This very distinct and curious species has hitherto only been known to science from the type specimen in the British Museum, and the accounts of its discoverer, Dr. Edward Rüppell. Last year, during his very successful expedition through Abyssinia, Captain Powell-Cotton obtained four males and one female, one of which forms the basis of this note. Captain Powell-Cotton first met with this curious animal in the highlands of Gogain, just north of Abbai. None were observed in the low hot country or along the west of Lake Tana, except on 2nd April, 1900, when three were met with together, evidently in search of a female. They were always seen singly and in the neighbourhood of large colonies of a short-tailed brown rat with pale hind-quarters, which is their chief food. They appear to be about in the early morning and at night. The colour of this animal is a curious mixture of chestnut and greyish white, which produces the effect of the colour known in horses as "red roan."

This species can at once be distinguished from all other true Wolves by its very long and narrow and slender skull.

Dr. Rüppell records it as inhabiting most provinces of Abyssinia, hunting sheep and smaller wild animals in packs, and never being dangerous to human beings; but, except as regards its non-dangerous character, this was quite contrary to Captain Powell-Cotton's experiences.

Mr. Oldfield Thomas exhibited and made remarks on a peculiar Stag's frontlet and horns which had been obtained by Mr. Charles Hose in Borneo. Mr. Hose had informed him that the Deer came from a hitherto unvisited part of Borneo, the Pa Bauan country in the far interior, and that he had been told that several people had procured similar horns from that district.

Mr. R. Shelford, C.M.Z.S., exhibited a series of lantern-slides, exemplifying mimicry amongst Bornean insects, especially amongst the Longicorn division of the Coleoptera.

The following papers were read:—

1. On a new Hedgehog from Transcaucasia; with a Revision of the Species of the Genus *Erinaceus* of the Russian Empire. By Constantin Satunin, C.M.Z.S.

[Received May 29, 1901.]

In the autumn of 1900, I made an excursion into the sandy district lying along the foot of Mount Ararat, with the intention of studying its Fauna.

This locality is highly interesting, inasmuch as its Flora bears a great resemblance to the Flora of the Transcaspian province, the sands being for the greater part covered by shrubs of *Calligonum polygonoides* Pall., met nowhere else in Transcaucasia but which is exceedingly common in Transcaspia. I likewise found a great similitude between the faunas of these sands.

Of special interest for the locality near Ararat is the long-eared Hedgehog of the district, which belongs to a new species, and which shows closer affinities to the Transcaspian *Erinaceus albulus* than it does to the *E. auritus* of the Northern Caucasus.

I name this Hedgehog *E. calligoni* on account of its area in Transcaucasia being entirely limited to the distribution of *Calligonum polygonoides*.

I give the following description made by me from six specimens collected near the village of Aralyk, which lies some 40 versts to the south of Erivan.

Erinaceus calligoni, sp. nov.

This new species belongs to the group of *E. auritus* and resembles the young individuals of that species, but differs in some external characters as well as in the structure of the skull. It is even smaller than *E. auritus*, and is thus the smallest of the Russian Hedgehogs. The length of my largest specimen does not exceed 160 mm. from snout to vent, whereas a large *E. auritus* attains a length of 210 mm. The colouring of *E. calligoni* is lighter than that of *E. auritus*, and this depends on the circumstance that in the last-named species the ends of the spines are brown, whereas in the former the ends of the spines are wholly white. The dusky bases of the spines are broader, and the space between the latter and the black band is not white as in *E. auritus*, but light-grey. The upper part of the head, the ears, and the lateral line on the margin which separates the spiny surface from the fur are, as in *E. auritus*, brown. The upper surface of the foot has a brownish tinge. The whole underside is white; claws white. The ears are comparatively larger; the snout more acuminate.

The callosities on the under surface of the fore and hind extremities are sharply defined and deeply separated. The spines attain a length of 20 mm., and have from 16 to 17 finely tuberculated low longitudinal ridges.

The skull bears great resemblance to the skull of *E. albulus*. The relation of the greatest zygomatic breadth to the basal length of the skull is 1 : 1·6, as in *E. albulus*; whereas in *E. auritus* it is sometimes, and that only in very young specimens, 1 : 1·5; in full-grown animals it is always 1 : 1·4. The other peculiarities presented by the skull are shown at the end of this article, in the table of measurements (p. 290).

Measurements.

	a. ♀ senior. mm.	*b.* ♀ adult. mm.	*c.* ♂ adult. mm.
From snout to vent	160	143	142
From vent to tip of tail	25	26·5	16
From snout to external meatus ..	37	39	41
From snout to the middle of the eye	26	26	25
Length of hind-foot with claws..	34	36	33·5

It seems therefore that within the boundaries of European Russia and of the western part of her Asiatic possessions there are not less than six species of *Erinaceus*.

As there is but little to be found about the Russian Hedgehogs in existing literature, and as our information of their geographical distribution is very scanty and, for the greater part, erroneous, I will give here a brief revision of the species, following the classification adopted by the late Dr. J. Anderson (P. Z. S. 1895, p. 414).

A. The pterygoid fossæ are well developed and the pterygoids do not contribute to the enlargement of the auditory chamber.

a. Postglenoid process of the squamosal solid and much smaller than the mastoid. A narrow tract, bare of spines, on the middle of the head.

1. ERINACEUS EUROPÆUS L.

Erinaceus europœus, Linnæus, 'Syst. Nat. p. 75 (1766); Pallas, Zoogr. Rosso-Asiat. i. p. 137 (1811); Eversmann, Nat. Hist.

District Orenburg, ii. p. 75 (1850) (Russian); Simashko, Fauna of Russia, ii. p. 66, pl. vi. fig. 1 (1851) (Russian); Blasius, Säugeth. Deutschl. p. 153 (1857); Sabaneieff, The Vertebrata of the Northern Ural, p. 12 (1874) (Russian); Dobson, Monogr. of the Insectivora, i. p. 8 (1882).

The distribution of the common Hedgehog in Europe is pretty well known. In European Russia the northern limit of its distribution descends eastward and reaches, in the St. Petersburg government, Wego, 61° N. lat., whilst in the Ural mountains it does not go farther north than 59°,—*e. g.*, in the Verkhotursk district of the government of Perm, where the species is already scarce. In Central and Southern Russia and in the Caucasus this Hedgehog is everywhere common and more or less numerous, being found as well in forests and the steppes, together with *E. auritus*, as in the hills, up to 8000 feet. In the Transcaucasus these Hedgehogs attain a very great size.

We have but very scanty and little trustworthy data as to its distribution in Asia. According to Pallas it is absent on the other side of the Ural chain. But Sabaneieff [1] says that it is met with on the eastern slope of the Ural and that, there, it increases yearly in number. This author thinks that it is but recently that this species has penetrated into the Trans-Ural, and that Pallas's statement of its absence there is thus simply explained. Slowzoff [2] found it in the government of Tobolsk; Schrenck [3] and Radde [4] in Eastern Siberia; but, according to Prof. Kastchenko, it is wanting in the government of Tomsk. Schrenck (*l. c.*) distinguishes the Amoor Hedgehog as a separate variety. Radde (*l. c.*) does not find it possible to distinguish the Daoorian Hedgehog from the common one. It is difficult to come to any decided conclusion from the figure given by the last-named author, but it looks as if the skull figured on plate v. of Radde's work did not belong to *E. europæus*, but to some other species. According to Dobson, *E. dealbatus* Swinhoe, from Peking, scarcely differs from *E. europæus*. It is therefore evident that our knowledge of the distribution of *E. europæus* in Asia is in the hands of future explorers.

b. Postglenoid process of the squamosal as large as the mastoid process and is internally concave. No bare space on the head.

2. Erinaceus auritus Gmel.

Erinaceus auritus, Gmelin, Syst. Nat. Linn. i. p. 116 (1788); Pallas, Zoogr. Rosso-Asiat. i. p. 138 (1811); Eversmann, Nat Hist. District of Orenburg, ii. p. 76 (1850) (Russian); Simashko, Fauna of Russia, ii. p. 72, pl. vi. fig. 2 (1851) (Russian); Dobson, Monogr. Insectivora, i. p. 16 (1882).

[1] Sabaneieff, Vertebrat. of North. Ural, p. 12 (1874) (Russian).
[2] Slowzoff, The Vertebrata of the district Tümen, p. 212 (1892) (Russian).
[3] Schrenck, Reis. im Amur-Lande, i. p. 100, Taf. iv. fig. 2 (1858).
[4] Radde, Reis. im Süden von Ost-Sibir. p. 117, Taf. v. fig. 1 *a, c* (1862).

Differs manifestly from *E. albulus*, with which it has been confounded by many authors, in its smaller size, shorter ears, darker colouring, and broader skull, as will be seen in the table of measurements at the end of the present note. The geographical distribution of this species is far more restricted than it was commonly supposed to be. It does not go farther south than the Ust-Urt in the Transcaspian province, whence it has been recorded by Zaroudnoi, Radde and Walter, and others. These data are based on the confusion of this species with *E. albulus*. I have come to this conclusion after having examined the specimens in the Caucasus Museum (collected by Dr. Radde and Dr. Walter), as well as a great number of Hedgehogs received by me from Transcaspia through my correspondents. I know, from there, only *E. auritus* and *E. macracanthus*. The distribution of *E. auritus* begins in the steppes of the Northern Caucasus, in the plains of the Manytsh; it then extends to the north between the Don and the Volga, up to the hillocks of Ergheni, and thence goes eastward through the Volga-Ural and the Kirghiz steppes approximately between 45° and 55° N. lat. How far its distribution extends to the East is not well known. Pallas says that it reaches Lake Baikal, but the long-eared Hedgehogs which live along the River Irtysh are much larger; and those of the Trans-Baikal attain a size even greater than does *E. europæus*, so that they doubtlessly belong to some other species. It seems probable that the long-eared Hedgehog does not extend to the East beyond the Balkhash-depression and the 80th deg. of E. long. (Paris merid.). This supposition is confirmed by the fact that, though Middendorff [1], Schrenck [2], and Radde [3] mention in their works *E. auritus* from Eastern Siberia, they do so on the testimony of Pallas, but have not themselves succeeded in finding this species there.

What *E. dauuricus* Sundev.[4] is, I do not know, but according to what Pallas says of the long-eared Hedgehogs of Daooria, it is very probable that it belongs to some distinct, but now overlooked species.

3. ERINACEUS ALBULUS Stoliczka.

Hemiechinus albulus, Stoliczka, Journ. Asiat. Soc. Bengal, 1872, p. 226.

Erinaceus albulus, Blanford, Scient. Res. Second Yarkand Mission, Mamm. p. 14, pl. i. fig. 2, pl. ii *a*. fig. 1 (1879); Dobson, Monogr. Insectivora, i. p. 17 (1882).

Erinaceus auritus, Lichtenstein in 'Naturhistorischer Anhang' zu 'Reise von Orenburg nach Buchara' v. E. Eversmann, p. 124 (1823); Brandt in 'Zoolog. Anhang' z. A. Lehmann's 'Reise nach Buchara und Samarkand,' p. 299 (1852); M. Bogdanoff, The Oasis of Khiva and the desert Kyzil-Koom, p. 79 (1882) (Russian);

[1] Sibirische Reise, ii. 2, p. 76 (1853).
[2] Reis. in Amur-Lande, i. p. 105 (1858).
[3] Reis. im Süden v. Ost-Sibirien, i. p. 124 (1862).
[4] Wiegmann's Archiv, 1843, ii. p. 27.

Nikolsky, in the 'Works of the St. Petersb. Soc. of Naturalists,' vol. xvii. pt. 1, p. 384 (1886) (Russian); Radde & Walter, Zoolog. Jahrbüch., Syst. iv. p. 1006, partim (1888); Zaroudnoi, Rech. Zool. d. la Contrée Transcaspienne, separ. p. 33 (Bull. Nat. Moscou, 1889–90); Tikhomiroff, in the News of the Imp. Soc. of Lovers of Nat. Sciences, t. lxxxvi. p. 23, partim (1894) (Russian); Severzoff, Vert. and Horiz. distr. anim. of Turkistan, p. 61 (1873) (Russian).

Within the limits of the Russian Empire, this Hedgehog is very common in the Transcaspian province, where it takes the place of the foregoing species. The specimens from this locality agree perfectly with the excellent description and drawing in Blanford's work. This species will probably also be found to inhabit the southern parts of Russian Turkestan.

4. Erinaceus calligoni Satunin.

Known for the present only from the sandy district along the foot of Mount Ararat, near the village of Aralyk, about 40 versts to the south of Erivan.

It is possible that the long-eared Hedgehog of Mesopotamia belongs to this species, as the true *E. auritus* can certainly not exist there.

B. The pterygoid fossæ almost disappearing, the pterygoids being enlarged and bullate, the cavity contributing to the enlargement of the auditory chamber. On the top of the head a well-marked bare space, covered by folds of the skin.

5. Erinaceus macracanthus Blanford.

Erinaceus macracanthus, Blanford, Ann. Nat. Hist. (4) xvi. p. 310 (1875); Blanford, East. Persia, ii. p. 27, pl. i. (1879); Dobson, Monogr. Insectivora, pt. i. p. 15 (1888); Zaroudnoi, Rech. Zool. Contr. Transcaspienne, separ. p. 34 (1889–90).

Erinaceus auritus (partim!), Radde & Walter, Zool. Jahrb., Syst. iv. p. 1006, albino (1888).

Obviously not scarce in the South-eastern part of Transcaspia, whence I have received several specimens. More commonly met with in the neighbourhood of Askhabad.

The dark colouring, as given by Blanford, I find only in young animals. With age the colouring gets lighter, and in old specimens it becomes of a uniform yellowish-white.

6. Erinaceus hypomelas Brandt.

Erinaceus hypomelas, Brandt, Bull. Soc. d. l'Acad. des Sci. St. Pétersb. 1836, t. i. p. 32; Brandt in The Fauna of Russia, by Simashko, p. 74, pl. vi. fig. 3 (1851) (Russian); Eversmann, Nat. Hist. of the District of Orenburg, ii. p. 77 (1850) (Russian); Brandt in 'Zool. Anhang' z. A. Lehmann's 'Reise nach Buchara, etc.,' p. 300 (1852).

Erinaceus auritus juv.?, Dobson, Monogr. Insectivora, i. p. 16 (1888).

Of late there has prevailed a very false idea about this species, which has been forgotten for full half a century. This is probably due to the fact that Brandt described an apparently young specimen, and that the description of the full-grown animal, given by Eversmann, and the more detailed one of Brandt, were written in Russian and were published in works that have long ago become bibliographical rarities. That is the reason why I find it necessary to dwell at some length on this species.

It was evident, from the study of the existing literature, that Dobson's opinion as to *E. hypomelas* being the young *E. auritus* could not stand, as the young Hedgehogs of the last-named species are much lighter-coloured than are the old ones, and they are nearly white on the under surface of the body. I was myself disposed to think that *E. hypomelas* might prove to be the young of *E. macracanthus*.

In the summer of 1900 I had the opportunity of examining Eversmann's specimens in the Zoological Museum of the Kazan University, which had served him as types for his description. These were two well-preserved stuffed specimens, one of them having a nearly perfect skull, which I had the good luck to extricate entire.

This skull differed from the skulls in my possession of *E. macracanthus* only by its greater length (61 mm.); and I think that it would be difficult to distinguish the two species by the skulls alone.

The bare space on the head is as well-defined as it is in *E. macracanthus*. In his article, P. Z. S. 1895, Anderson says (footnote on p. 421) that Büchner, the then curator of the Mammalian Department of the Zool. Museum of the St. Petersburg Academy of Sciences, told him that the type which had served for Brandt's description had no bare space on the head and that the spines were disposed as in *E. auritus*. Now I think that there must have been a mistake about this point, and that it is sometimes quite impossible to see this character in stuffed specimens and especially in such a very old one (dating from 1838) as Brandt's type specimen, which was the skin of a very young animal [1]. In both the adult specimens of the Kazan Museum this bare space is well marked. That both Brandt and Eversmann have described the same species was made clear to me by the following circumstance: on the drawing made from the St. Petersburg specimen (Simashko, pl. vi.) of *E. hypomelas*, as well as on the stuffed specimens of the Kazan Museum, there is a very noticeable character which neither Brandt nor Eversmann has mentioned,—namely, in *E. hypomelas* the whole head up to the hind part of the crown is quite

[1] At my request, Prof. N. Kastchenko has obligingly examined this specimen, and has found on the head a bare area of which he has sent me a drawing. This leaves no doubt as to the bare space on the head of *E. hypomelas* having exactly the same appearance as it has in *E. macracanthus*.

Measurements of the Skulls in millims.

	E. europæus.	*E. auritus.*			*E. calligoni.*			*E. albulus.*	*E. macracanthus.*	*E. hypomelas.*
1. From the anterior border of the præmaxillla to the most prominent point of the occipital bone	63·5	46	46	44	43·1	44	43	50	55	61
2. Basilar length	59·5	44	43	41	40·2	40·5	40·8	47	53	58·5
3. Greatest breadth across the zygomatic bones	39	31	30	27	25	24·8	25	30	30	33
4. Least width behind the frontals	14·5	12	12	12·5	11	11	11	12	13	13·5
5. Length of the bony palate	36	25·8	25·5	24·5	24	24	24·8	27	31	34
6. Infraorbital foramen to end of præmaxillary	17	13	12	12·5	10·6	11·6	10	13	15	16
7. Length of nasalia	17	...	14	12	12	12	12	21 (!)	14	15
8. Width between anterior margins of 1st upper molars	24·8	19	19·2	18	16·4	16·6	17	18	19	21·8
	♂ adult. Near Tiflis.	Senior. Akmolinsk district.	Adult. Govern. of Stavropol.	Juv. District Tourgaï.	♀ senior. Aralyk, near Mount Ararat.	♂ adult.	♀ adult.	South Transcaspia.	South Transcaspia.	Ust-Urt.

spineless, and the spines begin only somewhat behind the line that unites the bases of the inner margins of the ears; whereas in *E. macracanthus* the spines begin considerably in front of this line.

I give here the following description of an adult specimen of this little-known species :—

Size of a large *E. europæus.*

Ears comparatively a little smaller than in *E. auritus.* Head and upper part of neck whitish, with a rufous tinge on the upper part of the head. The spines are very long, up to 43 mm., and have a white base and two black and two white bands, and their long black apex has a blue lustre which gives to the whole colouring of this Hedgehog a very dark appearance. The fur behind the ears and on the sides of the body is brownish; the abdomen and the feet are pure black.

This Hedgehog has only been found in the country named Ust-Urt, which lies between the Caspian and the Aral seas. At present this is a quite out of the way place, distant from all roads. This is the reason, I think, that it has not been visited for a very long time by a naturalist, and that the animals described from this country have been almost forgotten, e. g., *Ovis arkal* Brandt.

It is very likely that besides the above named species of Hedgehogs, there will also be found in the Transcaspian province *E. megalotis* Blyth, so common in Afghanistan. I may also state that Zaroudnoi speaks of a Hedgehog found by him in the Tedgen oasis and along the middle course of the Murgab (Bull. Nat. Moscou, 1889), which, in its characters, according to this author, does not agree with any of the species enumerated here. Unfortunately I have not had the opportunity of examining the specimens collected by him.

2. Field-Notes on the Antelopes of the White Nile. By Captain Henry N. Dunn[1].

[Received May 29, 1901.]

On putting together these few notes on the Antelopes of the While Nile, I am merely giving information as to what I know personally of their habits, and will speak only of those species observed by myself, and that mainly, too, from a sportsman's point of view. Not having my diary at hand, I am unable to give exact dates.

My only opportunity of shooting on the upper reaches of the White Nile was when attached, as Medical Officer, to an expedition formed for the purpose of clearing away the sudd-obstruction in the Bahr-el-Jebel.

[1] Communicated by the Secretary.

The expedition left Omdurman in December 1899 and returned early in May 1900, and as I had received only a few weeks' notice of my appointment to the expedition, I had very little time for making preparations, and had no idea that any of the Antelopes we might meet would be particularly interesting from a scientific point of view.

Having remained almost the whole five months at the Base Camp, on the right bank, within a few miles of the junction of the Bahr-el-Zeraf with the White Nile, I had much better opportunities of shooting than the other members of the expedition, who were mostly engaged in working on the sudd itself. The season being an exceptionally dry one we had good sport; and as most of the game was secured in much the same sort of country, I may as well describe what it was like in and around our Base Camp. The Base Camp was situated at Gabt-el-Megahid, on the right bank, six miles north of the junction of the Bahr-el-Zeraf with the White Nile, and was pitched in the midst of a patch of red-gum scrub interspersed with larger trees. This site was chosen, as fuel for the steamers was our main object. The jungle extended more or less thickly for seven or eight miles along the bank, with an average depth of from a quarter to half-a-mile. Outside the jungle stretched an undulating plain, as far as the eye could reach, covered by coarse brown grass averaging from a few inches to 2 or 3 feet in height, but in few places affording much cover for stalking purposes.

In the rainy season, of course, these conditions are greatly changed, and from all accounts the grass is then several feet high and the whereabouts of game is only to be ascertained by climbing trees.

On the bank opposite to our camp the country was somewhat different, as the ground was more low-lying, and the grass was longer and higher and afforded excellent cover. Stalking was difficult owing to the numerous low-lying strips of land containing water (khors) and mud. The natives of the country, Shuluks, burn the grass as soon as the dry-season has set in, and these fires were in full swing on our arrival.

The following were the Antelopes that I met with :—

1. Damaliscus tiang. (The Tiang.) [1]

Several large herds of this Antelope were seen on the left bank between El Duem and Fashoda, but it was well into January before I personally secured a specimen. My best heads carried horns of 22 and $22\frac{1}{8}$ inches, but I subsequently saw one of 23 inches. The horns of the female are lighter and more slender, and apparently average from 12 to 16 inches. The herds were generally met with in the drier ground, and, as is the case with most Antelopes, coming down to water in the evening or moving up from the river as the sun rose. Even with the aid of good field-glasses, I always found it exceedingly difficult to distinguish males from females, except that, if I remember correctly, the males were

[1] Scl. & Thom. Bk. of Ant i. p. 63.

of a decidedly lighter colour. On one occasion I came across an immense herd of fully three or four hundred of this Antelope, on the left bank opposite the junction of the Bahr-el-Jebel with the White Nile. They allowed me to approach within 400 yards; and a splendid sight it was to see them galloping along when startled and changing direction like so much cavalry, the leading buck on either flank going more slowly and the wings wheeling round, the whole herd galloping off in the fresh direction when squared.

The "Tiang," when wounded, is sometimes dangerous to approach. I know of one instance in which a buck charged so viciously, that it was only stopped by being clubbed across the head with a rifle, the sportsman breaking his weapon in doing this. In March and April I saw several young ones, but apparently the mothers and young kept apart from the males in small herds. When not with their young, the animals seem to move about either alone or in small parties, and are comparatively easily stalked, even in the open. Sometimes single bucks attached themselves to a herd of Water-buck, and on one occasion I observed a buck of this species attempt to have connection with several females of the herd, although the male Water-buck resented it. The Tiang at times takes an extraordinary amount of killing, and I have seen a buck carry off eight ·303 bullets in him, and only finally brought to grass after a long hunt, and when he had apparently but one sound leg left to travel with. The flesh of the Tiang is excellent.

2. Ourebia montana. (The Abyssinian Oribi.)[1]

These animals were found in considerable numbers close to the Camp, and in fact afforded one of our main supplies of meat for our men. They were not at all shy, and generally moved about in pairs, or in pairs with a single fawn. When wounded they will lie extraordinarily close at times in the long grass, so close, indeed, that I found it much simpler to approach a wounded buck with a double twelve-bore and No. 4 shot; otherwise it was not an easy thing to kill him, as he bounded away through the reeds. I have never seen Oribi actually drinking at the river, but have little doubt that they do so, having noticed numbers of tracks along the bank. When startled and galloping through high grass the Oribi at times bounds much after the manner of a Black Buck. The natives apparently kill numbers by trapping. A small fence of split reeds is made, enclosing a strip of river-bank on which the grass is exceptionally good grazing, and to which the Oribi come to feed at night-time. Small gates are left in the fencing, and in these openings the traps are laid. The trap used is made by lashing a stick to one upright of the opening, bending over the fore end and pegging down an attached noose to the ground in the middle of the opening. Beneath, where the noose is pegged out, a small pit covered by pieces of bark, has been prepared beforehand. By a trigger-like arrangement, the Oribi, in thrusting

[1] Scl. & Thom. Bk. of Ant. ii. p. 25.

his foot through the bark, sets free the pegged-down noose and is caught by the leg as the bent stick springs upright. The natives attach a rattle made of dome-palm nut to the string, so that the Oribi is heard as soon as he struggles to escape.

3. Cobus defassa. (The Defassa Water-Buck.)[1]

This Water-buck is plentiful along both banks of the White Nile from the north of El Duem to the junction with the Bahr-el-Jebel. They generally moved about in herds of from four to six up to forty, and on one occasion I counted sixty-four, young and adults of both sexes intermingled.

On our first arrival at the Base Camp, buck were plentiful in the proportion of about 1 to 4 females, but owing to the necessity of obtaining meat, they had become greatly thinned-out before our departure. My best heads measured 31 and $31\frac{1}{2}$ inches, but I believe one of 34 inches was shot by Major Peake, R.A.

Its native name here was "Tetel," but this does not go for much, as I have heard the same term applied to other animals, including Tiang and White-eared Kob. During the daytime the herds moved out from the river into the open, and seemed to spend their time in grazing and lying up in the long grass, coming down towards the river again as the sun became lower. It was a pretty sight at times to watch a herd of the Water-bucks approaching the river of an evening. The herd, led by the largest buck, generally moved slowly along through the grass in single file, pausing every few yards and gazing around to see whether the coast was clear or not. The massive horns of the bucks and dark coats showed up well against the yellow background of the sun-parched grass. When alarmed the herd rushed together, but were at times very easy to approach; and I have stalked single bucks in the open by merely creeping along, keeping my eyes fixed on the tips of the animal's horns as he fed, and dropping down when he began to raise his head. When feeding anywhere close to jungle, they almost invariably grazed head on and towards the direction they feared danger.

On one occasion one of my natives had a narrow escape from a wounded buck. He attempted to grasp the buck's horns preparatory to cutting the animal's throat, but was struck full in his chest by the horns, receiving a couple of nasty wounds, which, if lower, might easily have proved fatal. The meat of the Water-buck is poor-eating, but the hide was greatly sought after by our workmen for making sandals, to protect their feet from the thorns of the red gum-trees.

4. Cobus maria. (Mrs. Gray's Waterbuck.)[2]

So far as my personal experience goes, I have only seen this Antelope along the left bank of the Nile almost opposite the junction of the Bahr-el-Zeraf, on the right bank in small herds

[1] Scl. & Thom. Bk. of Ant. ii. p. 115, pl. xxxvi.
[2] *Ibid.*, p. 121, pl. xxxvii.

between Lake No and the Bahr-el-Zeraf, and once in the less swampy portion of the sudd itself, close to Hellet-el-Nuer. *Cobus maria* is almost invariably found in swampy ground or close to it. During several trips up the Bahr-el-Zeraf river, I never saw one at any great distance from the Nile itself; the banks of the Bahr-el-Zeraf at that season of the year being very dry and without much cover. When we arrived at the Base Camp there was a large herd of from fifty to a hundred of these Antelopes on the opposite bank, and several specimens were shot from time to time by members of the expedition. I constantly watched them from our steamer with a telescope. During the day the herd selected an open bare-burnt patch of ground to lie out on, feeding down towards the river in the evening, and roaming about on the higher and more open ground during the earlier hours of the day. The herd seemed to keep very much together; and all the various gradations of colour, from the yellow and dirty white of the females and young of both sexes, to the tawny black and almost pure white of the mature bucks, were to be seen intermingled. At first we had a certain amount of difficulty in distinguishing them from the White-eared Kob, not knowing anything about their distinctive markings; and it was not until I had shot a specimen, and noticed the smooth kid-like appearance of the skin on the back of the fetlock, between the supernumerary and true hoof, that I knew they must be of a different species; the White-eared Kob having no such distinctive feature. Of course, the white patch on the withers of *Cobus maria* is very striking; but it is next to impossible to distinguish the young and females from those of *Cobus leucotis* at a distance. In fact, the young buck *C. maria*, too, before the horns have become long enough to take on the spiral twist, and while the coat is still yellow, is very like a young *C. leucotis*, except that, no doubt, it is a heavier animal; and I could never be certain as to which species they belonged unless I got close to the herd. On one occasion, having shot a young buck *C. maria*, showing an almost entire absence as yet of the black and white markings of the more mature animal, I took the trouble to skin it. As the sun was hot and I had been out since daylight, I left the feet-bones in the skin (intending to remove them on arrival in camp), and gave the skin to a native to carry to the boat. On arriving at the boat I found, much to my disgust, that the native had cut the feet off for the sake of the bones attached. This annoyed me so much at the time, that I threw the skin away, and so lost what would have been an interesting specimen for the Museum. As I have already stated, we, at the Base Camp, had an exceptionally good opportunity of getting specimens and observing the Mrs. Gray's Antelopes. That portion of the bank on which the herd lived was a semi-detached strip of land, of about seven miles in length by four or five in breadth, and bounded behind by an arm of the river, along the bank of which, on the higher ground, the Shulluks had built their villages; and curiously enough, during the entire five months of our stay at the Base Camp, the herd never left this portion of the bank. At first the herd was fairly easy to approach, but, of course, they became more wary later on. The young and females (in January and February) kept, as a rule, close to the bucks, and this was probably due to the more or less constant worrying they had from the Shulluks and their dogs, who were always on the look-out to cut off a stray doe with young. Once, when shooting along with another officer, opposite the mouth of the Bahr-el-Zeraf, a female dashed past within forty yards of our camp, hard pressed by a Shulluk dog: my friend was just in time to cram in a cartridge and put a bullet into a second dog who was following, much to the disgust of the owner, who shortly afterwards appeared on the scene.

This Antelope will take readily to the water when pressed. On the day after our arrival at the Base Camp, a magnificent buck, wounded by a Shulluk's spear and hard-pressed by a dog, dashed into the river immediately opposite to our steamer and was shot from the deck itself. I once shot a rather fine buck under somewhat peculiar circumstances. Having set my heart on a particularly fine head, I had been following the herd for close on three hours, but could not manage to get a shot at the animal I wanted. Eventually I noticed a buck separate himself from the herd and disappear into some long reeds close to the river. This had also been observed by the natives on one of our expedition's sailing-boats, who, when I arrived, were just turning out, armed with sticks and knives, to make what they thought an easy capture of a badly wounded animal. Knowing that I could not have possibly wounded him myself, I formed the men up in a line and commenced beating up through the reeds, having taken a commanding position on some high ground. It was as well I had done so, as the buck lay until almost walked over, and then, springing up, dashed off at full speed, giving me an easy shot as he passed broadside on, not more than forty yards off. To my surprise I found on examining the body, that he had an old un-united fracture of the left shoulder, due to an accident probably, as I could find no external wound. He had evidently become tired at being kept so long on the move, and had lain down for a rest, as his leg was no doubt giving him trouble.

The full-grown Maria buck is a fine animal, his head having very much the appearance of that of an Ibex, except, of course, that the beard is replaced by the somewhat shaggy and coarse hair of the neck and throat. When alarmed the herd dashes off, led by one or two of the old bucks, and tailing out to almost single file. When galloping the buck carries his muzzle well forward, horns thrown back, and moves with a much more lumbering gait than one might expect. I never observed these Antelopes spring into the air, and they appeared rather to dash through than attempt to clear small obstacles. The meat of this Antelope is excellent. The horns of my best specimen measured $29\frac{1}{4}$ inches, and I got a single horn of 32 inches.

5. Cobus leucotis. (The White-eared Kob.)[1]

This species is found in great numbers along both banks of the White Nile, Bahr-el-Zeraf, and Bahr-el-Ghazal Rivers, but chiefly on the left bank of the Nile between Lake No and the junction of the Bahr-el-Zeraf. They were to be seen in all numbers, from solitary bucks or females with young to herds of forty or sixty, or even more. The young with their mothers, apparently accompanied the bucks in March and April, although I have often observed herds of bucks only. The female carries no horns, and it is almost impossible to distinguish it at a distance from the female Mrs. Gray's Waterbuck, both being of much the same colour and size. This remark applies also to the young males of both species. The female does not change in colour as she becomes older, but the buck develops the characteristic black and white markings as age advances; and bucks in all stages of reddish yellow with indistinct whitish markings, to the mature animal of an almost pure black and white, may be seen in the same herd. When compared side by side, *Cobus leucotis* is no doubt a much lighter and smaller animal than *Cobus maria*. My best horns measured $20\frac{1}{2}$ and $20\frac{5}{8}$ inches.

The White-eared Kob is at times exceedingly easy to approach, but sometimes hard to kill, and its flesh is excellent eating. The females are very inquisitive and will frequently approach to within a hundred yards, circling slowly round and making a peculiar whistling sound at intervals. It is stated that the male bounds into the air at times like a Bless-bok; personally I cannot say I have noticed this, and, so far as I can remember, they gallop with a much less springy action than might be expected from their build.

6. Cervicapra bohor. (Bohor Antelope.)[2]

The single specimen of this Antelope obtained by me was shot lying down in some long grass when I was stalking a Tiang. I was attracted by the peculiar shape of the animal's horns, shot it, and in my hurried inspection of the body was disgusted at having killed what I took at the time to be a young White-eared Kob. On my return to camp, I found that the natives had cut up the animal and had merely kept the horns and skull, and these I threw away on reaching the Base Camp. On examining some heads shot by other members of the expedition subsequently, I came to the conclusion that my specimen was also a Bohor, and I was lucky enough to retrieve the horns and skull, which I had thrown aside.

7. Gazella rufifrons. (Red-fronted Gazelle.)[3]

I only shot one specimen of this Gazelle south of Fashoda, and that was on the right bank of the Bahr-el-Zeraf, about 20 miles upstream. In fact, the only place I saw a Gazelle south of Fashoda was on the Bahr-el-Zeraf.

[1] Scl. & Thom. Bk. of Ant. ii. p. 127, pl. xxxviii.
[2] *Ibid.*, p. 165. [3] *Ibid.*, iii. p. 163, pl. lxvii.

I presented the skin I shot on the Bahr-el-Zeraf to Capt. Flower, and see that he has named it *Gazella rufifrons* (P. Z. S. 1900, p. 55). I have shot Gazelles at other places on the White Nile, but have never noticed such distinct markings as on those found on the Zeraf.

8. Hippotragus equinus bakeri. (Baker's Antelope.)[1]

I shot only one of these Antelopes and that was on the Bahr-el-Zeraf, and I found them very easy to approach. There is one point worth mentioning, and that is in connection with the name "*Marif*," applied by Baker to this species. "*Marif*" in Arabic literally means "I do not know," and is constantly used by natives when asked the name of an animal.

3. On a Collection of Birds made by Dr. Donaldson Smith in Northern Somali-land. By R. Bowdler Sharpe, LL.D., F.Z.S.

[Received June 18, 1901.]

During the early part of 1889, Dr. Donaldson Smith conducted an expedition of several months' duration through Northern Somali-land for the purpose of making collections for the Baroda Museum. It was hoped at first that H.H. the Gaikwar of Baroda would have accompanied the expedition, but he was unfortunately not able to do so, and Dr. Smith's only companion was Mr. Carlile Fraser.

Starting from Bulhar at the beginning of January, the route taken ran south towards Hargeisa, and a stay of some days was made at Ania, and again at Magog, which was reached on the 11th of February. Thence the expedition proceeded in an easterly direction to Adadle, and on the 17th of February Dr. Donaldson Smith went after "big game" in the Haud, leaving Mr. Fraser to collect birds and insects in the Adadle district. Leaving here, they went by Gan Liban (Feb. 22) to Berbera, whence short expeditions were made to the Goolis Mountains.

H.H. The Gaikwar has very kindly presented to the British Museum such specimens as were desiderata to that Institution.

List of Authorities.

The following books and papers are referred to in the present paper :—

1. Shelley, G. E.—"On Mr. E. Lort Phillips' Collection of Birds from Somali-land." Ibis, 1885, pp. 389–418, plates x., xi., xii.

[1] Scl. & Thom. Bk. of Ant. iv. p. 4.

2. OUSTALET, E.—"Catalogue des Oiseaux rapportés par M. G. Révoil de son deuxième Voyage aux Pays de Çomalis." Bibl. École Hautes-Études; Sci. Nat. xxxi. Art. x. pp. 1–12 (1886).
3. SALVADORI, T.—"Uccelli del Somali raccolti da D. Eugenio dei Principi Ruspoli." Mem. R. Accad. Sci. Torino, (2) xliv. pp. 547–564 (1894).
4. SHARPE, R. BOWDLER.—"On a Collection of Birds made by Dr. Donaldson Smith during his recent expedition in Western Somali-land." P. Z. S. 1895, pp. 457–520, plates xxvii., xxviii.
5. SALVADORI, T.—"Uccelli raccolti da D. Eugenio dei Principi Ruspoli durante l'ultimo suo viaggio nelle regione dei Somali e dei Galla." Ann. Mus. Genov. (2) xvi. pp. 43–46 (1896).
6. PHILLIPS, E. LORT.—"On Birds observed in the Goolis Mountains in Northern Somali-land." Ibis, 1896, pp. 62–87, plate ii.
7. ELLIOT, D. G.—"Catalogue of a Collection of Birds obtained by the Expedition into Somali-land." Field-Columb. Mus. Ornith. Series, vol. i. no 2, pp. 29–67 (1897).
8. PHILLIPS, E. LORT.—"Narrative of a visit to Somali-land in 1897, with Field-notes on the Birds obtained during the Expedition." Ibis, 1898, pp. 382–425, plates viii., ix., x.
9. HAWKER, R. McD.—"On the results of a Collecting-tour of three months in Somali-land." Ibis, 1899, pp. 52–81, plate ii.
10. PEEL, C. V. A.—Somali-land; being an Account of two Expeditions into the far Interior. 1900. Appendix: Birds, pp. 305–333.

List of Species.

1. RHINOCORAX AFFINIS.

Corvus affinis (Rüpp.); Shelley, Ibis, 1885, p. 389.

Rhinocorax affinis (Rüpp.); Elliot, Field-Columb. Mus. Orn. i. p. 30 (1897); Lort Phillips, Ibis, 1898, p. 394; Peale, Somali-land, App. p. 305 (1900).

No. 26. ♂ ad. Near Bulhar, Jan. 1, 1899.
No. 268. Gan Liban (5900 ft.), March 25, 1899.

2. COSMOPSARUS REGIUS.

Cosmopsarus regius Reichen.; Shelley, Ibis, 1885, p. 411; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 559 (1894); Sharpe, P. Z. S. 1895, p. 459; Hawker, Ibis, 1899, p. 58; Peel, Somali-land, App. p. 306 (1900).

No. 181. ♂ ad. Adadle, Feb. 16, 1899.
No. 189. ♂ ad. Adadle, Feb. 20, 1899.
No. 220. ♂ ad. Adadle, March 8, 1899.
No. 221. ♂ ad. Adadle, March 8, 1889.

3. Amydrus blythi.

Amydrus blythi (Hartl.); Elliot, Field-Columbian Mus., Orn. i. p. 31 (1897); Lort Phillips, Ibis, 1898, p. 395; Peel, Somali-land, App. p. 305 (1900).

No. 31. ♂ imm. Near Bulhar, Jan. 4, 1899.

No. 199. ♂ ad. Gan Liban (4700 ft.), Feb. 23, 1899. Eye green.

No. 203. ♀ ad. Gan Liban (4700 ft.), Feb. 24, 1899. Eye black or very dark blue.

No. 240. ♀ ad. Gan Liban (5900 ft.), March, 14, 1899. Eye black and reddish-yellow.

No. 244. ♂ ad. Gan Liban (5900 ft.), March 15, 1899.

No. 262. ♀ ad. Gan Liban (5900 ft.), March 22, 1899.

4. Lamprocolius chalybæus.

Lamprocolius chalybæus (Ehr.); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 559 (1894); Sharpe, P. Z. S. 1895, p. 460; Lort Phillips, Ibis, 1896, p. 84, 1898, p. 394; Hawker, Ibis, 1899, p. 59; Peel, Somali-land, App. p. 306 (1900).

No. 239. ♂ ad. Gan Liban (5900 ft.), March 14, 1899.

5. Heteropsar albicapillus.

Heteropsar albicapillus (Blyth); Salvad. Mem. R. Accad. Sci. Tor. (2) xliv. p. 559 (1894); Sharpe, P. Z. S. 1895, p. 461; Elliot, Field-Columb. Mus., Orn. i. p. 32 (1897); Lort Phillips, Ibis, 1898, p. 395; Hawker, Ibis, 1899, p. 59; Peel, Somali-land, App. p. 306 (1900).

Notauges albicapillus, Shelley, Ibis, 1885, p. 413; Oustalet, Bibl. Haut.-Études, xxxi. Art. x. p. 11 (1886).

No. 83. ♀ ad. Biji (1200 ft.), Jan. 19, 1899. Eye yellow.

No. 187. ♀ ad. Adadle, Feb. 20, 1899.

6. Spreo superbus.

Spreo superbus (Rüpp.); Sharpe, P. Z. S. 1895, p. 461; Elliot, Field-Columb. Mus., Orn. i. p. 32 (1897); Lort Phillips, Ibis, 1898, p. 396; Hawker, Ibis, 1899, p. 59.

Notauges superbus (Rüpp.); Shelley, Ibis, 1885, p. 412; Oust. Bibl. Haut-Études, xxxi. Art. x. p. 9 (1886); Lort Phillips, Ibis, 1896, p. 83.

Lamprotornis superbus, Peel, Somali-land, App. p. 306 (1900).

No. 28. ♀ ad. Near Bulhar, Jan. 2, 1899.

No. 85. ♂ ad. Biji (1200 ft.), Jan. 19, 1899.

No. 105. ♂ ad. Laskarato, Jan. 27, 1899.

a. ♂ ad. Adadle, Feb. 20, 1899.

7. Buphaga erythrorhyncha.

Buphaga erythrorhyncha (Stanl.); Shelley, Ibis, 1885, p. 410; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 561 (1894); Sharpe, P. Z. S. 1895, p. 461; Salvad. Ann. Mus. Genov. (2) xvi. p. 45

(1896); Lort Phillips, Ibis, 1896, p. 82; Elliot, *t. c.* p. 33 (1897); Lort Phillips, Ibis, 1898, p. 390; Hawker, Ibis, 1899, p. 59; Peel, Somali-land, App. p. 306 (1900).

No. 158. ♂ ad. Sheikh Abukadle, Feb. 9, 1899. Eye black and yellow, eyelid bright yellow; bill red.

Nos. 210. ♀; 211, 212. ♂ ad. Adadle, March 1, 1899. Eye black and yellow, lid yellow; bill red; feet green.

Nos. 225, 226. ♂ ♀ ad. Adadle, March 9, 1899.

8. Buchanga assimilis.

Buchanga assimilis Bechst.; Shelley, Ibis, 1885, p. 401; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 555 (1894); Sharpe, P. Z. S. 1895, p. 462; Lort Phillips, Ibis, 1896, p. 76; Elliot, *t. c.* p. 33 (1897); Lort Phillips, Ibis, 1898, p. 396; Hawker, Ibis, 1899, p. 60; Peel, Somali-land, App. p. 306 (1900).

No. 19. ♂ ad. Near Bulhar, Dec. 30, 1898.
No. 72. ♀ ad. Biji (1200 ft.). Jan. 15, 1899.
No. 191. ♀ ad. Adadle, Feb. 20, 1899.
No. 198. ♂ ad. Gan Liban (4700 ft.), Feb. 23, 1899.
No. 242. ♀ ad. Gan Liban (5900 ft.), March 15, 1899.

9. Granatina hawkeri.

Uræginthus ianthinogaster, Shelley, Ibis, 1885, p. 408.

Granatina ianthinogastra (nec. Reichen), Sharpe, P. Z. S. 1895, p. 467; Elliot, *t. c.* p. 35; Hawker, *t. c.* p. 62; Peel, Somali-land, App. p. 307 (1900).

Granatina hawkeri, Lort Phillips, Bull. B. O. C. viii. p. xxiii (1898).

No. 12. ♀ ad. Bihen Dula, Dec. 27, 1898.
No. 122. ? ♀ ad. Ania (4000 ft.), Feb. 4, 1899.
No. 123. ♂ ad. Ania (4000 ft.), Feb. 4, 1899.
No. 127. ? ♀ ad. Ania (4000 ft.), Feb. 4, 1899.
No. 138. ♀ ad. Ania (4000 ft.), Feb. 5, 1899.

10. Anaplectes melanotis.

Anaplectes melanotis (Lafr.); Sharpe, Cat. B. Brit. Mus. xiii. p. 413 (1890); Shelley, B. Afr. i. p. 35 (1896).

Nos. 121, 125. ♂ ♀ ad. Ania (4000 ft.), Feb. 4, 1899.

This species, which is the true *A. melanotis* and not *A. blundelli* Grant, seems to have hitherto been unrecorded from Somali-land. The red on the head appears to vary slightly, being darker in some individuals than in others. The female is greyish brown, with no red on the back, but having red margins to the greater coverts and primaries; the under surface is dull white, slightly tinged with ochreous brown on the fore neck and chest. Total length 6 inches, culmen 0·7, wing 3·2, tail 1·95, tarsus 1·08.

It differs very conspicuously from the female of *A. rubriceps*, as it has none of the yellow colour on the head and throat.

11. Hyphantornis galbula.

Hyphantornis galbula (Rüpp.); Sharpe, P. Z. S. 1895, p. 468; Elliot, Field-Columb. Mus., Orn. i. p. 35 (1897); Lort Phillips, Ibis, 1898, p. 397; Peel, Somali-land, App. Birds, p. 308 (1900).

Nos. 49, 51. ♂ ad. Biji, Jan. 8, 9, 1899.

12. Dinemellia dinemelli.

Textor dinemelli Rüpp.; Shelley, Ibis, 1885, p. 409; Lort Phillips, Ibis, 1896, p. 82.

Dinemellia dinemelli, Salvad. R. Accad. Torino, (2) xliv. p. 558 (1894); Sharpe, P. Z. S. 1895, p. 469; Elliot, Field-Columb. Mus., Orn. i. p. 36 (1897); Lort Phillips, Ibis, 1898, p. 397; Hawker, Ibis, 1899, p. 62; Peel, Somali-land, App. Birds, p. 308 (1900).

No. 169. Ad. Magog (4000 ft.), Feb. 14, 1899.

13. Petronia pyrgita.

Gymnorhis pyrgita (Heugl.); Shelley, Ibis, 1885, p. 408.

Petronia pyrgita, Sharpe, P. Z. S. 1895, p. 469; Elliot, *t. c.* p. 35 (1897); Lort Phillips, Ibis, 1898, p. 397; Hawker, Ibis, 1899, p. 63; Peel, *t. c.* p. 309 (1900).

No. 11. ♀ ad. Bihen Dula, Dec. 27, 1898.
No. 96. ♂ ad. Laskarato (3025 ft.), Jan. 22, 1899.
No. 201. ♂ ? ad. Gan Liban (4700 ft.), Feb. 24, 1899.
No. 209. ♂ ad. Adadle, Feb. 28, 1899.
No. 213. Adadle, March 1, 1899.

14. Serinus maculicollis.

Serinus maculicollis, Sharpe, P. Z. S. 1895, p. 471, pl. xxvii. fig. 1; Elliot, *t. c.* p. 36; Lort Phillips, Ibis, 1898, p. 399; Hawker, Ibis, 1899, p. 63; Peel, *t. c.* p. 309.

No. 136. ♀ ad. Ania, Feb. 5, 1899.
No. 200. ♀ ad. Gan Liban (4700 ft.), Feb. 24, 1899.

15. Emberiza poliopleura.

Emberiza poliopleura (Salvad.); Sharpe, P. Z. S. 1895, p. 471; Elliot, *t. c.* p. 36; Hawker, *t. c.* p. 64; Peel, *t. c.* p. 309.

Nos. 116, 134, 135. ♂ ad. Ania (4000 ft.), Feb. 2–5, 1899.

16. Mirafra gilletti.

Mirafra gilletti, Sharpe, P. Z. S. 1895, p. 472; Elliot, *t. c.* p. 37; Lort Phillips, Ibis, 1898, p. 401; Hawker, *t. c.* p. 64; Peel, *t. c.* p. 310 (1900).

No. 173. ♂ ad. Magog (4000 ft.), Feb. 14, 1899.

17. Galerita cristata.

Galerita cristata (Linn.); Oust. *t. c.* p. 8 (1886); Sharpe, P. Z. S. 1895, p. 472; Lort Phillips, Ibis, 1898, p. 401; Hawker, *t. c.* p. 65.

Nos. 44, 50. ♂ ♀ ad. Biji, Jan. 7, 8, 1899.
No. 172. Ad. Magog, 4000 ft., Feb. 14, 1899.

These specimens appear to be identical with the Red Sea form of *G. cristata*, and, if separable, should be called *G. senegalensis*.

18. Ammomanes akeleyi.

Ammomanes deserti (nec Licht.), Sharpe, P. Z. S. 1895, p. 473.
Ammomanes akeleyi, Elliot, *t. c.* p. 39; Lort Phillips, Ibis, 1898, p. 401; Hawker, *t. c.* p. 65; Peel, *t. c.* p. 311.

Nos. 1. Ad.; 2. ♂ ad. Near Bulhar, Dec. 25, 1898.
No. 174. ♂ ad. Magog, Feb. 14, 1899.

19. Pyrrhulauda melanauchen.

Pyrrhulauda melanauchen (Cab.); Sharpe, P. Z. S. 1895, p. 472; Peel, *t. c.* p. 310.
No. 18. ♂ ad. Near Berbera, Dec. 3, 1898.

20. Motacilla alba.

Motacilla alba Linn.; Hawker, Ibis, 1899, p. 66.

Nos. 5. ♂; 6, 14. ♀. Near Bulhar, Dec. 25–28, 1898.

The White Wagtail has been obtained by Mr. Hawker at Gebili, but the species is omitted by Mr. Peel in his list of Somali birds.

21. Nectarinia metallica.

Hedydipna metallica (Licht.); Elliot, *t. c.* p. 41; Lort Phillips, Ibis, 1898, p. 404.
Nectarinia metallica, Peel, *t. c.* p. 312.

Nos. 163, 164. ♂ ♀ ad. Magog, Feb. 12, 1899.

22. Cinnyris albiventris.

Cinnyris albiventris (Strickl.); Salvad. Mem. R. Accad. Torino, (2), xliv. p. 556 (1894); Sharpe, P. Z. S. 1895, p. 474; Lort Phillips, Ibis, 1896, p. 82; Elliot, *t. c.* p. 41; Lort Phillips, Ibis, 1898, p. 403; Hawker, Ibis, 1899, p. 67; Peel, *t. c.* p. 312.

No. 38. ♂ ad. So Midgan, Jan. 5, 1899.
No. 141. ♀ ad. Ania (4000 ft.), Feb. 6, 1899.

23. Cinnyris habessinica.

Cinnyris habessinica (Hempr. & Ehr.); Shelley, Ibis, 1885, p. 406; Salvad. Mem. R. Accad. Torino, (2) xliv. p. 556 (1894); Sharpe, P. Z. S. 1895, p. 474; Lort Phillips, Ibis, 1896, p. 81, 1898, p. 402, cum fig.; Hawker, *t. c.* p. 67; Peel, *t. c.* p. 312.

Nos. 33, 39. ♂ ad. Near Bulhar, Jan. 4, 5, 1899.
No. 166. ♂ ad. Magog (4300 ft.), Feb. 13, 1899.
Nos. 192, 210. ♀ ad. et juv. Adadle, Feb. 20, March 1, 1899.
Nos. 263, 264. ♂ ♀ ad. Gan Liban (5900 ft.), March 23, 1899.

24. Cinnyris hawkeri.

Cinnyris osiris (nec Finsch), Lort Phillips, Ibis, 1896, p. 81; Elliot, Field-Columb. Mus., Orn. i. p. 40; Hawker, Ibis, 1899, p. 66; Peel, Somali-land, App. p. 312.

Cinnyris mariquensis hawkeri, Neum. Orn. M.B. vii. p. 24 (1899).

Nos. 118, 139. ♂ ♀ ad. Ania (4000 ft.), Feb. 3–5, 1899.

25. Parus thruppi.

Parus thruppi, Shelley, Ibis, 1885, p. 406, pl. xi. fig. 2; Sharpe, P. Z. S. 1895, p. 476; Lort Phillips, Ibis, 1898, p. 404; Hawker, *t. c.* p. 67; Peel, *t. c.* p. 313.

No. 41. ♂ ad. So Midgan, Jan. 5, 1899.
Nos. 119, 137. ♂ ad. Ania, Feb. 3, 5, 1899.

26. Lanius antinorii.

Lanius antinorii Salvad.; Sharpe, P. Z. S. 1895, p. 477; Lort Phillips, Ibis, 1896, p. 76; Elliot, *t. c.* p. 42; Lort Phillips, Ibis, 1898, p. 404; Hawker, Ibis, 1899, p. 68; Peel, *t. c.* p. 312.

No. 25*a*. ♀ ad. Near Bulhar, Jan. 1, 1899.
Nos. 47, 48. ♂ ♀ ad. So Midgan, Jan. 7, 1899.
No. 55. ♂ ad. Biji (1200 ft.), Jan. 10, 1899.
Nos. 87, 88. ♀ ♂ ad. Biji (1200 ft.), Jan. 19, 1899.

27. Lanius phœnicuroides.

Lanius phœnicuroides Severtz.; Lort Phillips, Ibis, 1896, p. 77; id. Ibis, 1898, p. 404; Peel, *t. c.* p. 313.

No. 66. ♀ imm. Biji (1200 ft.), Jan. 13, 1899.

28. Laniarius cruentus.

Laniarius cruentus (Hempr. & Ehr.); Shelley, Ibis, 1885, p. 402; Sharpe, P. Z. S. 1895, p. 477; Lort Phillips, Ibis, 1896, p. 77; Elliot, *t. c.* p. 42; Lort Phillips, Ibis, 1898, p. 405; Hawker, Ibis, 1899, p. 68; Peel, *t. c.* p. 313.

Rhodophoneus cruentus, Salvad. Mem. R. Accad. Torino, (2) xliv. p. 555 (1894).

No. 79. ♂ ad. Biji (1200 ft.), Jan. 19, 1899.
Nos. 148, 149. ♂ imm. Ania (5000 ft.), Jan. 30, 1899.
Nos. 146, ♂; 154, 157. ♀ ad. Sheikh Abukadle, Feb. 9, 1899.
No. 176. ♀ ad. Magog (4300 ft.), Feb. 14, 1899.
No. 186. ♀ ad. Adadle, Feb. 19, 1899.
No. 261. ♂ ad. Gan Liban (5900 ft.), March 22, 1899.

29. Dryoscopus æthiopicus.

Dryoscopus æthiopicus (Gm.); Sharpe, P. Z. S. 1895, p. 478; Lort Phillips, Ibis, 1898, p. 405; Hawker, Ibis, 1899, p. 69; Peel, *t. c.* p. 313.

No. 249. ♀ ad. Gan Liban (5900 ft.), March 16, 1899.

30. Dryoscopus funebris.

Dryoscopus funebris Hartl.; Sharpe, P. Z. S. 1895, p. 478; Lort Phillips, Ibis, 1896, p. 77; Elliot, *t. c.* p. 42; Lort Phillips, Ibis, 1898, p. 406; Peel, *t. c.* p. 314.

a. ♂ ad. Gan Liban, March 13, 1899. Iris black.

31. Eurocephalus rueppelli.

Eurocephalus rueppelli Bp.; Shelley, Ibis, 1885, p. 403; Oust. *t. c.* p. 5; Sharpe, P. Z. S. 1895, p. 480; Lort Phillips, Ibis, 1896, p. 78; 1898, p. 406; Hawker, Ibis, 1899, p. 69; Peel, *t. c.* p. 314.

No. 89. ♂ ad. Biji (1200 ft.), Jan. 20, 1899.

No. 103. ♀ ad. Laskarato (3025 ft.), Jan. 25, 1899. Iris dark green.

No. 132. ♂ ad. Ania, Feb. 4, 1899.

32. Bradyornis pumilus.

Bradyornis pumilus, Sharpe, P. Z. S. 1895, p. 480; Lort Phillips, Ibis, 1896, p. 76; Elliot, *t. c.* p. 44; Lort Phillips, Ibis, 1898, p. 406; Peel, *t. c.* p. 314.

No. 40. ♂ ad. Near Bulhar, Jan. 5, 1899.

No. 62. Ad. Biji (1200 ft.), Jan. 12, 1899.

No. 130. ♀ ad. Ania, Feb. 4, 1899.

33. Sylvia cinerea.

Sylvia cinerea (Bechst.); Lort Phillips, Ibis, 1898, p. 407; Peel, *t. c.* p. 314.

No. 260. ♂ ad. Gan Liban (5900 ft.), March 22, 1899. Iris black and red.

34. Eremomela flavicrissalis.

Eremomela flavicrissalis, Sharpe, P. Z. S. 1895, p. 481; Elliot, *t. c.* p. 44; Lort Phillips, Ibis, 1898, p. 409; Hawker, Ibis, 1899, p. 70; Peel, *t. c.* p. 315.

No. 222. Ad. Adadle, March 9, 1899.

35. Calamonastes simplex.

Calamonastes simplex (Cab.); Sharpe, P. Z. S. 1895, p. 482; Lort Phillips, Ibis, 1896, p. 80; Elliot, *t. c.* p. 44; Lort Phillips, Ibis, 1898, p. 410; Hawker, Ibis, 1899, p. 71; Peel, *t. c.* p. 315.

No. 111. ♂ ad. Laskarato (3500 ft.), Jan. 29, 1899.

This male seems to be rather large when compared with an example from the Goolis Mts. The dimensions are as follows:—

	Total length.	Culmen.	Wing.	Tail.	Tarsus.
♂. Laskarato (*Donaldson Smith*)	6·1	0·7	2·4	2·4	0·9
♂. Goolis Mts. (*E. Lort Phillips*)	5·1	0·7	2·25	1·8	0·85

36. SYLVIELLA GAIKWARI.

Sylviella isabellina (nec Elliot), Hawker, Ibis, 1899, p. 70.
Sylviella gaikwari, Sharpe, Bull. Brit. Orn. Club, xi. p. 47 (1901).

No. 117. ♂ ad. Ania, Feb. 3, 1899.

This is the bird called by Mr. Hawker (*t. c.*) *Sylviella isabellina* Elliot. I find, however, that both Mr. Hawker's specimen and the one obtained by Dr. Donaldson Smith have the entire upper surface grey, and have not a "buff rump" as described by Dr. Elliot, so I have named the species after H.H. The Gaikwar of Baroda.

37. SYLVIELLA MICRURA.

Sylviella micrura Rüpp.; Sharpe, P. Z. S. 1895, p. 482; Lort Phillips, Ibis, 1898, p. 409; Hawker, Ibis, 1899, p. 70; Peel, *t. c.* p. 318.

No. 32. ♀ ad. Near Bulhar, Jan. 4, 1899.
No. 64. ♂ ad. Biji (1200 ft.), Jan. 13, 1899.
No. 112. ♂ ad. Near Ania, Jan. 29, 1899.

38. DRYODROMAS SMITHI.

Dryodromas smithi, Sharpe, P. Z. S. 1895, p. 482; Elliot, *t. c.* p. 44; Lort Phillips, Ibis, 1898, p. 409; Hawker, Ibis, 1899, p. 70; Peel, *t. c.* p. 316.

No. 129. ♂ ad. Ania (4000 ft.), Feb. 4, 1899.
No. 219. Ad. Adadle, March 7, 1899.

39. ERYTHROPYGIA LEUCOPTERA.

Erythropygia leucoptera (Rüpp.); Shelley, Ibis, 1885, p. 406; Sharpe, P. Z. S. 1895, p. 483; Lort Phillips, Ibis, 1896, p. 80; id. Ibis, 1898, p. 410; Peel, *t. c.* p. 318.

Nos. 65, 76. ♂ ad. Biji (1200 ft.), Jan. 13, 17, 1899.
No. 101. ♀ ad. Laskarato, Jan. 25, 1899. Iris black.
No. 217. ♀ ad. Adadle, March 6, 1899.

40. MERULA LUDOVICIÆ.

Merula ludoviciæ, Lort Phillips, Bull. Brit. Orn. Club, iv. p. xxxvi; id. Ibis, 1895, p. 383; 1896, p. 78, pl. ii.; 1898, p. 410; Peel, *t. c.* p. 315.

Nos. 237, 266. ♂ ♀ ad.; 267. ♀ juv. Gan Liban (5900 ft.), March 14, 25, 1899.

Bill and feet yellow; iris black and red.

41. MONTICOLA SAXATILIS.

Monticola saxatilis (Linn.); Sharpe, P. Z. S. 1895, p. 485; Lort Phillips, Ibis, 1898, p. 410; Hawker, Ibis, 1899, p. 72; Peel, *t. c.* p. 315.

No. 29. ♂ ad. Near Bulhar, Jan. 3, 1899.
No. 73. ♂ ad. Biji (1200 ft.), Jan. 15, 1899.
No. 227. Ad. Adadle (4000 ft.), March 11, 1899.

42. Monticola cyanus.

Monticola cyanus (Linn.); Lort Phillips, Ibis, 1898, p. 411; Peel, *t. c.* p. 315.

No. 7. ♂ ad. Bihen Dula, Dec. 26, 1898.

43. Monticola rufocinerea.

Monticola rufocinerea (Rüpp.); Shelley, Ibis, 1885, p. 404; Lort Phillips, Ibis, 1896, p. 79; id. Ibis, 1898, p. 411; Peel, *t. c.* p. 315.

Nos. 197, 204. ♀ ad. Gan Liban (4700 ft.), Feb. 22, 24, 1899.

Nos. 229, 235. ♂ ad. Gan Liban (5900 ft.), March 13, 14, 1899.

44. Saxicola isabellina.

Saxicola isabellina Rüpp.; Shelley, Ibis, 1885, p. 405; Sharpe, P. Z. S. 1895, p. 485; Lort Phillips, Ibis, 1896, p. 80; Elliot, *t. c.* p. 46; Lort Phillips, Ibis, 1898, p. 412; Hawker, Ibis, 1899, p. 72; Peel, *t. c.* p. 316.

No. 80. ♂ ad. Biji (1200 ft.), Jan. 19, 1899. Iris black.

No. 177. ♂ ad. Magog (4300 ft.), Feb. 14, 1899.

No. 184. ♀ ad. Adadle, Feb. 17, 1899.

No. 238. ♀ ad. Gan Liban (5900 ft.), March 14, 1899.

45. Saxicola phillipsi.

Saxicola phillipsi, Shelley, Ibis, 1885, p. 404, pl. xii.; Sharpe, P. Z. S. 1895, p. 486; Lort Phillips, Ibis, 1896, p. 79; Elliot, *t. c.* p. 46; Lort Phillips, Ibis, 1898, p. 412; Peel, *t. c.* p. 316.

No. 16. ♂ ad. Bihen Dula, Dec. 29, 1898.

No. 97. ♀ ad. Laskarato, Jan. 24, 1899.

No. 179, 182. ♂ ♀ ad. Magog (4300 ft.), Feb. 11–14, 1899.

No. 218. ♂ ad. Adadle, March 6, 1899.

46. Saxicola pleshanka.

Saxicola morio Hempr. & Ehr.; Oustalet, *t. c.* p. 7; Lort Phillips, Ibis, 1898, p. 413; Hawker, Ibis, 1899, p. 72; Peel, *t. c.* p. 316.

No. 156. ♂ ad. Sheikh Abukadle, Feb. 9, 1899. Iris dark green.

No. 178. ♀ ad. Magog (4300 ft.), Feb. 14, 1899. Iris black.

No. 259. ♀ ad. Gan Liban (5900 ft.), March 12, 1899. Iris black.

47. Saxicola deserti.

Saxicola deserti Temm.; Shelley, Ibis, 1885, p. 405; Lort Phillips, Ibis, 1896, p. 79; Ibis, 1898, p. 413; Hawker, Ibis, 1899, p. 72; Peel, *t. c.* p. 316.

No. 155. ♂ ad. Sheikh Abukadle, Feb. 9, 1899.

48. Myrmecocichla melanura.

Myrmecocichla melanura (Temm.); Sharpe, P. Z. S. 1895, p. 486; Lort Phillips, Ibis, 1896, p. 79; Elliot, *t. c.* p. 47; Lort Phillips, Ibis, 1898, p. 413; Hawker, Ibis, 1899, p. 72; Peel, *t. c.* p. 316.

Ad. Bihen Dula, Dec. 25, 1899.

49. Crateropus smithi.

Crateropus smithi, Sharpe, Bull. Brit. Orn. Club, iv. p. xli; id. P. Z. S. 1895, p. 487; Lort Phillips, Ibis, p. 80; Hawker, Ibis, 1899, p. 73; Peel, *t. c.* p. 317.

No. 245. ♀ ad. Gan Liban (5900 ft.), March 19, 1899.

50. Pycnonotus arsinoë.

Pycnonotus arsinoë (Hempr. & Ehr.); Lort Phillips, Ibis, 1898, p. 413; Hawker, Ibis, 1899, p. 73; Peel, *t. c.* p. 317.

No. 34. ♂ ad. Near Bulhar, Jan. 4, 1899.

No. 142. Ad. Ania (4000 ft.), Feb. 6, 1899.

Nos. 196, 241. ♂ ad. Gan Liban (5900 ft.), Feb. 22, March 15, 1899.

51. Myopornis boehmi.

Parisoma boehmi Reichenow; Sharpe, P. Z. S. 1895, p. 490; Elliot, *t. c.* p. 48; Hawker, Ibis, 1899, p. 74; Peel, *t. c.* p. 317.

Myopornis böhmi, Reichenow, J. f. O. 1901, p. 285; Sharpe, Hand-l. B. iii. p. 243 (1901).

Nos. 167, 175. ♀ ad. Magog (4700 ft.), Feb. 13–14, 1899.

52. Terpsiphone cristata.

Terpsiphone cristata (Gm.); Shelley, Ibis, 1885, p. 400; Sharpe, P. Z. S. 1895, p. 490; Lort Phillips, Ibis, 1896, p. 76; Elliot, *t. c.* p. 48; Lort Phillips, Ibis, 1898, p. 414; Peel, *t. c.* p. 318.

No. 206. ♂ imm. Gan Liban (4700–5900 ft.), Feb. 25 to March 16, 1899.

53. Cryptolopha umbrivirens.

Cryptolopha umbrivirens (Rüpp.); Sharpe, Cat. B. Brit. Mus. iv. p. 401 (1879); id. Hand-l. B. iii. p. 274.

No. 231. ♂ ad. Gan Liban, March 13, 1899.

54. Campothera nubica.

Campothera nubica (Gm.); Shelley, Ibis, 1885, p. 393; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 552; Sharpe, P. Z. S. 1895, p. 492; Salvad. Ann. Mus. Genov. (2) xvi. p. 44; Elliot, *t. c.* p. 49; Lort Phillips, Ibis, 1898, p. 415; Hawker, Ibis, 1899, p. 74; Peel, *t. c.* p. 319.

No. 52. ♀ ad. Biji, Jan. 9, 1899.

55. Dendropicus hemprichi.

Dendropicus hemprichi (Hempr. & Ehr.); Shelley, Ibis, 1885, p. 393; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 552;

Sharpe, P. Z. S. 1895, p. 491; Elliot, *t. c.* p. 48; Lort Phillips, Ibis, 1898, p. 414; Hawker, Ibis, 1899, p. 74; Peel, *t. c.* p. 319.

Nos. 60–89. ♂ ad. Biji, 1200 ft., Jan. 12–20, 1899.
No. 152. ♀ ad. Near Ania, Feb. 4, 1899.

56. Indicator indicator.

Indicator indicator (Gm.); Sharpe, P. Z. S. 1895, p. 492.

Nos. 153, 216. ♂ ♀ ad. Morobegih (4100 ft.), Feb. 8 to March 6, 1899.
No. 230. ♀ ad. Gan Liban, March 13, 1899.

57. Trachyphonus margaritatus.

Trachyphonus margaritatus (Cretzschm.); Elliot, *t. c.* p. 49; Lort Phillips, Ibis, 1898, p. 415; Peel, *t. c.* p. 319.

No. 100. ♂ ad. Laskarato (3025 ft.), Jan. 25, 1899.

58. Tricholæma blandi.

Tricholæma blandi, Lort Phillips, Bull. Brit. Orn. Club, iv. p. xlvii; id. Ibis, 1898, p. 415, pl. xi. fig. 1; Hawker, Ibis, 1899, p. 75; Peel, *t. c.* p. 320.

No. 140. ♀ ad. Ania (4000 ft.), Feb. 6, 1899.

59. Pœocephalus rufiventris.

Pœocephalus rufiventris (Rüpp.); Shelley, Ibis, 1885, p. 393; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 551; Sharpe, P. Z. S. 1895, p. 494; Salvad. Ann. Mus. Genov. (2) xvi. p. 44; Lort Philips, Ibis, 1896, p. 72; Elliot, *t. c.* p. 50; Peel, *t. c.* p. 323.

No. 77. ♀ ad. Biji (1200 ft.), Jan. 17, 1899.
No. 104. ♂ ad. Laskarato (3025 ft.), Jan. 27, 1899.
Nos. 193, 224. ♂ ad. Adadle, Feb. 20 to March 9, 1899.

60. Coccystes glandarius.

Coccystes glandarius (Linn.); Shelley, Cat. B. Brit. Mus. xix. p. 212 (1891); id. B. Africa, i. p. 123 (1896).

Nos. 48, 51. ♀ ad. Biji, Jan. 8, 1899.

61. Schizorhis leucogaster.

Schizorhis leucogaster Rüpp.; Shelley, Ibis, 1885, p. 400; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 552; Sharpe, P. Z. S. 1895, p. 495; Lort Phillips, Ibis, 1896, p. 74; Elliot, *t. c.* p. 51; Lort Phillips, Ibis, 1898, p. 416; Peel, *t. c.* p. 320.

Nos. 25, 30. ♂ ♀ ad. Near Bulhar, Jan. 3, 1899.
No. 59. ♂ ad. Biji (1200 ft.), Jan. 12, 1899.
Nos. 98, 99. ♀ ♂ ad. Laskarato, Jan. 24, 1899.

62. Coracias nævius.

Coracias nævius Daud.; Shelley, Ibis, 1885, p. 399; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 554; Sharpe, P. Z. S. 1895,

p. 496; Lort Phillips, Ibis, 1896, p. 74; Elliot, *t. c.* p. 51; Lort Phillips, Ibis, 1898, p. 416; Hawker, Ibis, 1899, p. 75; Peel, *t. c.* p. 323.

No. 24. ♀ ad. Near Bulhar, Jan. 1, 1899.
No. 90. ♂ ad. Laskarato (3175 ft.), Jan. 21, 1899.
No. 114. ♂ ad. Ania, Feb. 1, 1899.

63. LOPHOCEROS MEDIANUS.

Lophoceros erythrorhynchus (Heugl.); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 553; Elliot, *t. c.* p. 52; Peel, *t. c.* p. 322.

Lophoceros medianus, Sharpe, P. Z. S. 1895, p. 498.

No. 115. ♂ ad. Anai, Feb. 1, 1899.

64. LOPHOCEROS FLAVIROSTRIS.

Lophoceros flavirostris (Rüpp.); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 554; Sharpe, P. Z. S. 1895, p. 499; Elliot, *t. c.* p. 53; Lort Phillips, Ibis, 1898, p. 417; Hawker, Ibis, 1899, p. 75; Peel, *t. c.* p. 322.

Nos. 194, 195. ♂ ♀ ad. Adadle, Feb. 21, 1899.

65. UPUPA SOMALENSIS.

Upupa senegalensis Swains.; Shelley, Ibis, 1885, p. 397.

Upupa somalensis Salvin; Sharpe, P. Z. S. 1895, p. 500; Lort Phillips, Ibis, 1896, p. 73; Elliot, *t. c.* p. 53; Lort Phillips, Ibis, 1898, p. 417; Peel, *t. c.* p. 321.

No. 102. ♀ ad. Laskarato (3025 ft.), Jan. 25, 1899.

66. IRRISOR ERYTHRORHYNCHUS.

Irrisor erythrorhynchus (Lath.); Shelley, Ibis, 1885, p. 395; Sharpe, P. Z. S. 1895, p. 500; Lort Phillips, Ibis, 1896, p. 72; Elliot, *t. c.* p. 54; Lort Phillips, Ibis, 1898, p. 417; Hawker, Ibis, 1899, p. 76; Peel, *t. c.* p. 321.

No. 56. ♂ ad. Biji (1200 ft.), Jan. 11, 1899.
Nos. 128, 131. ♂ ad. Ania, Feb. 4, 1899.
No. 145. ♂ ad. Laskarato, Jan. 30, 1899.
Nos. 248, 250. ♂ ad. Gan Liban (5900 ft.), March 16, 1899.

67. RHINOPOMASTUS MINOR.

Irrisor minor (Rüpp.); Shelley, Ibis, 1885, p. 397.

Rhinopomastus minor, Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 553; Sharpe, P. Z. S. 1895, p. 500; Elliot, *t. c.* p. 54; Lort Phillips, Ibis, 1898, p. 417; Hawker, Ibis, 1899, p. 76; Peel, *t. c.* p. 321.

Nos. 45. ♂ ad.; 46. ♀ juv. Biji, Jan. 7, 1899.
No. 190. ♂ ad. Adadle, Feb. 20, 1899.

68. MELITTOPHAGUS CYANOSTICTUS.

Melittophagus pusillus cyanostictus (P. L. S. Müll.); Shelley, Ibis, 1895, p. 398.

Melittophagus cyanostictus, Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 553; Sharpe, P. Z. S. 1895, p. 501; Lort Phillips, Ibis, 1896, p. 73; Elliot, *t. c.* p. 54; Lort Phillips, Ibis, 1898, p. 418; Hawker, Ibis, 1899, p. 76; Peel, *t. c.* p. 321.

Merops cyanostictus (Cab.); Oustalet, Bibl. Haut.-Études, xxxi. Art. x. p. 4.

Melittophagus sharpei Hartert, Sharpe, Hand-l. B. ii. p. 72 (1900).

No. 35. ♂? ad. Near Bulhar, Jan. 4, 1899.
Nos. 70, 71. ♂ ad. Biji (1200 ft.), Jan. 15, 1899.
No. 113. ♂ ad. Laskarato, Jan. 29, 1899.
No. 132. ♂ ad. Ania (4000 ft.), Feb 4, 1899.

69. Melittophagus revoili.

Merops revoili Oust. in Revoil's Faune et Flor. Çomalis, Ois. p. 5, pl. 1 (1882); Peel, *t. c.* p. 321.

Melittophagus revoili, Shelley, Ibis, 1885, p. 398; Sharpe, P. Z. S. 1895, p. 502; Lort Phillips, Ibis, 1896, p. 74; Elliot, *t. c.* p. 55.

Merops (*Melittophagus*) *revoili*, Oust. *t. c.* p. 4.

No. 159. ♀ ad. Sheikh Abukadle, Feb. 9, 1899.

70. Colius macrurus.

Colius macrurus (Linn.); Oust. *t. c.* p. 3; Sharpe, P. Z. S. 1895, p. 502; Elliot, *t. c.* p. 56; Hawker, Ibis, 1898, p. 77; Peel, *t. c.* p. 320.

No. 36. ♂ ad. Near Bulhar, Jan. 4, 1899.
Nos. 182, 183. ♂ ad. Adadle, Feb. 16, 1899.

71. Caprimulgus nubicus.

Caprimulgus nubicus Licht.; Elliot, *t. c.* p. 56; Peel, *t. c.* p. 321.

No. 69. ♂ ad. Biji (1200 ft.), Jan. 14, 1899.
Nos. 108, 109. ♂ ♀ ad. Laskarato (3500 ft.), Jan. 28–29, 1899.

72. Caprimulgus inornatus.

Caprimulgus inornatus Heugl.; Sharpe, P. Z. S. 1895, p. 503; Lort Phillips, Ibis, 1898, p. 418; Peel, *t. c.* p. 321.

No. 78. Ad. Biji (1200 ft.), Jan. 17, 1899.

73. Bubo cinerascens.

Bubo cinerascens Guér.; Salvad. Mem. R. Accad. Sci. Torino (2) xliv. p. 550; Hawker, Ibis, 1899, p. 78.

No. 258. ♂ ad. Adadle, March 5, 1899.

74. Carine spilogaster.

Carine spilogaster (Heugl.); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 551; Sharpe, P. Z. S. 1895, p. 504; Lort Phillips, Ibis, 1898, p. 418; Hawker, Ibis, 1899, p. 77; Peel, *t. c.* p. 323.

No. 9. ♂ ad. Bihen Dula, Dec. 26, 1898.
No. 42 *a.* ♂ ad. Near Bulhar, Jan. 5, 1899.
No. 93. ♀ ad. Laskarato (3025 ft.), Jan. 22, 1899.
No. 144. ♂ ad. Ania (4000 ft.), Feb. 6, 1899.

75. Melierax poliopterus.

Melierax poliopterus (Cab.); Salvad. Mem. Accad. Sci. Torino, (2) xliv. p. 550; Sharpe, P. Z. S. 1895, p. 506; Elliot, *t. c.* p. 57; Lort Phillips, Ibis, 1898, p. 419; Peel, *t. c.* p. 324.

No. 10. ♀ ad. Bihen Dula (1400 ft.), Dec. 27, 1898.
No. 54. ♀ ad. Biji (1200 ft.), Jan. 9, 1899.
No. 185. ♂ ad. Adadle, Feb. 17, 1899.

76. Melierax gabar.

Melierax gabar (Daud.); Shelley, Ibis, 1885, p. 391; Sharpe, P. Z. S. 1895, p. 506; Hawker, Ibis, 1899, p. 77; Peel, *t. c.* p. 325.

No. 146. ♂ imm. Ania, Feb. 3, 1899.

77. Melierax niger.

Melierax niger (Heugl.); Sharpe, P. Z. S. 1895, p. 506; Lort Phillips, Ibis, 1898, p. 419; Hawker, Ibis, 1899, p. 77; Peel, *t. c.* p. 325.

No. 257. ♀ ad. Adadle, March 5, 1899. Iris dark brown.

78. Aquila albicans.

Aquila rapax, Sharpe, P. Z. S. 1895, p. 507; Elliot, *t. c.* p. 57; Lort Phillips, Ibis, 1898, p. 419; Peel, *t. c.* p. 325.

No. 151. ♀ ad. Laskarato (4500 ft.), Jan. 24, 1899.
No. 150. ♂ ad. Jifa Uri (5000 ft.), Jan. 26, 1899.
No. 215. ♂ ad. Adadle, March 3, 1899.

79. Milvus ægyptius.

Milvus ægyptius (Gm.); Oust. *t. c.* p. 2; Sharpe, P. Z. S. 1895, p. 509; Lort Phillips, Ibis, 1898, p. 420; Peel, *t. c.* p. 325.

No. 67. ♂ ad. Biji (1200 ft.), Jan. 13, 1899.
No. 253. ♂ ad. Gan Liban, March 21, 1899.

80. Poliohierax semitorquatus.

Poliohierax semitorquatus (Smith); Shelley, Ibis, 1885, p. 391; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 550; Sharpe, P. Z. S. 1895, p. 510; Elliot, *t. c.* p. 58; Lort Phillips, Ibis, 1898, p. 420; Hawker, Ibis, 1899, p. 78; Peel, *t. c.* p. 324.

No. 22. ♀ ad. Near Bulhar, Dec. 31, 1898.
Nos. 81, 82. ♀ ♂ ad. Biji (1200 ft.), Jan. 19, 1899.
No. 124. ♀ ad. Ania, Feb. 4, 1899.

81. Cerchneis tinnunculus.

Tinnunculus tinnunculus (Linn.); Shelley, Ibis, 1885, p. 392.
Cerchneis tinnunculus, Sharpe, P. Z. S. 1895, p. 510; Lort Phillips, Ibis, 1898, p. 420; Peel. *t. c.* p. 324.

No. 165. ♂ ad. Magog (4300 ft.), Feb. 12, 1899.
Nos. 208, 236. ♂ ad. Gan Liban (5900 to 6700 ft.), Feb. 27 to March 14, 1899.

82. CERCHNEIS FIELDI.

Cerchneis fieldi, Elliot, Field-Columb. Mus., Orn. i. p. 38; Hawker, Ibis, 1899, p. 79; Peel, *t. c.* p. 324.

No. 180. ♂ ad. Adadle, Feb. 16, 1899.

83. LOPHOGYPS OCCIPITALIS.

Lophogyps occipitalis (Burch.); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 550; id. Ann. Mus. Genov. (2) xvi. p. 43; Elliot, *t. c.* p. 59; Peel, *t. c.* p. 326.

No. 68. ♀ ad. Biji (1200 ft.), Jan. 14, 1899.

84. NEOPHRON PERCNOPTERUS.

Neophron percnopterus (Linn.); Sharpe, Cat. B. Brit. Mus. i. p. 17 (1874); Peel, *t. c.* p. 326.

No. 8. Ad. Bihen Dula, Dec. 26, 1898.

85. NECROSYRTES MONACHUS.

Neophron monachus (Temm.); Sharpe, Cat. B. Brit. Mus. i. p. 19 (1874); Shelley, B. Africa, i. p. 155 (1896).

Necrosyrtes monachus, Sharpe, Hand-l. B. i. p. 243 (1899).

No. 57. ♂ ad. Biji (1200 ft.), Jan. 12, 1899.
No. 107. ♂ ad. Laskarato, Jan. 28, 1899.

86. HETEROTETRAX HUMILIS.

Heterotis humilis (Blyth); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 562.

Heterotetrax humilis, Sharpe, Cat. B. xxiii. p. 297 (1894); id. Hand-l. B. i. p. 174 (1899); Peel, Somali-land, App. Birds, p. 330 (1900).

No. 37. ♂ ad. Near Bulhar, Jan. 4, 1899.

87. LOPHOTIS GINDIANA.

Lophotis gindiana (Oust.); Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 563; id. Ann. Mus. Genov. (2) xvi. p. 45; Lort Phillips, Ibis, 1896, p. 86; Elliot, *t. c.* p. 60; Lort Phillips, Ibis, 1898, p. 421; Peel, *t. c.* p. 330.

No. 20. Ad. Near Bulhar, Dec. 30, 1898.

No. 86. Ad. Biji (1200 ft.), Jan. 19, 1899. Iris very light yellow.

88. ŒDICNEMUS AFFINIS.

Œdicnemus affinis Heugl.; Sharpe, P. Z. S. 1895, p. 513; Elliot, *t. c.* p. 61; Lort Phillips, Ibis, 1898, p. 421; Peel, *t. c.* p. 331.

No. 43. ♀ ad. Near Bulhar, Jan. 6, 1899. Tarsus 3·2 in.
No. 223. ♂ ad. Adadle, March 9, 1899. Tarsus 3·9 in.

The difference in the length of tarsus in these two individuals is somewhat remarkable.

89. Rhinoptilus cinctus.

Rhinoptilus cinctus (Heugl.); Shelley, Ibis, 1885, p. 416; Sharpe, P. Z. S. 1895, p. 513; Elliot, *t. c.* p. 62; Lort Phillips, Ibis, 1898, p. 421; Peel, *t. c.* p. 331.

No. 23. ♀ ad. Near Bulhar, Dec. 31, 1898.
No. 63. ♂ ad. Biji (1200 ft.), Jan. 12, 1899.
No. 143. ♀ ad. Ania (4000 ft.), Feb. 6, 1899.

90. Cursorius somalensis.

Cursorius gracilis somalensis, Shelley, Ibis, 1885, p. 415.

Cursorius somalensis, Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 563; Lort Phillips, Ibis, 1896, p. 86; Elliot, *t. c.* p. 62; Lort Phillips, Ibis, 1898, p. 422; Peel, *t. c.* p. 330.

No. 10. ♀ ad. Bihen Dula, Dec. 26, 1898.
No. 27. ♂ ad. Near Bulhar, Jan. 2, 1899.
No. 170. ♀ ad. Magog (4300 ft.), Feb. 14, 1899.
Nos. 205, 251. ♂ ♀ ad. Gan Liban (4700 ft.), Feb. 24 to March 19, 1899.

91. Stephanibyx coronata.

Chettusia coronata (Gm.); Shelley, Ibis, 1885, p. 417; Oustalet, *t. c.* p. 12; Peel, *t. c.* p. 331.

Stephanibyx coronata, Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 564; Sharpe, P. Z. S. 1895, p. 514; Elliot, *t. c.* p. 62; Lort Phillips, Ibis, 1898, p. 422; Hawker, Ibis, 1899, p. 80.

Nos. 94, 95. ♀ ♂ ad. Laskarato (3025 ft.), Jan. 22, 1899.

92. Ægialitis dubia.

Ægialitis dubia (Scop.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 263 (1896); Shelley, B. Africa, i. p. 190 (1896).

No. 4. ♂ ad. Near Berbera, Dec. 25, 1898.
No. 110. ♀ ad. Laskarato, Jan. 29, 1899.

93. Vinago waalia.

Treron waalia (Gm.); Shelley, Ibis, 1885, p. 414.

Vinago waalia, Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 561; Sharpe, P. Z. S. 1895, p. 516; Lort Phillips, Ibis, 1896, p. 85; 1898, p. 424; Peel, *t. c.* p. 328.

No. 106. ♂ ad. Laskarato (3025 ft.), Jan. 27, 1899.
Nos. 233–235. ♂ ad. Gan Liban (4700–5900 ft.), Feb. 24 to March 13, 1899.

94. Columba arquatrix.

Columba arquatrix Temm. & Knip; Salvad. Cat. B. Brit. Mus. xxi. p. 276 (1893); Shelley, B. Africa, i. p. 135 (1896).

No. 207. ♀ ad. Gan Liban (5800 ft.), Feb. 25, 1899. Bill and feet yellow.

95. Turtur senegalensis.

Turtur senegalensis (Linn.); Sharpe, P. Z. S. 1895, p. 517; Elliot, *t. c.* p. 64; Peel, *t. c.* p. 328.

No. 21. ♀ ad. Near Berbera, Dec. 31, 1898.
No. 28. ♀ ad. Near Bulhar, Jan. 2, 1899.

96. Turtur damarensis.

Turtur damarensis Hempr. & Ehr.; Sharpe, P. Z. S. 1895, p. 518; Elliot, *t. c.* p. 65; Hawker, Ibis, 1899, p. 81; Peel, *t. c.* p. 328.

Nos. 53, 84. ♂ ♀ ad. Biji (1200 ft.), Jan. 9, 1899.
Nos. 243, 265. ♂ ad. Gan Liban (5900 ft.), March 16, 1899.

97. Turtur semitorquatus.

Turtur semitorquatus (Rüpp.); Salvad. Cat. B. Brit. Mus. xxi. p. 416 (1893); Shelley, B. Africa, i. p. 136 (1896).

No. 61. Juv. Biji, Jan. 12, 1899.

98. Œna capensis.

Œna capensis (Linn.); Oust. *t. c.* p. 11; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 561; Sharpe, P. Z. S. 1895, p. 518; Elliot, *t. c.* p. 65; Lort Phillips, Ibis, 1898, p. 424; Hawker, Ibis, 1899, p. 81; Peel, *t. c.* p. 329.

Nos. 74, 75. ♂ ad. Biji (1200 ft.), Jan. 16, 1899.

99. Pterocles lichtensteini.

Pterocles lichtensteini Blyth; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 561; Lort Phillips, Ibis, 1898, p. 424; Peel, *t. c.* p. 329.

Nos. 91, 92. ♀ ad. Laskarato (3025 ft.), Jan. 22, 1899.
No. 160. ♀ ad. Sheikh Abukadle, Feb. 10, 1899.

100. Francolinus granti.

Francolinus granti Hartl.; Shelley, Ibis, 1885, p. 414; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 562; Sharpe, P. Z. S. 1895, p. 520; Lort Phillips, Ibis, 1896, p. 85; Elliot, *t. c.* p. 66.

Nos. 126. ♂; 133, 168. ♀ ad. Ania (4000 ft.), Feb. 4, 1899.

101. Francolinus kirki.

Francolinus kirki Hartl.; Lort Phillips, Ibis, 1898, p. 425; Hawker, Ibis, 1899, p. 81; Peel, *t. c.* p. 329.

No. 17. ♂ ad. Bihen Dula (1400 ft.), Dec. 28, 1898.

102. Pternistes infuscatus.

Pternistes infuscatus Cab.; Salvad. Mem. R. Accad. Sci. Torino, (2) xliv. p. 562; Elliot, *t. c.* p. 66; Lort Phillips, Ibis, 1898, p. 425; Peel, *t. c.* p. 329.

♂ ad. Gan Liban, April 3, 1899.

103. Numida ptilorhyncha.

Numida ptilorhyncha Licht.; Grant, Cat. B. Brit. Mus. xxii. p. 379 (1893); Peel, *t. c.* p. 330.

No. 58. ♂ ad. Biji (1200 ft.), Jan. 12, 1899.

4. On the Evolution of Pattern in Feathers.

By J. L. Bonhote, M.A., F.Z.S.

[Received May 30, 1901.]

(Plates XIX. & XX.[1])

The pattern on the feathers of birds is a subject deserving of a somewhat more careful study than has been hitherto accorded to it; my attention was first drawn to the subject by having at different times observed several notable varieties of young Sparrow-hawks. I have since studied the very large series of that species in the National Collection. The feathers on the breast of the typical young Sparrow-hawk are shown in diagrammatic representation in the drawing (Plate XIX. fig. 1). The ground-colour of the feather is white, while along the proximal edge of each of the transverse bars, which are dark brown, there is a light margin of yellowish, as well as in the centre of the terminal spot. Such, then, are the markings of the typical breast-feather of a young Sparrow-hawk; but, from a study of a large series of these birds, endless varieties of this pattern may be noticed, showing clearly the gradual evolution of the barred markings from a simple longitudinal streak, and giving us, as I hope to show, a clue to the patterns on the feathers of all birds, or rather on all the birds treated of in this article, and also giving us a hint as to what extent of evolution they have undergone. A reference to the figures will enable the evolution of one pattern from another to be more clearly understood. The figures (see Plate XIX.), although diagrammatic, are accurate representations of actual feathers of *Accipiter nisus*. In fig. 2[2] we may note a simple darkening of the rhachis, but with the colour more intense at certain places. The next stage may be noticed in fig. 3, where the rhachis is pure white in between thicker blotches of the darker colour. Figs. 4, 5 show further stages in the gradual forming of a bar.

Another mode of attaining the same result is shown in fig. 6, where the longitudinal stripe has not become broken, but has merely spread out into bars still connected by a darker portion along the rhachis. Fig. 7 is another stage of this method in which the proximal bar has become cut off and distinct, while the terminal spot is much larger and has a great tendency to reach the bars above it. From this to fig. 8 is an easy stage in which the horns have grown up rather more and are farther removed from the edge of the feather, forming a heart-shaped marking. It may be noticed, by the way, that this form most nearly approaches the typical feather fig. 1; the only difference being that in fig. 1 the space

[1] For explanation of the Plates, see p. 326.

[2] Where no Plate is mentioned the figures refer to Plate XIX.

J. Smit lith.

Mintern Bros. imp.

EVOLUTION OF PATTERN IN FEATHERS.

J Smit lith.

Mintern Bros. Chromo.

EVOLUTION OF PATTERN IN FEATHERS.

between the two horns has been filled in. Figs. 9 and 10 show a further stage in the gradual cutting-off of the upper part of the spot to form a bar [1]. Figs. 11 and 12 represent two other stages in another line of development, showing the formation of the crescent.

Disregarding the pattern for a minute we may turn to the question of colour, and imagine the typical feather with its dark bars. At first, as I mentioned above, there is a slight tinge of lighter colour towards the upper margin of the feather (not shown in the figure); in other specimens we notice that the dark bars are narrower, and that the lighter colour has a reddish tinge and appears on *both* sides of the bars. In another specimen, again, the bar is still narrower, and the red darker and overspreading a much larger area, while what is left of the bar has, so to speak, been unevenly eaten away, so that merely a thin vermiculated stripe is left; and finally the feather is almost entirely suffused with red which is rather more intense where the bars were; this last stage being that found in some adult males. In these stages, however, although the intensity of the red may vary considerably, the original position of the bars may always be traced.

Lest I should be misunderstood, I would mention that in all these cases the feathers have been taken from different birds, and that I have no proof of the pattern on any individual feather being changed as some writers (*cf.* R. B. Sharpe, P. Z. S. 1873, p. 44) have suggested: it may be so, or it may not, but that contingency has not been taken into account in this paper.

I propose now to make a few deductions from these various patterns, and then, if possible, prove them to hold good by taking examples from various species in widely different Orders.

First, I would suggest that the most primitive feathers were entirely colourless, or of a dull dingy grey, the first trace of a pattern being a longitudinal stripe of colour down the rhachis. Possibly the feathers of some species became self-coloured without undergoing any pattern stage, but this is doubtful; and in the majority of self-coloured birds, even when white, the self-coloration has been subsequently assumed. The self-coloured feathers are those in which it is most difficult to fix the period of evolution. They may, for instance, be merely the very much enlarged longitudinal stripe, as in the case of those birds whose young show light edgings to their feathers. This is probably the most usual form; or they may come about by the gradual reabsorption of the bars, the colour spreading over the entire feather; or they may be of a later stage altogether, as in the breast of Gulls and many other birds, where the light colour of the underparts has probably been assumed for protection.

The following tree will perhaps give a closer idea of the possible stages in the evolution of pattern.

[1] It may be noted that in most of the figures four bars are shown, and that therefore the terminal spot in figs. 7–10 probably represents the two terminal bars.

- White feather.
  - White feather with narrow longitudinal streak.
    - Stripe broken and when existing widening out into bars.
      - Stripe forming irregular spots where the bars should be. (Figs. 4, 5.)
    - Stripe not broken but spread out into bars. (Fig. 6.)
      - Proximal bars disconnected. Distal ones joined or curving round by the edge of the feather. (Fig. 7.)
        - (1) Two arms of distal bar having joined the bar above enclosing a spot on either vane: *e.g.* Great Northern Diver.
        - (2) Heart - shaped marking with bars above. (Fig. 1.)
        - (3) Heart-shaped marking split in centre to form V-shaped marking. (Fig. 13.)
          - Two longitudinal stripes along the centre of either vane, with light-coloured rhachis. (Fig. 14.)
            - Lateral stripes joining in the middle line, leaving a terminal spot. (Plate XX. fig. 11.)
              - Self-coloured feather.
        - (3) Heart - shaped marking forming crescent. (Fig. 12.)
        - (3) Heart - shaped marking constricted and with terminal portions elongated. (Fig. 10.)
        - (3) Heart - shaped marking ovate, no bars above. (Plate XX. fig. 8.)
      - Feathers of Wren and Partridge.
    - Stripe so broad as to cover most of the feather, leaving only a light margin.
      - The same without the light margin, *e.g.* a self-coloured feather.

(1) These spots may become round and pigmented to form ocelli.
(2) This spot may become lighter in the centre and form a single ocellus.
(3) In all these cases the proximal bars may persist, or all the markings may disappear and leave a self-coloured feather

The distinctive patterns of birds caused by different patterns on a number of feathers taken together owe their origin to other causes, and must not be taken into account in this paper except in so far as they have been directly modified from these primitive patterns. This class of markings, although the most important for the bird's welfare, is probably the most unstable, being continually altered to keep the race distinct when it meets with various other nearly allied members of its genus, either in extending its range, or from some other cause. It is worth mentioning on this subject that when a race finds it essential to differentiate itself from a closely allied form, it has to cover up its distinctive mark as well as to evolve a new one; and consequently we may suppose that some of the markings on birds are the degenerate race-marks of former generations. The genus *Fringilla* offers a good example of this.

There are eight species or forms known, namely :—

F. teydea	inhabiting	Teneriffe.
F. cœlebs	,,	Europe generally.
F. maderensis	,,	Madeira.
F. maderensis moreleti ..	,,	Azores.
F. maderensis canariensis	,,	Teneriffe.
F. maderensis palma	,,	Las Palmas, Canaries.
F. spodiogenys	,,	Algeria.
F. montifringilla	,,	Europe generally.

The whole of these species (with one exception, *F. teydea*) may be recognized by two distinct cross-bars on the wing, especially noticeable when the bird is flying; these cross-bars being formed by a more or less broad white tip to certain of the wing-coverts.

In only two places is more than one species of this genus found, namely, in Europe, where we find *F. cœlebs* and *F. montifringilla*, the latter having, however, a different breeding range; and at Teneriffe, where there is a very restricted forest-form, *F. teydea*, and a species of the more normal type, *F. canariensis.*

It is instructive therefore to notice that in these two cases only, where the risk of intermingling between the species might occur, do we find any attempt on the part of one or other of them to alter or modify the characteristic cross-bars of the wing. *F. teydea* accomplishes this more completely and successfully than *F. montifringilla*; but, considering its restricted range and the comparatively greater amount of in-breeding which must go on, such a result is only natural. *F. teydea* obliterates the cross-bars altogether, and does not assume any other distinctive mark, the confined space of its range tending to render such a mark unnecessary.

With *F. montifringilla* the case is different, and while the cross-bars are being obliterated, it has assumed a further distinctive marking in having a white rump. We are, however, I think, quite justified in coming to the conclusion that this species is still in a state of transition, since it is seldom that the rump is purely white, being frequently interspersed with darker feathers, while on the cross-bars feathers are found of all shades from deep orange to yellowish white.

These remarks, although somewhat beside the point, have been inserted as showing one of the many causes by which the development of the pattern in the feather would tend to be altered and modified, in the young birds no less than in the adults, to such an extent as to overturn at first sight the theory contained in this paper.

It is, perhaps, needless to add that these are the patterns on which the large majority of species are based; they have in reality but little in common with the markings on a feather itself, about which this paper is written. Other causes such as protection, vigour, and adornment, all play a part in the general pattern and markings on the birds; but, leaving the modification caused by all these as far as possible out of consideration, let us look at a few examples from widely-spread Orders, and see to what extent the process of evolution as set forth above is borne out by the facts.

In the young Peregrine the back is of a uniform brown, with a light edging; after its first moult the feathers are clearly referable to the type in fig. 6, while those on the tail are of a similar type, but with the tips of the bars quite joined up in an exaggerated form of fig. 7. In the adult bird the bars on both the back and the tail are complete. On the pattern of the breast it is unnecessary to enlarge, for it is similar to that of the Sparrow-hawk. It is worth noting, however, that while the back and breast have undergone similar changes, the back has become considerably darker, having been presumably modified for protective purposes. The Kestrel, on the other hand, offers an example in which, in the young bird, the tail and the back have complete bars which are afterwards to a great extent lost, while on the breast the bars are either very incomplete or we have merely the very early form of longitudinal stripe. This is but one case of a very common phenomenon to which I shall have occasion to refer again, namely: that when the upper and under sides of the plumage show different stages of evolution, the upper parts are generally the most advanced.

Before leaving the Hawks, where similar observations may be made on most species, we might look at the back and tail of the adult male Sparrow-hawk. At first sight the whole of the upper surface will appear self-coloured, but a closer look will reveal two or three darker patches on the tail showing the last remnants of the bars. It will then seem that in this case the tail has not advanced so quickly as the body-feathers in its rate of evolution. If, however, the feathers of the back be raised up, we find that these feathers are in reality a modified form of the type shown in fig. 8, with the terminal marking relatively very large and quite concealing the white base of the neighbouring feather. With regard to the Strigidæ as a group, I have not had time or opportunity to go into the matter very thoroughly; but, in those I have examined, the patterns lend themselves to classification as in other groups, although at first sight they appear somewhat puzzling. The vermiculated form of pattern is very common among them, and in some extreme cases, e. g. *Asio otus*, the whole feather seems to be mottled indiscriminately, while in others, e. g. *Scops*, the vermiculation is confined to the bars, or the area that should be covered by bars. The Barn Owl, however (Plate XX. fig. 5) forms a good connecting link for this vermiculated pattern, which has broken off from the main line of evolution at an early stage. Fig. 4 shows the earliest beginnings of it in the typical series. It will be noticed on reference to Plate XX. fig. 5 that all the markings are confined to the tip of the feather, and that no distinct bars can be made out in the vermiculation itself; but if this vermiculated part be omitted from consideration for a minute, we have clearly the stage very nearly approaching fig. 3.

Plate XX. fig. 6 represents the feather from the breast of a young Scops Owl showing the vermiculation restricted to the bar area.

The Burrowing Owl does not bear out the statement that the upper parts (where any difference exists) show a higher form of evolution than the underparts. In this case the feathers of the back are of the form shown in fig. 7, while the underparts are barred. This need not, however, occasion much difficulty, for it will be readily seen that the habit of this bird being to sit at the mouth of its burrow, the underparts would be the most exposed, and consequently those on which laws causing evolution would tend to act most vigorously.

The large order of Passeres is that to which we may next turn. The British Thrushes as a series show us clearly the lines of evolution. In the young of *Turdus viscivorus*, we find on the back the last bar alone persistent, so that according to the table they may be considered as forming a highly evolved race. The individual feathers on the back of the young Missel Thrush exhibit considerable variation: some of them show the bar as V-shaped, in others it is straight, while in some the dark colour is no longer to be found on the rhachis and is only found in two longitudinal bars along the centre of the vane on either side. In White's Thrush this stage persists in the adult, but the tip always remains as a bar, more or less crescentic, whereas in the Missel Thrush the feathers have become self-coloured.

The young of the Song-Thrush (Plate XX. figs. 10 & 11) is similar to that of the Missel Thrush, except that evolution has gone slightly further as it is much more nearly self-coloured. On the wing-coverts all trace of a bar has disappeared, the two longitudinal stripes, representing the original arms of the V-shaped bar, have covered the whole vane, the rhachis being alone left of a yellowish colour with Λ-shaped markings of a similar colour at the tip. The feathers still show traces of the dark V-shaped bar; but a tendency to slur over the stages is shown, so that they are not distinct as in the Missel Thrush.

As regards the underparts, they are never in advance of the upper.

The Song-Thrush, Missel Thrush, Redwing, and hen Blackbird have the usual Thrush marking, viz. Pl. XX. fig. 8, which I take to be a shortening of the primitive longitudinal streak; in the young of the Missel Thrush, and sometimes in the case of the Song-Thrush, the terminal light edgings are visible. In the Fieldfare (Plate XX. fig. 9) we may note the terminal spot much enlarged, with a tendency to become light in the centre and form the V-shaped markings, whilst in White's Thrush the markings are crescentic. A Table of the Thrushes drawn from the original tree would make them break off from the 4th line in the main tree.

Heart-shaped markings forming crescent. (*Turdus varius.*)	Heart-shaped marking split in centre to form V-shaped marking. (Breast of *T. pilaris*. Young of *T. viscivorus.*)	Heart-shaped marking ovate, no bars above (Fig. 8. Pl. XX.). Breast of *T. viscivorus, T. musicus, T. iliacus,* ♀ *T. merula.*

Two longitudinal stripes along the centre of either vane, with light rhachis.

The longitudinal stripes joined, leaving only a light terminal spot.

Self-coloured feather.
(♂ *T. merula* and back of *T. pilaris. T. iliacus. T. musicus. T. viscivorus.*)

Judging from pattern alone, we should therefore be led to classify them in the following order, starting from the highest form:—

(1) *T. merula.* (2) *T. musicus.* (3) *T. viscivorus.* (4) *T. pilaris.* (5) *T. iliacus.* (6) *T. varius.*

T. iliacus is placed after *T. pilaris* owing to the markings on the breast being of a slightly more primitive type. This suggestion, however, is only given as showing how a study of the pattern might be applied.

It would make the paper too long and tedious to take many examples of the Passeres, and necessitate a careful examination of a large series of young birds, which, unfortunately, I have not at hand. It may be mentioned, however, as I have noted them, that the back of the young Spotted Flycatcher greatly resembles that of the young Missel Thrush, and that the markings of a young Hawfinch are very similar to those of White's Thrush. Plate XX. fig. 1 represents a feather from the breast of the Wren, showing how the Λ-marking, most clearly visible in the Nutcracker, might be brought about if it did not follow the line shown in the Thrushes.

In the Wryneck we find the young with a barred plumage on the breast, while the adult has the V-shaped markings; and on reference to the table it will be noticed that it has followed the form of evolution shown in the centre or main line, the only difference being that *all* the bars are disconnected. The Woodpeckers are from this point of view a comparatively low form: in the young of *Picus viridis* very incomplete bars are seen, while in *Dendropicus minor* the longitudinal streak of an early type persists in the adult. I am further inclined to believe that the dull dirty white of the chin and throat represents the primitive patternless feather, but am not in a position to express a *definite* opinion on the point at present.

Having already dealt with the Owls and Hawks, the next group to claim our attention is that of the Steganopodes. In the Cormorants we find a type of pattern with which we hitherto have not had to deal, namely, a feather with a darker margin. At first I was inclined to regard this as merely an exaggerated form of the crescent, but an examination of the young bird speedily dismissed that idea, as in it the pattern is identical with the adult; whereas if it were, as I imagined, an exaggerated crescent, one ought undoubtedly to see traces of a light margin. An examination of a young Cormorant, in which the feathers are whitish with a longitudinal stripe, showed that the darker marginal border could be distinguished even in the case of the white feather. Green and metallic colours are almost always due, not to a difference of pigment, but to a condition known as "surface structure" due to ridges on the surface of a feather breaking up the colours into their component parts, and acting by interference so that only rays of a certain colour reach the eye[1]. Here, then, is the explanation of this marking. The feather itself is a purely self-coloured one, but round the margin, where the feather is more broken, the true colour of the pigment, which has been obstructed by the process of surface-structure, is able to show itself and forms the darker margin.

While the genus *Phalacrocorax* has been evolving in this manner, the Gannet (*Sula*) has taken another course, and by proceeding along the line we are more particularly studying, has so far evolved as to have reached a secondary white stage. It is not easy to see the stages between the dark brown semi-adult birds and the pure white adult: great irregularity is noticeable in birds assuming the white plumage, as regards the tracts in which it is first assumed (although the back, wings, and tail are invariably the last); but what is perhaps of most importance to us is the fact that in the parti-coloured feathers, of which there are many, we lose all *trace* of the patterns which we have hitherto been able to refer to a common origin, however different the general appearance may have been.

In the immature bird, however, matters follow what we may now perhaps call the normal course; and in its first plumage it starts at a high level, by the feathers being apparently self-coloured with Λ-shaped white tips as in the Nutcracker or young Thrush.

Of the Ardeidæ I have only had opportunity of studying a few commoner types, and they all seem to have very similarly marked feathers, which, when not self-coloured, consist of a

[1] See Gadow, P. Z. S. 1889, p. 240.

longitudinal stripe down the centre of each vane. This type is found in the young of *Nycticorax* and also of *Ardea cinerea* and *A. purpurea*; this marking was presumably assumed long ago, as even in young birds we get no trace of the earlier stages. In the Bittern, however, similar markings exist and we also find connecting bars, these features being especially well marked on the scapulars; and so we may be entitled to assume that in *Ardea* the former pattern was derived along the same line.

Among the Anatidæ we may notice that the barred form is the commonest and most usual type. Taking *Anas boschas* as our example, and the feathers on the breast in particular, we may notice that in the immature bird the feather is brownish with a longitudinal stripe; this pattern also persists in the adult female. In the male the feathers are self-coloured on the breast, but with minutely vermiculated bars on the chest; in his summer dress, however, the pattern of the feathers is barred and not longitudinally striped, but otherwise similar in colour to the female. The bars vary greatly in their development, but for the most part they are not strikingly defined.

Over the Common Partridge (*Perdix cinerea*)—which we may take as practically typical of the group to which it belongs—it may be worth while to spend a few minutes. The most conspicuous parts of the Partridge's feather are the longitudinal white stripes along the rhachis. These stripes occur in the very young bird on almost all the feathers both of the back and front; but in the adult, although far more conspicuous, they are restricted to the flanks and scapulars. Starting with a very young bird which has just got its first feathers, we may notice that the feather has a narrow light centre bounded on either side by a longitudinal dark stripe, which is again succeeded by a lighter area. In most of the feathers this stripe appears uniform and unbroken, but generally a few isolated feathers may be found in which either the stripe on one side or the other is abruptly broken by a light bar, or the stripe shows signs of being darker and thicker in certain places. It is therefore obvious that this stage is not developed along the line in which the proximal pattern has disappeared and the terminal bar has grown out with elongated arms until the centre becomes obliterated, leaving the arms, but that each of these longitudinal dark stripes is made up of portions of successive bars. The key to this system is that in the youngest bird the light centre widens out to form a white tip similar in shape to that of the Nutcracker, and noticed previously in this paper when dealing with the Wren. The method of evolution will be most clearly understood by a study of the figures (see Plate XX. figs. 2, 3 & 4).

The next order which we will notice is that of the Limicolæ; they show comparatively few feathers of interest from the point of view of pattern, and may be discussed in a few words. They are all rather primitive, and except in a few cases hardly reach the complete barred stage. The Norfolk Plover shows a very primitive form, the pattern being chiefly mere longitudinal stripes; while the Golden (Plate XX. fig. 7) and Grey Plovers show the most common form of marking, the yellow spot being the ground-colour or what is left of it, between greatly-enlarged and connected bars. Passing over many forms of more or less interest, we may take as our typical example the Knot (*Tringa canutus*). The young shows on the back a plain grey feather with light border and a dark arrow-shaped edge representing the last bar; on the breast there is the primitive dark stripe, especially on the throat and chest, and the whole is slightly suffused with pink. In the adult in winter the dark bar on the back has been absorbed, and we have the plain grey self-coloured feather; while on the breast, which is quite white, the longitudinal dark markings have been replaced by bars of more or less irregular shape. In the summer, the adult has the feathers of the scapulars black with a white edge and with four or more reddish spots, the type of feather being as in that of the Golden Plover; the breast is entirely suffused with red, having the black markings, where they occur, as in winter, but the majority of the feathers being self-coloured.

It will be noticed by those who have borne with me so far, that these sequences of plumage offer some difficulty, for if we imagine the young to be the nearest to the archaic type, the winter bird will follow naturally as a higher form; but then we are met by the fact that although the colours are much brighter, the pattern on the adult in summer is hardly so far evolved as that on either the young or the winter bird.

This is a difficulty to which I am unable to offer a satisfactory solution. The tendency of young waders to resemble the breeding-plumage of their parents, rather than the duller plumage, has always puzzled me, long before any ideas of pattern entered into my thoughts; and now we see that the breeding dress represents a lower form of evolution, if my ideas be right, than the non-breeding dress, the reverse of what is usually the case. The only suggestion I can offer is that in the young and breeding dress we have the plumage worn at a time when, food being more plentiful and its breeding-haunts more congenial, there was no need for the bird to undertake such long journeys, and that scarcity of food, causing diminished energy, combined with the necessity of a more protective colouring from its many new enemies met with in the course of its wanderings, led to the adoption of the grey winter dress.

The Gulls and Terns need no comment; in their young state they all show in various stages the longitudinal stripes, or half-formed bars, showing clearly that their adult plumage has been subsequently evolved. The spots of Colymbidæ are the white interspaces between the very much overgrown bars.

I have now been roughly through many of the main orders of birds, and have tried to show that the ideas suggested by the variations in the Sparrow-hawk hold good for all the groups on which I have touched, and, if so, probably for all birds. In some cases my reasonings may appear a little far-fetched, and in others doubtless I have not chosen a correct interpretation of the method employed. The same results can be reached by several ways ; and without a large series of young and immature birds, not only of the particular species but also of those nearly allied, it is impossible to form a *positive* opinion.

My object has rather been to show that all the many and diverse markings on the feathers of birds are in the main variations of one type, namely: a longitudinal stripe with great tendency towards lateral expansions into transverse stripes, and that on modifications of this, by suppressing one portion or increasing another, all the various patterns have been built up. I have not entered into the question of the more peculiarly marked feathers in the cases where groups of feathers form conspicuous patterns, as such markings must have been subsequently acquired, for the recognition of the species by its own race, and do not in consequence enter into the purport of this paper. The main question that now remains to be answered is that relating to the method in which the pigment groups itself to form these markings, but that is a matter which I hope to be able to investigate when dealing with the question of colour-change. At present I will only say that there is usually, if not always, but one pigment in any particular feather, the difference in shade or colour being due, in the case of shade to a greater or lesser concentration of the pigment, and in the case of colour to surface-structure.

To sum up—Apart from the main principles of the evolution as shown in the table (p. 318), and through one or other lines of which all birds seem to have passed, it should be noted that the most exposed portions of a bird, generally the upper parts, undergo a further evolution than those less conspicuously situated, and if there be any difference between the sexes, the male shows the higher form.

I should like to add that this paper has no pretensions at being in any way complete or exhaustive. The subject has, so far as I am aware, not hitherto been treated from this standpoint, and I shall be most grateful to any who may care to honour me with their criticisms regarding it.

EXPLANATION OF THE PLATES.

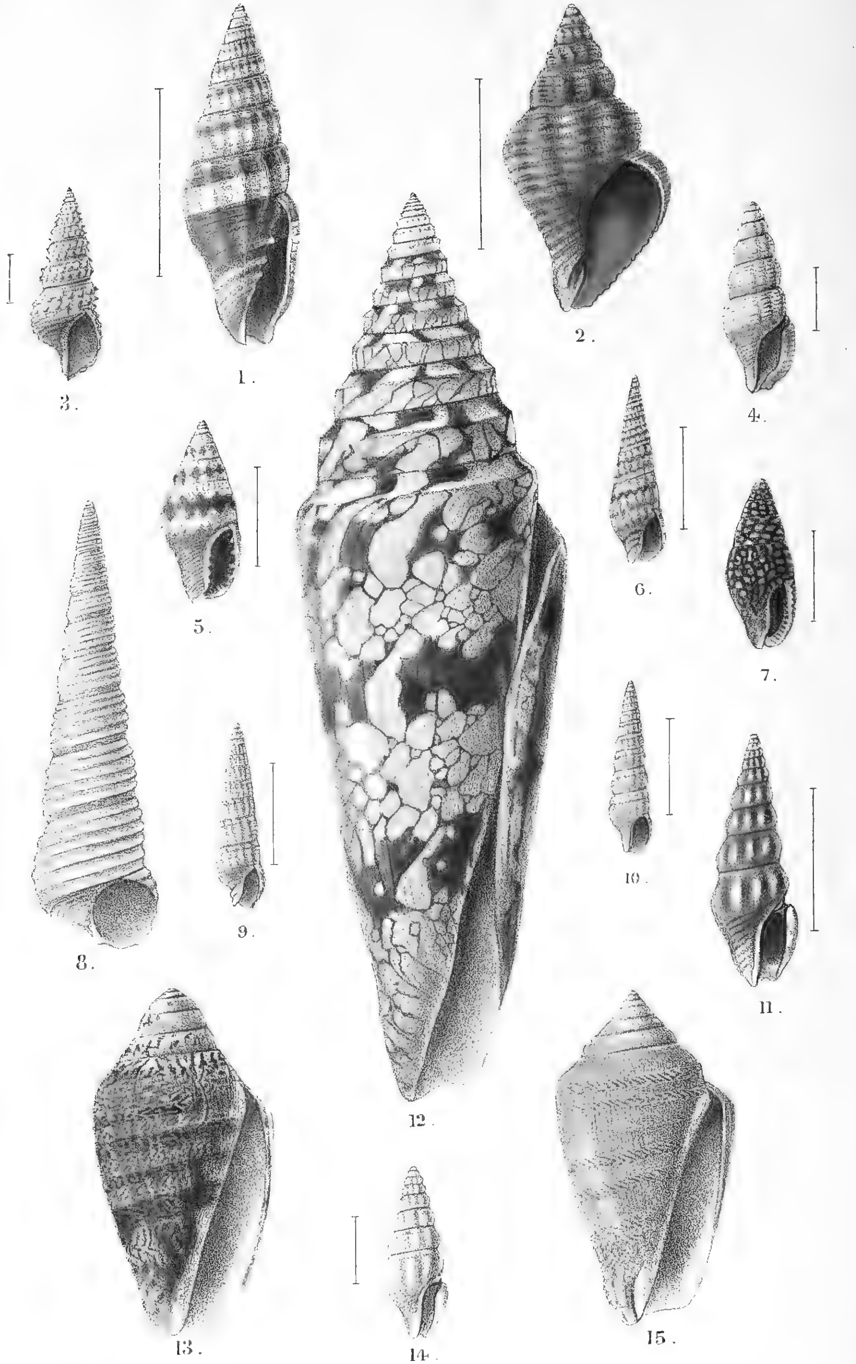
Plate XIX.

Figs. 1–13. Diagrammatic representation of the pattern on the feathers of various individuals of the Sparrow-hawk (*Accipiter nisus*).

Fig. 14. Diagrammatic representation of the pattern on the feather from the breast of a Night-Heron (*Nycticorax griseus*).

Plate XX.

Fig. 1. Feather from the breast of Wren (*Troglodytes parvulus*).
Figs. 2, 3, 4. Feathers from Partridge: figs. 2 & 3 are from young birds.
Fig. 5. Feather from Barn-Owl (*Strix flammea*).
6. „ „ Scops Owl (*Scops giu*).
7. „ „ Golden Plover (*Charadrius pluvialis*).
8. „ „ breast of Song-Thrush (*Turdus musicus*).
9. „ „ „ „ Fieldfare (*Turdus pilaris*).
Figs. 10 & 11. „ „ young of Song-Thrush.



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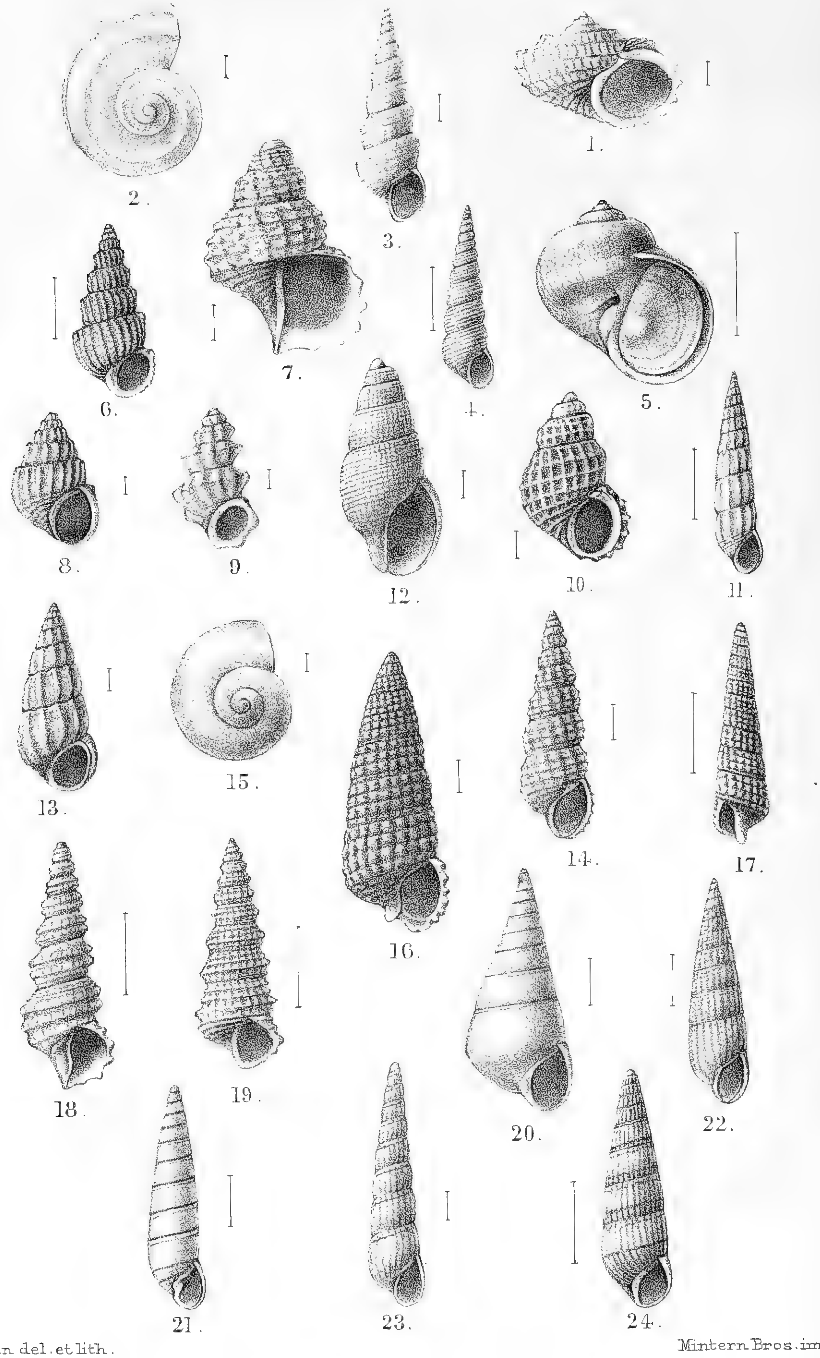
Mintern Bros. Chromo.

MOLLUSCA OF THE PERSIAN GULF AND ARABIAN SEA.



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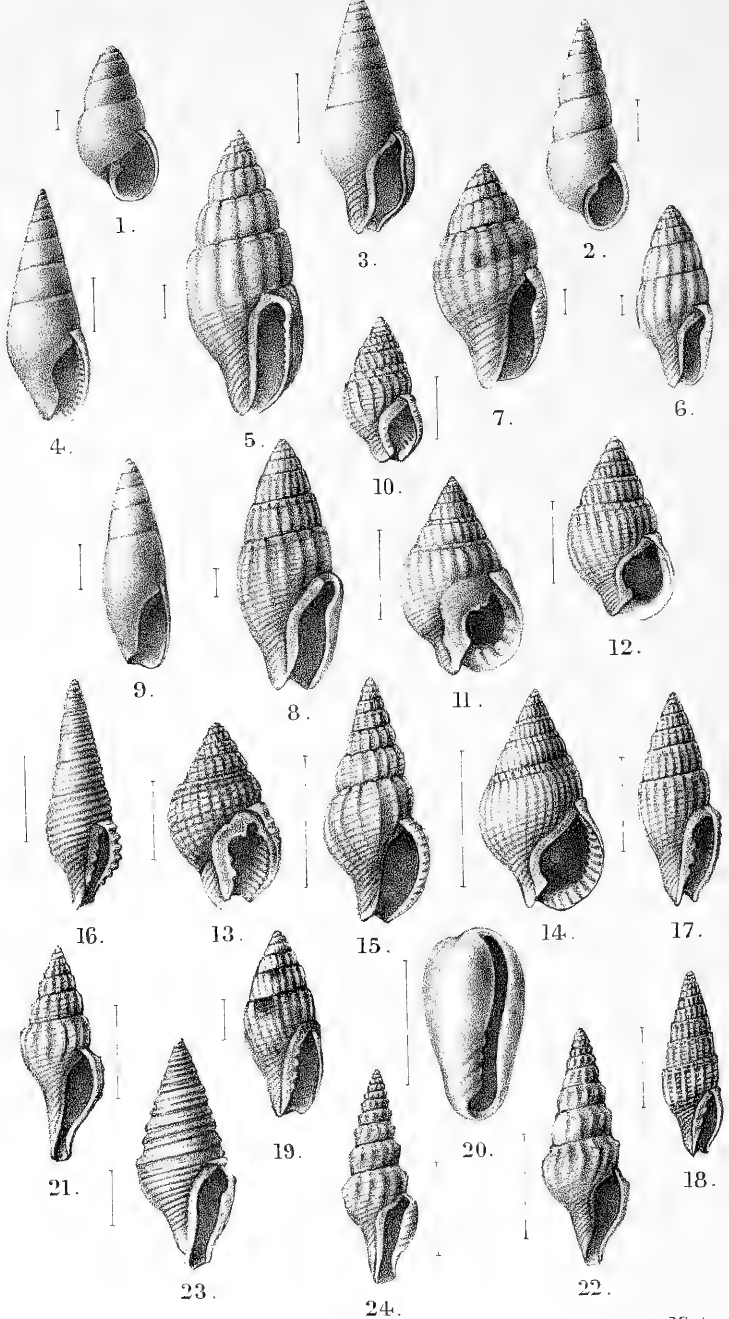

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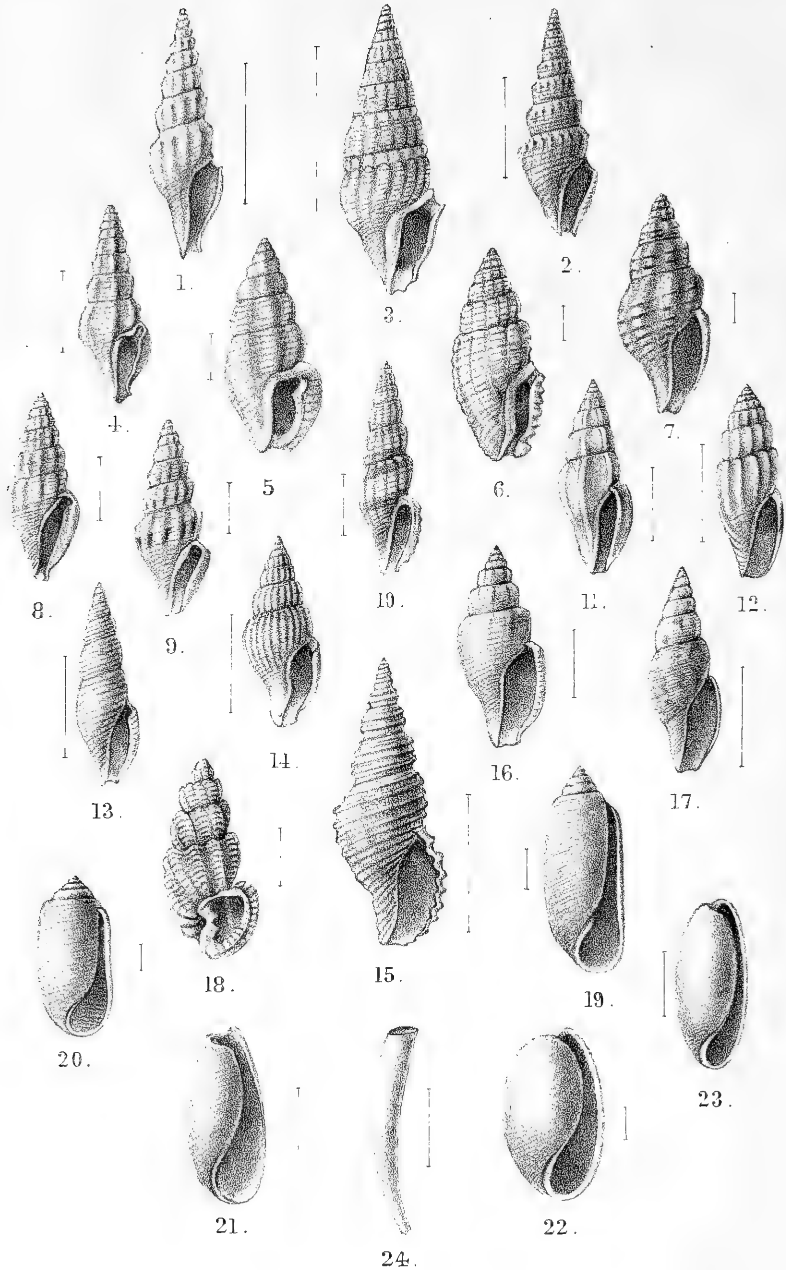

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MOLLUSCA OF THE PERSIAN GULF AND ARABIAN SEA.

5. The Mollusca of the Persian Gulf, Gulf of Oman, and Arabian Sea, as evidenced mainly through the Collections of Mr. F. W. Townsend, 1893–1900; with Descriptions of new Species. By James Cosmo Melvill, M.A., F.L.S., F.Z.S., and Robert Standen, Assist.-Keeper, Manchester Museum.

Part I.—CEPHALOPODA, GASTROPODA, SCAPHOPODA.

[Received June 4, 1901.]

(Plates XXI.–XXIV. [1])

It is certainly remarkable that the nineteenth century should have passed away without any serious attempt to chronicle systematically the Mollusca inhabiting the Persian Gulf and Arabian Sea having been made, and more especially so, since the waters of the last named wash the Western shores of our great Indian Empire itself, where are situate, amongst other towns of lesser note, those two important centres of commerce and civilizing influences, Karachi and Bombay, either of which might, one cannot help thinking, have ere this have provided both the opportunity and the man to carry out so desirable a project of research.

However, there have been, during the past forty years especially, several distinguished pioneers in the field, such well-known names occurring to the mind at once as the late Dr. F. Stoliczka, the late Mr. Geoffrey Nevill, formerly of the Indian Museum, Calcutta, his brother Mr. H. Nevill, the late Dr. S. B. Fairbank of Bombay, the late Mr. Henry F. Blanford, F.R.S., formerly Meteorological Reporter to the Indian Government, Mr. W. T. Blanford, F.R.S., formerly of the Geological Survey of India, besides the late Dr. Anderson, F.R.S., and J. Wood-Mason, late Superintendent and Deputy Superintendent of the Indian Museum respectively; and lastly Dr. A. Alcock, F.R.S., whose deep-sea dredgings, mostly in the Bay of Bengal, or amongst the Laccadive group, just south of our proposed limit as regards the Mollusca treated of in this paper, have resulted in so many discoveries. Most of the above-named Naturalists collected material more or less largely, and, indeed, went further in contributing various treatises and papers from time to time, which form the bases of our knowledge.

In addition, mention must be made of the late Major Baker, author of a short list of Karachi Mollusca [2]; Mr. W. D. Cumming, of the Persian Telegraph Service; the late Mr. R. MacAndrew, donor of much valuable material, especially of Col. Pelly's collections from the Persian Gulf, many species of which have been described by

[1] For explanation of the Plates, see p. 459.
[2] *Cf.* Woodward, Man. Moll. ed. ii. p. 73.

Mr. Edgar Smith; Col. G. B. Mainwaring, Mr. W. Theobald; and, more recently, Capt. Cartwright, R.N., Commander E. R. Shopland, K.I.M., M. F. Houssay, Mr. W. C. Carphin, Mr. J. O. Twells, Lt.-Col. H. D. Olivier, Mr. Alexander Abercrombie of Bombay, and Mr. Frederick W. Townsend.

It is especially with the collections of the last-named that we are dealing at the present opportunity.

Mr. Townsend has been for many years officially connected with the Indo-European Company, whose cable extends from Bushire in the Persian Gulf along the Mekran Coast to Karachi, where, at Manora, he resides, the total distance being considerably over one thousand miles.

For the past eight or nine years, as Chief of the Telegraph Staff of the Indian Government steamer 'Patrick Stewart,' he has been assiduously dredging wherever opportunity offered, and not only exercising the greatest possible care and discrimination as to the quality of the specimens gathered, but making notes, at the time, of locality, depth, and other particulars, which so much increase the value of the material dredged.

Though, perhaps, not quite exhaustive, we imagine the larger proportion of the species of Mollusca actually inhabiting this vast region will be found catalogued in the accompanying List.

It was in 1892–93 that Mr. Townsend's earliest consignments were despatched home; and Mr. G. B. Sowerby described certain new forms from these, of which we would especially mention *Mangilia townsendi*, *Niso venosa*, *Spondylus exilis*, *Pecten townsendi*, and *Sunetta kurachensis*[1].

Just at the same juncture, too, Mr. Alexander Abercrombie began to turn his attention to the Molluscan Fauna of the vicinity of Bombay, as far south as Ratnagiri, and, in coadjutorship with one of the present authors, essayed a preliminary Catalogue[2], numbering in all some 325 species. It was then that this Fauna was termed 'specialized,' so many interesting new forms did it produce, and we wrote then in ignorance of what, so shortly, Mr. Townsend's successful dredgings would reveal. By far the greater part of the 52 species differentiated as new to science from Mr. Abercrombie's collections reappeared, some in great quantity, especially from the neighbourhood of Manora and Charbar; and, as several were described from poor or insufficient material, it is gratifying to say with regard to nine-tenths of them, that the examination of fine specimens more than endorses the reasons for their differentiation. Some indeed, are very plentiful, such as *Marginella mazagonica*, *Engina zea*, *Columbella euterpe*, *Ocinebra bombayana*, *Purpura blanfordi*, *Sistrum xuthedra*, *Pyrgulina callista*, *Odostomia syrnoloides*, *Cyclostrema solariellum*, and *Tellina lechriogramma*.

These Bombay gatherings, mainly made by Mr. Abercrombie, slightly supplemented by Mr. Townsend, supplied the primary

[1] Proc. Mal. Soc. Lond. i. p. 214 *sqq.*, 278 *sqq.* etc.
[2] Mem. Manch. Soc. vii. pp. 17–51.

constituents of our own investigations into this fauna, and we have thought it best to enumerate them all in the following pages, as tending to make the Catalogue more complete.

The region we are now discussing forms the N.W. portion of the immense Indo-Pacific Province, an area so vast, and yet so homogeneous in the general character of its natural productions, as to preclude the desirability of further subdivision.

If the map of Asia be examined, it is seen at once that the Persian Gulf and Gulf of Oman constitute a 'cul-de-sac,' and that, indeed, the northern portion of the Arabian Sea may all be considered land-locked, the continent of India, with Ceylon, extending as far south as lat. 6° N. while, on the west, the Arabian shores trend obliquely to Aden, lat. 13° N. Under the circumstances, we hardly think it surprising that so many endemic forms have been brought to light, both in the Mollusca and in other branches of zoology, especially the Fishes and Crustacea; and as regards the former, at all events, Erythræan[1] affinities seem more prevalent than Ceylonese. Most of the genera and many of the leading species, it is true, have a wide range, and are identical on both sides of Hindostan, but not, we think, to so large an extent as might be surmised. For instance, when working at the Booley collections[2] from the Andaman Islands, only two of the new species described recently from the Townsend collections occurred, viz., *Cerithiopsis hinduorum* Melv., and a variety (*andamanica*) of *Natica strongyla* Melv.

And, again, in an account of the Marine Mollusca of Madras[3] we published in 1898, out of about 400 names there given about 70 also occurred at Bombay, mostly widely-spread species, but including a few comparatively recently described, e. g., *Terebra persica* Smith, and *Mangilia chilosema* (erroneously identified as *horneana* Sm.), *Columbella euterpe*, *C. flavilinea*, *Aclis eoa*, *Sistrum konkanense*, and *Solarium delectabile*, all of Melvill.

These seem a very small proportion out of about 240 species differentiated during the past decade, if we include those described in this paper. As might be supposed, a considerable number of these belong to the smaller and more obscure groups, which, though several have near allies in the outlying portions of the Indo-Pacific Province, especially Japan, it has not been found feasible to unite with species already recorded by A. Adams and others. We have paid special attention to the many minute forms described by this author, the types of which are mostly in the British Museum (Nat. Hist.), though, unfortunately, so few have as yet been figured, or

[1] Since this was written, a rough comparison made between our Catalogue and that compiled by Commander E. R. Shopland (Journ. Bombay N. Hist. Soc. x. pp. 217–235, with Addenda t. c. pp. 503, 534) has elicited the fact that out of 501 species of Gastropoda enumerated from Aden, 189 occur in the region treated of by us.

[2] Proc. Mal. Soc. Lond. ii. p. 164 *sqq.*, iii. p. 35 *sqq.*, p. 220 *sqq.*

[3] Journ. of Conch. vol. ix. pp. 30 *sqq.*, 1 pl.

indeed described fully enough to satisfy the more exigent requirements of the present time. Great care has also been taken in the comparison with the types described by the Rev. R. Boog Watson as collected during the voyage of the s.s. 'Challenger.'

In many instances we had to be content with descriptions or figures, notably in the case of the Marquis de Folin's species (mostly Andamanese), or M. Vélain's. These last consist mainly of *Turbonillæ* and *Odostomiæ* from the South Indian Ocean, one or two of which are found to occur in our lists. The Erythræan species also, mostly described by Arturo Issel and Dr. F. Jousseaume, have so far as practicable been examined. Certain Mediterranean species exhibit near alliances, but we believe the axiom a correct one, that only about a dozen species are common to the northern and southern shores of the Isthmus of Suez, though since the Canal was opened for traffic a few have extended their boundaries, and the numbers will probably increase yearly. It is fortunate, therefore, that investigations as to this point were made beforehand.

We are informed by Mr. W. T. Blanford, that the greater portion of the large collections made by him [1] some time ago, off Gwadûr, on the Mekran Coast, and Tumb Island, Persian Gulf, and one or two other localities, are in the Indian Museum, Calcutta, and that only a few have yet been worked out, it being otherwise happily with his Bombay series, which are in the British Museum, and have been of the greatest service to us. We feel it to be unfortunate that circumstances have not allowed an examination of these stores at Calcutta, and not only of these, but of the collections made by Messrs. Geoffrey and Hugh Nevill, also, we believe, in the same museum. The former (Mr. G. Nevill) indeed treated of a few families in his fragmentary 'Hand-list of the Mollusca in the Indian Museum,' but even in this publication too many are put down as 'species novæ,' with neither name, description, nor figure added.

It will be noted that we have included some of these references, mainly of *Rissoidæ* and *Pleurotomidæ*, in order that the list may be made as representative and perfect as possible.

It would take far too much space to closely dilate upon the peculiarities of the fauna of the Persian Gulf: suffice to say, that the section *Leptoconus* of *Conus* here attains its maximum development, while many peculiar *Mitræ* and *Nassæ* occur. *Nassaria* and *Cyllene* abound, rare in most other seas. *Oliva* hardly occurs, while *Ancilla* is well represented. *Voluta* is absent; but certain species of *Marginella*, some handsome (*obtusa*), others small, but mostly apparently endemic, are very frequently met with throughout the whole area. Some peculiar and beautiful *Scalariæ*, *Cancellariæ*,

[1] *Cf.* Journ. As. Soc. Bengal, vol. xliv. pt. 2, p. 103, where Messrs. G. & H. Nevill estimate the number of species collected by Mr. W. T. Blanford at from 600 to 700.

and *Trichotropis* are especially noteworthy, as, among the Strombidæ, are *S. beluchiensis* Melv., *Rostellaria curta* Sowb., and *R. delicatula* Nevill; this last, originally discovered at Arakan, is now found to occur at considerable depths in the Gulf of Oman, in all stages of growth.

Many *Columbellidæ*, *Enginæ*, and *Ricinulæ* seem peculiar; while the *Pleurotomidæ* are by far the most numerously distributed family in these Seas, abounding in forms either endemic or extending only as far as Aden and the Red Sea.

Fusus, *Lotorium*, and *Murex* do not exhibit here their larger representatives, but those that do occur are refined and select examples of their genera; some, e. g. *Ocinebra bombayana* Melv., being akin to a Mediterranean species: the same may be said with *Purpura*. In *Terebra* there are many, mostly endemic, small species, mainly described by Mr. Edgar Smith from Col. Pelly's collections. *Coralliophila rubro-coccinea*, described in this paper, is an interesting addition to a circumscribed genus. *Bullia* here rivals its South African series in interest: *B. ceroplasta* Melv., *kurrachensis* Sowb., and *persica* E. Sm., are all endemic. *Natica* abounds; so do *Cerithiidæ*, *Littorinidæ*, and allied small families, the *Rissoidæ* being especially interesting. In *Turritella*, *T. fultoni* Melv., discovered at Ormara, is now found larger and more generally distributed on the Mekran Coast; many endemic *Trochidæ* likewise occur, but few *Haliotis*, *Fissurellæ*, or *Patellæ*. Two *Siphonaria* (*kurrachensis* Sowb., and *basseinensis* Melv.) from the coasts of India are peculiar. Among the *Scaphopoda*, *Cadulus* possesses two or three curious forms, and *Dentalium* abounds. The *Polyplacophora* are hardly seen, indeed we have no occurrences in our Catalogue; but, on the other hand, the *Tectibranchiates* are very well represented, many new kinds being chronicled, and there being still some which, for want of proper material, we are compelled to leave untouched for the present. Indeed, this is the case in other Orders as well.

We wait to give a résumé of the *Pelecypoda* until they are finally worked out, and we hope their enumeration will form a second part of our paper, at no very distant date.

The following are the titles of the chief works and papers bearing on this subject during the last 45 years:—

1894. Abercrombie (Alexander).—The Common Shells of the Bombay shore. Journ. Bombay Soc. N. H. viii. pp. 212–221 & 335–345.

1867. Blanford (W. T.).—Description of *Irawadia*, n. gen. Journ. Asiat. Soc. Bengal, vol. xxxvi. pt. 2, pp. 56–57.

1868. Id.—*Fairbankia*, a new genus and species of Rissoidæ from W. India. Ann. Nat. Hist. ser. 4, vol. ii. pp. 399–401.

[N.B. Nine-tenths of Mr. Blanford's writings on the Molluscan Fauna of India deal with the Terrestrial and Fluviatile species alone, and the same may be said regarding the papers of his brother, the late Mr. H. F. Blanford, F.R.S.]

1891. FISCHER (Dr. Paul).—Liste de Coquilles recueilles par M. F. Houssay dans le Golfe Persique. Journ. de Conchyl. xxxix. pp. 222–230.

The enumeration of a small collection made near Bander-Bouchir (Bushire), Persian Gulf, thirty-three species in all, of which six remain doubtful as to name.

(*See also* Woodward, S. P.)

1892. GELLATLY, A.—The Pearl Molluscs of the Persian Gulf. P. Phys. Soc. Edinb. xi. pp. 30–31.

1865. ISSEL (Arturo).—Catalogo del Molluschi raccolti della Missione Italiana in Persia. Mem. delle Reale Accademia della Scienze di Torino, ser. ii. vol. xxiii., 1865.

[Mainly giving an account of but 17 species, collected by G. Doria and Philippi at Bunder Abbas and the island of Ormuz.]

1874. Von MARTENS (Dr. E.).—Ueber Vorderasiatische Conchylien. Cassel, 1874.

[An enumeration of forty-nine species of Mollusca collected at Bushire by Dr. Haussknecht.]

1893. MELVILL (J. C.) and ABERCROMBIE (A.).—The Marine Mollusca of Bombay. Mem. Manch. Soc. ser. 4, vii. pp. 17–51.

1893. MELVILL (J. C.)—Descriptions of twenty-five species of Marine Shells from Bombay. *Op. cit.* vii. pp. 52–61, 1 pl. Reprinted in J. Bombay Soc. viii. pp. 234–245, 1 plate.

1894. ID.—Description of a new species of *Engina* (*E. epidromidea*) from Bombay. P. Malac. Soc. London, i. p. 162, fig.

1896. ID.—Descriptions of new species of minute Marine Mollusca from Bombay. P. Malac. Soc. Lond. ii. pp. 108–116, 1 pl. Reprinted in J. Bombay Soc. xi. pp. 406–514, 1 pl. (1898).

1897. ID.—Description of *Plecotrema sykesii*, n. sp., from Karachi. P. Malac. Soc. Lond. ii. p. 292, fig.

1897. ID.—Descriptions of thirty-four new species of Marine Mollusca from the Arabian Sea, Persian Gulf, and Gulf of Oman. Mem. Manch. Soc. xli. no. 7, pp. 25, 2 pls.

1898. ID.—Further investigations into the Molluscan Fauna of the Arabian Sea, Persian Gulf, and Gulf of Oman, with descriptions of forty species. Mem. Manch. Soc. xlii. no. 4, pp. 40, 2 pls.

1898. ID.—Description of a new Strombus from the Mekran coast of Baluchistan. *Op. cit.* pp. 37–38.

1899. ID.—Notes on the Mollusca of the Arabian Sea, Persian Gulf, and Gulf of Oman, mostly dredged by Mr. F. W. Townsend, with descriptions of twenty-seven species. Ann. Nat. Hist. iv. pp. 81–101, pls. i. & ii.

1899. ID. & STANDEN, R. Description of *Conus clytospira*, sp. n., from the Arabian Sea. Ann. Nat. Hist. iv. pp. 461–463.

1887. MURRAY (J. A.).—The Conchology of the Sind Coast. Ind. Ann. i. pp. 26–28.

[No new forms mentioned.]

1875. Nevill (Geoffrey & Hugh).—Descriptions of new Marine Mollusca from the Indian Ocean. Journ. Asiat. Soc. Bengal, xliv. pt. 2, pp. 83–104, pls. vii. & viii.

[*Drillia lucida*, *Clathurella smithi*, *lemniscata*, from the Persian Gulf; *Mangilia fulvocinta*, *fairbanki*, *Clathurella perplexa*, *Cythara gradata*, *Marginella inconspicua*, from Bombay; *Nassa obesa* from Kutch, described and figured.]

1884. Iid.—Descriptions of new Mollusca from the Indian Ocean, by G. & H. Nevill. Journ. Asiat. Soc. Bengal, xliii. pt. 2, pp. 21–30.

1885. Nevill (Geoffrey).—Hand-list of Mollusca, Indian Museum, Calcutta. Part ii. Gastropoda: Prosobranchia—Neurobranchia, cont. Calcutta. Printed by order of the Trustees, 1885.

[Contains descriptions of many *Rissoidæ*, *Littorinidæ*, and *Planaxidæ* in the Museum, some collected by Mr. W. T. Blanford, G. Nevill, and others at Gwadûr, Mekran Coast, Tumb Id., Persian Gulf, &c.]

1877. Smith (Edgar A.).—Ann. Nat. Hist. [4] xix. p. 226 *sqq.*

[In this paper many *Terebræ*, collected by Col. Pelly in the Persian Gulf, are described.]

1882. Id.—Ann. Nat. Hist. [5] x. p. 206 *sqq.*

[Various Pleurotomidæ, including *P. soror*, *albicaudata*, and *macandrewi*, from the Persian Gulf and Arabian Sea, described.]

1884. Id.—Diagnoses of new Species of *Pleurotomidæ* in the British Museum. Ann. Nat. Hist. [5] xiv. p. 317 *sqq.*

[Here *Drillia portia*, *pupiformis*, *scitula*, *Clathurella horneana*, &c. from the Persian Gulf, and *P. lucida*, Bombay, are described.]

1887. Id.—Description of *Conus milesi*, from Maskat. Journ. of Conch. v. p. 244.

1888. Id.—Diagnoses of new species of *Pleurotomidæ* in the British Museum. Ann. Nat. Hist. [6] ii. p. 300 *sqq.*

[*Drillia crassa*, *Mangilia fortistriata*, Bombay, and *Mangilia recta*, Persian Gulf, described.]

1894. Id.—Report upon some Mollusca dredged in the Bay of Bengal and the Arabian Sea.[1] Ann. Nat. Hist. [6] xiv. pp. 137 *sqq.*, & 366–368, 3 plates.

[Contains descriptions, *inter alia*, of *Murex malabaricus*, *Nassaria coromandelica*, *Lacuna indica*, *Sigaretus tener*, &c.]

1895. Id.—Report upon Mollusca dredged in the Bay of Bengal and the Arabian Sea in 1893-94[1]. Ann. Nat. Hist. [6] xvi. pp. 1–19, 2 plates.

[Mostly abyssal species, from the Bay of Bengal and Ceylon, very few from the Arabian Sea.]

1895. Id.—Ditto, in 1894–95[1]. Ann. Nat. Hist. [6] xvi. pp. 262–265.

[1] These collections were obtained by H.M. Indian Marine Survey steamer Investigator,' under the command of Commdr. C. F. Oldham, R.N.

1896. SMITH (Edgar A.).—Descriptions of new Deep-Sea Mollusca. Ann. Nat. Hist. [6] xviii. p. 367 *sqq.*
[*Natica abyssicola* described from Cutch.]

1899. ID.—Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander T. H. Heming, R.N.—No. I. On Mollusca from the Bay of Bengal and the Arabian Sea. Ann. Nat. Hist. [7] iv. pp. 237–251.
[Mostly from South Indian Ocean.]

1894. SOWERBY (George B.).—Descriptions of nine new Species of Shells. Proc. Mal. Soc. Lond. i. pp. 214–217.
[*Conus elegans* from Persian Gulf, *Pecten townsendi* and *Sunetta kurachensis* from Karachi, all collected by Mr. F. W. Townsend, described.]

1894. ID.—Descriptions of four new Species of Shells from the Persian Gulf and Bay of Zaila. *Op. cit.* i. pp. 160–161, 1 plate.
[*Cancellaria paucicostata, Donax townsendi.*]

1895. ID.—New Species of Shells from Karachi and the Mekran Coast collected by Mr. F. W. Townsend. *Op. cit.* i. pp. 278–280, 1 plate.
[*Mangilia townsendi*, *Bullia nitida*, *Niso venosa*, *Enida townsendi*, *Minolia gradata*, *Spondylus exilis*, and *Meretrix tumida.*]

1856. WOODWARD (S. P.).—A Catalogue of Mollusca collected at Karachi by Major Baker, 1850; numbering about 100 species. Manual of the Mollusca, ed. ii. p. 73.
[This catalogue is also given in full by P. Fischer (Man. de Conchyliologie, p. 160, 1887.]

We have restricted the area embraced in these investigations to the entire Persian Gulf, Gulf of Oman, and that portion of the Arabian Sea lying north of an imaginary line running obliquely from Ras-el-Hadd, S.E. of Maskat, to Panjim on the Indian coast[1]. This will include not only Bombay and Ratnagiri, but also the Angrias Bank and that portion of the Eastern Telegraph Co.'s Cable that was examined by Mr. Townsend and Captain Tindall in 1899, with such very successful results. Since the coasts of Arabia, from Aden to Ras-el-Hadd, with its contiguous seas, have not yet been in the least explored scientifically, it seems useless to propound Lat. 15° N. as the boundary, as we had at one time contemplated.

We would further, for the sake of convenience, propose three subdivisions, as follows:—

(i) P.G. The whole Persian Gulf, including the Gulf of Oman, with Maskat and Jask, bordered to the East by Long. 59° 48′ E.

(ii) M.C. The Mekran Coast of Persia and Baluchistan, between Long. 59° 48′ E. and the River Hab.

(iii) I. The Coast of Continental India, from East of River Hab, abutting on Karachi, say, Long. 66° 40′ E., S.E. to Panjim, Lat. 15° 50′ N., Long. 74° E.

[1] From Lat. 22° 34′ N., Long. 51° 48′ E. to Lat. 15° 50′ N., Long. 74° E.

At our request, the following particulars have been kindly drawn up by Mr. Townsend of the chief places exploited by him during the past ten or more years, starting from Karachi, and finishing with Reshire and Fao, at the head of the Persian Gulf.

(A.) *Karachi Harbour.*

This is essentially a backwater harbour, in area about 20 square miles, the navigable portion of which is small and consists of a deep channel, about $\frac{1}{3}$ to $\frac{1}{2}$ a mile wide, running inland some 3 miles from the entrance, the remainder being mud-flats of great extent intersected by numerous creeks. This is the one locality which has been most thoroughly worked, both as regards dredged specimens and those to be found above low-water mark, a short description of it having already been given in the Memoirs and Proceedings of the Manchester Literary and Philosophical Society, vol. xlii. Part 2, 1897–98. Of the numerous mouths of the Indus south of Karachi, only two have been worked and these only very slightly, viz.: the Hajamro about 50 miles, and the Dubba 30 miles S.S.E. of Karachi. At the former, large quantities of dead specimens of two kinds of *Pholas* were found, and doubtless living specimens could have been obtained at the same place if time had admitted of digging in the hard thick black mud; there were several other species of dead bivalves at the same place, and also at the water's edge. On a very low tide, many fine living specimens of *Bullia kurrachensis* Sowb. were found. The ground at both these places is chiefly hard sandy mud with patches of clean sand. Going west from Karachi, the first part of the coast examined was Ras Kuchar, distant about 55 miles. The coast here is of hard sandstone rocks, and though a whole afternoon, on a very low tide, was spent here no shells were obtained, even the most common forms not being found.

(B.) *Mekran Coast.*

Ormara, or *Ras Ormara*, is a mountain 1550 feet high, 7 miles long east and west, 2 miles being its greatest width north and south; it is joined to the mainland by a low sandy spit $1\frac{1}{2}$ mile wide, and on this spit is situated the village of Ormara, containing a population of about 3000 inhabitants, chiefly fishermen. The Government of India have a Telegraph-station here, the telegraph land-line, which is laid from Karachi to Jask, passing through. Dredging has been done in the bays on both sides of the village, but the bottom is a hard clay-mud from which good results are seldom obtained; young *Bullia kurrachensis*, *B. nitida* Sowb., *Meretrix tumida* Sowb., are, however, found here. Between the tide-marks the ground is chiefly hard sand or muddy sand; and it is on the clean sand that the pretty *Bullia ceroplasta* Melv. is found, also *Bullia malabarica* Hanley, but little else of interest.

Ras Basul, 23 miles west of Ormara. A small river, dry except during the rains, comes out here. In the sand and mud at the mouth are to be found numerous dead bivalves, while on the rocks which jut out from the high land on the east side of the river, are a few of the commonest species of univalves, none of which were worth collecting.

Astola Island, 40 miles west of Ormara, is in appearance very like the Ormara headland on a small scale, being a little over 2 miles long east and west, half a mile wide north and south, and only 213 feet high; it is about 15 miles from the nearest point on the mainland. The island rises perpendicularly out of the sea, except at the north-west end, where there is a small sandy bay, at one corner of which is a low ledge of rocks, uncovered at low tides. These have been well searched; but beyond fine specimens of the ordinary *Cypræœ* (*C. arabica*, *C. turdus*, *C. ocellata*, *C. pallida*), and the usual common species met with on most rocky places, nothing was found. Five miles south of the island is a rocky shoal, called *Webb bank*, with 3 fathoms on it at low tide. The bottom between the shoal and the island is very uneven and rocky, the very worst kind there is to dredge on. A few short drags were, however, made here some years ago, and some nice things obtained, amongst them one or two new species, but at the expense of the heavy iron dredge, which was smashed to pieces.

Gwadûr, 130 miles west of Ormara, is very much like that place, having two large bays formed by a long narrow isthmus of sand, joining on to a high hammerhead-shaped headland 270 feet high.

The town of Gwadûr is of considerable importance owing to the trade which is carried on by native craft to Indian Ports, there being a good caravan track to the Port through the mountains from the Kej Valley, &c. The British India mail-steamers call here once a fortnight, both going up and returning from the Gulf. The land-line telegraph from Karachi to Jask passes through here. The sea-bottom in the bays is hard blue clay, much the same as in the Ormara bays, the few species obtained being common to both places.

Charbar, 110 miles west of Gwadûr, is the first place we have so far spoken of that can be called really good, from the shell-collector's point of view. The village itself is of small importance, containing some few hundred inhabitants, mostly Balochis and Khojas, the chief industry being the manufacture of matting from the pish palm.

Charbar Bay proper is a great bay, $7\frac{1}{2}$ miles wide east and west and 12 miles deep north and south, the depth of water being 8 fms., to 3 or 4 at the head. The nature of the bottom varies considerably: across the mouth of the bay, or between the east and west points, only a few short drags with the dredge have been made, when patches of clear sand alternating with others of soft black mud were met with; both bottoms yield good results, as will be seen from the Catalogue, the species from the different bottoms being quite distinct. This bay is quite well worth carefully working, and no opportunity is missed of putting the dredge over, when going to or leaving Charbar.

The little bay inside the large one, and near which the village is situated, has a clean sandy bottom, and this from a depth of 2 to 5 fathoms has been carefully dredged over, with the result that several new species have been discovered and added to the List. From the sandy shore that has been examined, nothing has been obtained, while the rocky point on the east corner of the bay is rich in some forms, particularly cowries and cones—10 species of the former and 9 of the latter having been found here, the names of which appear in the List. To the south of this point in 7 fathoms one drag was made, but the ground was too foul for the dredge though otherwise good, the single drag resulting in examples of two or more new species. We also dredged to the north-east of the big bay off *Tiz Valley*, which is I believe the only place on the coast that retains its original name, or at least the name it went under when Alexander the Great passed along the Mekran Coast, leading his army inland, the fleet accompanying off the coast. In Tiz Valley itself are the ruins of what at one time must have been a city of considerable size, the graves on the surrounding hills are very numerous: I have dug up many of them hoping to find something in the shape of seals or money that would help to identify the period to which they belonged. Off this valley, in 5 fathoms, I have dredged with no success, the bottom being coarse sand with overfalls or loose boulders and stones. One peculiar thing will be noticed on reference to the List, viz., that several of the species found at Charbar have also been found at Muscat, and nowhere else; and this is the more remarkable as the two places are 150 miles apart, the depth of water between them being in places as great as 1900 fathoms.

Jask, 165 miles west of Charbar, which may be considered the western extreme of the Mekran Coast, or commencement of the Gulf of Oman, has been fairly well exploited for shells, both on the adjacent shores and by dredging, with moderate success. Many of the Charbar species are repeated here, both places being in many respects very similar in character. Charbar has, however, the advantage in the number of species found. On the rocky ledge off Jask Point, which dries at low tide, numbers of *Cypræa arabica* and *C. turdus* are to be found, and two or three common cones such as *C. tæniatus* and *C. minimus*, but very little else except the common rock-creatures which are met with almost everywhere. Between the rocky point and the clean sandy beach forming Jask bay, where is the usual landing-place, the fore-shore is, for about 200 yards, composed of dirty muddy sand, and it is here that many of the creatures mentioned in the List are found, amongst them being several species new. On the clean sandy beach, as at Charbar, nothing has been found. Three miles north of the landing-place is a small salt-water creek, the entrance to which dries at very low tides, when mud-banks of considerable extent are exposed: on these are found numbers of dead bivalves, as is the case at the mouths of all the creeks on the Mekran Coast. At the mouth of the creek at high-water mark the beach, at a little distance, presents a very pretty pink appearance caused by large quantities of dead specimens of *Umbonium vestiarum* Linn. having been washed up there; living specimens can be obtained in any quantity and many varieties, by dredging in 3 to 6 fathoms off the north of the creek. In Jask bay itself, the bottom is a hard muddy sand and hardly worth dredging over, as, with few exceptions, the same species found there can be collected with less trouble at low tides on the small stretch of muddy beach mentioned above. Four miles west of the point is Mason Shoal, a coral patch of small extent: this has been well dredged over and a good many things obtained, none however of any interest. *Conus quercinus* and *C. tessellatus* L., both the orange and brown varieties, are plentiful here. The Government Submarine cables between Karachi and Bushire land here, the Telegraph Staff being accommodated in a large imposing looking stone building. There are also barracks for about 200 Native troops, these, like the Telegraph-building, having been built by the Indian Government. At the present time there are about 40 British Indian soldiers stationed here under a Native Officer, to protect the Telegraph Staff in case of a rising amongst any of the surrounding tribes, which is always more or less imminent. The Native village is small and insignificant, and there is little or no trade, though the British Indian mail-steamers call once a fortnight both on the upward and downward trip to the Gulf.

In concluding the remarks about the Mekran Coast, it may be said that the sea-bottom has not been anywhere dredged over at a greater depth than 100 fathoms, and only in one or two places beyond 50 fathoms, inside which the Government Submarine Telegraph-cable is laid. The bottom is generally a stiff blue clay or mud, with occasional patches of thin black mud, the former yielding a very small return for the most careful dredging; in the soft black mud more specimens are generally obtained.

On the cable itself there is, as a rule, very little shell-growth; when it does occur, it is generally when the line passes near rocky patches or submerged reefs. A few specimens of *Rostellaria curta* Sowb. have been dredged inside the 50-fathoms line, but as dead specimens of this are plentiful all along the coast, is is probable that they would be found in numbers at a greater depth. In some places numbers of young *Murex malabaricus* Sm. have come up adhering to the telegraph-cable, so that adult specimens of this species must be plentiful in the neighbourhood. The only other large species found is *Murex ternispina*, which seems to be common from 3 to 50 fathoms.

(C.) *Gulf of Oman.*

Proceeding west from the Mekran Coast, the next locality to be described is the Gulf of Oman, which may be said to lie within the following limits, namely: on the south and east, a line drawn from Jask to Muscat, and on the north one from Mussandam Id. due east to the Persian coast.

In October last a rough survey was made by the Indian Government Telegraph-steamer 'Patrick Stewart' (Capt. W. A. Tindall), outside the 100-fathoms contour, between Jask and Muscat, including the great bight to the south and west of the direct line between those two places. 184 soundings were taken, the greatest depth attained being 1785 fathoms (mud) in lat. 24° 12′ N., long. 58° 32′ E.

Except on the direct course between Jask and Muscat, no soundings were taken at night, the strong currents experienced in those localities rendering it impossible to obtain correct positions for each sounding when the land was not visible.

The procedure followed was to put down a mark-buoy at dusk, when the last position was taken, and then to anchor the ship close to it with a large deep-sea trawl, and in the early morning draw it over the bottom by steaming ahead or astern for about an hour. In this way a good deal of material was collected, and all the shells have been sent to Mr. Cosmo Melvill, who, as opportunity offers, is working them out.

A fish-trap was each time attached to the moorings of the mark-buoy, and by this means some fish, crabs, &c., were obtained, which have been sent to the British Museum. Mr. Boulenger, F.R.S., has written a short paper on them which will be published in the 'Annals and Magazine of Natural History.'

The following are the positions where the trawl was put down, with the soundings, &c. noted :—

Lat.	25°	22′ N.	Long.	57°	47′ E.	Sounding	225	fms.;	bottom mud.	
,,	25	24	,,	57	27	,,	243	,,	,,	
,,	25	31	,,	57	14	,,	198	,,	,,	& mud-worms
,,	25	12	,,	57	03	,,	500	,,	,,	
,,	24	49	,,	56	56	,,	225	,,	,,	
,,	24	21	,,	57	5	,,	179	,,	,,	& dead shells
,,	24	05	,,	57	35	,,	205	,,	,,	
,,	23	56	,,	58	05	,,	142	,,		

The drag made in 500 fathoms unfortunately was without much result, as the net fouled the frame of the trawl in lowering.

The following temperatures of the sea-bottom were observed :—

53° at 425 fms. 60° at 230 fms. 51° at 500 fms. 62° at 205 fms. 37° at 1495 fms. 45° at 700 fms. Surface temperature 84°.

Muscat (Maskat).—Several days were spent dredging in and near Muscat Cove, in from 5 to 20 fathoms, with very good results. The bottom varies considerably in nature—shingle, coarse sand, fine sand, muddy sand, and weeds, sandy mud, and mud, all being met with on the ground dredged over. It would be difficult to say which particular kind of bottom is the best to dredge on, when, as in this case, all are profitable from a shell-collector's point of view. One of the most beautiful shells in the collection, *Scalaria fimbriolata* Melv., was found here on mud, in the Cove itself.

Kubbatt Ghazira or Malcolm Inlet.—Reference to the Admiralty Chart shows that this is a deep inlet about 3 miles wide at the entrance, and running inland $8\frac{1}{2}$ miles; the surrounding shores are very precipitous except where the few little sandy bays occur. Near some of these are small villages consisting of a few loose stone huts, the inhabitants of which obtain their living by fishing.

The soundings are from 20 to 35 fathoms—a few casts of the dredge have been made here, the bottom being hard sandy mud; the shells obtained were chiefly dead specimens, some of which were in good condition and have proved to be new species.

The Government of India's Submarine cables, from Jask to Bushire, are, in the Gulf of Oman, laid in from 40 to 60 fathoms on a soft muddy bottom, and when picked up in any part for repairs the marine growth on them is usually found to be slight, and to consist chiefly of worm-cases.

(D.) *Persian Gulf.*

Henjam Island.—A large rocky island 5 miles long, north and south, and about 2 miles broad, separated from the great Island of Kishm, on the north, by a deep narrow channel $1\frac{1}{3}$ mile wide. The usual anchorage for vessels is close in, in 5 to 8 fathoms, off the spit of sand on the extreme north of the island. Since the Government cables were removed from here in 1881, steamers very rarely visit the island, the object of the few that do call being to lie in a sheltered anchorage while loading salt, which is brought in small native craft from the salt caves of Kishm, distant about 25 miles. Large native craft also use this anchorage while loading salt. The reefs and sandy beach on the north and west sides of the island have been well searched for shells, but none except the most common species obtained. At and to the north of the anchorage, a little dredging has been done, with moderate success. In the very thin black mud met with in 12 fathoms a mile north of the anchorage, several young living specimens of *Conus elegans* Sow. were obtained: this species has not been found in a living state anywhere else, though dead ones are very common amongst shingle on the Jask beach. To the north-east of the island, in 25 fathoms (mud), and due east in 15 fathoms (sandy mud), a few short drags have been made, but the things obtained were chiefly dead and uninteresting. A few drags have also been made to the west of the island in 6 to 15 fathoms, with no better results.

Jezirat Nabiya Tamb (*or Tumb*).—A small rocky island, steep all round, the soundings being 30 to 50 fathoms to within a quarter of a mile. The coast-line consists of low rocky cliffs alternating with small sandy bays. Dredging has been attempted within half a mile of the shore, with no success, the bottom being rocky and uneven. A heavy iron dredge was lost here owing to the foul bottom. On the sandy beach large quantities of dead shells are washed up, most of which have not been found in a sufficiently good state to put in the cabinet or include in the List.

Linja.—Dredging has been done on several occasions at and near the anchorage here, close in to the boat harbour, in 4 fathoms. The bottom is hard coarse sand, amongst which are many minute species. Further off the shore, in deeper water, the bottom is soft black mud, from which several interesting specimens have been obtained, as will be seen from the List.

Gais (*or Kais*) *Island.*—An oval-shaped island, about 8 miles east and west by 4 north and south, low-lying, and chiefly composed of dead coral and sandstone. Dredging has been done on the north with little or no success, the bottom from 20 to 8 fathoms being hard muddy sand, with loose rocks. On the south side very good results have been obtained, the coarse coral-sand which seems to extend all along the south side of the island, from 15 to 10 fathoms, being particularly rich in many forms, as is also the muddy sand. Stones and living coral are found close in, in 5 to 10 fathoms.

Hindarabi and Shaikh Shuaib Islands.—The former in shape and formation very like Gais, only much smaller, being only 4 miles east and west and 2 north and south. The latter is considerably larger than either Gais or Hindarabi, being about 13 miles east and west and $2\frac{1}{2}$ north and south, though otherwise much the same. Dredging has been done round both these islands, and the bottom found to be similar to that round Gais, the same species being common to all these.

The inhabitants of both Gais and Shaikh Shuaib send a good many boats to the pearl-fishery on the Arabian side of the Gulf. Pearl-diving is also done somewhere close to the island, but the exact spot where the pearl-oysters are to be found appears to be kept secret by the inhabitants. It seems to have been a custom formerly to land quantities of oysters near the villages, when the women opened and examined them for pearls. About 12 years ago I saw them doing this near the village of Laz, on Shaikh Shuaib Island; and two years later landed and examined the heaps of empty shells and refuse, amongst which were great numbers of *Cypræa lentiginosa*, *C. turdus*, and *C. fimbriata*. I have visited the same place on several occasions since, but there did not appear to be any fresh heaps of shells. At Gais Island no opportunity has yet offered of landing to examine the shell-heaps, which are known to be there, as when steaming close past the south side of the island a couple of years ago, with a telescope the women were clearly to be seen at work, opening oysters.

Bushire.—The bottom at the anchorage here is soft mud, a little of which has at different times been sifted and found to contain many minute species of shells, most, if not all, of which have been found at other places in similar kind of mud.

Rishire (*or Reshire*).—This is the place where the Government cables land, and is situated about 8 miles south of the Bushire anchorage; the bottom is the same as at that place, similar species being obtained from it.

Government Cables.—The single cable between *Rishire* and *Fao* is mostly laid in 30 to 20 fathoms, on a soft black-mud bottom, and when picked up for repairs in more than 10 fathoms of water it is invariably found to be thickly coated with shell and weed growth; immense quantities of oysters are found on any part that has been immersed more than 3 or 4 years, the common species being *O. imbricata* Lam. From Rishire to Jask the two cables are in 30 to 50 fathoms, bottom mostly blue mud, the shell and weed growth being considerable in most places where they have been laid any length of time, but only off Mussandam is it as great as on the Fao cable. The original Persian Gulf cable, which was condemned in 1885, was picked up as opportunity offered during the next few years, 200 or 300 miles being recovered after I joined the Department in 1887. Unfortunately I took no interest in shells at that time, for there has never been such a good opportunity for a collector since the old cable was all removed. Two miles an hour is the maximum speed at which the cable is wound in, and when recovering this old cable it often took 6 and 8 men, working as hard as they could, to shovel the shells and weed overboard as it came in. In recovering one length of about 20 knots, hundreds of the very pretty *Latiaxis diadema* Sowb. came in, and I saved some on account of their beauty to give away, and when I commenced to collect for myself I found I still had a couple of specimens. Since that time not a single example has been procured.

There does not seem to be anything more of interest to say about the places where collecting has been done, but any one wishing further information on the Gulf generally, might find all they want in the 'Persian Gulf Pilot,' an Admiralty publication, which can be obtained from J. D. Porter, 11 King Street, Tower Hill, London.

F. W. TOWNSEND.

Mr. B. T. Ffinch, C.I.E., Director General of Indian Telegraphs, Captain W. A. Tindall of the s.s. 'Patrick Stewart,' Mr. Julian Adrian O'Maley, of the same ship, and other friends of Mr. Townsend, have aided him in his researches by all means in their power; and we are requested by him to say that had it not been for the kindness especially of Captain Tindall, ably seconded by all his officers and crew, much would have been left undone, notably the deep soundings and dredgings in the Gulf of Oman.

We would take this opportunity ourselves of thanking Mr. Townsend for all the care and zeal bestowed by him in the collecting and preserving of his collections, it is, indeed, but rarely that they come to hand in such perfect order. And we must also record our indebtedness for advice and assistance to Mr. W. T. Blanford, F.R.S., Mr. Edgar A. Smith, F.Z.S., Mr. Hugh Fulton, Mr. G. B. Sowerby, F.L.S., Mr. Alexander Abercrombie, Commander Shopland, R.I.M., Mr. W. E. Hoyle, F.R.S.E., Mr. W. Neville Sturt, the Rev. Professor Gwatkin, D.D., and Mr. E. R. Sykes, F.Z.S. Nor must we forget Mr. Stephen Pace, who examined with much care the whole of the Columbellidæ, and gave us the benefit of his wide experience in the arrangement of this difficult family, which we have followed implicitly. We are also obliged to Mr. C. Davies Sherborn, F.Z.S., for information on one or two points of nomenclature.

Regarding the *Classification* adopted in this Catalogue, we have relied on the generic sequence proposed by P. Pelseneer in his

'Introduction à l'étude des Mollusques' [1], and likewise referred often to P. Fischer's 'Manuel de Conchyliologie,' 1887. For the characters of the species we have to some extent followed Tryon's 'Manual of Mollusca,' so admirably continued by Dr. H. A. Pilsbry, but we have at all times allowed our own views fair latitude.

Economy of space being imperative we have, excepting in a few isolated instances, omitted all synonymy, but have endeavoured in every case to give the name sanctioned by the laws of priority.

Catalogue of the Species.

CEPHALOPODA.

Order DIBRANCHIATA.

Suborder OCTOPODA.

Fam. Argonautidæ.

Argonauta hians Soland.
P.S. North beach of Henjam Island.

GASTROPODA.

Order PROSOBRANCHIATA.

Suborder i. DIOTOCARDIA.

(*a*) Docoglossa.

Fam. Patellidæ.

Patella (Scutellaria) pica Reeve.
M.C. Not very frequent, but no special locality given.

Helcioniscus testudinarius (L.); Dall, 1871.
Patella testudinaria L. Syst. Nat. x. p. 783.
M.C.

Helcioniscus novem-radiatus Q. & G. (*Patella*).
I. Bombay (*Abercrombie*), as *Patella aster* Reeve.

(*b*) Rhipidoglossa.

Sect. i. **Zygobranchiata.**

Fam. Fissurellidæ.

Glyphis bombayana (Sowb.). (*Fissurella* Lam. in pt.)
I. Bombay (*Abercrombie*).

[1] Mém. Soc. Malacol. Belg. xxvii. (1892) pp. 31–243, and (1894) as a separate publication.

GLYPHIS FUNICULATA (Reeve).

P.G. Bushire.
M.C. Gwadur. Charbar. 3 fathoms, sand.
I. Karachi, mouth of the Indus.

Var. *indusica* Rve.
Var. *dactylon* Rve.

I. Karachi. Both these varieties collected by the late Major Baker.

GLYPHIS JUKESII (Reeve).

Fissurella jukesii Reeve, Conch. Icon. f. 45, 1849.
Fissurella fimbriata Reeve, Conch. Icon. f. 104, 1850.
P.G. Gulf of Oman. Mason Shoals, Jask.
M.C. Ormara Bay.
This is identified without much doubt as identical with a well-known Australian species.

GLYPHIS LIMA (Sowb.).

I. Bombay (*Abercrombie*).

GLYPHIS RÜPPELLII (Sowb.).

M.C.

GLYPHIS SALEBROSA (Reeve).

I. Karachi, particularly near the mouth of R. Indus.

GLYPHIS SUBROSTRATA (Gray).

M.C. The type came from St. Vincent. Identified with a little doubt.

GLYPHIS TENUISTRIATA (Sowb.).

P.G. On the telegraph-cable.

GLYPHIS TOWNSENDI (Melv.)

I. Karachi.
Allied to *G. corbicula* Sowb.

Fam. EMARGINULIDÆ.

EMARGINULA ELONGATA Costa.

I. Bombay (*Abercrombie*).
A Mediterranean and Atlantic species, seemingly very widely distributed.

EMARGINULA RADIATA Gould.

I. Bombay (*Abercrombie*).
An Australian form.

SUBEMARGINULA NOTATA (L.).

Clypidina notata Ad. P. Z. S. 1851, p. 87.
I. Bombay (*Abercrombie*).
The West Indian habitat is probably erroneous.

Rimula propinqua A. Ad.

P.G. (*W. T. Blanford*).

Scutus unguis (L.).

P.G. & M.C. Fairly general.

I. Bombay (*Abercrombie*). On muddy rocks and under stones; extending south to Ratnagiri, Goa, and Panjim (*Lt.-Col. H. D. Olivier*).

Fam. Haliotideæ.

Haliotis rufescens Sowb.

I. Bombay (*Abercrombie*), rare, extending southwards to Ceylon.

Sect ii. **Azygobranchiata.**

Fam. Stomatellidæ.

Stomatella elegans Gray.

I. Karachi. Found under rocks at low tide.

Stomatella imbricata Lam.

I. Karachi.

Stomatella sulcifera Lam.

I. Karachi. Both these last occur in Col. Baker's list.

Stomatia duplicata Sowb.

P.G. Gais (or Kais) Island, 10 fathoms. Gulf of Oman, Maskat, 10–15 fathoms, coral-sand.

M.C. Charbar. Dead shells only, but fine and large.

Stomatia phymotis Helbl.

I. Karachi.

Fam. Cyclostrematidæ.

Cyclostrema carinatum H. Ad.

Hab. P.G. Lat. 26° 44′, long. 52° 30′. On telegraph-cable, 40 fathoms, sand and mud.

Differs from its congeners in greater solidity and incrassate spiral ribs. It is, however, undoubtedly very akin to *C. cinguliferum* A. Ad., from Japan and the Philippines; this latter species, judging from our examples, showing generally less boldness in sculpture.

Cyclostrema cingulatum Dkr.

P.G. Gulf of Oman, lat. 26° 23′ N., long. 54° 55′ E. 25 fathoms, sand.

I. Bombay (*Abercrombie*).

Cyclostrema cinguliferum A. Ad.

I. Karachi.

CYCLOSTREMA EBURNEUM Nevill.

P.G. Bushire, Rishire, Kishen Island.
M.C. Charbar. 7 fathoms, sand and mud.

Assuming our identification to be correct, we fail to appreciate the real distinctness of this species, described by Nevill from the Bay of Bengal, from the original type of the genus, *C. cancellatum*, as founded by the late Captain Marryat [1], Trans. Linn. Soc. 1818, vol. xii. p. 338.

CYCLOSTREMA MICANS A. Ad.

I. Karachi. Bombay (*Abercrombie*), under name *Liotia pulchella* Dkr.

CYCLOSTREMA OCRINIUM [2], sp. n. (Plate XXII. fig. 1.)

C. *testa umbilicata, alba, delicata; anfractibus quatuor, quorum apicalis vitreus, mamillatus, ad apicem ipsum depressus, apud suturas paullum canaliculatis et excavatis, longitudinaliter arctissime et pulcherrime costulatis, costulis angulatis, ad angulos gemmulatis, ultimo anfractu quinque-angulato, simul ac circa regionem umbilicarem fortiter spiraliter angulatim gemmulifero, deinde costulis longitudinalibus in umbilicum ipsum descendentibus; apertura circulari, alba; peristomate extus* 7–8-*crenulato, continuo; margine columellari parum versus umbilicum extenso, nitido, albo.*

Alt. 2, *diam.* 3 *mm.*

Hab. Persian Gulf, lat. 25° 44′ N., long. 52° 30′ E.; on telegraph-cable, at 40 fathoms, mud and sand.

This exquisite and very delicate *Cyclostrema* is slightly comparable with *C. anaglyptum* A. Ad., from Japan, but is smaller, not so conical, and destitute of spiral ribs. The longitudinal riblets are very close and fine, say 26 in number on the basal whorl, five-angled, that surrounding the umbilicus at the base being the strongest and most conspicuous. Regular rows of shining gemmæ on the costulæ at the point of the angular projections take the place of spiral liræ; the interstices are plain, vitreous-white; mouth circular, peristome continuous, outer lip crenulate; columellar margin not reflexed over the umbilicus, which is deep and conspicuous.

CYCLOSTREMA QUADRICARINATUM, sp. n. (Plate XXII. fig. 2.)

C. *testa depressa, straminea, umbilicata, solidula; anfractibus* $3\frac{1}{2}$, *apicali depressulo, vitreo, cæteris longitudinaliter undique arctissime sub lente tenuistriatis, ultimo rapide accrescente, acute quadricarinato; peristomate extus sexangulato, incrassato, continuo; operculo corneo, multispirali.*

Alt. 1, *diam.* 2·25 *mm.*

Hab. Gulf of Oman, lat. 24° 49′ N., long. 55° 56′ E. 225 fathoms, sand and mud.

[1] Captain Francis Marryat, R.N., the famous novelist, only known to have described one other species—*Mitra zonata*, from the Mediterranean.

[2] ὄκρις, a projection.

Highly sculptured, the angle minute, the whorls being $3\frac{1}{2}$, the upper small, the body-whorl larger in proportion, four-keeled, the carinæ acute. With the aid of a lens the surface is seen to be longitudinally extremely shagreened or striate. The peristome is continuous, six-angled externally, aperture round. The operculum is present, horny and multispiral. The nearest ally, *C. tricarinatum* Smith, from W. Africa, we have compared with our species. There is some affinity, but, as its name implies, that species is but three-angled and is likewise radiately lirate.

CYCLOSTREMA SOLARIELLUM Melv.

P.G. Fao. Bushire. Gulf of Oman, lat. 26° 23′ N., long. 54° 55′ E. 25 fathoms, mud; with *C. cingulatum* but much more frequent.

I. Karachi, fine and large. Bombay (*Abercrombie*), only worn examples, from one of which the type was described in 1893.

This species has the aspect of a small *Torinia*, and by some malacologists would perhaps be relegated to that genus. We await examination of the soft parts and operculum before deciding.

CYCLOSTREMA (DARONIA) SUBDISJUNCTUM Ad.

P.G. Gulf of Oman, Maskat. 15 fathoms, muddy sand and loose stones. Always local, the range is wide, extending from the North Arabian Sea, through Ceylon, to the Andaman Isles (*G. H. Booley*).

Fam. LIOTIIDÆ.

LIOTIA CIDARIS Reeve.

I. Angrias Bank (*Capt. W. A. Tindall*).

Fam. TROCHIDÆ.

TROCHUS BICINCTUS Phil.

M.C. Charbar. 3 to 7 fathoms, sand.

We cannot satisfactorily locate this species.

TROCHUS (INFUNDIBULUM) ERYTHRÆUS Brocchi.

Var. *persica* Fisch., J. de Conch. xxxix. p. 226, 1891.

P.G. Linjah. $3\frac{1}{2}$ fathoms. Noted by M. F. Houssay in the Gulf.

M.C. Charbar.

TROCHUS (INFUNDIBULUM) FULTONI Melv.

P.G. At the entrance to the Gulf proper through the Gulf of Oman.

TROCHUS (INFUNDIBULUM) KOTSCHYI Phil.

P.G. Noted as abundant at Bushire by M. Houssay.

TROCHUS (INFUNDIBULUM) RADIATUS Gmel.

P.G., M.C. Common and generally distributed on rocks at low tide. Dredged mostly young.

I. Bombay, abundant (*Abercrombie*), where *T. incrassatus*

Lam. probably also occurs. Also near Goa and Panjim (*Lt.-Col. H. D. Olivier*).

TROCHUS (BELANGERIA) SCABROSUS Phil.

P.G. Gulf of Oman, Maskat. 10 fathoms; coral-sand.
I. Bombay (*Abercrombie*).

CLANCULUS ATROPURPUREUS Gould.

M.C. Very local.

CLANCULUS CEYLANICUS Nevill.

I. Bombay (*Abercrombie*).

CLANCULUS DEPICTUS A. Ad.

I. Karachi (*F. W. T. & J. O. Twells*). On rocks at low tide. Bombay (*Abercrombie*). Near Goa and Panjim (*Lt.-Col. H. D. Olivier*).

There seems close affinity between this species and *Belangeria scabrosa* Phil.

CLANCULUS MICRODON A. Ad.

M.C. Generally found on rocks from low-tide mark to 7 fathoms. This species extends to the Andaman Isles (*Booley*).

CLANCULUS PHARAONIUS L.

M.C.

Its headquarters are Erythræan.

MONODONTA LABIO L.

I. Karachi (*W. C. Carphin*).

MONODONTA VERMICULATA Fisch.

I. Karachi. Abundant on rocks at half-tide. Reported by Pilsbry (Man. Conch. xi. p. 90) from Maskat, but not found there yet by Townsend.

Widely distributed; South and East African.

THALOTIA BELUCHISTANA Melv.

M.C. Charbar. 7 fathoms, rock.

Might almost, with equal reason, be by some considered a *Calliostoma*.

CANTHARIDUS KOTSCHYI Phil.

M.C. Dead examples only.
I. Karachi (*W. C. Carphin*).

GIBBULA DECLIVIS Forsk.

P.G. Gulf of Oman, Maskat. 7 to 10 fathoms; coral-sand and stone bottom.

GIBBULA FANULOIDES Fisch.

P.G. Shaikh Shuaib Island. Gulf of Oman, Maskat. 10 fathoms; coral-sand and stone. Lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

Gibbula pulcherrima A. Ad.

M.C. A superb example.

Forskalia H. & A. Ad. is now entirely submerged in *Gibbula* Risso.

Gibbula (Cantharidella) phædra Melv.

M.C. Charbar Point. 7 fathoms.

Allied to the Ceylonese *G. stoliczkana* G. Nevill.

Gibbula (Enida) townsendi Sowb.

M.C. Generally distributed, and locally abundant.

Monilea astolensis Melv., nom. emend.

M.C. Astola I.

By a clerical error this species was described (Mem. Manch. Soc. vol. xli. No. 7, p. 15) as *astrolabensis* with locality "Astrolabe Island." We submit that the law of priority does not insist on the perpetuation of so evident a "lapsus calami."

Monilea callifera Lam.

Var. *masoni* Nevill.

M.C.

Monilea swainsoni A. Ad.

I. Bombay (*Abercrombie*).

Priotrochus sepulchralis Melv.

P.G. Kais Island. 7–14 fathoms, coral-sand. Gulf of Oman, Maskat, 10 fathoms. The first examples procured were dredged in a semi-fossilized condition; hence the specific name.
I. Karachi.

Minolia biangulosa A. Ad.

P.G. Henjam Island, 15 fathoms.

Minolia climacota Melv.

M.C. Charbar.
I. Karachi.
At 7 fathoms, muddy sand. Many very beautiful varieties occur.

Minolia eudeli Desh.

P.G. Gulf of Oman, Maskat. 15 fathoms.
I. Karachi. Angrias Bank (*Capt. W. A. Tindall*).

Minolia gilvosplendens Melv.

P.G. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

The type was described (Journ. of Conch. vi. p. 407, pl. ii. fig. 8) from the Philippine Islands, based upon specimens formerly in the collection of the late Mr. T. Lombe Taylor.

Minolia gradata Sowb.

P.G. Gulf of Oman, Maskat, Jask. 2 fathoms, mud.
M.C. Charbar.

Minolia nedyma Melv.

P.G. Off anchor, Bunder-Abbas. Gulf of Oman, Jask, 26 fathoms.

M.C. Charbar.

I. Karachi.

Minolia (Conotrochus) holdsworthiana G. & H. Nevill.

Minolia (*Conotrochus*) *holdsworthiana* G. & H. Nevill, Journ. Asiat. Soc. Beng. 1871, p. 3, pl. i. fig. 18.

Minolia variabilis A. Ad. P. Z. S. 1873, p. 207, pl. xxiii. fig. 10.

P.G. Rishire, Gulf of Oman (*W. T. Blanford*), abundantly.

I. Karachi. In mud, 3 to 7 fathoms, rarely.

Calliostoma fragum Phil. (*Zizyphinus* Leach).

P.G. Galig Island. At low tide, alive.

M.C. Off Charbar. On rocks at 7 fathoms.

I. Karachi. Rock and sandy mud at 3 fathoms.

Calliostoma funiculare Melv.

P.G. On cable, lat. 27° N., long. 52° E. Amongst shell-growth, 30–50 fathoms, mud.

Calliostoma laugieri Payr.

P.G. No special locality mentioned. The two examples we have seen are somewhat narrower than the Mediterranean species. It is hoped that more material will be shortly forthcoming.

Calliostoma polychroma A. Ad.

P.G. Hindarabi Island.

Calliostoma scobinatum A. Ad.[1]

I. Bombay, where it is apparently endemic (*Abercrombie*).

Euchelus asper Gmel. (*Aradasia* Gray).

I. Karachi. Found in quantity amongst muddy rocks at low tide. Bombay to Goa (*Lt.-Col. H. D. Olivier*).

Euchelus atratus Gmel.

I. Karachi.

Euchelus clathratus H. Ad.

I. Karachi. Rare.

Euchelus foveolatus A. Ad.

Var. *angulatus* Pease.

M.C. Charbar. 7 fathoms.

I. Angrias Bank (*Capt. W. A. Tindall*).

[1] *C. duricastellum* Melvill, Mem. Manch. Soc. vol. xlii. pt. 2, p. 26, pl. i. fig. 14, described from specimens in F. W. Townsend's collection, was only obtained by Captain Tindall at Batticaloa, Ceylon, far south of our limit.

EUCHELUS HORRIDUS Phil.

M.C. I. Karachi.

EUCHELUS INDICUS A. Ad.

I. Bombay. Abundant (*Abercrombie*). Goa (*Lieut.-Col. H. D. Olivier*).

EUCHELUS PERSICUS v. Mart.

P.G. Bunder-Abbas (*M. F. Houssay*).
I. Karachi (*W. C. Carphin*).
Nearly allied to *E. atratus* Gm.

EUCHELUS PROXIMUS A. Ad.

I. Karachi. At 5 fathoms, hard muddy sand.

EUCHELUS QUADRICARINATUS Chemn.

I. Bombay (*Abercrombie*).

TURCICA (PERRINIA) STELLATA A. Ad.

P.G. Gulf of Oman, Maskat. 15 fathoms, alive.
M.C. Charbar. 7 fathoms, dead examples only.

UMBONIUM VESTIARIUM L. (*Rotella* Lam.).

P.G. Bunder-Abbas (*M. F. Houssay*).
M.C. Abundant.
I. Karachi (*W. C. Carphin*). Bombay (*Abercrombie*), in countless thousands, possessing all the shades of colour, variety, and differentiation in marking. Bassein and Goa (*Lt.-Col. H. D. Olivier*).

Var. *depressa* Ad. (sp.).

I. Karachi. Inseparable specifically from the type.

ETHALIA CARNEOLATA Melv.

P.G. Shaikh Shuaib Is. 10 fathoms, coral-sand. Gulf of Oman, Maskat. 10 fathoms.

ETHALIA MINOLINA Melv.

P.G. Gulf of Oman, Maskat. At 10 fathoms, muddy and coral-sand. Much rarer than *E. carneolata*.

ISANDA CRENELLIFERA A. Ad.

I. Bombay (*Abercrombie*).
For some information about this species and its allies, *cf.* Journ. Linn. Soc., Zool. vol. xxvii. pp. 177, 178.

Fam. TURBINIDÆ.

PHASIANELLA ELACHISTA Melv., nom. nov.

Phasianella minima Melv. P. Malac. Soc. Lond. ii. p. 115, *non* Phil.

P.G. Bushire. Off anchor, Bunder-Abbas.
I. Karachi. Abundant, found amongst muddy stones in shoal-water. Bombay (*Abercrombie*).

The name originally propounded is antedated by *P. minima* Phil., from the Peruvian coast.

PHASIANELLA VARIEGATA Lam.

M.C. Generally, from 3 to 7 fathoms, mud.

Var. *nivosa* Reeve (sp.).

M.C. Charbar. Ormara Bay.
I. Karachi.

Usually found from 3 to 7 fathoms, sand and mud. Young shells abound on dredged algæ.

TURBO CORONATUS Gmel.

I. Karachi. On rocks at half-tide.

Several interesting embryonic examples occurred, all distinctly and prominently angled at the periphery.

TURBO INTERCOSTALIS Menke (= *elegans* Phil.).

I. Karachi, on rocks at low tide. Bombay (*Abercrombie*).

TURBO RADIATUS Gmel.

P.G. On coral-reefs that were uncovered at low tide.
M.C. On rocks at low water.

The form *T. chemnitzianus* Reeve (sp.) occurs at I., Karachi, the three transverse spiny ridges on the body-whorl being characteristic. *T. ticaonicus* Reeve, a species common farther east, has, we think on insufficient data, also been recorded from Karachi.

ASTRALIUM STELLATUM Gmel.

I. Bombay (*Abercrombie*).

LEPTOTHYRA FILIFERA Desh.

M.C. Charbar beach.

LEPTOTHYRA LÆTA Montr.

I. Lat. 18° 58′ N., long. 71° 45′ E.

This may possibly be an undescribed species near the New Caledonian *L. læta*, being more finely striate. It is of a fine uniform pink colour externally.

LEPTOTHYRA PILULA Dunker.

I. Karachi.

Another species may likewise occur, a specimen not quite referable to either of the preceding species having been recently forwarded from the Persian Gulf. This may possibly be identical with *L. yemenensis* Melv., from Aden (Ann. Nat. Hist. ser. 7, vol. i. p. 201, pl. xii. fig. 7).

Fam. Neritidæ.

Nerita albicilla L.

I. Karachi. Upon rocks at half-tide. Bombay (*Abercrombie*); southwards to Goa (*Lt.-Col. H. D. Olivier*).

Nerita chamæleon L.

Var. *arabica* Reeve (sp.).

P.G. Gulf of Oman, Maskat. Upon rocks at half-tide.

Var. *quadricolor* Gmel. (sp.).

I. Bombay.

Nerita longii Récluz.

I. Karachi, at half-tide. Recorded likewise from Bombay, where, however, Mr. A. Abercrombie did not succeed in procuring it.

Nerita oryzarum Récluz.

I. Bombay, very abundant (*Abercrombie*).

Nerita plexa Chemn.

M.C. On rocks at high-water mark, generally distributed; I have also found them above high-water mark, where they could only possibly be reached by spray (*F. W. T.*).

I. Karachi.

Nerita (Pila) chrysostoma Récluz.

I. Karachi, at half-tide.

Nerita (Odontostoma) polita L.

I. Bombay (*Abercrombie*); not reported as yet farther north.

Nerita (Heminerita) anodonta Melv.

I. Karachi (*J. O. Twells* per *G. B. Sowerby*).

Neritina (Dostia) crepidularia Lam.

I. Karachi (var. *depressa*). Bombay (*Abercrombie*; *Olivier*).

Though, properly speaking, an inhabitant of brackish waters, it is so frequently found on the sea-shore, especially at the mouths of rivers, that it is not out of place to include it in a list of Marine Mollusca.

Suborder ii. MONOTOCARDIA.

(*a*) Ptenoglossa.

Fam. Ianthinidæ.

Ianthina fragilis Lam.

I. Bombay (*Abercrombie*).

Ianthina globosa Swains.

P.G. Gulf of Oman, near Maskat, particularly large and fine.

I. This is probably the species undifferentiated by Mr. Abercrombie, as occurring at Bombay with *I. fragilis* Lam. (*communis* Lam.).

Recluzia rollandiana Petit.

I. Bombay (*Abercrombie*). A rare species.

Fam. Scalidæ.

Scala alata Sowb. (*Scalaria* Lam.).

P.G. Galig I., at low tide.
M.C. Charbar.

Scala clementina Grat.

I. Karachi. At 3 to 7 fathoms, amongst loose rocks and sandy mud.

Scala confusa Sm.

M.C. On the borderland towards I., 10 to 25 miles W. of Karachi.

Scala glabrata Hinds.

P.G. Gais (or Kais) Island. 14 fathoms.

Near the better-known *S. maculosa*, Ad. & Rve., from which it differs in the smooth and continuous lamellæ which are never angled nor uncinate below the sutures.

Scala irregularis Sowb.

M.C. Gwadûr. 2 fathoms, hard mud.

Scala laxata Sowb.

P.G. Gais (or Kais) Island. 14 fathoms, amongst broken coral, much rarer than *S. glabrata* which occurred with it.

Scala lineolata Sowb.

M.C. Fairly general.
I. Near Karachi. 5 fathoms, muddy sand.

Scala maculosa Ad. & Rve.

P.G. Gais (or Kais) Island. 14 fathoms, amongst broken coral.

Scala pallasi Sowb.

I. Karachi; no full-grown examples occurring.

Scala pretiosa Lam.

P.G. No special locality given, at 26 fathoms, mud.

M.C. Fairly general, 3 to 7 fathoms, amongst loose rocks and muddy sand. At Ormara, a fine dead specimen found measures $1\frac{3}{4} \times 1$ in.

I. Bombay (*Abercrombie*), rare.

Scala replicata Sowb.

P.G. Lat. 26° 50′ N., long. 52° 50′ E. 29 fathoms, mud.
Off Jask Point. 8 fathoms, mud.

Scala (Clathrus) aculeata Sowb.

I. Karachi. 3 fathoms, muddy stones. Common at Bombay.

Scala (Clathrus) clathrus L.

M.C. Charbar.

Scala (Clathrus) gloriola, sp. n. (Plate XXII. fig. 6.)

S. *testa ovato-fusiformi, imperforata, tenui, delicata, alba ; anfractibus* 9, *quorum apicales duo, læves, subpellucidi, cæteris turritis, apud suturas impressis, longitudinaliter arctissime et tenuissime lamellatis, lamellis papyraceis, fragilibus, undique serrulato-uncigeris, unculis acutis, paullum incurvis, albis, nitidis, circa novem ad undecim apud anfractus ultimis lamellas, lamellis ipsis in eodem anfractu septem et viginti, interstitiis omnium anfractuum spiraliter quadrato-cancellatis ; apertura rotunda, labro extus serrulato, uncinato, planato, incrassato ; peristomate fere continuo.*

Long. 8, *lat.* 3·50 *mm.*

Hab. Gulf of Oman, Maskat. 75 fathoms.

One of the most truly exquisite of the genus, renowned though it already be for forms of surpassing beauty, albeit *S. gloriola* is but of small dimensions. But few of its congeners have their lamellæ so thickly disposed nor with such elaboration of sculpture, the serrulations being regular though extremely fragile and deciduous. The body-whorl possesses 27 lamellæ, and each of these, in turn, from 9 to 11 hooked serrulations. Five minute cancillæ give a quadrate appearance to the narrow interstices when viewed with a good lens. The aperture is round, peristome almost continuous; outer lip flattened, shining, incrassate, beautifully serrulate exteriorly.

S. echinicosta d'Orb., from the West Indies, would appear to be allied, though not very nearly.

Scala (Clathrus) malcolmensis Melv.

P.G. Gulf of Oman: Malcolm Inlet (Kubbatt Ghazira), 24 fathoms.

The winged, expanded lamellæ to some extent resemble those of *S.* (*Opalia*) *dianæ* Hinds, from Amboyna; but notwithstanding this, being more comparable in other particulars with *S.* (*Clathrus*) *muricata* Risso, from the Mediterranean, it is best, at all events provisionally, to place it near this last species.

Scala (Clathrus) ovalis Sowb.

I. Bombay (*Abercrombie*). Identified with but little doubt, but worn examples only found.

Scala (Clathrus) phillippinarum Sowb.

P.G. Gulf of Oman: Jask, dead examples dredged at 7 fathoms.

Scala (Opalia) lamellosa Lam.

Scalaria clathrus L. Syst. Nat. xii. 1769, 1237.

M.C. Charbar, and other localities, not infrequent.

Var. *pseudoscalaris* Brocchi.

I. Karachi. Among seaweed, low-tide mark.

We cannot separate this variety from Brocchi's Mediterranean species.

Scala (Opalia) consors Crosse & Fischer.

I. Bombay (*Abercrombie*).

Some little doubt attaches to this name, the type being Australian, but *S. perplexa* Pease seems identical; this last is merged by Tryon (Man. Conch. ix. p. 74) into a variety of *S. lamellosa* Lam., and it would be perhaps best to treat *S. consors* likewise as subspecific only.

Scala (Amæa) raricostata Lam.

P.G. Gulf of Oman, Maskat. From 10 fathoms, coral-sand. Small, but quite adult, examples.

Scala (Cirsotrema) crassilabrum Sowb.

M.C. Charbar.

Scala (Cirsotrema) fimbriolata Melv.

P.G. Gulf of Oman. Two off Maskat, 10 fathoms, black mud. One of these, constituting the most elegant and refined, perhaps, of all the Mollusca collected by Mr. Townsend, is 52 mm. in length. The whorls are not nearly so ventricose as in *decussata* Kien., and the lamellæ more delicately fringed.

I. Karachi. Small, and not fully grown.

Scala (Cirsotrema) hidryma Melv.

I. Karachi.

Scala (Cirsotrema) kieneri Tapp.-Canefri.

Scalaria (*Cirsotrema*) *decussata* Kien.

I. Angrias Bank (*Capt. W. A. Tindall*).

Scala (Acrilla) acuminata Sowb.

I. Karachi, 15 fathoms, very rare. Bombay (*Abercrombie*), not infrequent, but fragmentary, in shell-sand.

Scala (Acrilla) minor Sowb.

Scalaria (*Acrilla*) *gracilis* A. Ad. non Sowb.

M.C. Charbar, 5 fathoms, mud. In colour of a darker brown than is typical, lamellæ more distant and fewer in number.

I. Karachi, 3 fathoms, among muddy stones.

Scala (Constantia) standeni Melv.

I. Karachi. Also in lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms.

EGLISIA LEPTOMITA Melv. & Sykes.

Turritella leptomita Melv. & Sykes, Proc. Mal. Soc. Lond. vol. ii. p. 171.

P.G. Linjah, $3\frac{1}{2}$ fathoms.

The extremes seem distinct from *E. tricarinata* Ad. & Rve., but the species is evidently, though rare, very widely distributed, and intermediates may, in time, be found to occur.

I. Lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms.

ACLIS ? ATEMELES Melv.

I. Bombay (*Abercrombie*).

It seems doubtful whether this species be rightly relegated to this genus. From the description, it might be nearer allied to *Onoba*. Unfortunately, the type having been accidently broken, the question is not easily cleared up.

ACLIS CALOTROPIS [1], sp. n. (Plate XXII. fig. 3.)

A. *testa minuta, attenuato-fusiformi, gracili, pellucente, tenui, nitida; anfractibus* 10, *quorum duo apicales mamillati, vitrei, simplices, cœteris nitidis, lævibus, spiraliter tornatis, obscure liratis, apud medium conspicue acuticarinatis, ultimo anfractu paullulum producto, versus basim spiraliter lirato; apertura ovata; labro tenui, ad basim angulato; columella recta, producta.*

Long. 3, *lat.* 1 *mm.*

Hab. Gulf of Oman; lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms.

A very delicate species, vitreous, 10-whorled, delicately spirally lirate; the liræ distant, few, and conspicuously once acutely keeled at the centre of each whorl; the last whorl is slightly prolonged; mouth ovate, lip thin; columella produced, causing a slight angular projection at the base of the lip.

ACLIS ENILDA, sp. n. (Plate XXII. fig. 4.)

A. *testa pergracili, delicata, subvitrea; anfractibus* 12, *quorum apicales tres, læves, vitrei, cœteris ventricosis, apud suturas multum impressis, nitidis, undique spiraliter arcte et regulariter liratis, liris filosis, albidis, pellucentibus; apertura rotunda; labro effuso, tenui; columella fere recta.*

Long. 8, *lat.* 2 *mm.*

Hab. Gulf of Oman, Maskat. 15 fathoms.

A peculiarly refined and exquisite shell, allied in form to *A. loveniana* A. Ad. from Japan, but abundantly distinct. It is not unlike a small *Turritella*, being twelve-whorled, including three apical smooth and vitreous, the remaining nine being ventricose, much impressed at the sutures, uniformly closely spirally lirate, the liræ threaded, subpellucid; mouth rounded, outer lip thin, effuse; columella almost straight.

[1] *καλότροπις*, with beautiful keel.

ACLIS EOA Melv.

I. Bombay (*Abercrombie*).
Has likewise occurred at Madras, *vide* J. of Conch. ix. p. 75.

(*b*) TÆNIOGLOSSA.

Sect. i. **Platypoda.**

Fam. NATICIDÆ.

NATICA ALA PAPILIONIS Ch. (=*N. tæniata* Menke).

P.G. Henjam Island. Gulf of Oman: Maskat, 15 fathoms. Jask, 3–5 fathoms.
M.C. East of Jask, not infrequent.

NATICA ANTONI Phil.

P.G. Shaikh Shuaib I. 5 fathoms.
M.C. Between Gwadûr and Charbar (*Mr. J. O. Twells*).

NATICA BURIASENSIS Récluz.

P.G. Bahrein I.

NATICA DILLWYNI Payr.

P.G. Gulf of Oman: Jask beach, at very low tides only.

NATICA EUZONA Phil.

P.G. Very rarely, on telegraph-cable.
Tryon (Man. Conch. viii. p. 22) considers this a variety of *picta* Récluz.

NATICA LINEATA Lam.

I. Karachi. Bombay (*Abercrombie*); extending southwards (*Lt.-Col. H. D. Olivier*).

NATICA MACULOSA Lam.

I. Bombay (*Abercrombie*; *Olivier*). Karachi; 3-7 fathoms, muddy sand.

NATICA PONSONBYI Melv.

P.G. Linjah, 3½ fathoms. Maskat, 15 fathoms.
I. Karachi.
Dredged also by Captain Tindall off Ceylon, near Batticaloa.

NATICA PULICARIS Phil.

M.G. Generally 3–7 fathoms, sandy mud.
I. Karachi; adult specimens of a smaller variety. Bombay (*Abercrombie*).

NATICA QUEKETTI Sowb.

P.G. Henjam Island. I. Karachi.
The type is South African.

NATICA RUFA Born.

I. Karachi. Bombay (*Abercrombie*).

NATICA STRONGYLA Melv.

P.G. Shaikh Shuaib I. Kais (or Gais) Island. Hindarabi I. Usually about 7–10 fathoms, on coral-sand bottom. Extends to the Andamans (*Booley*).

NATICA TRAILLII Reeve.

P.G. Gulf of Oman: Maskat, 15 fathoms. I. Karachi.

NATICA (EUNATICA) TRANQUILLA, sp. n. (Plate XXII. fig. 5.)

N. *testa globosa, nitida, solidiuscula, apud umbilicum albo-callosa, umbilico angusto, profunde perforato; anfractibus, apicali incluso, sex, perlævibus, ventricosulis, apud suturas paullulum excavatis, pallide albo-cinereis, obscurissime castaneo-vittatis vel fasciatis, ultimo anfractu rapide accrescente, omnino lævi, fascia centrali castanea circa regionem umbilicarem pulchre et regulariter sagittifera; apertura ovata, castaneo-tincta; labro, præcipue circa columellam, albo-calloso, nitido; operculo albo, nitido, centraliter lævissimo, fortiter marginato, nucleo centrali.*

Alt. 11, *diam.* 13 *mm.*

Hab. Gulf of Oman, Maskat. 10 fathoms.

This *Natica* differs from all forms of the protean and widely distributed *N. marochiensis* Gmel., with which Tryon (Man. Conch. vol. viii. p. 22) has merged nearly thirty so-called species, in its perfectly smooth surface at the sutures, nor trace of any plications being visible. Likewise the operculum is peculiar; the strong marginal ridge not being present in *marochiensis*, which is completely smooth throughout. We may add, that we consider the operculum an important factor in the differentiation of, at all events, the typical section of this difficult genus, so many species of which are very nearly allied.

NATICA (NEVERITA) DIDYMA Bolten (*N. ampla* Phil.).

M.C. Generally distributed.

I. Karachi. Bombay (*Abercrombie*), and southwards (*Lt.-Col. H. D. Olivier*).

Usually found from low tide to 3 fathoms, mud and hard sand.

NATICA (MAMMA) ALBUMEN L.

I. Lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms. A semi-pellucid variety.

NATICA (MAMMA) CUMINGIANA Récluz.

P.G. Henjam Island. 10 fathoms, sandy mud.

Mr. Townsend notes as a curious fact that his single specimen, though alive when dredged, was destitute of an operculum.

Tryon unites this with *N. powisiana* Récluz.

NATICA (MAMMA) MAMILLA L.

P.G. Gulf of Oman, Maskat.

M.C. Occurs generally from low-tide mark to 10 fathoms, on muddy sand.

The above localities include records for *N. pyriformis* Récluz, which seems hardly even a variety.

I. Bassein. Bombay; common southwards (*Lt.-Col. H. D. Olivier*).

NATICA (MAMILLA) MELANOSTOMA Gmel.

Var. *fibrosa* Souleyet.

P.G. Gulf of Oman, Maskat. 24 fathoms, mud.

Var. *zanzibarica* Récluz.

M.C. No special locality mentioned.
I. Bombay (*Abercrombie*).

SIGARETUS CUVIERIANUS Récluz.

I. Bombay (*Abercrombie*).

SIGARETUS NERITOIDEUS L.

I. Karachi.

SIGARETUS PLANULATUS Récluz.

I. Bombay (*Abercrombie*).

SIGARETUS (EUNATICINA) FIBULA Rve.

I. Bombay (*Abercrombie*).

SIGARETUS (EUNATICINA) PAPILLA Gmel.

P.G. Gulf of Oman, Jask.
M.C. East of Jask to Charbar.
I. Karachi. Bombay (*Abercrombie*).

SIGARETUS (EUNATICINA) PELLUCIDUS Rve.

P.G. Kais Island. 14 fathoms, among broken shells and coral, sand.

SIGARETUS (EUNATICINA) POMATIELLA Melv.

Naticina pomatiella Melv. Mem. Manch. Soc. vii. p. 62.

P.G. Linjah, $3\frac{1}{2}$ fathoms.
I. Bombay (*Abercrombie*).
Was dredged off Ceylonese coast (*Capt. W. A. Tindall*).

Fam. TRICHOTROPIDÆ.

TRICHOTROPIS TOWNSENDI, sp. n. (Plate XXII. fig. 7.)

T. *testa parva, imperforata, alba, epidermide fuscata contecta, triplici setarum serie spirali prædita; anfractibus* $4\frac{1}{2}$, *quorum apicales* $1\frac{1}{2}$ *nitidi, candidi, perlæves, depressi, cæteris arcte decussato-cancellatis et alveatis, interstitiis quadratulis, ultimo anfractu usque ad basim alveato, cæteros magnopere superante; apertura subquadrata, alba, tenui, ad basim breviter rostrato, truncatulo.*

Alt. 5, *diam.* 3·25, *sp. maj.*

Hab. P.G. Gulf of Oman, lat. 24° 5′ N., long. 57° 35′ E., at 205 fathoms, mud; and lat. 25° 31′ N., long. 57° 14′ E., at 198 fathoms, mud. Also lat. 25° 14′ N., long. 59° 45′ E., 80 fathoms.

It is very interesting to announce the discovery of an Arctic genus in Indian waters. Though, as seen by the dimensions just given, it is a small species, *T. townsendi* is one of the most remarkable of the many forms discovered by him whose name it aptly now bears. It is four-and-a-half whorled, the apex being flattened and much depressed. Of the ten or twelve examples we have examined, two only possess the epidermis; this is dark fuscous, covering the whole surface, and emitting a bristle at regular intervals on the three spiral ribs, viz. at the point of junction with the cancellations. The shell, when decorticated, is milky-white, the surface to the base of the last whorl being entirely cancellate, the interstices deeply alveate. Mouth somewhat square, outer lip effuse; columella straightened down to the short truncated rostrum.

The genus is almost wholly Arctic or North Boreal, occurring in Europe (*T. borealis* Brod. & Sowb.), this species also having a wide range in the far North, where *T. coronata* Gould, *T. kröyeri* Phil., *T. insignis* Midd., and the conspicuous *T. bicarinata* Brod. & Sowb., occur, though most of these are local, and restricted in their habitats. *T. clathrata* A. Ad., comes from New Zealand, and several N. Japan species have been described, the only ones from absolutely tropical waters being *T. migrans* Dall, from Cuba, while Mr. Brazier has also described two from N. Australia, *T. tricarinata* and *T. gracilenta*. These last we have not seen.

LIPPISTES GRAYI A. Ad. (*Separatista*, Gray).

M.C. Charbar. Rarely amongst shingle.

LIPPISTES HELICOIDES Mtft.

Separatista chemnitzii A. Ad.

I. Karachi, dredged in fine condition.

The position of this genus is not yet quite fixed, but it seems to have a certain amount of affinity with the *Trichotropidæ*.

Fam. VANIKORIDÆ.

VANIKORO CANCELLATA Lam.

P.G. Hindarabi I. Linjah, 3½ fathoms.
I. Karachi.

VANIKORO CLATHRATA Récluz.

Var. *granulosa* Récluz (sp.).

P.G. Hindarabi Island.

Perhaps only a variety of *V. cancellata* Lam., as we have seen intermediate forms.

Var. *cumingiana* Récluz (sp.).

P.G. Jask, on borders of Mekran Coast.

Fam. XENOPHORIDÆ.

XENOPHORA CORRUGATA Reeve.

P.G. M.C. Sparingly but generally distributed at about 7 fathoms, mud and stones.

XENOPHORA (ONUSTUS) SOLARIS L.

P.G. M.C., off Cape Monze, in mud, living.

Fam. CAPULIDÆ.

CRUCIBULUM SCUTELLATUM Gray.

Var. *pectinatum* Carp. (sp.).

P.G. Gulf of Oman: Maskat, mud, adhering to shells.

Var. *violaceum* Carp. (sp.).

I. Bombay (*Abercrombie*).

Var. *verrucosum* Reeve (sp.).

M.C. Charbar, adhering to the apex of *Conus flavidus*.

CALYPTRÆA EDGARIANA Melv.

P.G. Adhering to shells on telegraph-cable, October 1894.
The type comes from Aden (*Shopland*), described Ann. N. H. ser. 7, vol. i. p. 201.

CALYPTRÆA PELLUCIDA Reeve.

I. Bombay (*Abercrombie*). Very near *sinensis* L.

CREPIDULA (SIPHOPATELLA) WALSHI Herm.

I. Bombay (*Abercrombie*), abundant.

CALYPTRÆA (TROCHITA) SPINIFERA Gray.

I. Karachi. 3 fathoms, among stones.

CAPULUS LISSUS E. Sm.

M.C. Adhering to telegraph-cable, 55 fathoms, mud. Lat. 25° 58′ N., long. 57° 08′ E.

CAPULUS VIOLACEUS Angas.

M.C. Charbar. Dead specimens only, collected amongst shingle.

AMATHINA TRICOSTATA Gmel.

I. Karachi (*Col. Baker*).
As explained in Man. Conch. viii. p. 133, this is not the *Patella tricarinata* L.

Fam. HIPPONYCIDÆ.

MITRULARIA EQUESTRIS L.

P.G. On cable, dead.

Var. *layardi* Reeve (sp.).

M.C. Ormara Bay. I. Karachi.

Fam. SOLARIIDÆ.

SOLARIUM LÆVIGATUM Lam.

P.G. No special locality given.
M.C. Charbar. I. Karachi.
Generally found at from 3 to 7 fathoms, amongst loose rocks and muddy sand.

SOLARIUM PERSPECTIVUM L.

P.G. Henjam I. 15 fathoms, mud. Remarkably fine.

M.C. Near Charbar. At 5 to 10 fathoms, amongst loose rocks and muddy sand.

SOLARIUM REGIUM Hanley.

I. A fine single specimen only, dredged at 4 fathoms, Karachi, amongst loose rocks.

SOLARIUM (TORINIA) CÆLATUM Hinds.

P.G. Henjam Island. 10 fathoms, sand.

SOLARIUM (TORINIA) CYLINDRACEUM Chemn.

M.C. Charbar. *T. chemnitzii* Kien., from the Layard Coll. in Brit. Mus., is identical.

SOLARIUM (TORINIA) DORSUOSUM Hinds.

P.G. Shaikh Shuaib I.

M.C. Charbar. I. Karachi.

Found generally from low-tide mark to 7 fathoms, amongst muddy rocks and sand.

SOLARIUM (TORINIA) DELECTABILE Melv.

I. Karachi. Dredged at 7 fathoms, several examples. The type from Bombay (*Abercrombie*).

SOLARIUM (TORINIA) HOMALAXIS Melv.

P.G. Gulf of Oman, lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms. Very young examples are smooth, semi-nacreous, thin, ammonitiform, with large globular protoconch, the sculpture commences on the third whorl only.

I. Karachi. Bombay (*Abercrombie*), found at low tide among muddy rocks. Lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

Until specimens quite full-grown are obtained, this must necessarily be considered a somewhat doubtful species; the white colour seems fairly constant and characteristic, its nearest ally being *S. dorsuosum* Hinds.

SOLARIUM (TORINIA) PERSPECTIVIUNCULUM Dillw.

P.G. Shaikh Shuaib Island. Perhaps only a variety of the next.

SOLARIUM (TORINIA) VARIEGATUM Gmel.

P.G. Kais Island.

M.C. Charbar. I. Karachi.

Found usually from 3 to 7 fathoms, among sand and stones.

Fam. LITTORINIDÆ.

LITTORINA VENTRICOSA Phil.

I. Bombay (*Abercrombie, W. T. Blanford*), abundant.

LITTORINA (MELARAPHE) SCABRA L.

Var. *carinifera* Menke (sp.).
Var. *intermedia* Phil. (sp.).
Var. *newcombi* Reeve.
Var. *punctata* Phil.
Var. *pyramidalis* G. Nevill.

I. Karachi. Bombay (G. Nevill, var. *punctata*; Rev. S. B. Fairbank, W. T. Blanford, var. *intermedia*; S. B. F., W. T. B., var. *carinifera* and var. *pyramidalis*).

Intermedia seems the most abundant form.

LITTORINA (MELARAPHE) UNDULATA Gray.

I. Karachi.

TECTARIUS ARMATUS Issel.

P.G. Henjam I.
M.C. Gwadûr (*W. T. Blanford* in *G. Nevill*).

TECTARIUS NODULOSUS Gmel.

P.G. Gulf of Oman, Jask. Rocks at high-water mark.
I. Bombay. Abundant (*Abercrombie*) (and, under name *T. trochoides* Gray, *F. Stoliczka*, *G. Nevill*, *W. T. Blanford*).

TECTARIUS GRANULARIS Gray (= *millegranus* Phil.).

P.G. Maskat (*W. T. Blanford*). Gulf of Oman, Jask, with the preceding.

LACUNA TENUISTRIATA Melv.

P.G. Maskat, 7 fathoms.

RISELLA (PEASIELLA) ISSELI Semper.

P.G. Gulf of Oman, Maskat (*W. T. Blanford*).

Fam. FOSSARIDÆ.

FOSSARUS BICARINATUS A. Ad. (*Fossar* Adanson).

I. Karachi.

FOSSARUS FENESTRATUS A. Ad.

P.G. Kais (or Gais) Island. 7 fathoms, coral-sand. Not perhaps quite typical.
I. Bombay (*Abercrombie*).

FOSSARUS SULCATUS S. Wood.

Fossarus tornatilis Gould.
Fossarus stoliczkanus Nevill.

I. Bombay (*Abercrombie*, *Rev. S. B. Fairbank*).
All these probably forms of one variable species.

FOSSARUS TROCHLEARIS A. Ad.

I. Bombay (*Stoliczka*, *W. T. Blanford*, *G. Nevill*, *J. Wood-Mason*, *A. Abercrombie*).

Fossarus (Couthouyia) appressus G. Nevill.
P.G. Larah. Tumb I. (*W. T. Blanford*).

Fossarus (Couthouyia) reticulatus A. Ad.
Var. *delicatula* G. Nevill.
I. Bombay (*Rev. S. B. Fairbank*).

Fossarus (Couthouyia) solutus G. Nevill.
M.C. Gwadûr (*W. T. Blanford*).

Fossarus (Couthouyia) styliferinus G. Nevill.
I. Bombay.

Fossarus (Couthouyia) subreticulatus G. Nevill.
P.G. Tumb I. (*W. T. Blanford*).
M.C. Gwadûr (*W. T. B.*).
I. Bombay (*Rev. S. B. Fairbank*).

Fossarus (Conradia) adamsiana G. Nevill.
P.G. Gulf of Oman (*W. T. Blanford*).

Fossarus (Conradia) doliaris A. Ad.
Var. *minor* G. Nevill.
P.G. Tumb I. (*W. T. Blanford*).
I. Bombay (*Rev. S. B. Fairbank*; also *A. Abercrombie*).

Fam. Rissoidæ.

Rissoa (Apicularia) charope, sp. n. (Plate XXII. fig. 8.)

R. *testa vix rimata, rotundo-ovata, candida, nitida, calcarea; anfractibus* 5, *quorum apicales duo læves, albi, cæteris gradatis, multum apud suturas impressis, undique acuticostatis, costis fere rectis, infra, juxta suturas noduliferis, nitidis, ad ultimum circa sedecim, ad basim continuis, sed obscuris, inde fortiter spiraliter sulculosis; apertura rotunda, labro tenui; columella tenui, simplice.*

Long. 1·75, *lat.* 1 *mm.*

Hab. Gulf of Oman, lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms.

Similar to the *R. xanthias* and *R. pyrrhias* Watson, dredged off Culebra I., W. Indies, during the 'Challenger' Expedition. Our species is, however, a little smaller than either, and possesses more ribs, which are sharp and more angled at the upper part, the granuled spiral row of shining nodules being conspicuous.

Rissoa (Apicularia) versoverana Melv.

I. Karachi. Amongst muddy rocks at low tide, common Bombay (*Abercrombie*). One of the most characteristic of the smaller mollusks of that locality.

Rissoa (Manzonia) petronella, sp. n. (Plate XXII. fig. 9.)

R. *testa minutissima, pagodæformi, solidula, alba; anfractibus 5–6, quorum apicalis crassus, albo-vitreus, mamillatus, cæteris crassicostatis, apud suturas multum impressis, costis nodulosis, prominulis, albis, interstitiis planatis; apertura circulari, peristomate incrassato, continuo.*

Long. 2, *lat.* 1 *mm.*

Hab. Karachi.

A very minute, elegant, white pagoda-shaped species, with angled nodulous ribs, sutures much impressed, peristome thickened, continuous, mouth circular. We have provisionally located it in the subgenus or section *Manzonia* Brus., of which the European *R. costata* Ads. is the type.

Rissoa (Onoba) delicata Phil.

P.G. Bushire.

I. Karachi; also reported from Bombay (*Rev. S. D. Fairbank*), not collected by Abercrombie.

Rissoa (Onoba) egregia A. Ad.

P.G. Kishm Island. 5 fathoms, mud.

Very beautiful, the whorls delicately longitudinally multiplicate.

Rissoa (Alvania) alveata, sp. n. (Plate XXII. fig. 10.)

R. *testa ovato-oblonga, solida, albo-calcarea; anfractibus quinque, apicalibus duobus lævibus, subpellucidis, inclusis, cæteris tribus angulatim prominulis, apud suturas impressis, spiraliter fortiter bi- in ultimis quinquecostatis, undique alveolatis et decussatis, interstitiis quadratis, profundis; apertura rotunda; labro crasso, albo, extus crenulato; columella incrassata, peristomate continuo.*

Long. 3, *lat.* 1·25 *mm.*

Hab. Angrias Bank, W.S.W. of Bombay (*Capt. Tindall*). Also recorded from Quilon, further south, on the Malabar Coast.

A stout, incrassate *Alvania*, the upper two (or sometimes three) whorls simple and smoothish, the remainder ruggedly angled, uniformly cancellate, the interstices being deep and square; outer lip very thickened. Of the same character as the W. Indian *A. didyma* Watson, or the Australian *A. australis* Sowb.

Rissoa (Alvania) interfossa Nevill.

I. Indian Coast (*G. Nevill*).

Rissoa (Alvania) mahimensis Melv.

I. Bombay (*Abercrombie*).

In G. Nevill's 'Hand-list of the Mollusca of the Indian Museum, Calcutta,' p. 112, an *Alvania* sp. is marked with a var. *b. robusta* Nevill, from Bombay, an unique instance, perhaps, of the name of a variety being gazetted before that of its type-form. The nearest ally of this species is *R. interfossa* Nevill.

RISSOINA AMBIGUA Gould.

I. Bombay. Old record.

Reported from both Aden and Ceylon. There are no typical specimens in the Indian Museum, Calcutta, from our area (*cf.* G. Nevill, Hand-list of Mollusca, Calcutta, 1885, p. 73.) Of the var. *perpusilla* Nevill, examples occur from P.G. Henjam I., and I. Bombay, collected by Mr. W. T. Blanford.

RISSOINA MICANS A. Ad.

P.G. Tumb I., Kishm I., and Mutef (*W. T. Blanford* in G. Nevill, Hand-list). Gulf of Oman, lat. 26° 23′ N., long. 56° 53′ E.; also lat. 24° 44′ N., long. 55° 56′ E. 205 fathoms.

Var. *perstriatula* Nevill.

P.G. Tumb I. (*W. T. Blanford*, l. c.).

RISSOINA SCEPTRUM-REGIS, sp. n. (Plate XXII. fig. 11.)

R. *testa subperforata, pergracili, nitida, solida, albescente; anfractibus* $12\frac{1}{2}$, *quorum* $3\frac{1}{2}$ *apicales, mamillati, parvi, vitrei, cæteris nitentibus, lævissimis, longitudinaliter recticostatis, costis lævibus, ad suturas impressis, tumidulis, ultimo anfractu infra medium costis evanidis, deinde ad basim spiraliter sex vel septem lirato; apertura rotundo-ovata; labro incrassato, ad basim paullum effuso; columella simplice, nitida.*

Long. 9·50, *lat.* 2 *mm.*

Hab. Gulf of Oman, lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms.

One of the most interesting of the abyssal species dredged at over the 100-fathoms line. It is quite unlike any Rissoid known to us, and there is nothing approaching it in the National Collection, or depicted in any monograph of the family. From the figure of *R. nevillana* Weink., from Hongkong, a rapprochement is, we fancy, discernible, and for the present, at all events, would place it among the *Eurissoinæ*, near that species.

It is a solid, shining, smooth, hardly perforate, attenuately slender, whitish cinereous shell, with very faint, almost imperceptible ochreous tinge below the sutures; the $3\frac{1}{2}$ apical whorls are small, shining, vitreous, the next rapidly increasing proportionately in size, and then with but gradual increase to the body-whorl. All these whorls are longitudinally smoothly costate, the 10 ribs of the body-whorl vanishing below the middle, which is thence to the base six or seven times spirally lirate. The mouth is oval; outer lip thickened, only slightly effuse towards the base; columella simple, white.

RISSOINA (RISSOLINA) DISTANS Anton (=*canaliculata* Schw.).

I. Bombay (*Abercrombie*).

RISSOINA (RISSOLINA) PACHYSTOMA Melv.

P.G. Bushire.

I. Karachi. Bombay (*Abercrombie*).

The few ribs, eight on the body-whorl, and smooth interstices between the ribs, the outer lip being extremely incrassate, may serve to distinguish this species. It has only occurred in small quantity.

RISSOINA (RISSOLINA) PLICATULA Gould.

P.G. Kishm I. (*W. T. Blanford*).
I. Bombay. Old record.

RISSOINA (RISSOLINA) PLICATA Ad.

Var. *bertheloti* Aud.
Var. *scalarina* A. Ad.

P.G. Kharg (*W. T. Blanford*). Kishm I. (var. *bertheloti*: *W. T. B.*).
I. Karachi. Common.

RISSOINA (RISSOLINA) PSEUDO-SCALARIS, sp. n. (Plate XXII. fig. 13.)

R. *testa minuta, fusiformi, solida, nitida, lævi, albida; anfractibus octo, quorum apicales* $3\frac{1}{2}$ *attenuati, apice ipso brunneo, omnibus vitreis, cæteris albo-calcareis, longitudinaliter paucicostatis, costis lamellarum instar, ultimo in anfractu circa undecim, prope ante basim evanidis, basi sub lente minutissime spiraliter striata; apertura rotunda; peristomate scalariformi incrassato continuo, sub lente striatulo; columella obliqua.*

Long. 3, *lat.* 1 *mm.*

Hab. Gulf of Oman, lat. 24° 25′ N., long. 57° 59′ E. 37 fathoms.

A very minute scalaroid species, solid, shining, with regular straight lamelliform ribs; the protoconch extends to three and a half whorls, is vitreous and smooth, and very attenuate; aperture round; the very delicately striate peristome thickened, continuous. Allied, but not very nearly, to *P. gradata* d'Orb., a West Indian species.

RISSOINA (RISSOLINA) RISSOI Aud.

I. Karachi.

RISSOINA (RISSOLINA) SUBFUNICULATA G. Nevill.

P.G. Kishm I. (*W. T. Blanford*).
M.C. Gwadûr (*W. T. Blanford*).

RISSOINA (PHOSINELLA) CLATHRATA Ad.

P.G. Linjah Anchorage, 5 fathoms. Kishm I. (*W. T. Blanford*).
M.C. Gwadûr (*W. T. B.*).
I. Karachi. Bombay (*Abercrombie*).

RISSOINA (PHOSINELLA) PASCHALIS, sp. n. (Plate XXII. fig. 12.)

R. *testa oblonga, delicata, candida, paullum nitente; anfractibus probabiliter 7–8, apicalibus . . . . ?, cæteris gradatulis, ad suturas impressis, omnino arctissime et pulcherrime sub lente cancellatis,* *striis spiralibus ultimum ad anfractum circa* 15; *apertura ovata, albescente; peristomate percrasso, nitido.*

Long. 4, *lat.* 1·50 *mm.*

Hab. Karachi, 7 fathoms.

A beautiful little *Rissoina*, mainly distinguished by its most delicate cancellations, its pure white surface, and its roundly-thickened, but translucent white peristome.

Rissoina (Phosinella) seguenziana Issel.

P.G. Kharg. Tumb I. (*W. T. Blanford*).
I. Bombay (*Abercrombie*, *W. T. B.*).

Rissoina (Schwartziella) mainwaringiana G. Nevill.

P.G. (*Col. G. B. Mainwaring*).

Rissoina (Schwartziella) triticea Pease.

Var. *microstoma* Nevill.

P.G. Gulf of Oman (*W. T. Blanford*).

Rissoina (Zebina) applanata Melv.

I. Karachi. Bombay (*Abercrombie*).

Rissoina (Zebina) oryza Garrett (=*R. stoppani* Issel).

P.G. Tumb I. (*W. T. Blanford*).

Rissoina (Stossichia) abnormis G. Nevill.

I. Bombay (*W. T. Blanford* and *J. Wood-Mason*).

A Ceylonese species, not apparently trending very far northward. It must be very uncommon at Bombay, as it does not appear in any recent collections.

Rissoina (Pyramidelloides) miranda A. Ad.

Var. *bellardi* Issel.

P.G. Gulf of Oman, Jask (*W. T. Blanford*, *Col. Mainwaring*).
I. Karachi. Rare at low tide among rocks.

Var. *insolita* Desh.

I. Bombay (*Rev. S. B. Fairbank*; *A. Abercrombie*).

Irawadia trochlearis Gould.

P.G. Bushire. Gulf of Oman, common in most hauls of the dredge.
M.C. Charbar Point, Gwadûr. Ormara. Astola I.
I. Karachi. Bombay (*F. Stolickza*, *W. T. Blanford*, *A. Abercrombie*).

Found mostly at muddy rocks at low tide. Often associated with it is the *Oscilla indica* Melv., so like it as to suggest a possible protective resemblance.

Fairbankia bombayana W. T. Blanf.

I. Bombay Harbour (*Rev. S. B. Fairbank*, *W. T. B.*, and *A. Abercrombie*).

FENELLA CERITHINA Phil.

P.G. Bushire. Gulf of Oman, lat. 26° 23′ N., long. 54° 58′ E.; also Tawila Bay (*W. T. Blanford* in G. Nevill).

I. Karachi. Mostly found amongst rocks and algæ at low tide. Bombay (*Abercrombie*).

Var. *scabra* A. Ad. (sp.).

P.G. Gulf of Oman, Maskat. 15 fathoms.

I. Bombay (*W. T. B.*, *G. Nevill*).

FENELLA PUPOIDES A. Ad.

P.G. Bushire.

A variety from the Japanese type, being calcareous, and with only a slight indication of the brown median band.

Var. *fusco-apicata* G. Nevill (an sp. propr. ?).

I. Bombay (*W. T. Blanford*).

FENELLA RETICULATA A. Ad. (*Dunkeria* Ad.).

P.G. Henjam I. (*W. T. Blanford*).

FENELLA TANYSPIRA[1], sp. n. (Plate XXII. fig. 14.)

F. *testa parva, perlonga, attenuata, castanea; anfractibus* 11, *quorum apicales tres, læves, albati, cæteris castaneis unicoloribus, apud suturas multum impressis, ventricosis, longitudinaliter arcte recticostatis, spiraliter tri-, ultimo anfractu quadriliratis, interstitiis alveatis, liris ad costarum juncturas gemmulatis, costis in ultimo evanidis; apertura ovata; peristomate fere continuo, tenui, castaneo; columella obliqua.*

Long. 4·25, *lat.* 1·25 *mm.*

Hab. Karachi.

The great length of the spire will serve to distinguish this from others of this obscure genus: so obscure indeed that Mr. Geoffrey Nevill in his 'Hand-list,' p. 113 *sqq.*, enumerates, out of a total of 26 species, no less than 15 as n. sp. or n. sp.? unnamed. *F. tanyspira* will probably be one of these.

FENELLA VIRGATA Phil. (*Dialæ* sp.).

P.G. Bunder Abbas, off anchor.

M.C. Charbar Point, and elsewhere on the Persian coast.

I. Karachi, very abundant. Found mostly amongst algæ at low tide. The varices are very conspicuous in the Indian specimens.

SCALIOLA ARENOSA A. Ad.

I. Bombay. Probably common (*W. T. Blanford*); also at Manora Point, Karachi.

SCALIOLA ELATA Semper.

P.G. Rishire. Linjah. $3\frac{1}{2}$ fathoms, with *Dialæ*, *Fenellæ*, &c. in much profusion, and appearing to be a small variety.

[1] τάναος and σπεῖρα, with long spire.

A small *ochraceous Scaliola*, much agglutinated, likewise occurs with the other species; it may be only a variety, but has a distinct appearance.

Fam. Litiopidæ.

Litiopa ventrosa A. Ad.

P.G. Gulf of Oman.

M.C. Gwadûr (*W. T. Blanford*), with var. *minor* n., an sp. propr.?

Litiopa (Alaba) blanfordi A. Ad.

I. Bombay (*Dr. F. Stoliczka, H. F. Blanford*). Not in the Abercrombie collection.

Litiopa (Alaba) rectangulata Craven.

I. Bombay (*Abercrombie*).

Litiopa (Diala) leithi Sm.

I. Bombay (*Abercrombie*). Probably inhabits brackish water, with many spp. of *Stenothyræ* and *Assiminieæ*.

Litiopa (Diala) semistriata Phil. (=*macula* Récluz).

P.G. Gulf of Oman, near Maskat. 20 fathoms.

I. Bombay (*Dr. F. Stoliczka*).

Litiopa (Diala) sulcifera A. Ad.

P.G. Gulf of Oman, near Maskat, with the preceding. Also recorded by Mr. W. T. Blanford.

I. Bombay (*Rev. S. B. Fairbank*).

Litiopa (Styliferina) fulva B. Wats. (*Alaba*).

P.G. Gulf of Oman, near Maskat.

The specimens are worn, but both in coloration and sculpture agree with description and figure (Rep. Challenger Exped. vol. xv. p. 571, pl. xlii. fig. 5).

Litiopa (Styliferina) savignyi Issel.

P.G. Gulf of Oman, Maskat (*Dr. F. Stoliczka, W. T. Blanford*).

Argyropeza [1], genus novum.

Testa parva, gracilis, fusiformis, tenuis, nitida vitrefacta, albo-cinerea vel cinereo-straminea; anfractus 10, *quorum tres apicales, læves, parvi, brunnei vel straminei, cæteri multum apud suturas impressi, ventricosi, bicarinati, carinæ spiraliter arcte et regulariter noduloso-gemmatæ, ultimus anfractus cæteros exæquans, tricarinatus, carina inferior planatus, deinde ad basim spiraliter liratus; apertura ovata; peristoma tenue, sinuatum, paullum effusum; columella ad basim subproducta.*

[1] ἀργυρόπεζα, silver-foot, the Homeric epithet of Thetis.

ARGYROPEZA DIVINA, sp. n. (Plate XXI. fig. 3.)

A. *testæ characteribus uti supra. Long.* 6·50, *lat.* 1·75 *mm., sp. maj.*

Hab. Gulf of Oman: lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms, mud.

Shell small, fusiform, 10-whorled, three of these being apical, brown, vitreous, small and smooth; the remainder, much impressed suturally and ventricose, are glazed with a peculiar silvery lustre, though by no means nacreous, being uniformly adorned by two keeled spiral rows of close-set and conspicuously noduled gemmæ, the rest of the surface being smooth and shining. Body-whorl slightly produced, below the two gemmuled carinæ is a strong spiral plain keel, and thence to the base several liræ or striæ. Mouth oval, outer lip a little effuse, thin, and with the columella produced basally. We have not seen the operculum, and, in spite of the benevolent endeavours of the Rev. Prof. H. M. Gwatkin to extract the radula, success has not yet been attained in that respect.

The substance is peculiar, the thin shell being covered with a porcellanous or vitreous glaze. The basal prolongation of the lip and the columella recall certain *Dialæ*, e. g. *D. pagodula* A. Ad. from Australia, which species is embellished with a spiral row of nodules; the whole characters, however, appear to us to differ fundamentally from the one under discussion.

Again, *Cerithiopsis sinon* Bayle (*Pirenella clathrata* A. Ad.), a solid, fair-sized, elaborately sculptured species, bears a resemblance, but only superficial, to the *Argyropeza*; the lip characters are Cerithioid, and the anterior canal distinct and short.

P. Fischer (Man. de Conch. 1887, p. 697 *sqq.*) places the recent genus *Vanesia* Ad. (type *V. rufofasciata*), from Manchuria, in the family Pseudomelaniidæ, consisting otherwise wholly of extinct representatives only; the well-known Eocene *Bayania* M.-Chalmas is by him merged into a subgenus only of *Pseudomelania* Pict and Champ. *Loxonema* Phil., a Palæozoic fossil, is allied, and has the aperture dilated in front; whorls convex, strictly flexuose. All the species of this Family were or are marine. *V. rufofasciata* Ad., in the collection of one of us, is melaniform, smooth, excepting for longitudinal striation in the uppermost whorls, banded thrice spirally, and does not seem near our species.

Certain *Melaniæ*, especially of the Section *Melanoides*, e. g. *asperata* Lam., *dactylus* Lea, &c., seem to possess analogous labial characteristics; and our species bears, when highly magnified, so great a resemblance to these fluviatile Mollusca as to suggest the possibility of their having a marine representative in the Arabian Sea; but it would perhaps be best for the present to locate this species as an outlying form of Cerithiidæ, or of Litiopidæ.

About thirty examples were dredged in the above given locality, all very similar in size, but only a very few showing the complete characters of the peristome. Immature examples exhibit the columella fairly straight and sharply projecting.

Fam. Adeorbidæ.

Adeorbis placens, sp. n. (Plate XXII. fig. 15.)

A. *testa depressa, umbilicata, albo-vitrea, tenuissima, minuta; anfractibus quatuor, apicali vitreo, nitido, undique concentrice spiraliter tenuistriatis, apud suturas paullum impresso-excavatis, ultimo rapide accrescente, circa umbilicum nitido, perlævi; apertura rotunda; peristomate vix incrassato, margine columellari excepto, circa umbilicum triangulatim reflexo.*

Alt. 50, *diam.* 1·50 *mm.*

Hab. Gulf of Oman: lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms.

One of the minutest of a genus replete with "minutiora." We should consider its nearest congener *A. clausus* Adams, from Japan; but this species, besides being less depressed, is more than double the diameter. Several specimens occurred in the above locality, and would appear to have attained their full growth. One indeed bears the round bore-hole, showing its inmate had succumbed to the attack of a carnivorous enemy.

Var. complanata, nov.

Testa ut in typo, sed undique planata, nitida, perlævi.

Hab. Persian Gulf: Rishire.

Till more examples are obtained, we prefer considering this a varietal form. It is possible that it is a nearly allied but separate species. Upon one of the specimens before us of the type, we have lately noticed absence of the usual striæ round the inner dorsal surface of the body-whorl.

Adeorbis vanikoroides Melv.

I. Bombay (*Abercrombie*).

Fam. Cerithiidæ.

Cerithium adenense Sowb.

P.G. Bunder Abbas (*M. F. Houssay*).

Cerithium bornii Sowb.

I. Karachi. On rocks at low tide.

Cerithium cæruleum Sowb.

P.G. Bushire.
I. Karachi, with *C. bornii.*

Cerithium clypeomorus Jouss.

P.G. Bunder Abbas (*M. F. Houssay*).
I. Karachi.

Cerithium lemniscatum Quoy.

I. Karachi, along with *C. bornii*

CERITHIUM MORUS Lam.

I. Karachi. Bombay Harbour (*Lt.-Col. H. D. Olivier*).
Var. *patiens* Bayle (= *C. rugosum* Wood, præocc.). With the type. A variety of this occurs as follows:—
P.G. Gulf of Oman, near Jask, at low tide.

CERITHIUM RUBUS Martyn.

I. Bombay (*Abercrombie*).

CERITHIUM SCABRIDUM Reeve.

Cerithium columna Sowb., var.

P.G. On the telegraph-cable, not common.

CERITHIUM TORRESI Sm.

I. Karachi.
Seemingly identical with a N. Australian form.

CERITHIUM YERBURYI Sm.

I. Karachi. 5 fathoms, among mud and stones.

CERITHIUM (COLINA) PINGUE A. Ad.

M.C. Charbar, and generally along the coast to Jask.
I. Karachi.
At 5 to 7 fathoms, muddy sand and on rocky bottom, the var. *tæniatum* Sowb. occurring occasionally with the type.

Described originally from South Africa, a great extension of range is now presented by this species.

CERITHIUM (COLINA) MACROSTOMA Hinds.

I. Karachi. 1 to 5 fathoms, on shingle.
There are one or two doubtful *Colinæ* in the collection, but in view of the variability of the species it is best not to attempt to differentiate them at present.

CERITHIUM (VERTAGUS) ATTENUATUM Phil.

M.C. On telegraph-cable, rare.
This is the *C. longicaudatum* Ad. & Rve.

CERITHIUM (VERTAGUS) FASCIATUM Brug.

Var. *martinianum* Pfr.
P.G. Gulf of Oman, Maskat. Dredged in 10 to 15 fathoms, muddy sand.

CERITHIUM (VERTAGUS) KOCHI Phil.

M.C. Charbar Bay. 3 to 7 fathoms, amongst stones in sandy mud bottom.
Extends to E. Africa.

CERITHIUM (VERTAGUS) OBELISCUS Brug.

I. Karachi. On rocks at low tide.

Bittium atramentarium [1], n. sp. (Plate XXII. fig. 16.)

B. *testa dolioliformi, solidula, castaneo-brunnea vel nigrescente; anfractibus undecim, quorum apicales tres, vitrei, parvi, delicatissime decussati, cæteris apud suturas impressis, subventricosis, tribus ordinibus gemmularum arcte spiraliter prœditis, gemmulis nitidis, interstitiis alveatis, qnadratulis, ultimo anfractu quadrigemmulato; apertura quadrato-ovata, labro exteriore tenui, canali brevi; columella recta.*

Long. 4, *lat.* 150 *mm.*

Hab. Karachi.

A cylindrical, dark chestnut-coloured merging into blacker, and very small species; the three apical whorls white, pellucid, and small, suddenly developing below into seven or eight subventricose compact whorls, alveolate, regularly gemmulate, with three rows of transverse shining nodules, the last whorl possessing four; mouth somewhat square, outer lip thin, canal short, and columella straight. Several examples, we think mostly adult.

Bittium tenthrenoïs Melv.

P.G. Bushire.

Agreeing with the Bombay form in sculpture, but with no trace of the white extremities.

I. Bombay (*Abercrombie*).

N.B.—*Cerithium mamillatum* Risso has been reported from Bombay. This is synonymic of the well-known European *Bittium reticulatum* Da Costa, and its record is no doubt erroneous.

Potamides (Tympanotonus) fluviatilis Pot. & Mich.

P.G. M.C. I.

According to Mr. Townsend a distinctly marine species, occurring on muddy sands, both amongst rocks and on mud-flats, at half to lowest tide. A variety also occurs at Karachi.

Potamides (Telescopium) telescopium L.

Telescopium fuscum Schum.

I. Karachi. On mud-flats only just covered at high tide, occasionally wandering even beyond tide-mark range. To show how tenacious of life is this mollusk, some specimens were placed in a tin-box containing sand, and at the end of three months, when taken out, were still alive, and seemed none the worse for their incarceration, the sand being *perfectly dry* the whole time (*F. W. T.*).

Potamides (Terebralia) sulcatus Born.

I. Karachi. On mud-flats, but no live specimens seen.

[1] *Atramentarius,* inky, from the colour.

Potamides (Pirenella) conicus Blainv.

Var. *cinerascens* Pallas.

P.G., occasional. Originally described from the Island of Karak in the Gulf.

Potamides (Pirenella) layardi A. Ad.

Var. *bombayanus* Sowb. (sp.).

I. Bombay. Both the type and the variety recorded.

Potamides (Cerithidea) rhizoperarum A. Ad.

I. Bombay. On mangrove-roots.

Triforis acutus Kien.

M.C. Charbar.
I. Karachi.
Most abundant and variable in coloration.

Triforis cingulatus A. Ad.

P.G. Bushire. Gulf of Oman, Maskat, 10 fathoms. On muddy rocks from low-water to 50 fathoms. Also (in the Gulf) amongst shell-growth on the telegraph-cable.

Triforis corrugatus Hinds.

P.G. Gulf of Oman, Maskat.
I. Karachi.

Triforis idoneus[1], sp. n. (Plate XXII. fig. 17.)

T. *testa anguste fusiformi, solida, calcareo-alba ; anfractibus forsan quatuordecim, quorum apicales . . . ?, cæteris (undecim) omnino regulariter spiraliter triseriatis, cancellatis, suturaliter impressis, ad juncturas nodulifero-gemmatis, nodulis regularibus, rectis, ultimo anfractu serie quarta prædito ; apertura ovata ; columella crassa ; canali brevi, paullulum recurvo.*

Long. 10, *lat.* 2·50 *mm.*

Hab. Linjah Anchorage, 5 fathoms.

This *Triforis*, distinguished by its uniform chalky whiteness and regular rows of gemmuled cancellations, coarse, uniform, three-ranked on all the upper whorls, four on the body-whorl, is of a graceful shape and fairly sized. It is unfortunate that all the specimens we have examined are without the apical whorls.

Triforis perversus L.

P.G. Bushire.
I. Bombay (*Abercrombie*).

We cannot distinguish the Bushire and Bombay specimens from the Mediterranean shell. The *Triforides* (especially *acutus*) are amongst the most plentiful small mollusca dredged at a few fathoms' depth.

[1] *Idoneus,* suitable.

CERITHIOPSIS ANGASI Semper (=*clathrata* Angas).

I. Karachi. Also lat. 18° 58′ N., long. 71° 45′ E.

The type is Australian, but we cannot separate it.

CERITHIOPSIS PAGODULUS A. Ad.

I. Karachi. Rocks at low tide. Also from Japan.

CERITHIOPSIS PULCHERRIMA Melv.

I. Bombay (*Abercrombie*).

CERITHIOPSIS RUBRICINCTA Melv.

I. Karachi. Found at low tide amongst loose rocks, mud, and algæ. Bombay (*Abercrombie*).

CERITHIOPSIS SYKESII Melv.

I. Karachi. Found with *C. rubricincta*. Bombay (*Abercrombie*).

CERITHIOPSIS (SEILA) BANDORENSIS Melv.

M.C. Charbar.

I. Karachi. Found at low tide amongst rocks and algæ. Bombay (*Abercrombie*).

CERITHIOPSIS (SEILA) HINDUORUM Melv.

M.C. Charbar.

I. Karachi, especially near Manora, abundant, varying much in colour from pale to dark brown. (Andaman Isles, *Booley*.)

Fam. PLANAXIDÆ.

PLANAXIS BREVICULUS Desh.

Var. *tessellata* G. Nevill.

P.G. (*W. T. Blanford* in G. Nevill).

PLANAXIS LINEATUS Da Costa.

Var. *labiosus* A. Ad.

I. Karachi.

PLANAXIS NIGER Quoy (=*P. similis* Sm.).

I. Karachi. Bombay (*Abercrombie; Rev. S. B. Fairbank*).

PLANAXIS SULCATUS Born.

P.G. Rishire. Common on rocks at half-tide.

I. Bombay (*Abercrombie*; *Olivier*). Abundant in similar situations.

Var. *savignyi* Desh. (sp.).

P.G. (*W. T. Blanford*).

M.C. Often found, though locally, on rocks at low tide.

Var. *subnigra* G. Nevill.

P.G. Gulf of Oman, Hormuz and Maskat (*W. T. Blanford*).

Fam. Turritellidæ.

Turritella bacillum Kien.

M.C. Ormara.

I. Bombay (*Abercrombie*). Only in juvenile condition. It is *T. cerea* Reeve.

Turritella cingulifera Sowb.

P G. Linjah, $3\frac{1}{2}$ fathoms. Gulf of Oman, Malcolm Inlet (Kubbatt Ghazira). Mostly young.

Turritella fultoni Melv. (Plate XXI. fig. 8.)

P.G. Linjah. Henjam Island; 7–25 fathoms, live, fine specimens. Gulf of Oman, Jask beach.

M.C. Charbar. Ormara Bay; 2 fathoms, in sand.

The type, described in 1897 from the last-mentioned locality on the Mekran Coast, was only 27 mm. in length, and now, from Henjam Island, have been brought fine examples nearly 3 inches long, but with the same characters of pure white coloration and revolving liræ. This species was first found by Mr. W. D. Cumming, whose specimens are in the British Museum, but till lately unlabelled.

Turritella terebra L.

Var. *spectrum* Reeve (sp.).

P.G. Bunder Abbas (*M. F. Houssay*).

Turritella (Haustator) columnaris Kien.

P.G. Shaikh Shuaib Island. 3–10 fathoms.

Gulf of Oman, Maskat. 5–12 fathoms, muddy sand and stones.

Turritella (Haustator) maculata Rve.

P.G. Shaikh Shuaib Island. Gulf of Oman, Maskat. 5–12 fathoms, muddy sand, accompanying the last-named (*T. columnaris*).

Turritella (Haustator) vittulata Ad. & Rve.

P.G. Gulf of Oman, Jask. 5 fathoms, muddy rocks.

Turritella (Torcula) exoleta L.

P.G. Gulf of Oman, Maskat. 15 fathoms.

T. cochlea Reeve is synonymic.

Turritella (Zaria) duplicata L.

I. Bombay (*Abercrombie*), plentifully.

Mathilda gracillima, sp. n. (Plate XXII. fig. 18.)

M. *testa gradato-attenuato, fusiformi, albida, delicata; anfractibus* 8–9, *quorum duo apicales vitrei, læves, globosi, cæteris multum* *gradatis, apud suturas canaliculato-impressis, spiraliter tricarinatis, carinis præcipue apud medium binis, conspicuis, acutis, prominulis, gemmulatis, ultimo anfractu quadricarinato, superficie interstitiali inter carinas principales regulariter quadrata, infra suturas excavata; apertura ovato-quadratula, labro tenui, angulari; columella fere recta.*

Long. 11, *lat.* 4 *mm.*

Hab. Gulf of Oman: lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud bottom.

In form turritelloid, gradate, becoming rapidly attenuate, white, delicate, 8- or 9-whorled, two of these being apical, globular, smooth, glassy, the rest thrice (the lowest whorl four times) keeled, the two lowermost carinæ being acute, prominent, conspicuous; the interstitial ground between the carinæ is regularly divided into quadrate spaces, a small gemma or nodule being present on the keels at the points of transition. The mouth is squarely oval; outer lip thin, angled, columella almost straight. A very remarkable species; conspicuous for its graceful, attenuate form.

Mathilda zmitampis [1], sp. n. (Plate XXII. fig. 19.)

M. *testa turrita, gracili, fusiformi, delicata, alba; anfractibus* 9, *quorum apicales duo conspicue heterostrophi, mamillati, vitrei, perlæves, cæteris apud suturas impressis, deinde supra, juxta suturas, spiraliter acute bicarinatis et biliratis, undique longitudinaliter arctè costatis, costis acutis, angustis, tenuibus, ad juncturas lirarum gemmulatis, interstitiis alveatis, quadratulis; apertura fere rotunda, alba; labro tenui, extus crenulato; columella paullum incrassata, alba, nitida; ultimo anfractu ad basim spiraliter tornato, fortiter striatulo.*

Long. 10, *lat.* 3·50 *mm.*

Hab. Gulf of Oman: lat. 24° 5′ N., long. 37° 35′ E. 208 fathoms, sand.

We are not satisfied with the present location of *Mathilda* Semper (1865) amongst the *Turritellidæ*. Dr. P. Fischer (Man. de Conch. p. 695) styles the genus as possessing the shell of *Turritella*, with the embryonic heterostrophe-whorls of the *Pyramidellidæ*; but in that case we should consider that its alliance would be with the latter family. Certain of the *Odostomiæ* possess the same fenestrate and alveolate sculpture, *Turbonilla fenestrata* Forbes, for example.

The species before us is most elaborately chased and ornamented with four spiral carinæ, two being little more than striations or liræ; the two lower bolder, acute, and giving an angled contour to the whorls. The longitudinal thin costæ, crossing these carinæ and liræ at right angles, form quadrate interstitial divisions. The whorls are nine, two of which are apical, heterostrophe, and crystalline. The mouth is roundly oval, outer lip rather thin; columella white, shining.

[1] *Zmitampis,* a precious stone mentioned by Pliny.

Fam. VERMETIDÆ.

VERMETUS sp.

I. Bombay (*Abercrombie*). Found cast up from deep-water amongst shell-sand.

SILIQUARIA sp. juv.

I. Lat. 18° 58′ N., long. 71° 45′ E.; 40 fathoms.

Fam. STROMBIDÆ.

STROMBUS (GALLINULA) DEFORMIS Gray.

M.C. A single dead specimen only dredged, without more exact record of locality.

STROMBUS (GALLINULA) FUSIFORMIS Sowb.

P.G. Shaikh Shuaib Island, &c. This rare species, queried by Tryon (Man. de Conch. vii. p. 117) as inhabiting the Red Sea, seems to be general in the Persian Gulf, being found at from 7 to 10 fathoms in coral-sand bottom. Many varieties occur, one being pale lemon-yellow. Juvenile examples exhibit strong varices and transverse striation throughout. In the Gulf of Oman it occurs near Maskat at 15 fathoms.

STROMBUS (CANARIUM) FLORIDUS Lam.

M.C. Charbar. On mud-covered rocks at low tide.

STROMBUS (CANARIUM) GIBBERULUS L.

P.G. Maskat, 15 fathoms. Not common in the Gulf, but one of the most widely-distributed gastropods in the Indo-Pacific region.

I. Bombay (*Abercrombie*). Bassein, southwards (*Lt.-Col. H. D. Olivier*).

STROMBUS (CANARIUM) YERBURYI E. Sm.

P.G. Kais and Shaikh Shuaib Islands. From 7 to 10 fathoms, coral-sand. Our examples appear almost intermediate between typical *yerburyi* and *pulchellus* Rve., and suggest these two being extremes of a variable species.

STROMBUS (CONOMUREX) BELUCHIENSIS [1] Melv. (nom. emend.). (Plate XXI. figs. 13, 15.)

P.G. Linjah. 3½ fathoms, December 1900. Maskat (*Dr. A. R. Jayakar*).

M.C. Charbar. 7 fathoms, mud and sand.

The more recently-dredged Persian Gulf examples exhibit variety in colour and marking, though none in form. One example is banded with pale straw-coloured fasciæ, the spaces filled with delicate zigzag lines; another strongly banded with dark-brown fasciæ of varying thickness. The first examples discovered in 1898

[1] I described this as *belutschiensis*, but venture to emend the spelling to *beluchiensis* as more in harmony with the dictates of orthography.—J. C. M.

on the Mekran Coast were almost plain. Commdr. E. R. Shopland has likewise received it recently from Aden, in some variety.

Our two figures are taken from Dr. Jayakar's specimens in Mus. Brit.

STROMBUS (CONOMUREX) MAURITIANUS Lam.

P.G. In 6 fathoms, sandy mud.

M.C. In 3 to 10 fathoms, and on coral-beds. Mostly var. *cylindricus* Swains.

β. *coniformis* Sowb.

P.G. This noduled form in fine condition, with the type.

PTEROCERA LAMBIS L.

P.G. Gulf of Oman, Maskat. On rocks at low tide.

I. Bombay (*Abercrombie*).

ROSTELLARIA CURVIROSTRIS Lam.

Var. *curta* Sowb. (sp.).

M.C. One live example dredged at 7 fathoms, in mud, off Pusni. Dead specimens not infrequent generally over the whole area.

I. Bombay (*Abercrombie*). Mostly found with a *Pagurus* sp. in possession.

ROSTELLARIA DELICATULA G. Nevill, Journ. Asiatic Soc. Beng. 1881, p. 262.

P.G. Gulf of Oman: lat. 24° 49′ N., long. 55° 56′ E. 225 fathoms, mud; all young. In the vicinity of the above sounding occurred about six fine, well-grown examples, from 200–400 fathoms. Originally noted from Arakan, in the Bay of Bengal, this species is probably common in deep water throughout the North-Indian Ocean.

With reference to the dredging of this species, Mr. Townsend (*in litt.*) gives some interesting remarks as to the temperatures taken of the sea-bottom at various depths in the Gulf of Oman :—

At 205	fathoms	62°	Fahr.
230	,,	61°	,,
415	,,	52°	,,
425	,,	53°	,,
500	,,	51°	,,
1495	,,	37°	,,

adding that the *Rostellaria* was always found at an even temperature, of about 62° Fahr.

SERAPHS TEREBELLUM Montf.

Terebellum subulatum Klein.

P.G. Gulf of Oman, Maskat. 9–20 fathoms, on muddy sand.

Fam. Cypræidæ.

Cypræa annulus L.

P.G. Gulf of Oman, Maskat. Very abundant, and from thence exported to India as an article of commerce (*F. W. T.*).

I. Karachi. A single dead specimen only occurred (*F. W. T.*).

Cypræa arabica L.

P.G. M.C. Generally common, mostly being found under rocks at low tide.

I. Karachi. Bombay (*Abercrombie*).

Var. *histrio* Meusch (sp.).

I. Bombay (*Abercrombie*), with the type.

Var. *reticulata* Martyn (sp.).

I. Karachi. Small but well-developed forms; also a large variety, with the white dorsal patches remarkably distinct and quadrate.

Cypræa carneola L.

P.G. Local, but variable. Found from low-tide mark to 3 fathoms. Remarkably light forms occur at Shaikh Shuaib Island and Henjam I., while from Linjah, at $3\frac{1}{2}$ fathoms, were dredged alive dark examples, spirally four-banded with chocolate, and with lilac annulus just beyond the columellar and labial callosities extending dorsally. These same forms occur from Jask eastwards.

M.C. Charbar, at 3 fathoms.

Cypræa caurica L.

P.G. Common in shoal-water amongst rocks.

M.C. Very rare, have only dredged four specimens in eight years (*F. W. T.*).

Cypræa erosa L.

P.G. M.C. Not abundant, but widely distributed. Found usually on muddy sand near rocks, at low water to 7 fathoms.

Cypræa felina Gmel.

P.G. Gulf of Oman, Maskat.

M.C. Rare. Found at half-tide mark, never much below that, under rocks.

Var. *fabula* Kiener (sp.).

P.G. Gulf of Oman, Maskat. Very finely coloured and large.

Cypræa fimbriata Gmel.

P.G. M.C.

Generally found, from 5 to 10 fathoms, amongst coral-sand and algæ.

Var. *macula* Ad. (sp.).

P.G. With the type. Many authors consider this a good species, but to us it appears to merge into the type insensibly.

Cypræa lamarckii Gray.

I. Bombay (*Abercrombie*).

Cypræa lentiginosa Gray.

P.G. Shaikh Shuaib Island. 5 to 10 fathoms, coral and stones.
M.C. Locally general.
I. Karachi. Here the finest examples have been dredged, and also occur at very low tide amongst muddy rocks. Bombay (*Abercrombie*). Extends south to Ceylon.

Cypræa listeri Gray.

P.G. Gulf of Oman: Ras El Hadd, near Maskat, very infrequent.

Cypræa mauritiana L.

P.G. Gulf of Oman, Maskat. Obtained from the native boatmen, who said they had found them on rocks at extreme low tide (*F. W. T.*).

Cypræa moneta L.

P.G. Gulf of Oman, Maskat. Exported in quantity to India with *C. annulus* L., these two so-called species probably being the extremes of one variable mollusc.

Cypræa ocellata L.

P.G. M.C. I.

Generally diffused, mostly occurring at low tide amongst muddy stones. The finest specimens occur off Karachi. One example is particularly noticeable, being, though normal in size and marking, of a pale lilac-cinereous hue with pink suffusion, resembling *C. listeri* Gray.

Var. *calophthalma* Melv.

One example occurred only of the form with large ocellations.
A pale sub-pellucent form occurred in lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

Cypræa onyx L.

P.G. Adhering to the telegraph-cable from 15 fathoms, mud, principally at the head of the Gulf.
I. Karachi; sparsely occurring.

Cypræa pallida Gray.

I. Karachi. At low tide, under muddy rocks.
Variable as regards marking and coloration, the series in this collection being almost uniquely beautiful, embracing every gradation between plain cinereous and rich brown with large dorsal maculations. Bombay (*Abercrombie*).

Cypræa pulchella Swains.

P.G. Gulf of Oman.
Adhering to telegraph-cable, from 50 fathoms, mud. One variety, very perfect, not exceeding $\frac{7}{8}$ inch longitudinally.

CYPRÆA PULCHRA Gray.

P.G. Shaikh Shuaib Island. Not hitherto found alive in this region.

CYPRÆA OVATA Perry, Conch. pl. xxi. fig. 3 (1811).

Cypræa turdus Lam. An. sans Vert. vii. p. 392 (1822).

P.G. M.C. I.

Found generally, and at all states of the tide down to 10 fathoms, the quality of the ground making no difference. The finest examples certainly occur at Karachi, amongst muddy stones at extreme low-tide mark.

Var. *nivea* Gray.

M.C. Colourless examples, with almost the aspect of *C. eburnea* Barnes.

CYPRÆA ZICZAC L.

P.G. Tumb Island. Gulf of Oman, Maskat.

Occurs on muddy sand and stones at 7 to 15 fathoms; very beautiful varieties occurring, though always rare.[1]

TRIVIA GLOBOSA Gray.

I. Lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms.

TRIVIA SCABRIUSCULA Gray.

P.G. Gulf of Oman, Malcolm Inlet. Dead examples at 24 fathoms, mud. Lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

AMPHIPERAS ADAMSI Reeve (*Ovula* Brug.).

P.G. Linjah. $3\frac{1}{2}$ fathoms, mud.

AMPHIPERAS OVOIDEUS H. Ad.

P.G. Linjah. $3\frac{1}{2}$ fathoms, mud.
I. Karachi.

These are the first extra-Erythræan records.

AMPHIPERAS PUDICUS A. Ad.

I. Bombay (*Abercrombie*).

AMPHIPERAS PULCHELLUS H. Ad.

I. Karachi.

Perhaps, as suggested by Tryon, a variety of *A. punctatus* Duclos.

[1] [*Cypræa valentia* Perry, 1811.
Cypræa princeps Gray, 1824.
This species is termed popularly "The Brindled Cowry of the Persian Gulf," and but six or seven examples alone have been discovered. It is probably an inhabitant of deep water, and it is doubtful whether its correct habitat is the one now given. The Persian Gulf proper, into which the great rivers Tigris and Euphrates (after effecting a junction at Kornah, nearly a hundred miles from their mouth) flow, is nowhere of very great depth. Far different is the case, however, as we have clearly shown, with the Gulf of Oman, where soundings have been obtained of nearly 1500 fathoms. It is here, therefore, that this rare and beautiful mollusc should be searched for.]

Amphiperas pyriformis Sowb.

P.G. Gulf of Oman, Maskat. 15 fathoms.
Very near *A. nubeculatus* Ad. & Rve.

Amphiperas striatulus Sowb.

P.G. Linjah. $3\frac{1}{2}$ fathoms, mud.
I. Lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms. Very fine.
A. dorsuosus Hinds is probably a variety.

Amphiperas (Cyphoma) indicus Reeve.

I. Bombay (*Abercrombie*).
An endemic species, nearly allied to *A. obtusus* Rve., with which, indeed, it is united by Tryon.

Amphiperas (Cyphoma) traillii A. Ad.

I. Karachi. Bombay (*Abercrombie*). In shell-sand.

Amphiperas (Volva) lanceolatus Sowb.

P.G. Tumb Island. 15 fathoms, sand.

Amphiperas (Neosimnia) spelta L.

M.C. Charbar. In 3–7 fathoms, sandy mud.
I. Karachi. Bombay (*Abercrombie*).

Erato olivaria Melv.

I. Karachi.

Erato pellucida Reeve.

I. Karachi. 3 to 5 fathoms, amongst loose stones and muddy sand. Bombay (*Abercrombie*), among shell-shingle.

Fam. Doliidæ.

Dolium dunkeri Hanley.

M.C. Charbar, not dredged alive. 7 fathoms.

Dolium galea L.

Var. *luteostomum* Küster (sp.).
M.C. Charbar beach, only once occurring.

Dolium maculatum Lam.

I. Karachi, muddy rocks. Bombay (*Abercrombie*).

Dolium olearium Brug.

Var. *cumingii* Hanley.

P.G. Linjah. $3\frac{1}{2}$ fathoms.

Pyrula ficus Lam. (= *P. lævigata* Reeve).

P.G. Kais Island. 7 fathoms, coral-sand.
M.C. Charbar Bay. I. Bombay (*Abercrombie*).

Pyrula reticulata Lam.

P.G. On cable. 30–50 fathoms, amongst weed and shell-growth. I. Bombay (*Abercrombie*).

Fam. Tritonidæ.

Lotorium olearium (L.) (*Triton* Montft.).

M.C. Amongst loose muddy rocks at low tide. Largest specimens measure $5\frac{1}{4}$ in. × 3 in.

Lotorium (Simpulum) labiosum (Wood).

P.G. Gulf of Oman, Maskat.
M.C. Charbar Bay.
I. Karachi. 2 to 5 fathoms, loose stones and muddy sand.

Lotorium (Simpulum) aquatile (Reeve).

I. Bombay (*Abercrombie*).

Lotorium (Simpulum) pileare (L.).

P.G. Mussandam Inlet. 2 to 3 feet of water at low tide.
I. Bombay (*Abercrombie*; *Olivier*).

Lotorium (Gutturnium) retusum (Lam.).

P.G. Gulf of Oman, Maskat. 10 fathoms, stones and sandy mud bottom. Extending past Jask to the Mekran Coast.

Lotorium (Gutturnium) trilineatum (Rve.).

P.G. Shaikh Shuaib Island. 7 fathoms muddy sand.
M.C. Not infrequent.
I. Karachi. On mud-flats at low tide.

Lotorium (Gutturnium) vespaceum (Lam.).

P.G. Shaikh Shuaib Is.
M.C. Charbar.
I. Karachi. 3 fathoms, loose stones and muddy sand.

Lotorium (Epidromus) bracteatum (Hinds).

I. Karachi.

Lotorium (Epidromus) ceylonense (Sowb.).

P.G. Ras Maidar. 8 fathoms.

Lotorium (Epidromus) distortum (Schub. & Wagn.).

P.G. Linjah. $3\frac{1}{2}$ fathoms.

Lotorium (Epidromus) testaceum (Mörch).

M.C. Charbar.

Lotorium (Lagena) cingulatum (Pfr.).

I. Ratnigiri (*Abercrombie*).

Gyrineum albivaricosum (Reeve) (*Ranella* Lam.).

I. Karachi. 20 fathoms, mud.

Gyrineum crumena (Lam.).

P.G. 13 fathoms, rock and muddy sand.
M.C. S.E. of Astola Island.

Gyrineum spinosum (Lam.).

M.C. Dead specimens noticed everywhere along the coast-line.
I. Karachi. Alive, but sparingly, on mud-flats. Bombay (*Abercrombie*; *Olivier*).

Gyrineum subgranosum (Sowb.).

I. Bombay (*Abercrombie*; *Olivier*).

Gyrineum (Lampas) graniferum (Lam.).

M.C. Charbar. 7 fathoms, on rocks.
I. Karachi. Amongst muddy rocks at low tide.

Gyrineum (Lampas) lampas (L.).

P.G. Dredged at 7 fathoms.
I. Karachi. At very low tide on muddy rocks.

Gyrineum (Lampas) ranelloides (Rve.).

I. Karachi.

Gyrineum (Argobuccinum) anceps (Lam.).

I. Karachi.

Gyrineum (Argobuccinum) bituberculare (Rve.).

P.G. On telegraph-cable. 40 fathoms.

Gyrineum (Argobuccinum) pusillum (Brod.).

P.G. Gulf of Oman, Maskat.
M.C. Charbar. 12 fathoms.

Gyrineum (Argobuccinum) tuberculatum (Brod.).

P.G. M.C. I., Karachi; widely distributed on muddy banks at low tide. Bombay (*Abercrombie*).

Distorsio cancellinus Roissy.

Var. *decipiens* Reeve.

P.G. Gulf of Oman, Maskat. 15 fathoms.

Sect. ii. **Heteropoda.**

Fam. Pterotrachæidæ.

Carinaria sp.

P.G. Gulf of Oman. Only an apical fragment.

Fam. Atlantidæ.

Atlanta peronii Less.

P.G. Gulf of Oman. From 37-500 fathoms, with the above. None taken living.

(c) Gymnoglossa.

Fam. Eulimidæ.

Eulima acicula Gould.

M.C. Charbar.

Eulima augur Angas.

M.C. Among shingle, dead.

Eulima cumingi A. Ad.

I. Karachi.

Eulima dens-colubri Melv.

. Bombay (*Abercrombie*).

Eulima epiphanes Melv.

P.G. Maskat. Linjah anchorage, 5 fathoms. Kishm Island, 5 fathoms, soft mud.

I. Lat. 18′ 58° N., long. 71° 45′ E. 40 fathoms.

Eulima gentilomiana Issel.

P.G. Gulf of Oman; lat. 26° 10′ N., long. 52° 20′ E. 32 fathoms. Maskat, 15 fathoms.

M.C. Charbar.

I. Karachi. Occasionally found amongst rocks and algæ at low water.

Eulima martinii A. Ad.

P.G. Henjam Island. 7 to 12 fathoms, sandy mud.

Eulima nitidula A. Ad.

P.G. Gulf of Oman; lat. 24° 5′ N., long. 57° 35′ E. 205 fathoms, mud.

Eulima shoplandi Melv.

P.G. Kishm Island. 6 fathoms.

I. Karachi.

Described originally from Aden.

Eulima styliferoides, sp. n. (Plate XXII. fig. 20.)

E. *testa polita, subpellucida, albo-lactea, versus apicem multum attenuata, plerumque incurva vel intorta; anfractibus* 10–12, *nitidissimis, subventricosis, apud suturas paullum impressis, utrinque linea suturali pellucente prœditis, anfractu ultimo lato, obliquato, ad peripheriam subangulato; apertura mediocri, labro apud basim crassiusculo, albo, nitido; columella paullum producta.*

Long. 6, *lat.* 3 *mm.*

Hab. Karachi. 5 fathoms.

Seven or eight full-grown examples of a distinct form in a genus where, perhaps, too much similarity already prevails. It possesses kinship, especially, with *E. solida* Sowb. and *inflexa* Pease, from both of which it can be differentiated by its delicate translucent substance and smaller size. From *E. australasiaca* M. & S., recently described from the Torres Straits, it differs in greater attenuation and rapidly contracting spire. It much exceeds in size *E. latipes* Wats., and is broader in convolution of body-whorl than any varieties of *E. gentilomiana* Issel and *E. shoplandi* Melv., both of which occur in the same seas. The specific term chosen indicates its *Stylifer*-like appearance.

EULIMA (LIOSTRACA) ARABICA Issel.

P.G. Bushire. Found amongst mud at anchor. Gulf of Oman, lat. 24° 5′ N., long. 57° 55′ E.; 205 fathoms.

EULIMA (LIOSTRACA) BIVITTATA H. & A. Ad.

P.G. Bushire. Kishm Island; 5 fathoms, soft mud. Gulf of Oman, lat. 24° 5′ N., long. 57° 55′ E.; 205 fathoms, mud.

A pure white albino form, agreeing precisely in other details, occurs with the type at this latter locality.

Maskat. 15 fathoms.

EULIMA (LIOSTRACA) UNILINEATA Ad. & Rve.

P.G. Gulf of Oman, Maskat. A dark clearly-banded form.

I. Karachi. A pale variety.

EULIMA (APICALIA) *cf.* HOLDSWORTHI A. Ad.

I. Karachi.

Only in juvenile condition, and therefore almost impossible to determine with certainty.

NISO VENOSA Sowb.[1]

P.G. Bahrein Isles.

M.C. Charbar. I. Karachi.

Mostly found from low-tide mark down to 10 fathoms, on sandy mud or sand, frequent.

Var. *pura*, nov.

Somewhat broader, and often with the longitudinal varices wanting, uncoloured. A deep-water form.

P.G. Gulf of Oman; lat. 24° 5′ N., long. 57° 35 E. 205 fathoms, mud.

Linjah. 3½ fathoms.

Fam. PYRAMIDELLIDÆ.

PYRAMIDELLA DOLABRATA L., var. TEREBELLOIDES A. Ad.

M.C. Charbar. In 3 to 5 fathoms, sand.

I. Karachi; lat. 26° 55′ N., long. 57° 59 E. 37 fathoms.

[1] *Niso pyramidelloides* G. & H. Nevill (Journ. As. Soc. Beng. vol. xl. pt. ii. p. 5, pl. i. fig. 14, 1871), is undoubtedly near this species, but considerably smaller. It is reported from the "Persian Coast" by Nevill (*t. c.* vol. xliv. pt. ii. p. 103) as having been collected by Mr. W. T. Blanford.

PYRAMIDELLA MACULOSA Lam. (=*P. acus* Gmel.).

P.G. Off Shaikh Shuaib Island. In 7 fathoms; mud, sand, and stones. I. Karachi.

PYRAMIDELLA PULCHELLA A. Ad.

P.G. Kishm Island. In 6 fathoms, mud.
M.C. Charbar. I. Bombay (*Abercrombie*).

Considered a *Syrnola* by some authors, but there exist two columellar plications.

PYRAMIDELLA (LONCHÆUS) SULCATA A. Ad.

P.G. Maskat. In 10 to 15 fathoms, loose stones and muddy sand.

PYRAMIDELLA (OTOPLEURA) MITRALIS A. Ad.

P.G. Kais Island. In 5 to 10 fathoms, coral-sand.
M.C. Charbar. Dead specimens.

PYRAMIDELLA (OTOPLEURA) PROPINQUA A. Ad.

P.G. M.C. I. Karachi.

SYRNOLA BRUNNEA A. Ad.

I Karachi, rare.

SYRNOLA CINCTELLA A. Ad.

P.G. Kishm Island. In 6 fathoms, mud.
M.C. Charbar. I. Karachi.

SYRNOLA ELEGANS A. Ad.

M.C. Charbar.
I. Karachi. Dredged amongst muddy sand and shingle, 7 fathoms.

SYRNOLA KARACHIENSIS Melv.

M.C. Charbar.
I. Karachi. Amongst weed and mud on rocks at low tide.

SYRNOLA MEKRANICA, sp. n. (Plate XXII. fig. 21.)

S. *testa gracillima, nitida, lævissima, attenuata, candida; anfractibus* $11\frac{1}{2}$, *quorum* $1\frac{1}{2}$ *apicales, heterostrophi, globulares, crystallini, cæteris ad suturas subimpressis, vix ventricosis, perlævibus, supra suturas spiraliter anguste unifilosis, filo rufo, interdum ad medium internis lineis lacteis accinctis, ultimo ad medium, simul ac versus basim, bifiloso; apertura ovata, peristomate fere continuo; columella incrassata, alba, obliqua, fortiter uniplicata.*

Long. 7, *lat.* 1·75 *mm.*

Hab. Charbar. 7 fathoms.

Allied to *S. subulina* Ad., from Japan, but considerably larger. It is a graceful species, narrow, attenuate, shining, 11 to 12-whorled, the protoconch heterostrophe, vitreous, globular; the rest of the whorls smooth, hardly ventricose, once spirally rufous-threaded or banded, just above the sutures, on the last whorl there being two such spiral threads, one in the middle, the other towards the base. The peristome is quite or almost continuous, columella white, strongly one-plaited.

This species differs, also, from all forms of the somewhat protean *S. cinctella* Ad. in its slight ventricosity and more elegant attenuations of whorl, the body-whorl, especially, being broader in the commoner species.

SYRNOLA METRIA Melv.

P.G. Bushire.

I. Karachi. At low tide amongst mud, weeds, and loose rocks.

Very near some large forms of *Odostomia*, this species has, so far, been found but very rarely.

OSCILLA INDICA Melv.

I. Bombay (*Abercrombie*). Karachi.

The commoner species of the two *Oscillæ*, found in the same localities, but always distinguished by its oblongo-fusiform shape.

Reported from Aden by Commander Shopland.

OSCILLA TORNATA (A. Ad. inedit.) Melv.

I. Bombay (*Abercrombie*). Karachi. Amongst muddy rocks at low tide.

AMATHIS FILIA Melv.

I. Bombay (*Abercrombie*). Rare always; in shell-sand.

ELUSA BRUNNEOMACULATA Melv.

P.G. Dredged in 5 fathoms, mud and sand. Gulf of Oman: Malcolm Inlet (Kubbatt Ghazira), 24 fathoms.

M.C. Charbar, a few specimens only.

I. Karachi, also rare.

This is a remarkably isolated form.

ELUSA STRIGILLATA A. Ad.

P.G. Gulf of Oman, Maskat. 15 fathoms.

I. Karachi. Amongst stones and mud at very low tides.

ELUSA SUBULATA A. Ad.

I. Lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms.

An interesting shell, with narrow caudate apical whorls. Type Japanese.

MORMULA MACANDREWI A. Ad.

P.G. Lat. 45° 55 N., long 57° 59′ E. in Gulf of Oman.

M.C. Charbar. On rocks at 7 fathoms.

A very delicate species, peculiar for its numerous varices and golden hue.

MORMULA RISSOINA A. Ad.

M.C.

ACTÆOPYRAMIS FULVA Gray (*Monoptygma* Lea).

I. Bombay (*Abercrombie*); Karachi. Amongst dredged shingle; dead specimens only, but very fine. The four uppermost whorls are uniformly white, contrasting strongly with the darkly-coloured lower ones.

ARCTÆOPYRAMIS GAVISA Melv. (*Myonia* A. Ad.).

I. Bombay (*Abercrombie*).

ACTÆOPYRAMIS GRANULATA A. Ad.

I. Karachi.

ACTÆOPYRAMIS PSYCHE Melv.

I. Karachi.

ACTÆOPYRAMIS SPECIOSA A. Ad.

P.G. Linjah Anchorage.

MUMIOLA EPENTROMA Melv.

Rissoina epentroma Melv. Proc. Mal. Soc. Lond. ii. p. 110, pl. 8. fig. 23.

I. Karachi; mud-covered rocks at low tide. Bombay (*Abercrombie*).

The generic position we have, after much consideration, decided to assign to this very interesting small species, is merely tentative. Mr. Townsend's Karachi individuals are in finer condition than the Bombay types, which were collected in shell-sand, and the apices were therefore fractured. Now the examination of perfect specimens not only discloses an heterostrophe mamillate protoconch, but, though the facies be rissoid—a not infrequent circumstance in this family—and the outer lip thickened, with the columella simple, yet the texture of the shell is much like a *Pyrgulina*, e. g. *edgarii* or *interstriata*; and we have no doubt a step is now being taken in the right direction, even though the position may very possibly again be changed.

MUMIOLA SPIRATA A. Ad.

P.G. Bushire. M.C. Charbar. Gwadûr, Ormara.
I. Karachi.

TURBONILLA ABERCROMBIEI Melv.

I. Bombay (*Abercrombie*).

TURBONILLA BASILICA Melv.

P.G. Lat. 27° 52′, in 40 fathoms, on telegraph-cable. Kishm Island, in 6 fathoms, mud. Bushire.

TURBONILLA CANDIDA Folin.

P.G. Kishm Island. 6 fathoms, soft mud.

I. Karachi. Amongst rocks covered at low tide with muddy sand and weeds.

TURBONILLA (PYRGOSTELIS) CHARBARENSIS, sp. n. (Plate XXII. fig. 22.)

T. *testa aciculata, læte rufa, delicata; anfractibus* 12, *quorum apicales duo vitrei, lævissimi, heterostrophi, cæteris arcte longitudinaliter costatis, costis lævibus, interstitiis spiraliter sulculosis, apertura ovata; labro, simul ac columella, simplici.*

Long. 6, *lat.* 1·50 *mm.*

Hab. Charbar, Mekran Coast, 7–10 fathoms.

Of the same character as the European *T. rufa* Phil., but smaller, and the ribs are continuous beyond the periphery in our species, not evanescent as in *rufa*. Whorls 11 or 12, the two apical being glassy, vitreous, sinistral, the remainder closely longitudinally ribbed, ribs smooth, interstitially spirally striate. Eight examples were dredged, all precisely similar.

TURBONILLA EMILIÆ Melv.

I. Bombay (*Abercrombie*).

TURBONILLA LINJAICA sp. n. (Plate XXII. fig. 23.)

T. *testa delicatissima, angusta, aciculata, pergracili, omnino rufa, vel rarius rufo-albescente; anfractibus* 9–10, *quorum apicales duo, heterostrophi, vix pellucidi, rufi vel albi, cæteris subventricosis, arcte longitudinaliter recticostatis, costis in penultimo ad viginti, acutis, nitidis, interstitiis pulcherrime et arctissime spiraliter striatis; peristomate continuo, tenui; columella rufa, paullum obliqua.*

Long. 4, *lat.* ·75 *mm.*

Hab. Linjah, Persian Gulf. 3½ fathoms, sand. December 1900.

Very distinct, though so minute; being usually entirely rufous, though some examples are almost white, with rufous tinge alone on the body-whorl. It is one of the smallest *Turbonillæ* yet described, and remarkably graceful in contour. The ribs are nearly straight, acute, crowded, the spaces intervening being seen, with a lens, to be exquisitely closely striatulate; mouth ovate; peristome continuous. It bears no close resemblance to any other Eastern species known to us.

TURBONILLA MANORÆ Melv.

I. Karachi.

TURBONILLA SORORIA Melv.

P.G. Gulf of Oman, 250 fathoms.

Lat. 24° 5′ N., long. 57° 35′ E. 205 fathoms, sand and mud: a var. more slender and flattened than the type.

I. Karachi, rare. Bombay (*Abercrombie*).

TURBONILLA STEGASTRIS[1], sp. n. (Plate XXII. fig. 24.)

T. *testa gracili, attenuata, alba; anfractibus novem, apicali vitreo, mamillato, heterostropho, cæteris longitudinaliter arcti-costatis,*

[1] στέγαστρις, a weaver.

in ultimo anfractu (circa triginta et octo) numerosissimis, in penultimo viginti-sex, angustis, rectis, undique spiraliter arctissime intertextis et filostriatis, supra, juxta suturas unilineatis, linea rufa; apertura ovata; peristomate fere continuo, incrassato, margine columellari simplici.

Long. 11, *lat.* 2·50 *mm., spec. maj.*
Long. 8, *lat.* 2 *mm., spec. min.*

Hab. Persian Gulf, Gais (or Kais) Island.
I. Karachi.

A graceful shell, with many fine longitudinal riblets, spirally, as it were, interwoven with cross-threads; just above the sutures there is one rufous thin spiral line. The whorls, inclusive of the heterostrophe apical, are nine in number. The larger example, which we take as our type, came from Kais Island.

Turbonilla templaris Melv.

I. Karachi.

Turbonilla tenuicosta Issel.

P.G. Gulf of Oman, 250 fathoms. Many examples, but few adult. These show the plicæ evanescent on the broad body-whorl, the chief characteristic of Issel's species, and we think they are identical.

Turbonilla terebrina Melv.

P.G. Gulf of Oman, 250 fathoms.
I. Karachi, amongst muddy rocks at low tide.

Turbonilla velaini Tryon.

P.G. Gulf of Oman, 250 fathoms.
It is the *Turbonilla scalaris* Vélain non Phil.

Eulimella kaisensis Melv.

P.G. Near Fao, Bushire. Kishm Island. 6 fathoms, mud. Linjah, 3½ fathoms. The type from Kais Island.
Gulf of Oman, lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms. Mostly in juvenile, semipellucent condition.
I. Lat. 18° 58′ N., long. 71° 45′ E. 40 fathoms, fine.

Cingulina archimedea Melv.

I. Bombay (*Abercrombie*).

Cingulina isseli Tryon.

Eulimella cingulata Issel, Conch. Mare Rosso, p. 182, 1869.
P.G. Henjam Island.
M.C. Charbar, most abundant.
I. Karachi, Manora Point. Found on muddy weed-covered rocks at low water.

This species requires more study. It is protean in character, and it is possible that two species are at present here blended together.

CINGULINA SPINA Crosse & Fisch.

I. Karachi. Much rarer than the last.

ODOSTOMIA ANTELIA Melv.

P.G. Gulf of Oman, lat. 24° 49′ N., long. 55° 56′ E. 225 fathoms, mud.

I. Karachi, very rare. Bombay (*Abercrombie*).

ODOSTOMIA CARINATA H. Ad.

P.G. Bushire.

I. Karachi, off mud at anchorage.

ODOSTOMIA EUTROPIA Melv.

P.G. Bushire; lat. 26° 23′ N., long. 54° 53′ E. 250 fathoms.
M.C. Charbar.
I. Karachi, on mud in 25 fathoms.

Very near to two of Adams's Japanese species, *O. subangulata* and *O. tenera*, especially as concerns the body-whorl and carination, but differing in the shape of the mouth.

ODOSTOMIA LITIOPINA, sp. n. (Plate XXIII. fig. 1.)

O. *testa parva, subrimata, lævi, tenui, semipellucida, cornea; anfractibus* $4\frac{1}{2}$, *quorum* $1\frac{1}{2}$ *apicales, læves, nigrescentes, cæteris ad suturas gradatulis, ventricosis, ultimo oblongo, tumidulo; apertura ovata, labro tenui; columella haud incrassata, uniplicata.*

Long. 2, *lat.* 1 *mm.*

Hab. Gulf of Oman. Lat. 25° 24′ N., long. 57° 27′ E.; at 241 fathoms. Also lat. 25° 31′ N., long. 57° 14′ E.; 198 fathoms, mud.

A very minute and somewhat obscure species. It appears to have nearly attained its full growth, though the peristome is still thin. The protoconch does not seem heterostrophe, though slightly involved; the whorls are tumid, thin, olivaceous; mouth oval; columella once-plaited. It is superficially not unlike a *Litiopa*, whence the specific name.

ODOSTOMIA MAJOR, sp. n. (Plate XXIII. fig. 2.)

O. *testa oblonga, lævi, nitida, alba, apud apicem paullum attenuata; anfractibus novem, apicali lævi, vitrea, heterostropho, cæteris planatis, infra suturas zona subpellucida interna decoratis, ultimo anfractu obscurissime sub lente spiraliter albostriato; apertura paullum effusa, ovata, intus striata; labro continuo, tenui; columella fortiter implicata.*

Long. 6, *lat.* 2 *mm.*

Hab. I. Karachi. 3 fathoms.

Not so frequent as *O. eutropia* Melv., which occurs in the same locality. It is amongst the largest of the genus, and also distinguished by its oblong, attenuately fusiform shape, perfect smoothness, and aperture slightly effuse, striate within, three apical striæ showing semipellucently through on the body-whorl. There are no signs of peripherial carination.

Odostomia syrnoloides Melv.

P.G. Gulf of Oman. Lat. 24° 49′ N., long. 55° 56′ E; 225 fathoms, mud and sand. Lat. 24° 55′ N., long. 57° 59′ E.; 37 fathoms, mud and sand. Lat. 26° 35′ N., long. 54° 31′ E.; also lat. 24° 05′ N., long. 57° 35′ E.; 205 fathoms, mud.

I. Karachi.

Odostomia (Pyrgulina) callista Melv.

P.G. Kishm Island, in 5 fathoms.

M.C. Charbar. At low tide amongst mud and weed on loose rocks; much finer specimens than types from Bombay.

I. Karachi and Bombay (*Abercrombie*).

Its nearest ally is *P. cœlata* Ads., a much larger shell in all its parts.

Odostomia (Pyrgulina) casta A. Ad.

I. Karachi. Amongst mud, weed, and loose stones at low tide.

Odostomia (Pyrgulina) edgarii Melv.

I. Karachi. Amongst mud, weed, and loose stones at low tide. Bombay (*Abercrombie*).

Allied to *P. consobrina* Ad.

Odostomia (Pyrgulina) epentromidea Melv. (Ann. Mag. Nat. Hist. ser. 7, vol. iv. p. 94).

P.G. Bushire; lat. 26° 23′ N., long. 54° 53′ E. Kishm Island, in 5 fathoms, soft mud.

Near *O. brenda* A. Ad., from Japan, but differing in form of aperture and body-whorl.

Odostomia (Pyrgulina) glycisma Melv.

P.G. Bushire. I. Karachi.

Odostomia (Pyrgulina) interstriata Sowb.

I. Karachi. Bombay (*Abercrombie*).

Larger than *P. edgarii*. A New Caledonian species, with wide range.

Odostomia (Pyrgulina) pyrgomella Melv.

I. Karachi, on rocks at low tide, very rare. Bombay (*Abercrombie*).

Odostomia (Miralda) diadema A. Ad.

I. Karachi, 7 fathoms.

Odostomia (Miralda) idalima Melv.

P.G. Bushire. I. Bombay (*Abercrombie*).

Odostomia (Miralda) opephora Melv.

M.C. Charbar. I. Karachi.

(*d*) RHACHIOGLOSSA.

Fam. MURICIDÆ.

MUREX MALABARICUS Sm. Ann. Nat. Hist. [6] xiv. p. 162, pl. 3. fig. 1.

M.C. Young specimens in very perfect condition, adhering to the telegraph-cable, 10–30 fathoms, mud.

I. On Eastern Telegraph Co.'s cable, 125 m. W.S.W. of Bombay. 45 fathoms; and lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

This species was discovered by Dr. Alcock, F.R.S., and the late Prof. J. Wood-Mason during the survey of the s.s. 'Investigator' off the Malabar Coast, lat. 11° 05′ 43″ N., long. 78° 04′ 08″ E., in 35 fathoms; so its range is now extended considerably to the north and north-west.

MUREX TENUISPINA Lam.

I. Karachi. 20–30 fathoms, mud.

MUREX TERNISPINA Lam.

P.G. Jask, probably locally extending over the Mekran Coast.

MUREX TRIBULUS L.

I. Bombay (*Abercrombie*).

MUREX (CHICOREUS) ADUSTUS Lam.

I. Kolaba Point, Bombay (*Abercrombie*). Kolaba (or Colaba) Point and southwards (*Lt.-Col. H. D. Olivier*).

MUREX (CHICOREUS) AXICORNIS Lam.

P.G. Several adhering to telegraph-cable, 40–50 fathoms, mud. Henjam Island.

MUREX (CHICOREUS) BANKSII Sowb.

P.G. S. of Shaikh Shuaib Island. Only once dredged at 7 fathoms, coral and sand

MUREX (CHICOREUS) MAURUS Brod.

I. Bombay (*Abercrombie*).

MUREX (CHICOREUS) MICROPHYLLUS Lam.

I. Karachi.

We have this also from Ceylon. The locality "Panama" given in certain text-books seems untrustworthy.

MUREX (CHICOREUS) SPECTRUM Rve.

P.G. Henjam Island.

MUREX (PHYLLONOTUS) CIRROSUS Hinds.

M.C. Probably between Jask and Charbar. A remarkably beautiful example, with incurved spines.

MUREX (PHYLLONOTUS) RUSTICUS Rve.

M.C. Occasionally on telegraph-cable. We have also received this from the Andaman Is. (*Booley*).

MUREX (PHYLLONOTUS) TURBINATUS Lam. (=*spinosus* A. Ad.).

P.G. Found from low tide on coral-reefs to 10 fathoms' depth. Dredged specimens occur amongst coral, loose stones, and muddy sand.

I. Karachi.

MUREX (HOMALACANTHA) ROTA Sowb.

P.G. S.W. coast of Shaikh Shuaib Island. 7 fathoms, loose coral and muddy sand. Two or three examples of a variety, white, with violet tinge, on telegraph-cable at 45 fathoms.

This is *M. anatomicus* Perry, 1811, which name has priority.

MUREX (OCINEBRA) BOMBAYANUS Melv.

I. Karachi. From low-tide mark to 5 fathoms, amongst loose rock and muddy sand. Bombay and Ratnagiri, abundant (*Abercrombie*, *Herford*, and *W. T. Blanford*). Near Goa and Panjim (*Lt.-Col. H. D. Olivier*).

The Indian analogue of *M. cristatus* Brocchi, from the Mediterranean.

MUREX (OCINEBRA) CYCLOSTOMA Sowb.

P.G. S.E. of Shaikh Shuaib I. 7 fathoms, coral, loose stones. and sand. Rare.

MUREX (OCINEBRA) FLEXIROSTRIS Melv.

P.G. Gulf of Oman, Maskat; 15 fathoms, local.

Lat. 24° 55′ N., long. 57° 54′ E.; 37 fathoms, sand and mud.

One specimen, juvenile, light chestnut in colour, with the canal barely flexuose.

MUREX (OCINEBRA) PHOLIDOTUS B. Wats.

P.G. Henjam I.; 12 fathoms, mud and stone bottom. Gulf of Oman, Malcolm Inlet (Kubbatt Ghazira); 20 fathoms.

Dr. Boog Watson described this species (Rep. Voy. 'Challenger,' xv. p. 158, pl. x. fig. 3), collected at Flinders Passage, Cape York, from worn types; hence the figure is uncharacteristic.

MUREX (OCINEBRA) SEROTINUS A. Ad.

P.G. Gulf of Oman, Malcolm Inlet (Kubbatt Ghazira); on telegraph-cable, 30–40 fathoms. Not quite typical.

UROSALPINX CONTRACTA Rve.

I. Bombay (*Abercrombie*), typical. Goa and Panjim (*Lt.-Col. H. D. Olivier*).

Var. *calcarea* Dkr.

P.G. M.C. From half-tide mark to 50 fathoms, common. Deep-water specimens occur mainly amongst shell-growth on the telegraph-cable, and are always much smaller than those found between tide-marks.

UROSALPINX INNOTABILIS Sm.

P.G. Shaikh Shuaib Island, scarce.

RAPANA BULBOSA Soland.

P.G. Adhering in all stages of growth to the covering of telegraph-cable, 10–35 fathoms.

LATIAXIS DIADEMA Sowb.

P.G. Occurs locally amongst shell-growth on telegraph-cable, 50 fathoms, mud. This, one of the most beautiful of all Mollusca, was only obtained on one occasion, in 1887, by Mr. Townsend, but fortunately many examples were secured.

PURPURA PERSICA L.

M.C. Under rocks generally, often in clusters of twenty to a hundred individuals.

PURPURA RUDOLPHI Chemn.

I. Bombay (*Abercrombie*; *Olivier*).

PURPURA (THALESSA) BUFO Lam.

I. Karachi. Very abundant amongst rocks at half-tide to low-water mark (*F. W. T.*). Some specimens are unusually developed; in one the spire being entirely concealed by a thick coating of enamel (*W. C. Carphin*). Near Goa and Panjim (*Lt.-Col. H. D. Olivier*). Bombay (*Abercrombie*).

PURPURA (THALESSA) HIPPOCASTANUM Lam.

I. Bombay (*Abercrombie*).

PURPURA (THALESSA) ECHINULATA Lam.

I. Bombay (*Abercrombie*).

PURPURA (THALESSA) MANCINELLA Lam.

I. Karachi. At half-tide mark, on rocks, Black Fort reef.

PURPURA (STRAMONITA) BLANFORDI Melv.

M.C. Charbar. 7 fathoms.

I. Karachi (*W. T. Blanford* in Mus. Brit.). Bombay, Ratnagiri (*Abercrombie, Herford, & Blanford*). Near Goa and Panjim (*Lt.-Col. H. D. Olivier*).

PURPURA (STRAMONITA) RUSTICA Lam.

P.G. Gulf of Oman, Jask beach.

PURPURA (POLYTROPA) SACELLUM Ch. (= *Cuma rugosa* Born).

M.C. Charbar.

I. Karachi. Bombay (*Abercrombie*), on muddy rocks at low tide. Goa and Panjim (*Lt.-Col. H. D. Olivier*).

JOPAS SERTUM Brug.

Var. *francolina* Brug.

M.C. Charbar. On muddy banks at low tide, but rarely.

VEXILLA VEXILLUM Lam.

M.C. Charbar beach.

CUMA CARINIFERA (Lam.).

I. Karachi. Rocks at low-water mark. Fine examples recently collected measure 2 inches in length (*W. C. Carphin*). Near Goa and Panjim (*Lt.-Col. H. D. Olivier*).

SISTRUM ANAXARES Duclos.

P.G. Henjam Island, 7–25 fathoms, mud. Mussandam, on rocks.

SISTRUM CHRYSOSTOMA Desh.

P.G. Shaikh Shuaib Island.

SISTRUM CONCATENATUM Lam.

I. Karachi.

SISTRUM KONKANENSE Melv.

I. Karachi. Bombay (*Abercrombie, W. T. Blanford*).

SISTRUM MARGARITICOLUM Brod.

M.C. Rare.

For a remark about this species, *vide* Journ. Linn. Soc., Zool. xxvii. p. 163.

SISTRUM OCHROSTOMA Blv.

M.C. Rare. I. Karachi.

Var. *heptagonale* Rve. (sp.).

M.C. With the type.

SISTRUM SIDEREUM Rve.

I. Karachi.

SISTRUM SUBNODULOSUM Melv.

I. Karachi. Bombay (*Abercrombie, Herford*).

SISTRUM TUBERCULATUM Blv.

M.C.

I. Karachi, amongst rocks at low tide. Bombay, common (*Abercrombie; Olivier*).

SISTRUM UNDATUM Chemn. (= *Purpura muricina* Blake).

I. Karachi.

SISTRUM XUTHEDRA Melv.

I. Karachi. Ratnagiri (*Abercrombie*).

Fam. CORALLIOPHILIDÆ.

CORALLIOPHILA JEFFREYSII Sm.

M.C. Charbar Point, 5 to 7 fathoms.

I. Karachi Harbour. Bombay (*Abercrombie*).

Coralliophila persica Melv.

P.G. On the telegraph-cable, 20–30 fathoms.

Coralliophila rubrococcinea, sp. n. (Plate XXI. fig. 2.)

C. *testa perforata, ovato-fusiformi, versus apicem attenuata, undique aspera, squamulosa, rubescente vel cinerea, salmonea vel sordide alba; anfractibus novem, apicalibus duobus inclusis, pellucidis, cæteris ventricosis, longitudinaliter crassicostatis, costis anfractus ultimi novem, spiraliter arcte omnino, cum interstitiis, squamulatis; apertura pyriformi, in typo intus vivide rubescenti-coccinea vel miniata, interdum pallida vel cinerascente, labro tenui, paullum effuso, apud basim attenuato; columella paullum excavata.*

Long. 23, *lat.* 12·50 *mm.*

Hab. Persian Gulf: Shaikh Shuaib Island; Linjah, at 25 fathoms.

A very beautiful form: with no very near ally in the genus. Whorls nine, ventricose, impressed at the sutures, the protoconch vitreous, coloured (in the type) as the body of the shell, and centrally noduled, the remainder of the whorls are uniformly thickly longitudinally ribbed, spirally closely costulate, with scaly striæ; the interstices likewise scaly. Mouth pear-shaped, deep crimson-red (in the type), outer lip effuse, thin; columella slightly excavate.

Fam. Columbellidæ.

Columbella fuscata Ad.

I. Bombay (*F. W. T.*). Not occurring in the Abercrombie list.

Columbella pardalina Lam.

M.C. Charbar, on mud-covered rocks.
I. Karachi.

Columbella propinquans Sm.

P.G. Linjah, 3½ fathoms (Dec. 1900).
I. Karachi.

Columbella versicolor Sowb.

M.C. Charbar. Amongst shingle, finely marked.

Columbella (Mitrella) agnesiana, sp. n. (Plate XXIII. fig. 3.)

C. *testa nitida, eleganter fusiformi, perlævi, attenuata; anfractibus* 9–10, *quorum apicali parvo, mamillato, cæteris lævibus, albis, castaneo-reticulatis et maculatis, ultimo anfractu prolongato, fortiter infra medium ad basim spiraliter sulculoso; apertura* *oblonga, labro extus lævi, incrassato, intus* 8–9-*denticulato, denticulis albis vel (rarius) sanguineo-tinctis; columella flexuosa, alba vel sanguinea; canali paullum recurvo.*

Long. 9, *lat.* 2·50 *mm.*

Hab. P.G. Bushire. Gulf of Oman, Maskat.
M.C. Charbar. Sandy mud, 5 fathoms.

An elegant species which, in Mr. Pace's opinion, is distinct from all described, though near to *C. pudica* Braz. from the Torres Straits. From this it would seem to differ in size, number of whorls, peristome, though similar in disposition of markings and general form. One Charbar example possesses the periostracum, thin, semitransparent, sericeous, and olivaceous in colour.

Columbella (Mitrella) alizonæ, sp. n. (Plate XXI. fig. 5.)

C. *testa lævi, ovato-fusiformi, infra medium anfractus ultimi conspicue sulculosa ad basim, solida, straminea, plus minus castaneo-maculata vel fasciata; anfractibus octo, quorum tres apicales vitrei, læves, cæteris vix ventricosis, lævissimis, ultimo cæteros magnitudine superante* (7 *mm.*), *tumidulo; apertura obliqua, oblonga, intus pallide violacea vel albescente, labro intus circa quinque-denticulato; columella quadri- vel quinque-tuberculata, nitida, paullulum incrassata; canali lato.*

Long. 11·25, *lat.* 4·50 *mm.*

Hab. P.G. Shaikh Shuaib Island; Bushire; also dredged lat. 27° N., long. 52° E., and 26° N., 57° E., on the telegraph-cable.

I. Lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

Variable only in disposition of marking and pattern; the shell being uniformly smooth, body-whorl tumid, the remainder hardly ventricose; apical whorls three, vitreous. Occasionally, as in the specimens dredged at lat. 27° from the cable, they are wholly brown or chestnut-coloured, with hardly any discernible pattern; and again, as in the Bushire examples, beautifully tessellate, having on the body-whorl rounded spiral, regularly-arranged clear spaces beneath the sutures, and a well-defined central fascia below.

Mr. Pace considers this quite distinct from *C.* (*Mitrella*) *dunkeri* Tryon (=*varians* Dnkr. præocc.). Upon carefully comparing it with authentic specimens of this latter, to which it is certainly nearly allied, we note, first, that *C. alizonæ* possesses 8 as against 7 whorls, that the body-whorl is bolder and more tumid, that the disposition of marking is not so variable, *C. dunkeri* being either lineated, longitudinally linear-striped, or transversely dotted, and reticulate[1]; and, lastly, the mouth-processes and denticulations are stronger and better defined. The species, in fact, is larger and more solid in every way. We dedicate this interesting form to Miss Alizon Townsend, daughter of its discoverer.

[1] Some examples also being almost unicolorous lilac or salmon-coloured.

COLUMBELLA (MITRELLA) ASTOLENSIS, sp. n. (Plate XXIII. fig. 4.)

C. *testa lævissima, nitida, anguste fusiformi, subpellucente; anfractibus octo, apicali obtuso, cœteris nequaquam ventricosis, stramineis, infra, juxta suturas, albo et castaneo pellucide tæniatis et fasciatis, aliter (in typo) unicoloribus, in varietate undique castaneo obscure reticulata, tænia hic absente, illic obscure videnda, ultimo anfractu infra medium ad basim leniter spiraliter sulculoso; apertura ovata, labro perlævi, nitido, incrassato, intus* 8-9-*denticulato, albido; columella nitida, simplici, canali lato.*

Long. 7, *lat.* 2 *mm.*

Hab. M.C. Astola Island, 3 fathoms, sand. Charbar.

C. lincolnensis Reeve, from S. Australia, is considered by Mr. Pace the nearest ally to this species. It is, however, nearly twice the size, and though in one variety it assimilates in its markings to our type, it is nevertheless far more variable in its range of pattern. We have some examples which also exhibit a complete network of chestnut reticulations, as in our variety above noticed. Apart from the extreme difference in habitat, and the absence of any known intermediates, we, with Mr. Pace, consider *C. astolensis* should take rank as a good species, though we are bound to admit the difference in size just mentioned—12 mm. against 7 mm.—furnishes the chief argument for its separation.

COLUMBELLA (MITRELLA) BLANDA Sowb.

P.G. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 30 fathoms, sand and mud.

M.C. Occasionally near Gwadûr and Ormara.

I. Karachi. Not uncommonly from half-tide mark to 10 fathoms.

Var. *candidans*, nov.

Forma ut in typo, sed omnino albida, nitida.

I. Karachi. An interesting immaculate form.

COLUMBELLA (MITRELLA) CARTWRIGHTI Melv.

P.G. Bahrein (*Capt. Cartwright*). Usually found at 7 fathoms; muddy sand bottom.

COLUMBELLA (MITRELLA) DORIÆ Issel.

P.G. Bunder-Bouchir (Bushire) (*M. F. Houssay*). According to Tryon, a var. of *C. mindoroensis* Rve. A doubtful specimen in Townsend's collection.

COLUMBELLA (MITRELLA) EUTERPE Melv.

I. Karachi, abundant. Bombay (*Abercrombie*).

COLUMBELLA (MITRELLA) FLAVILINEA Melv.

I. Bombay (*Abercrombie*).

COLUMBELLA (MITRELLA) MARQUESA Gask.

I. Bombay (*Abercrombie*).

Columbella (Mitrella) nomadica[1], sp. n. (Plate XXI. fig. 7.)

C. *testa fusiformi, oblonga, robusta, perlævi, parum nitida, solida; anfractibus 8–9, quorum apicales tres læves, parvi, unicolores, cæteris albis, nigro-brunneo arcte reticulatis, interstitiis rotundis, infra, juxta suturas hic illic permagnis, conspicuis, anfractu ultimo versus basim spiraliter sulculoso; apertura oblonga, labro extus crassiusculo, intus denticulato; columella simplici.*

Lat. 8, *long.* 3 *mm.*

Hab. Karachi.

With a considerable resemblance to *C. cribraria* Lam. of the New World, this species is somewhat larger and coarser in detail; it is a particularly handsome form, and now that it has been differentiated will be probably considered very distinct.

Columbella (Mitrella) zebra Gray (=*miser* Sowb.).

P.G. Linjah.

M.C. Not infrequent, under stones at low water.

Mr. Pace writes: "A very elate and pale form of the species known usually as *C. miser* Sowb., agreeing perfectly with the type of *C. elata* Reeve; but the latter is recorded, perhaps erroneously, to come from California."

Columbella (Anachis) rugulosa Sowb.

I. Karachi.

Columbella (Anachis) terpsichore Leathes.

M.C. Often on mud-covered rocks at low tide.

I. Bombay (*Abercrombie*).

Mr. Pace notes on a specimen of gigantic dimensions (prob. *C. miser*) from Mekran Coast, that it "in some respects approaches *C. terpsichore* Leathes." Here we see the frequent futility of subgeneric distinctions; in the text-books the three nearly allied Columbellæ are at present placed in three subgenera, viz.:—

C. (*Atilia*) *elata* Reeve.
C. (*Mitrella*) *miser* Sowb.
C. (*Anachis*) *terpsichore* Leathes.

Columbella (Atilia) albinodulosa Gask.

M.C. Local.

This was at first referred to *C. nivosa* Reeve, the body-whorl being slightly nodulous and the brown maculation more intense.

Columbella (Atilia) compressa Gask.

I. Karachi. An Erythræan species.

Columbella (Atilia) conspersa Gask.

P.G., I. No precise localities; also dredged off Ceylon (*W. A. Tindall*).—Mr. S. Pace deems this synonymous with, at all events,

[1] *nomadica*, from the likeness in marking to the "ὄρνις νομάδικα," or Guinea-fowl.

the Andamanese *C. puella* Sowb. Under this latter name we have from Mr. Townsend beautiful examples from the Mekran Coast.

COLUMBELLA (SEMINELLA) ATOMELLA Duclos.

I. Seems to be the Bombay species, cast up in thousands below Malabar Hill and elsewhere in shell-sand. It differs from the species described below as *C. melitoma* in being longer, slightly larger, with straightened whorls; ribs thick, smooth; coloration more uniform.

COLUMBELLA (SEMINELLA) MELITOMA [1], sp. n. (Plate XXIII. fig. 5.)

C. *testa minuta, ovato-obesa, subpellucida; anfractibus sex, quorum tres apicales læves, albo-lactei, cæteris turritis, ventricosulis, ad suturas impressis, undique longitudinaliter costatis, costis crassis, rectis, ad ultimum circa quatuordecim, flavo-pellucidis, nitidis, lævissimis, supra juxta suturas, spiraliter albo-tæniatis, sæpe infra medium anfractus ultimi versus basim cancellatis, liris spiralibus delicatis, ad juncturas costarum minutissime gemmulatis, ad basim fortiter sulculosis; apertura angusta, labro flavo, lævi, incrassato, intus denticulato; columella flava, simplici, fere recta.*

Long. 3·25, *lat.* 1·50 *mm.*

Hab. Karachi.

A common species at the above-named locality. It is perfectly distinct from all forms of *C. selasphora* described in this paper; and, seemingly, the whorls are more ventricose than in *C. atomella* Ducl., which is the Bombay species, according to our present determinations. It is true *C. atomella* does not appear to have been perfectly described, and accordingly some element of doubt attaches to it. The present species (*C. melitoma*) differs in, as just said, its ventricose whorls, thick ribs, smooth, excepting where crossed by slender liræ towards the base of the body-whorl, and golden-yellow colour. The opaque white spiral band just below the sutures is likewise characteristic.

COLUMBELLA (SEMINELLA) PHAULA [2], sp. n. (Plate XXIII. fig. 6.)

C. *testa minuta, attenuato-fusiformi, tenui, sordide straminea vel fusca; anfractibus 5, quorum apicales duo sæpe nigro-fusci, undique longitudinaliter crassicostatis, costis in ultimo anfractu ad duodecim, interstitiis lævibus, planatis, ultimo anfractu ad basim sulco-lirato; apertura angusta, labro lævi, interdum purpureo-suffuso, intus planato; columella simplici.*

Long. 2, *lat.* 1 *mm.*

Hab. Karachi.

This very minute species, doubtless nearly allied to *C. melitoma* and others of this group, is much the smallest of the Karachi species, and the ribs are thicker in proportion to the size of the shell. There is no trace of spiral liration, nor has the lip any denticles on the inner surface. The form is also more attenuate and exiguous.

[1] *μελίτωμα*, a honey-cake, from the golden colour.
[2] *φαῦλος*, insignificant.

COLUMBELLA (SEMINELLA) SELASPHORA [1], sp. n. (Plate XXIII. fig. 7.)

C. *minuta, ovata, plerumque obesula, solidiuscula, cinereo-straminea, flammis fulgetrinis rufo-fuscis pulchre dispositis; anfractibus* 6–7, *quorum apicales tres globulosi, vitrei, cæteris regulariter costis longitudinalibus, lævibus, rectis, decoratis, ultimi anfractus ad tredecim, interdum supra basim evanidis, interdum, sed rarius, dorsaliter undique lævibus; apertura anguste oblonga, labro paullum incrassato, lævi, intus paucidenticulato; columella nitida, simplici.*

Long. 3, *lat.* $1\frac{1}{2}$ *mm.*

Hab. Karachi.

According to Mr. S. Pace, this species has hitherto been confounded with *C. troglodytes* Souv., from New Caledonia, or *C. ornata* Pease. It is by the former name that we have for years labelled it in our collections. There are, dispersed over the tropics of both hemispheres, about a dozen or more closely-allied species of *Seminellæ*, mostly gregarious, and collected in handfuls where they occur, and which only acute systematic research can hope to successfully differentiate. This species is principally conspicuous for its smooth longitudinal ribs, with no revolving lines, the ribs themselves being often obsolete on the last whorl, wholly or, at all events, in part. The beautiful zigzag painting, like lightning-flashes, is also characteristic.

COLUMBELLA (SEMINELLA) TOWNSENDI, sp. n. (Plate XXIII. fig. 8.)

C. *testa minuta, ovata vel obesula, brunnea vel castanea, vel straminea, solida; anfractibus* 6–7, *quorum apicales* $1\frac{1}{2}$ *albo-lactei, cæteris ad suturas impressis, subturritis, longitudinaliter crassicostatis, undique spiraliter liratis, liris ad juncturas costarum gemmulatis, nitidis, interdum ad medium anfractus ultimi absentibus aut partim evanidis; apertura anguste oblonga, labro incrassato, intus denticulato; columella recta, simplici, haud multum incrassta.*

Long. 3·50, *lat.* 1·50 *mm.*

Hab. Karachi.

A variable and locally abundant species, at first thought to be identical with *C. ostreicola* Sowb., or its ally *C. nigricans* Sowb.; both these being species of the New World. In the opinion of Mr. Pace it is sufficiently distinct from both these, and from *C. atrata* Gould, to need a cognomen and description. There appear two varieties: one, the typical, uniformly thickly ribbed, chestnut or brown unicolorous, crossed by revolving liræ entirely over the surface; while the other is spirally banded with darker brown, just where the liræ are present, they becoming either partially or entirely obsolete in the centre of the body-whorl, and in this instance a central light fascia is exhibited.

[1] σέλας, lightning; φέρω, I bear.

N.B.—The whole of our material has been carefully examined by Mr. S. Pace, with whom this difficult genus has been long the special subject of careful study; and we have in almost every instance followed his opinion. It is mainly by his recommendation that we have ventured to describe certain small, plentiful, but obscure forms, as they have been, perhaps, too hastily considered till now identical with certain forms of the Western Hemisphere, e. g., *atrata* Gould, *ostreicola* Sowb., *diminuta* C. B. Ad., *troglodytes* Souv., and *ornata* Pease.

ÆSOPUS URANIA, sp. n. (Plate XXIII. fig. 9.)

Æ. testa attenuata, fusiformi, angusta, nitida, brunnea, versus apicem albescente; anfractibus 6–7, *apicalibus tribus lævissimis, vitreis, cæteris obscure sed arcte spiraliter striatis, læte brunneis; apertura angusta, oblonga, labro paullulum expanso; columella obliqua, versus basim truncata.*

Varietas *albens*, nov.

Testa omnino albata, aliter uti supra.

Long. 6·50, *lat.* 2 *mm.*

Hab. Mekran Coast, in two or three localities, local; the variety rarer, found in company with the type.

A highly interesting mollusc. Judging from the shell alone, it might be considered a *Columbella*, *Euryta*, *Thala*, or even *Olivella* allied to *O. nympha* Ad. & Ang. In consultation with Mr. Stephen Pace, we decided to allocate it to the genus *Æsopus* Gould, allied to *Columbella*, and characterized by its author as possessing a fusiform shell, broadly truncate posteriorly, aperture linear, with posterior callus (this, we may say, does not appear present to any great degree in our specimens); columella smooth, vitreous.

The colour typically is uniformly chestnut or darker brown, fading into white towards the apex—the variety *albens* being, as aforesaid, wholly colourless; perhaps, as Mr. Pace opines, a bleached state only. The last two or three whorls are to a great extent vitreous. Aperture narrow; columella basally truncate, and oblique; outer lip inclined to slight effusion. The whole surface of the whorls is closely, but obscurely spirally striate. Mr. Pace adds that he considers *Truncaria australis* Ang. has affinity with it.

Fam. NASSIDÆ.

BULLIA (PSEUDOSTROMBUS) CEROPLASTA Melv.

M.C. Charbar. 7 fathoms, sandy mud, abundant.

This species might stand as the type of a new subgenus, the character of the longitudinal costæ being distinct from that obtaining in any other member of the group.

BULLIA (PSEUDOSTROMBUS) CUMINGIANA Oliv.

P.G. Galig I., at low tide, exhibiting much variation in colour. Some are pale stramineous, ashy only towards the apex, others banded with dark cinereous on a pale ground.

BULLIA (PSEUDOSTROMBUS) INDUSICA Melv.

I. Karachi. Only two specimens, neither quite adult, occurred, both now in the British Museum (Nat. Hist.).

BULLIA (PSEUDOSTROMBUS) KURRACHENSIS Angas.

M.C. "Found in Nov. 1896, off the Hajamra mouth of R. Indus, in hard muddy sand, during a very low tide. Their presence was indicated by a certain slight unevenness of the surface, and small air-holes. The only other specimens previously obtained came from 3–7 fathoms, on soft black bottom, and also hard mud, but no adults have ever been dredged." (*F. W. T.*)

BULLIA (PSEUDOSTROMBUS) LINEOLATA Wood (=*belangeri* Kien.).

M.C. Common along the coast of Baluchistan.

I. Karachi. An abundant species usually occurring from 2–5 fathoms, on hard, muddy sand-bottom. Bombay (*Abercrombie*). Near Goa (*Lt.-Col. H. D. Olivier*).

BULLIA (PSEUDOSTROMBUS) MALABARICA Hanley.

M.C. On clean sand at low-water mark on two or three points of the Baluchistan coast.

I. "During November and December 1895, large numbers in many varieties of colour, and all stages of growth, appeared on the Manora beach. Not seeming to have any holes to retreat into like *B. persica* Sm., they moved about a good deal, and when stationary remained only just below the sand-surface. After the end of January 1896, not a single specimen was to be seen, and up to the present time (November) they have not reappeared at Manora." (*F. W. T.*) Mentioned by Abercrombie as occurring at Bombay. Three colour varieties occur: pale stramineous merging into white, livid grey, and grey banded with stramineous centrally.

BULLIA (PSEUDOSTROMBUS) MAURITIANA Gray.

M.C. Dead examples only, and those but rarely.

I. Bombay (*Abercrombie*), rare.

BULLIA (PSEUDOSTROMBUS) NITIDA Sowb.

M.C. Charbar, Gwadûr, and other places. 2–7 fathoms, on clean sand.

I. Karachi, occasionally hauled up in some abundance, with *Cingulina*, *Odostomiæ*, &c.

BULLIA (PSEUDOSTROMBUS) PERSICA Sm.

M.C. "Common on the western shores of Baluchistan on clean, hard sand at low tides. Upon being approached the animal takes refuge in holes in the sand, burrowing to a considerable depth, and thus eluding capture. This species varies much in colour, from yellow, or livid purple, to almost white." (*F. W. T.*)

BULLIA (PSEUDOSTROMBUS) TAHEITENSIS Gmel.

P.G. M.C. From Bushire to Charbar dead shells are often observable on the shore.

I. Karachi, a few living at 4 fathoms.

Bullia (Pseudostrombus) vittata L.

M.C. Charbar Point.

Nassa arcularia L.

P.G. Gulf of Oman, Maskat.

M.C. Generally distributed on the coast of Baluchistan at from 10–20 fathoms, mostly muddy sand-bottom.

Nassa coronata L.

P.G. Gulf of Oman: Malcolm Inlet (Kubbatt Ghazira). 25 fathoms, muddy sand.

Nassa pulla L.

P.G. On Cable, 24 fathoms, muddy sand-bottom.
M.C. Charbar Point, at low tide.
I. Karachi.

Nassa (Arcularia) leptospira A. Ad.

I. Karachi. 3 to 7 fathoms, on hard sandy mud.

Nassa (Arcularia) obockensis Jouss. (=*zailensis* Sowb.).

P.G. Shaikh Shuaib Island. Linjah, 3½ fathoms.
I. Karachi.

This species has been found to extend to the Andamans (*Booley*).

Nassa (Arcularia) persica v. Mart.

P.G. and M.C. From half-tide to low-water mark on every variety of bottom.

Nassa (Arcularia) thersites Brug.

Var. *bimaculosa* A. Ad.

P.G. Galig Island.

I. Bombay, and Ratnagiri (*Abercrombie*), the typical form only.

Nassa (Alectryon) babylonica S. Wats.

P.G. Gulf of Oman: lat. 24° 55′ N., long. 57° 59′ E.; 37 fathoms, sand and mud. Also lat. 25° 14′ N., long. 59° 45′ E.; 80 fathoms.

I. Karachi. Rare at 7 fathoms. Lat. 18° 58′ N., long. 71° 45′ E.; 40 fathoms.

Nassa (Alectryon) cælata A. Ad.

I. Karachi. 3 fathoms, loose stones and muddy sand.

Nassa (Alectryon) collaticia[1], sp. n. (Plate XXIII. fig. 10.)

N. *testa mediocri, ovata vel oblongo-ovata, solida, alba, subnitente; anfractibus* 8, *quorum apicales tres subpellucidi, læves, ad medium sub lente delicate spiraliter unicarinati, cæteris turritis, infra suturas spiraliter uniplicatis, ad costas nodulosis, in typo castaneo-tinctis, undique longitudinaliter oblique paucicostatis, costis*

[1] *collaticius*, gregarious.

acutis, ultimum ad anfractum circa duodecim, interstitiis spiraliter argute sulcatis; apertura ovata, labro incrassato, intus denticulato, margine columellari supra uninoduloso, infra versus basim tridenticulato; canali brevissimo.

Long. 8·25, *lat.* 4 *mm.*, *sp. maj.*

Hab. Lat. 25° N., long. 63° E. 25 fathoms.

Several examples, many in subfossil condition. This seems a distinct form, to which we have not discovered a near ally. It may be distinguished by its ovate form, whorls slightly turreted, smooth protoconch, the next apical whorls being vitreous, once transversely carinate, the remainder of the whorls acutely longitudinally ribbed, ribs smooth, shining, the interstices being spirally sulcated with sharp, narrow furrows. The mouth is oval, outer lip denticulate within, the columella also being nodulous above, and thence denticulate near the base.

NASSA (ALECTRYON) ELEGANS Kien.

P.G. 24 fathoms, sandy mud.

M.C. Specimens all juvenile, but very finely and characteristially marked; dredged at 10 fathoms.

NASSA (ALECTRYON) ERANEA [1], sp. n. (Plate XXIII. fig. 11.)

N. *testa ovata, compressa, versus apicem attenuato-turrita, solida, castaneo-fulva; anfractibus octo, quorum apicales tres vitrei, delicatissime infra medium unicarinati, cæteris ad suturas impressis, arcte crassicostatis, costis infra, juxta suturas, uni- vel bi-nodulosis, liris spiralibus obscuris vel, interdum, omnino evanidis; apertura rotundo-ovata, intus fulvescente; labro albo, incrassato, nitido, intus paucidenticulato; columella supra denticulis binis, infra tribus prædita, alba, nitida; canali lato, brevi.*

Long. 12, *lat.* 6 *mm.*

Hab. Persian Gulf (no precise locality).

Allied to *N. bifaria* Baird. An obese species, pale fulvous brown, attenuate towards the apex; apical whorls three, once-carinate, otherwise quite smooth and vitreous, the remaining whorls hardly ventricose, closely stoutly ribbed longitudinally, just below the sutures they are spirally once or twice noduled, the remaining spiral lines are often almost obsolete but occasionally present throughout. Mouth round; outer lip thickened, white, with few denticles within; the columella possessing a callous nodule above, and being also denticled or rarely noduled basally; canal broad, short.

NASSA (ALECTRYON) HIRTA Kien.

I. Karachi. 3 to 7 fathoms, gravel.

NASSA (ALECTRYON) IDYLLIA, sp. n. (Plate XXIII. fig. 12.)

N. *testa ovata, spira paullum attenuata, solida, straminea; anfractibus 8, quorum apicales quatuor læves, ad medium fortiter*

[1] ἔρανος, a contribution.

acuticarinatis, cæteris ad suturas impresso-canaliculatis, gradatulis, undique longitudinaliter multicostatis (costis in ultimo circa 24), infra, juxta suturas, spiraliter incrassatis, deinde undique regulariter tenuiliratis, ultimo anfractu usque ad basim lirato ; apertura fere rotunda, labro multum incrassato, intus 6–8-denticulato ; columella nitida, alba.

Long. 11, *lat.* 5 *mm.*

Hab. Gulf of Oman, lat. 24°55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

The particular sounding, as given above, was prolific in results : this neat addition to the genus *Nassa* being noteworthy. It, perhaps, recalls the species described by Messrs. G. & H. Nevill as *N. obesa*, from Kutch, but is not half the size, and the cancellation is much finer and more uniform. The protoconch is interesting.

NASSA (ALECTRYON) MUCRONATA A. Ad.

I. Karachi. 3 to 7 fathoms, gravel and muddy sand. Bombay, common (*Abercrombie*).

NASSA (ALECTRYON) NODIFERA Powis.

I. Bombay (*Abercrombie ; Olivier*). Perhaps only a subspecies of *N. hirta* Kien.

NASSA (ALECTRYON) OBESA G. & H. Nevill.

I. Kutch.

NASSA (ZEUXIS) FILOSA Gray.

M.G. At low tide, both on sand, and in crevices of rocks.
I. Karachi. Bombay (*Abercrombie*).

NASSA (ZEUXIS) LENTIGINOSA A. Ad.

I. Bombay, rare (*Abercrombie*).

Tryon unites this, *filosa, picta*, and others with *N. gaudiosa* Hinds, but, in our opinion, he has been too sweeping and drastic in many of his conclusions. The first two variaties occur also at Bombay.

NASSA (ZEUXIS) MARRATI Smith.

M.C. Charbar. On sandy mud at low tide just under the surface, at the water's edge.

NASSA (ZEUXIS) PALLIDULA A. Ad.

P.G. Gulf of Oman, Malcolm Inlet. 55 fathoms on cable.
I. Karachi.

NASSA (ZEUXIS) PICTA Dkr.

Var. *marmorea* A. Ad.

P.G. On the telegraph-cable at 25 fathoms.

NASSA (ZEUXIS) PLANICOSTATA A. Ad.

I. Karachi. On soft mud-flats at low tide. Is also (unnamed) in Mr. Abercrombie's Bombay series.

Nassa (Uzita) nodicincta A. Ad.

P.G. Gulf of Oman: Maskat. 10 fathoms, amongst coral-sand. Is recorded from the Galapagos Islands.

Nassa (Niotha) albescens Dkr.

Var. *fenestrata* Marr.

P.G. Elphinstone Inlet, very large. Jask. Maskat, sand and beach.

M.C. Ormara. 2 fathoms, sand.

Nassa (Niotha) angriasensis, sp. n. (Plate XXIII. fig. 13.)

N. *testa ovato-globosa, apicalibus attenuatis, solidula, alba, stramineo- et brunneo-fasciata ; anfractibus* 8, *quorum apicales quatuor læves, apud medium unicarinati, subpellucentes, cæteris leniter gradatis, ad suturas impressis, arcte noduloso-costulatis et cancellatis, interstitiis lævibus, nodulis infra, juxta suturas, magnis, nitidis, penultimo et antepenultimo anfractu unifasciatis, ultimo tribus fasciis brunneo-stramineis decorato ; apertura ovata ; labro percrasso, albo, nitido, extus crenulato, intus decemdenticulato ; columella nitida, paullum effusa, supra univaricosa, versus basim tridenticulata ; canali brevi, crasso, paullum recurvo.*

Long. 10·50, *lat.* 6 *mm.*

Hab. Angrias Bank, Arabian Sea (*Capt. Tindall*).

Allied most nearly to *N. marginulata* Lam., from which it can be differentiated by its globose form, unicarinate protoconch, larger sutural spiral nodules or gemmæ, more elaboration of peristome, and better defined denticulations within ; the characters of sculpture, generally speaking, and of banding and coloration being identical.

Nassa (Niotha) gemmulata Lam.

P.G. From 5–50 fathoms, often found attached to the Cable. In the Gulf of Oman it was dredged, lat. 24° 55′ N., long. 57° 59′ E. ; 37 fathoms, sandy mud-bottom.

I. Lat. 18° 58′ N., long. 71° 45′ E. ; 40 fathoms. Semi-pellucid and fine-grained.

Nassa (Niotha) kieneri Desh.

I. Karachi.

Nassa (Niotha) ravida A. Ad.

M.C. Very rare, without precise locality.

Nassa (Niotha) sordida A. Ad.

P.G. On Cable. I. Karachi. 5 fathoms, sandy mud.

Nassa (Niotha) stigmaria A. Ad.

P.G. Gulf of Oman, Maskat.

I. Karachi, on hard sandy mud and coral-gravel.

Var. *adamsiana* Marr.

P.G. Kais (or Gais) Island. 14 fathoms.

NASSA (NIOTHA) STURTIANA, sp. n. (Plate XXIII. fig. 14.)

N. *testa ovato-fusiformi, versus apicem attenuata, albo-calcarea vel pallide fusca, haud nitente, delicata; anfractibus novem, quorum apicales quatuor vitrei, perlæves, spiraliter sub lente pulchre unicarinati apud medium, interdum fusco-tincti, cæteris apud suturas impressis, infra, juxta suturas, spiraliter fortiter unisulcatis, longitudinaliter multicostatis, costis obliquis, interdum lævibus, nitidis, interstitiis regulariter transversim sulculosis, interdum omnino cancellatis, ultimi anfractus costis triginta et quatuor, ad basim ipsam descendentibus, illic dorsaliter fortiter transversim sulculosis; apertura ovata, cinereo-alba, labro paullum effuso, intus* 10–11-*denticulato, haud multum incrassato; columella nitida, albida, nequaquam callosa; canali lato, brevissimo, paullulum recurvo.*

Long. 18, *lat.* 9 *mm., spec. maj.*

Hab. Gulf of Oman. Lat. 24° 55′ N., long. 57° 25′ E.; 37 fathoms, sand and mud. Lat. 24° 49′ N., long. 55° 56′ E.; 225 fathoms, mud.

A distinct *Niotha*, dull calcareous-white, or pale fuscous; nine-whorled, the four apical glossy, once delicately transversely keeled, the remainder either uniformly cancellate, or with the many close longitudinal ribs smooth and the interstices finely sulculose; just below the sutures in each whorl there is a strong deep apical sulcus. The mouth is oval, outer lip not very thick, within with ten or eleven denticles or raised striæ. Columella white, rather thin, shining, never callous. Canal very short, slightly recurved.

A good many examples dredged at the contiguous soundings given above.

We have unusual pleasure in associating with this most interesting species, at Mr. Townsend's request, the name of his and our friend, Mr. W. Neville Sturt, of the India Office.

NASSA (PHRONTIS) FISSILABRIS A. Ad.

P.G., M.C., generally. 10 fathoms, coral-sand. But always local.

NASSA (HIMA) DERMESTINA Gld.

M.C. Generally distributed along the coast of Baluchistan. From 3–10 fathoms.

I. Karachi. Among loose stones and sandy mud.

NASSA (HIMA) FREDERICI, nom. nov.

Nassa (*Hima*) *townsendi* Melv. Mem. Manch. Soc. vol. xli. part iii. (1897), no. 7, p. 4, pl. 6. fig. 1 (*non* Dall).

P.G. On Cable, 40 fathoms, mud.

M.C. Generally distributed, but not abundant.

The original name having been antedated, we have ventured to associate with this species the Christian name of Mr. Frederick W. Townsend.

NASSA (HIMA) ISCHNA Melv.

P.G. Gulf of Oman, near Maskat.

M.C. Charbar, and elsewhere along the coast of Baluchistan, not infrequent. There appear to be two varieties: one plain, unicolorous, the other banded with chestnut conspicuously below the sutures. We have noticed specimens, occasionally, varicose, as is the case with *N. pygmæa*, Ph.

NASSA (HIMA) MAMILLIFERA Melv.

P.G. 7 to 25 fathoms, mud. At Linjah, $3\frac{1}{2}$ to 5 fathoms. At Hindarabi I. a pure white variety, which might be designated var. *hindarabica*, occurs at 25–50 fathoms, mud. In sculpture and all other details it is identical with the typical form.

M.C. Charbar.

I. Karachi. 4 fathoms.

This was considered a *Niotha* at first, but it seems better placed here. Many of the Adamsian subdivisions of this genus run into each other; and such is the variation in many of the *Nassæ*, that individuals occur which possess, blended in themselves, certain qualifications of two, or even three, of the subgenera. We have emended the spelling of the specific name, '*mammillifera*' being unclassical.

NASSA (HIMA) PAUPERA Gould.

P.G. Gulf of Oman: Maskat, 15 fathoms. Also lat. 24° 55′ N., long. 57° 59′ E.; 37 fathoms, mud and sand.

M.C. Charbar. 7 fathoms, rock.

Identical with *N. plebecula* Gould, a very variable species. Some of our examples are wholly pale stramineous, others are adorned with a dorsal chestnut tænia across the base of the body-whorl. Tryon (Man. Conch. iv. p. 47) may be right in uniting many so-called species under this head.

NASSA (HIMA) PSEUDOCONCINNA Sm.

P.S. Gulf of Oman, rare. Lat. 27° N., long. 52° E.; on telegraph-cable, 54 fathoms.

I. Karachi. Bombay (*F. W. T.*).

NASSA (HIMA) STOLATA Gmel. (=*ornata* Kien.).

P.G. No special locality.

I. Bombay (*F. W. T.* and *Abercrombie*), amongst loose rocks at low tide. Common southwards (*Lt.-Col. H. D. Olivier*).

We have this also from Calcutta (*Lady Herschel*).

NASSA VARIANS Dkr.

P.G. Telegraph-cable, amongst shell-growth; 40 to 50 fathoms, mud. Lat. 27° N., long. 52° E.

CYLLENE FUSCATA H. Ad.

M.C. Charbar Bay. On sand, 4–8 fathoms.

I. Bombay, abundant (*Abercrombie*).

Cyllene grayi Rve.

M.C. Charbar Bay. Sand, 4–8 fathoms, with *C. fuscata*. These two species, indeed, may be only varietal forms, the latter (*grayi*) being as a rule longitudinally plicate, while the former is nearly smooth, the tessellated painting being in both identical.

Fam. Buccinidæ.

Pisania ignea Gmel.

M.C. Not abundant, but locally found at Charbar, Gwadûr, and Ormara.

Tritonidea rawsoni Melv.

Sistrum rawsoni Melv. Mem. Manch. Soc. vol. xli. part iii. no. 7 (1897), p. 5, pl. 6. fig. 3.

P.G. Shaikh Shuaib I. On telegraph-cable, lat. 27° N., long. 52° E. From 30 to 50 fathoms, amongst shell-growth.

This is one of those species on the border-line of at least three other genera: e. g., *Engina*, *Sistrum*, and *Cantharus* (*Tritonidea*). We follow the arrangement by Mr. Edgar Smith in our National Collection. It was named after the late Sir Rawson W. Rawson, K.C.M.G., a friend of both Mr. Townsend and the authors, who took a very great interest in the results of the dredging of the Persian Gulf and Arabian Sea.

Tritonidea rubiginosa Reeve.

I. Bombay (*Abercrombie*).

Tritonidea spiralis Gray.

M.C. Abundant everywhere between tide-marks, usually amongst loose muddy rocks.

I. Bombay (*Abercrombie*). Karachi, common. Near Goa (*Lt.-Col. H. D. Olivier*).

Tritonidea tissoti Petit.

I. Karachi. Bombay (*Abercrombie* as *Purpura*).

Very common on rocks at low tide: the generic position of this species being much contested. By some authors it is included in *Purpura*, while *Pisania* and *Tritonidea* (*Cantharus*) present almost equal claims to it.

Tritonidea undosa L.

M.C. Abundant amongst loose muddy rocks from half-tide to low-water mark, along the whole range of the W. coasts of India proper and Baluchistan, to Persia. We, however, have no exact records from the Persian Gulf.

I. Karachi. Not mentioned in Melvill and Abercrombie's Bombay Catalogue.

Metula trifasciata Sowb.

P.G. A very elegant shell, *Daphnella*-shaped, finely decussate, stramineous, thrice-banded on the body-whorl with reddish brown. The type was described from China.

ENGINA EPIDROMIDEA Melv.

I. Bombay (*Abercrombie*). The varices of this curious species are peculiar, as also its elongate form, and very possibly it may ultimately be relegated to a new genus.

ENGINA ZEA Melv.

P.G. A few specimens, dredged at $3\frac{1}{2}$ fathoms near Linjah in live condition, exhibit this most beautiful species more fully in detail than ever before, it being chiefly known from beach specimens gathered at Bombay and elsewhere. The nodules are light yellow-ochre, interstices clouded with brownish-black, the white peripherial band on the body-whorl is very distinct; outer lip thickened, 5–6-toothed within; lip and columellar area pale lilac, clouded with brownish-black round the region of the latter.

M.C. Found at low tide amongst muddy rocks.

I. Karachi. Bombay (*Abercrombie* and *W. T. Blanford* in Mus. Brit.). Near Panjim and Goa (*Lt.-Col. H. D. Olivier*).

We have also seen it from Aden (*E. R. Shopland*) and Ceylon.

ENGINA (PUSIOSTOMA) MENDICARIA L.

P.G. Linjah, $3\frac{1}{2}$ fathoms, with *E. zea*.

M.C. Charbar, rocks at low tide.

NASSARIA NIVEA Gmel. (*Hindsia* Gray).

P.G. Gulf of Oman, Malcolm Inlet, 24 fathoms. Also in the Gulf proper, Henjam Island, 15 fathoms.

M.C. Ormara, dead.

I. Karachi.

NASSARIA SUTURALIS A. Ad. (=*recurva* Sowb.).

P.G. Henjam Island. Gulf of Oman, Maskat.

M.C. An uncommon species found, locally, along the shores of Baluchistan, usually in crevices of rocks and in coral-sand. 7–15 fathoms.

I. Bombay (*Abercrombie*). Locally abundant.

PHOS GLADYSIÆ, sp. n. (Plate XXIII. fig. 15.)

P. *testa fusiformi, delicata, albida; anfractibus* 8–9, *quorum apicales* 4–5 *vitrei, albescentes, perlæves, turriti, infra medium spiraliter acute bicarinati, in uno specimine simplices, cæteris apud suturas impressis, longitudinaliter irregulariter costatis, bi- vel trivaricosis, spiraliter arctissime rugoso-liratis, interstitiis alveolatis; apertura ovata, labro paullum effuso, crassiusculo; canali brevi, lato; columella versus basim quasi uniplicata.*

Long. 18, *lat.* 8·50 *mm., sp. maj.*

Hab. Gulf of Oman, lat. 23° 44′ N., long. 57° 59′ E.; 37 fathoms, sand and mud.

Only a very few examples of a delicate and pure white *Phos*, apparently very nearly full-grown, though small, possessing in its irregular longitudinal varices and general character of spiral wrinkled liration some superficial resemblance to *P. roseatus* Hinds.

The principal distinguishing characteristic, however, lies in the protoconch, extended in one of our specimens over no less than five whorls, these being uniformly vitreous, shining, smooth, gradate, and embellished with two acutely formed close spiral keels, just below the centre. In one specimen, however, complete smoothness prevails. *P. roseatus* Hinds and probably all the genus possess large apical whorls, glassy, often once carinate below, but none, that we have ever seen, to the same extent, in proportion to the magnitude of the shell, as this small white species. Another character lies in the alveolation of the interstices between the ribs and spiral liræ, which juvenile *P. roseatus*, from the same seas, does not possess. The specimen figured is in the collection of Mr. W. N. Sturt.

Phos muriculatus Gld.

I. Karachi.

Phos roseatus Hinds.

P.G. Gulf of Oman, near Maskat. 7–40 fathoms. Those from deep water lighter-coloured; all occur amongst shell and growth of Algæ, &c., on the telegraph-cable that had been lying for some period on a muddy bottom. Also in shoal water amongst loose rocks, weed, coral, and sandy mud. Here several specimens were of an unusually dark colour. Small examples, very characteristic, were dredged, lat. 24° 55′ N., long. 57° 59′ E., at 37 fathoms in the Gulf of Oman.

Latrunculus spiratus (Lam.). [*Eburna* Lam. 1822 non 1801.]

I. Karachi (*Major Baker*). Bombay (*Abercrombie*). Bombay southwards to Goa (*Lt.-Col. H. D. Olivier*).

Latrunculus valentianus (Swains.).

Eburna molliana Chemn.

M.C. General, and sometimes very fine.

I. Karachi.

This species lives some distance down in the mud, in two or three feet of water, only coming up in the evening to feed upon defunct *Medusæ*, &c. They have been observed to emerge from their holes, go to their prey some distance away, feed, and then return to the same hole. The mud they frequent is of a soft spongy nature and largely micaceous, but it is probable that they live in the sand below the upper stratum, which is, as a rule, from one to three feet in depth (*F. W. T.*). A fine specimen measures $3\frac{1}{2} \times 2\frac{1}{2}$ inches.

Fam. Turbinellidæ.

Turbinella rapa Gmel.

I. Karachi. The Chank Shell is occasionally hauled up by the harbour dredgers.

Melongena bucephala Lam.

I. Karachi. On muddy rocks at low tide.

Fam. Fasciolariidæ.

Fusus forceps Perry, 1811.

Fusus turricula Kien.

P.G. Off Shaikh Shuaib I. 10 fathoms, amongst loose rocks and coral-sand. Allied to *F. assimilis* A. Ad., but whorls less angular, nodules fewer, and epidermis (periostracum) of different character.

Fusus townsendi Melv.

P.G. Kais and Hindarabi Is. Shaikh Shuaib I. In all stages of growth at 7 fathoms, among coral-sand and loose stones. Many juvenile specimens also occurred on the telegraph-cable from 10–50 fathoms, sand.

Fasciolaria trapezium Lam.

I. Ratnagiri (*Abercrombie*).

Latirus arabicus Melv.

Fusus arabicus Melv. Mem. Manch. Soc. vol. iv. pt. 2, p. 16, pl. i. fig 6.

P.G. Gulf of Oman, Maskat. 15 fathoms, mud and sand. The columellar plaits are more distinct in subsequent examples dredged than in the type, and, though the animal is unknown, there can be but little doubt that this is a true *Latirus*, though of unusually fusoid character.

Latirus filosus Schreb.

P.G. Lat. 25° 58′ N., long. 57° 3′ E. Telegraph-cable, 55 fathoms, mud. In juvenile condition only.

Latirus (Peristernia) nassatula Lam.

M.C. Charbar Point.

Latirus (Peristernia) pagodæformis Melv.

P.G. Adhering to cable, 20–25 fathoms, mud. Lat. 25° N., long. 63° E.

Latirus (Peristernia) pulchellus Rve.

P.G. Gulf of Oman, Maskat. 15 fathoms.
I. Karachi. 10 fathoms, muddy sand.

Fam. Mitridæ.

Mitra bovei Kien.

P.G. and Gulf of Oman. A few examples found at 7–15 fathoms, muddy sand and rock-bottom. The finest examples ($1\frac{5}{8}$ in.) occurred lat. 26° 50′ N., long. 54° 50′ E., in 10 fathoms, sand and rock.

I. Bombay Harbour and southwards (*Lt.-Col. H. D. Olivier*).

MITRA CHINENSIS Gray.

I. Bombay (*Abercrombie*). A large worn example only.

MITRA GUTTATA Sowb.

P.G. Gulf of Oman, Maskat.

MITRA (SCABRICOLA) ANTONIÆ H. Ad.

P.G. Shaikh Shuaib I. Henjam I. 5–20 fathoms. By some considered a variety of *pretiosa* Rve.

MITRA (SCABRICOLA) CRENIFERA Lam.

P.G. Shaikh Shuaib I. South of Kais (or Gais) Island. 5–10 fathoms, amongst muddy sand and stones.

MITRA (SCABRICOLA) PEASEI Dohrn.

P.G. Dead specimens in 24 fathoms, mostly near Malvern Inlet (Kubbatt Ghazira), Gulf of Oman.

MITRA (SCABRICOLA) PRETIOSA Rve.

P.G. Shaikh Shuaib I. 10 fathoms, coral-sand. Perhaps *M. antoniæ* H. Ad. is but a variety of this.

MITRA (SCABRICOLA) SCABRIUSCULA Lam.

P.G. Gulf of Oman, Malcolm Inlet. 25 fathoms, muddy sand.

MITRA (CANCILLA) CARNICOLOR Rve.

P.G. Shaikh Shuaib Island.

MITRA (CANCILLA) CIRCULATA Kien.

P.G. Henjam Island, 24 fathoms. Gulf of Oman, Malcolm Inlet, a variety.

M.C. 5–30 fathoms. Generally round the coast of Baluchistan, sandy mud and stone bottom.

MITRA (CANCILLA) INSCULPTA A. Ad.

P.G. Gulf of Oman, Malcolm Inlet.

I. Karachi.

MITRA (CANCILLA) LALAGE, sp. n. (Plate XXIII. fig. 16.)

M. *testa perattenuata, gracili, alba vel straminea; anfractibus* 9, *quorum apicales tres lævissimi, vitrei, nitidi, cæteris sex apud suturas impressis, supernis spiraliter quadriliratis, liris fortibus sæpe gemmulatis, interstitiis nitidis, striatis, ultimo circa duodecim liris prædito; apertura oblonga, alba, labro simplice, crenulato; columella quadriplicata.*

Long. 11·50, *lat.* 3·50 *mm.*

Hab. Gulf of Oman: Maskat, 10 fathoms; and Malcolm Inlet, 24 fathoms, mud.

Three examples; one straw-coloured, the others pure white. It is a beautiful *Cancilla*, extremely attenuate, small, nine-whorled, the glassy apical included; the revolving liræ, strong, mostly gemmulate, are four in number in each upper whorl, about twelve in the lowest; the interstitial pitting is nearly uniform, where not present slight striation is visible. Mouth oblong, outer lip crenulate, columellar four-plaited. We hardly think any of our specimens have attained full growth, but the sculpture seems distinct enough to warrant a specific separation from their allies.

MITRA (CHRYSAME) CŒLIGENA Reeve.

P.G. Linjah. $3\frac{1}{2}$ fathoms.

I. Karachi. At low tide, amongst bare muddy rocks. Bombay Harbour and Bassein, southwards (*Lt.-Col. H. D. Olivier*).

MITRA (CHRYSAME) MARGINATA Sowb.

M.C. Charbar, very rarely.

MITRA (CHRYSAME) PROCISSA Rve.

I. Karachi. Bombay (*F. W. T. & Abercrombie*). On muddy rocks, low tide.

MITRA (STRIGATELLA) LITTERATA Lam.

P.G. Gulf of Oman, Jask. A variety, dredged at 4 fathoms.

M.C. Charbar. At low tide on rocks covered with a thin layer of mud only. A fine variety with spiral black irregular banding dredged here at 7 fathoms.

MITRA (TURRICULA) CALIENDRUM [1], sp. n. (Plate XXI. fig. 1.)

M. *testa fusiformi, solida, alba, brunneo-, gilvo- vel castaneo-fasciata; anfractibus* 10–12, *quorum apicales . . . ?, ventricosulis, suturaliter impressis, supernis crebricostulatis, interstitiis undique spiraliter fortiter sulcatis, infra medium ad suturas albo-cinctis, ultimo anfractu* 11 *costis obliquis prædito, anguste ad medium albo-cincto, apud basim rugoso-noduloso, paullum squarrose producto; apertura angusta, subquadrata, intus (in typo) lavandulacea, labro recto, extus crenulato, crassiusculo; columella obliqua, quadriplicata.*

Long. 24·50, *lat.* 8 *mm.*

Hab. Persian Gulf, without exact locality. Mekran Coast, Charbar.

Several examples, mostly more or less weathered. We have taken for the type a live example, brown, narrowly white-banded spirally, and furnished with many ribs on the upper whorls, about eleven on the body-whorl. The mouth is squarely oblong, lilac within, outer lip thickened, crenulate, columella four times plaited.

MITRA (COSTELLARIA) ACUPICTA Rve.

P.G. Shaikh Shuaib Island. 10 fathoms, coral-sand. The specimens dredged here are very finely coloured, dark red spotted and banded, approaching the *M. zebuensis* Reeve, of the Eastern Archipelago, in general appearance.

[1] *caliendrum*, an ornamental head-dress.

MITRA (COSTELLARIA) ARMILLATA Rve.

P.G. Telegraph-cable. Lat. 25° 58′ N., long. 57° 5′ E. 50 fathoms.

MITRA (COSTELLARIA) COLLINSONI A. Ad.

P.G. No special locality.

MITRA (COSTELLARIA) CREBRILIRATA Rve.

P.G. Gulf of Oman, Maskat. 15 fathoms.

MITRA (COSTELLARIA) DÆDALA Rve.

P.G. Linjah. 3½ fathoms. Dec. 1900, near Fao, fine
M.C. Charbar Bay. 3 fathoms, sand and mud.
Dead examples frequently cast ashore all over the coasts of Baluchistan.

MITRA (COSTELLARIA) CASTA H. Ad. (*hastata* Sowb.).

P.G. Near Bushire, rarely.

MITRA (COSTELLARIA) DELICATA A. Ad.

P.G. Shaikh Shuaib I.
M.C. Charbar.

MITRA (COSTELLARIA) FUSCO-APICATA Sm.

P.G. Hindarabi Island.

MITRA (COSTELLARIA) MALCOLMENSIS sp. n. (Plate XXIII. fig. 18.)

M. *testa oblongo-ovata, fusiformi, pallide straminea vel albescente* (*var.* immaculata), *paullum nitida, delicata sed solidula ; anfractibus* 9–10, *quorum apicales tres lævissimi, vitrei, cæteris gradatulis, ad suturas impressis, infra (juxta suturas) spiraliter rufo-vittatis, longitudinaliter arcte lævicostatis, interstitiis spiraliter profunde sulculosis, penultimo anfractu infra inter costas rubro-fasciato, ultimo bifasciato, interdum omnino albo, immaculato ; apertura angusta, oblonga, labro ad basim flexuoso, paullum recurvo ; columella nitida, pallida, quadriplicata.*

Long. 9, *lat.* 3 *mm.*

Hab. Persian Gulf: Henjam Island, 15–25 fathoms (var. *immaculata*).

Linjah, 3½ fathoms, mud. Elphinstone Inlet, Mussandam, 15 fathoms.

Gulf of Oman: Malcolm Inlet (Kubbatt Ghazira), near Maskat. 24 fathoms, mud.

Lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud; abundant. Lat. 24° 5′ N., long. 57° 35′ E., 205 fathoms, mud (with var. *immaculata*, this variety predominating).

Variable both in sculpture and colouring, though not so in form, this little species, evidently abundant in certain favoured localities, differs in the number of longitudinal ribs, some specimens having half as many again on the body-whorl as have others. The rufous banding is also entirely absent in specimens dredged from any depth. Occasionally, too, examples with the body-whorl almost wholly rufous brown turn up. Perhaps the nearest ally to this is *M. scitula* Ad.; the body-whorl is not so attenuate basally (*vide* Sowb. Thes. Conch., *Mitra*, tab. xx. fig. 418). *M. discoloria* Reeve is hardly comparable, though a little similar in coloration. *M. fidicula* Gould is far more scalate. *M. mica* Reeve, from I. of Guimaras, which is only known from a figure, is more like in form but of different pattern; and *M. cœlata* Reeve has whorls angular above and outer lip more flexuous. It is likewise comparable to *M. delicata* Ad.

The type is twice banded with rufous brown spirally at the interstices between the ribs. The var. *immaculata*, a white or pale yellow almost unbanded variety, is found at 10–50 fathoms. This is probably the shell mentioned (Journ. As. Soc. Bengal, xliv. pt. 2, p. 106) by Messrs. G. & H. Nevill as "a new species closely allied to *Turricula* (*Thala*) *casta* H. Ad., which has been dredged rather abundantly by Mr. W. T. Blanford in the Gulf of Oman." *T. casta* H. Ad. is a synonym of *M.* (*Turricula*) *hastata* Sowb., which occurs in our catalogue, and which also might be mentioned as an ally of *M. malcolmensis*.

Mitra (Costellaria) modesta Reeve.

I. Angrias Bank (*Capt. W. A. Tindall*).

Mitra (Costellaria) obeliscus Rve.

I. Bombay (*F. W. T.*).

Mitra (Costellaria) pasithea[1], sp. n. (Plate XXIII. fig. 17.)

M. *testa fusiformi, alba, aspera, solidula, apud basim anfractus ultimi dorsaliter ochraceo-suffusa; anfractibus* 8, *quorum apicales duo vitrei, planati, gradatuli, cæteris apud suturas multum impressis, gradato-turritis, longitudinaliter arcte costatis, costis anfractus ultimi ad viginti, undique spiraliter sulculosis; apertura oblonga, labro vix effuso, extus crenulato; columella triplicata, canali paullum recurvo.*

Long. 9·50, *lat.* 4 *mm.*

Hab. Gulf of Oman, Maskat. 19 fathoms.

Distinguished by its conspicuously shouldered whorls, uniformly closely longitudinally oblique-ribbed, these ribs being crossed by many regular spiral sulci, which give them a beaded appearance. The surface is pure white, with the exception of a dorsal ochreous band on the lower portion of the body-whorl.

Mitra (Costellaria) revelata Melv.

P.G. Shaikh Shuaib I. Kais (or Gais) Island. 10–15 fathoms, shingle and dead coral bottom.

I. Karachi. Not infrequent.

[1] πασίθεος, altogether divine.

MITRA (COSTELLARIA) SCITULA A. Ad.

P.G. Gulf of Oman, Maskat. 10 fathoms, coral-sand, but exceedingly scarce.

MITRA (COSTELLARIA) STEPHANUCHA Melv.

P.G. Gulf of Oman, Maskat.

M.C. Charbar. 10 fathoms, black sandy mud.

Specimens not quite adult possess an interrupted spiral median line on the body and the penultimate whorls, this being quite evanescent in full-grown examples.

MITRA (COSTELLARIA) SUBTRUNCATA Sowb.

M.C. Charbar Point. 7 fathoms. Dead shells strewn abundantly over the whole Mekran Coast, but, strangely, no live examples have yet been dredged. This species may be identical with *M. crebrilirata* Rve. The type of *subtruncata* was from Japan, that of *crebrilirata* from Ceylon.

MITRA (PUSIA) AUREOLATA Swains.

P.G. Gulf of Oman, Malcolm Inlet.

MITRA (PUSIA) BLANFORDI, sp. n. (Plate XXIII. fig. 19.)

M. *testa parva, oblongo-fusiformi, solida, sordide alba, irregulariter castaneo-maculata, flammis fulgetrinis depicta vel omnino castaneo-suffusa; anfractibus sex, quorum apicales duo læves, mamillati, cæteris turritis, arcte longitudinaliter costulatis, costis lævibus, ultimum apud anfractum dorsaliter sæpius evanidis, undique spiraliter densiliratis; apertura angusta, labro paullum effuso, intus lævi, margine columellari incrassato, quadriplicato.*

Long. 5, *lat.* 2·25 *mm.*

Hab. Gulf of Oman, Maskat. 15 fathoms.

A small species, but our examples are evidently adult. Were it not for the plaits a decidedly columbelloid appearance would be presented. The spire is turreted; whorls closely longitudinally ribbed, most frequently vanishing on the body-whorl, transversely obscurely but closely lirate. It is not unlike *M.* (*Chrysame*) *tiarella* in miniature, but its structure is that of a *Pusia*. It is an interesting form, and we have unusual pleasure in connecting with it the name of Mr. W. T. Blanford, F.R.S., than whom no one has laboured more energetically to extend the knowledge, not only of the Zoology of India, but also of the neighbouring countries as well.

MITRA (PUSIA) DISCOLORIA Rve.

P.G. Gulf of Oman, Malcolm Inlet. 24 fathoms.

MITRA (PUSIA) ELIZÆ Melv.

P.G. Shaikh Shuaib I. 10 fathoms, on coral-sand.

MITRA (PUSIA) MULTICOSTATA Swains.

P.G. Shaikh Shuaib I. 10 fathoms, amongst live coral, sandy bottom.

MITRA (PUSIA) OSIRIDIIS Issel (=*umbonata* Sowb.).

P.G. Kais Island, 10 fathoms, coral-sand. In the Gulf of Oman an almost smooth variety occurs. Maskat, 20 fathoms. Also at lat. 20° 55′ N., long. 57° 59′ E., 37 fathoms, sand and mud.

MITRA (PUSIA) SHOPLANDI Melv.

P.G. Gulf of Oman, Malcolm Inlet. 24 fathoms. Described from Commander Shopland's Aden examples.

MITRA (PUSIA) VENUSTULA Rve.

P.G. Tumb Island. Shaikh Shuaib Island. 7–10 fathoms, coral-sand. Peculiarly large and dark wine-coloured.

MITRA (SWAINSONIA) FISSURATA Lam.

P.G. Gulf of Oman, Maskat. Not yet dredged alive.

MITRA (CYLINDRA) NUX Sowb.

P.G. Shaikh Shuaib I., 14 fathoms, amongst broken coral and shingle. Kais Island, same kind of ground. A very rare species everywhere.

Fam. HARPIDÆ.

HARPA CONOIDALIS Lam.

I. Bombay (*Herford*).

HARPA VENTRICOSA Lam.

P.G. Gulf of Oman, Jask beach, one dead specimen only.

Fam. MARGINELLIDÆ.

MARGINELLA (GLABELLA) FABA L.

P.G. Gulf of Oman, lat. 24° 50′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

MARGINELLA (GLABELLA) OBTUSA Sowb.

P.G. Gulf of Oman, Maskat. 10–20 fathoms, black mud mixed with sand.

[*M.* (*Glabella*) *quilonica* Melv. was collected by Captain W. A. Tindall south of our limit, at Quilon, Malabar coast.]

MARGINELLA (GIBBERULA) CHARBARENSIS Melv.

P.G. Gulf of Oman: Jask; Maskat, 3 to 5 fathoms, muddy sand. Lat. 24° 55′ N., long. 57° 59′ E., 37 fathoms, and up to 150 fathoms in other parts of the Gulf. In deep water it assumes a still more elegant and graceful form. Always smaller in all its parts than *monilis*, with more or less conspicuous spire.

MARGINELLA (GIBBERULA) FUSIFORMIS Hinds.

P.G. Gulf of Oman, Maskat. 15 fathoms. Also lat. 24° 5′ N., long. 57° 55′ E., 205 fathoms.

MARGINELLA (GIBBERULA) MONILIS L.

P.G. Maskat. 15 fathoms. The var. *terveriana* Petit has also occurred.

MARGINELLA (GIBBERULA) MAZAGONICA Melv.

P.G. Linjah, 3½ fathoms. Bushire and Kishm Island, 7 fathoms, soft mud. Gulf of Oman, Maskat, 15 fathoms. Lat. 24° 5′ N., long. 57° 55′ E., 205 fathoms.

M.C. Charbar. 2 to 7 fathoms.

I. Karachi. Bombay (*Abercrombie*).

MARGINELLA (GIBBERULA) NEVILLI Jouss. (=*inconspicua* Nevill, *non* Sowb.).

I. Bombay. Not in Abercrombie's collection.

MARGINELLA (GIBBERULA) SHOPLANDI Melv.

P.G. M.C. I. Seemingly widely distributed and usually collected alive, the shell then being beautifully transparent. Among loose stones, sand, and mud. It seems placed better as a *Gibberula* than in the section *Cryptospira*.

MARGINELLA (CRYPTOSPIRA) MABELLÆ, sp. n. (Plate XXIII. fig. 20.)

M. *testa nitida, oblonga, pallide straminea, solida; anfractibus quatuor, supernis callositate fere celatis, ultimo obscurissime spiraliter bicincto; apertura angusta, oblonga, straminea, labro extus fere recto, albo, nitidissimo, callositate crassa ochracea dorsaliter marginata; columella alba, late callo tenui nitente contecta, quadriplicata.*

Long. 16·50, *lat.* 6 *mm.*

Hab. Arabian Sea, off Indian coast, lat. 18° 43′ N., long. 71° 43′ E. Found adhering to old telegraph-cable when raised for repair.

A form distinct from any near ally. We think it more of a *Cryptospira* than a *Prunum*, though it might be placed equally well in either subgenus. In form it most recalls the West-Indian *M. oblonga* Sowb. It is gracefully oblong, very shining, straw-coloured, with white shining callous deposit over the columellar region and outer lip; the dorsal margin thick, with straw-coloured callus; mouth narrow, columella four times plaited.

MARGINELLA (CRYPTOSPIRA) QUINQUEPLICATA Lam.

M.C. "Rare," without particular locality given.

MARGINELLA (PERSICULA) DENS Reeve.

I. Angrias Bank (*Captain Tindall*).

Marginella (Persicula) isseli Nevill (=*pygmœa* Issel, *non* Sowb.).

P.G. Tumb Island (*W. T. Blanford in Mus. Brit.*).

Marginella (Persicula) oodes Melv.

P.G. Kishm Island. Bushire. 5 fathoms, soft mud.

Marginella (Persicula) pisum Rve.

P.G. Astola Island. 11 fathoms.
I. Karachi. 10 fathoms.

Marginella (Volvaria) attenuata Rve.

P.G. Henjam Island. Gulf of Oman, Maskat.
I. Karachi.

Marginella (Volvaria) effulgens Rve.

M.C. Perhaps a variety of *Volvaria avena* Val.

Marginella (Volvaria) obscura Reeve.

M.C. In 3 fathoms, sand.

Marginella (Volvaria) verdensis Sm.

M.C. Charbar. 5 fathoms, sand.

Fam. Olividæ.

Oliva bulbosa Jonas.

P.G. M.C. General. 3 to 7 fathoms, mostly on sandy-mud bottom.

Oliva inflata Lam.

P.G. Ormuz. Gulf of Oman, Jask.
I. Karachi.
Showing much variety. The banded form (*bicincta*) occurs near Goa (*Lt.-Col. H. D. Olivier*).

Oliva ispidula L.

M.C. Charbar. 7 fathoms, sandy mud.

Oliva maura L.

Var. *sepulturalis* Lam.

I. Bombay (*Abercrombie*).

Oliva (Agaronia) acuminata Lam.

P.G. I. Karachi. In all stages of growth off oyster-banks at 3 to 7 fathoms.

Oliva (Agaronia) hiatula Gmel.

Var. *ancillarioides* Reeve.
Var. *indusica* Reeve.

I. Karachi (*Col. Baker*). Both forms reported.

Oliva (Agaronia) nebulosa Lam.

I. Karachi. Bombay (*Abercrombie*), and southwards to Goa (*Lt.-Col. H. D. Olivier*).

Var. *intricata* Marrat (sp.).

I. Bombay (*Abercrombie*).

A very strikingly marked form, perhaps specifically distinct.

Olivella nympha Ad. & Ang.

M.C. Charbar.

I. Karachi. Amongst loose stones and mud at low tide.

Ancilla albifasciata Swains.

P.G. Gulf of Oman, Maskat.

I. Karachi.

Ancilla ampla Gmel.

P.G. Gulf of Oman, Maskat. 10 fathoms.

Ancilla castanea Sowb.

P.G. Gulf of Oman: Maskat, Jask.

M.C. Ormara. Amongst loose rocks and sandy mud at 7 fathoms.

Ancilla cinnamomea Lam.

Var. *albisulcata* Sowb.

P.G. Galig Island, 10 fathoms, coral-sand. Maskat, 15 fathoms.

M.C. Generally distributed over the coast of Baluchistan. Very variable: the variety occurs with the type.

Ancilla eburnea Desh.

P.G. Gulf of Oman, Jask beach, extending eastward to the Mekran Coast.

Ancilla fasciata Rve.

P.G. Gulf of Oman, Maskat and Jask, extending eastward to the Mekran Coast; also at low tide at the water's edge, just below the surface where the mud is sandy.

Ancilla lineolata Reeve.

P.G. General in the Persian Gulf, both the typical and varietal forms abounding.

Ancilla tindalli Melv.

I. Angrias Bank, lat. 16° 50′ N., long. 72° E. (*Capt. Tindall*).

Captain W. A. Tindall of the s.s. 'Patrick Stewart,' at the request of Mr. Townsend, took several soundings between the Angrias Bank and Ceylon with very favourable results.

Ancilla ventricosa Lam.

P.G. Bunder-Abbas. 7 fathoms, coarse coral-sand and loose rocks.

(e) Toxoglossa.

Fam. Terebridæ.

Terebra babylonia Lam.

P.G. Gulf of Oman. 10 fathoms, sandy mud.

Terebra cærulescens Lam.

P.G. Gulf of Oman: Maskat, 10 fathoms, sandy mud; Jask beach at low tide, extending to the M.C. and fairly general on the shores of Baluchistan.

Terebra capensis Sm.

I. Karachi. 3 to 7 fathoms, stones and mud.

Terebra cinctella Desh. (= *undulata* Gray).

I. Bombay (*Abercrombie*). Karachi (*Mus. Brit.*).

Terebra cognata Sm. (Plate XXI. fig. 9.)

M.C. Charbar. 3 fathoms, sandy mud.
I. Karachi. 3 to 7 fathoms, soft muddy bottom.

Terebra contracta Sm.

I. Karachi. In shoal water on muddy basis.

Terebra duplicata L.

P.G. On telegraph-cable young fresh specimens occurred often.
M.C. Charbar. 8 fathoms, sand and mud.

Terebra edgarii Melv.

M.C. Charbar.
I. Karachi.

Terebra gotoënsis Sm.

I. Karachi. 3 to 7 fathoms, stones and mud.

In the Man. Conch. (vii. p. 23) this is considered a mere variety of *T. alveolata* Hinds.

Terebra macandrewi Sm. (Plate XXI. fig. 6.)

M.C. Charbar. In 3 to 5 fathoms, sand.

Terebra lepida Hinds.

P.G. Gulf of Oman, Maskat. 10 fathoms, sandy mud.

Terebra nana Desh.

I. Karachi. 3 fathoms, amongst mud and stones.

Terebra pellyi Sm. (Plate XXI. fig. 10.)

M.C. Charbar.
I. Karachi. 3 to 7 fathoms, mud and stones.

Terebra persica Sm.

P.G. and M.C. Locally distributed and nowhere common along the coast.

Terebra polygyrata Desh.

M.C. General but local.
I. Karachi. 3 to 5 fathoms, soft mud.

Terebra serotina Ad. & Rve.

I. Karachi. The type came from the Philippine Is. (*Cuming*).

Terebra severa Melv.

I. Karachi. 3 to 7 fathoms, stones and mud.

Terebra strigillata L.

I. Karachi. Not yet dredged alive.

Terebra tantilla Sm.

I. Karachi. 3 fathoms, muddy stone bottom.

Terebra tenera Hinds.

I. Karachi. From low-tide mark to 7 fathoms, amongst mud and stones.
Bombay (*Abercrombie*). Common.

Terebra tricincta Sm.

I. Karachi. Only one dredged.

Terebra (Euryta) nassoides Hinds.

P.G. Gulf of Oman, Jask.
M.C. Generally, and in great variety of form and coloration, at low tide on sand, just below the surface of the water.

Terebra (Euryta) thyræa Melv.[1]

I. Karachi. Amongst loose stones and sandy mud, 3–5 fms. A curious species, with the facies of an *Æsopus* or *Olivella*.

Fam. Conidæ.

Conus (Stephanoconus) lividus Hwass.

P.G. Linjah. $3\frac{1}{2}$ fathoms.

Conus (Coronaxis) fulgetrum Sowb.

P.G. Maskat, but dead examples only.

[Conus (Coronaxis) hebræus L.

Is in the collection labelled "Laccadive Isles," a short distance south of our limit (*Capt. Tindall*). *C. flavidus* Lam. was collected with it.]

[1] Of the many species of *Terebra* described by Mr. Edgar Smith (Ann. N. H. ser. 4, 1877, xix. pp. 226 *et seqq.*) as having been dredged by Col. Pelly in the Persian Gulf, only two (*T. fuscobasis* and *fuscocincta*) do not occur in this collection.

CONUS (CORONAXIS) MINIMUS L.

P.G. Hindarabi Island.
M.C. No particular locality.
I. Karachi.
Found usually at low tide on mud-covered rocks.

CONUS (CORONAXIS) TÆNIATUS Brug.

P.G. Jask. Large and fine.

M.C. Though widely distributed, nowhere exactly common. Is found at extreme low tide, on rocks, amongst Algæ and in mud.

CONUS (DENDROCONUS) BETULINUS L.

P.G. Gulf of Oman, near Jask.

CONUS (DENDROCONUS) QUERCINUS Brug.

P.G. Gulf of Oman, Maskat.

Found in 3 to 20 fathoms among coral-sand and loose rock. Not met with east of Jask. One banded variety occurred.

CONUS (DENDROCONUS) SPURIUS Gmel.

P.G. Gulf of Oman, Maskat.

Found from 7 to 20 fathoms, coral-sand and stony ground.

CONUS (LITHOCONUS) FLAVIDUS Lam.

M.C. Charbar. On mud-covered rocks at low tide but rarely.

CONUS (LITHOCONUS) TESSELLATUS Born.

P.G. Henjam I. Maskat. Found at 5 to 20 fathoms on sandy mud and amongst loose rocks and coral-sand. Not yet found east of Jask, on borders of Gulf of Oman, and Mekran Coast.

CONUS (LEPTOCONUS) ACUTANGULUS Chemn.

P.G. Gulf of Oman. A single dried specimen only at 20 fathoms off Jask.

I. About 125 miles W.S.W. of Bombay, lat. 18° 43′ N., long. 71° 30′ to 71° 45′ E., adhering to the cable of the Eastern Telegraph Co. at 45 fathoms; abundantly, but dead.

CONUS (LEPTOCONUS) CLYTOSPIRA Melv. & Stand.[1] (Plate XXI. fig. 12.)

I. With the preceding, adhering to the cable of the Eastern

[1] Since this paper was read, Mr. H. B. Preston informs us that an inspection of the unique type in Dr. Jousseaume's private collection of *C. milne-edwardsi* Jouss. (Bull. Soc. Philomath. vi. p. 99, 1894) convinces him that it is specifically identical with *C. clytospira*, the main differences being in size and in the greater tenuity of the larger species, the measurements being 2 as against 5¼ inches. Not having ourselves yet had the opportunity to examine Dr. Jousseaume's type, we have read the description carefully, this tending in some measure to corroborate Mr. Preston's opinion; and it may be that *C. clytospira* is, after all, a deep-water gigantic variety of the small, and more solid, Adenese *C. milne-edwardsi*, in which case our form had best be varietally described as b. *clytospira*. Captain Shopland's specimen from Aden, which we have seen, is a somewhat incrassate juvenile example.

Telegraph Co. at 45 fathoms. Described (Ann. Nat. Hist. ser. 7, vol. iv. p. 462) as of the subgenus *Cylinder*, but though the markings are almost identical with those of *C. episcopus*, the carinated spire undoubtedly comes near to *C. acuminatus* Brug. and other *Leptoconi*. It is among the most beautiful of Cones and the finest mollusk yet found in this region, being in form like *C. gloria-maris*, but with even more conspicuous spire. Commander E. R. Shopland has shown us a specimen in juvenile condition from the vicinity of Aden. Two examples, averaging 5 inches in length, were procured by Mr. Townsend; a third, said to have been fully 7 inches long, unfortuuately was missed.

CONUS (LEPTOCONUS) DICTATOR Melv.

P.G. Shaikh Shuaib Island, at 10 fathoms, in coral-sand.

CONUS (LEPTOCONUS) ELEGANS Sowb.

P.G. Henjam Island. 25 fathoms, mud. Another on the telegraph-cable in the Gulf of Oman, beautifully variegated with fulvous markings, but more frequently found dead and discoloured.

M.C. Charbar Bay, 7 fathoms, mud; and Ormara Bay.

CONUS (LEPTOCONUS) INSCULPTUS Kien.

I. Bombay (*Abercrombie*).

CONUS (LEPTOCONUS) LENTIGINOSUS Rve.

I. Common at Bombay (*Abercrombie*). Endemic in the North Arabian Sea. Bombay Harbour, southwards (*Lt.-Col. H. D. Olivier*).

CONUS (LEPTOCONUS) LONGURIONIS Kien.

P.G. Malcolm Inlet or Kubbatt Ghazira, near Maskat. Muddy sand, at 24 fathoms. All so-called *C. aculeiformis* Reeve from this region seem invariably to be the allied and little understood *longurionis* of Kiener.

CONUS (LEPTOCONUS) MILESI Sm.

P.G. Maskat, 5–20 fathoms.

CONUS (LEPTOCONUS) ORBIGNYI Aud.

P.G. and M.C. (Borders of). A few juvenile examples at 20 fathoms S.E. of Jask.

CONUS (LEPTOCONUS) PLANILIRATUS Sowb.

Conus (Leptoconus) planiliratus Sowb. Proc. Zool. Soc. 1870, p. 255, pl. xxii. fig. 1.

P.G. Shaikh Shuaib I. A single specimen in fine condition at 7 fathoms.

I. With *C. clytospira* M. & S. and *acutangulus* Chemn. on telegraph-cable at 45 fathoms, 125 miles W.S.W. of Bombay. Very abundant, but all dead and found adhering to the pitch of the cable: perhaps one hundred or more examples. For remarks on this species consult E. A. Smith (Ann. Nat. Hist. ser. 6, vol. xiv. p. 159).

Conus (Leptoconus) sæcularis Melv.

P.G. Gulf of Oman, Malcolm Inlet. 24 fathoms, mud.

A remarkably beautiful and delicate species.

Conus (Leptoconus) semisulcatus Sowb.

I. Dredged inside Karachi Harbour. One or two other *Leptoconi* occur, the North Arabian Sea seemingly being the headquarters of this group; and we should not be surprised if some other fine species were yet awaiting discovery. Those just mentioned are not adolescent, and therefore are left for the present.

Conus (Rhizoconus) bayani Jouss.

I. Eastern Telegraph Co. cable. Many dead, adhering to the pitch at 45 fathoms, 125 miles W.S.W. of Bombay.

Conus (Rhizoconus) capitaneus L.

P.G. Shaikh Shuaib I. Dead specimens only.

Conus (Rhizoconus) eximius Reeve=*fulgurans* Hwass.

M.C. Charbar. On rocks at low water.

Conus (Rhizoconus) magus L.

I. Angrias Bank (*Capt. Tindall*), but only juvenile examples.

Conus (Rhizoconus) maldivus L.

P.G. Gulf of Oman, Maskat. We think this old Linnean species probably but a variety of the next.

Conus (Rhizoconus) monile L.

P.G. Gulf of Oman, Maskat, at 15 fathoms, muddy sand. Also in the Gulf proper at Shaikh Shuaib I., 10 fathoms, among sand and bare rocks.

Conus (Rhizoconus) mutabilis Chemn.

I. Bombay (*Abercrombie*). One of the most characteristic mollusks of this locality, occurring southwards to Goa and Panjim (*Lt.-Col. H. D. Olivier*).

Conus (Rhizoconus) nemocanus Hwass.

I. Karachi.

We think hardly a variety of the very different *C. sumatrensis* Hwass, as proposed by Tryon, Man. Conch. vol. vi. p. 39.

Conus (Rhizoconus) punctatus Chemn.

I. Karachi. In sandy mud, about rocks at low tide.

Conus (Rhizoconus) tegulatus Sowb.

P.G. Henjam Island, 5 to 25 fathoms. On border of the Gulf and M.C. near Jask at 20 to 26 fathoms, in mud. Lat. 26° N., long. 52° 50′ E.

CONUS (RHIZOCONUS) TRAVERSIANUS E. A. Smith.

P.G. and M.C. No exact locality given. At from 20–33 fms. on cable and in mud and rocky ground.

Also received from the Andaman Islands (*Booley*).

CONUS (CHELYCONUS) ACHATINUS Chemn.

P.G. Gulf of Oman, Jask. Just on the borders of M.C. also at Charbar on mud-covered rocks at low tide. This appears to be the *C. nigropunctatus* Sowb.

I. Bassein, Bombay Harbour, and southwards to Goa (*Lt.-Col. H. D. Olivier*).

CONUS (CHELYCONUS) MONACHUS L.

I. Bombay (*Abercrombie*). Nearly allied to the preceding.

CONUS (CHELYCONUS) PIPERATUS Reeve.

I. Bombay (*Abercrombie*). Perhaps, as suggested by Tryon, only a form of *C. erythræensis* Beck. This is not absent from the Persian Gulf, but we have no exact records from Mr. Townsend.

CONUS (CYLINDER) ELISÆ Kien.

P.G. Exact record not given. One characteristic example of this very rare Cone.

CONUS (CYLINDER) OMARIA Hwass.

P.G. Tumb Island.

CONUS (CYLINDER) PENNACEUS Born.

P.G. Elphinstone Inlet, in shoal water on coral-sand. One example exhibits a rare variation in the close interwoven longitudinal zigzag chestnut lines, merging into black, on a pale ground.

CONUS (CYLINDER) TEXTILE L.

P.G. Gulf of Oman, Maskat. Found from low-water mark to 20 fathoms on muddy rocks.

Var. *verriculum* Reeve (sp.).

P.G. Maskat. Fine.

CONUS (HERMES) THOMASII Sowb.

M.C. Charbar. A single example on muddy rocks. Perhaps too nearly allied to *C. terebra* Born, but with less acuminate spire and mouth beautifully suffused with violet.

PLEUROTOMA ACUTIGEMMATA Sm.

I. Lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

The locality hitherto unknown. In our opinion distinct from *P. jubata* Hinds, with which Tryon (Man. Conch. vi. p. 171) associates it.

PLEUROTOMA ALBATA E. A. Sm.

P.G. Linjah anchorage. 7–15 fathoms, mud, rare.

Pleurotoma albina Lam.

I. Lat. 18° 43′ N., long. 71° 45′ E.

Pleurotoma marmorata Lam.

P.G. Gulf of Oman. Good living examples dredged at 30 fathoms in lat. 23° 50′ N., long. 67° 20′ E. From Malcolm Inlet (Kubbatt Ghazira) came one specimen of a possible hybrid between *marmorata* and *tigrina*.

M.C. Dead specimens frequently washed ashore on the Persian coast.

Pleurotoma tigrina Lam.

P.G. Gulf of Oman, Malcolm Inlet at 24 fathoms, dead.

M.C. 7 fathoms, soft mud, but very scarce.

Pleurotoma (Gemmula) gemmata Hinds.

P.G. Gulf of Oman, lat. 24° 5′ N., long. 57° 35′ E., 205 fathoms, sand, abundant, none full-grown. Also lat. 24° 55′ N., long. 57° 59′ E., 37 fathoms, sand and mud, and lat. 24° 49′ N., long. 55° 26′ E., 225 fathoms, mud.

We can see no difference in *P. fusca* Hombron, described from New Caledonia.

Pleurotoma (Gemmula) multiseriata Sm.

P.G. M.C. In many places. 5–20 fathoms, mud.

M.C. I. 12 miles west of Karachi, on the border of the Mekran Coast, at 15 fathoms. Very large examples occurring here, measuring $\frac{5}{8}$ inch.

Pleurotoma (Gemmula) nelliæ Sm.

I. Karachi.

Pleurotoma (Oligotoma) makemonos Jouss.

P.G. Gulf of Oman, Jask beach.

This species, described originally by Dr. Jousseaume from Aden (Bull. Soc. Zool. France, 1883, p. 198, t. 10. f. 4), almost merges into some varieties of *pouloensis* of the same author, and perhaps is identical with *violacea* Hinds. In the more typical specimens the longitudinal zigzag marking is characteristic, but intermediates occur.

Pleurotoma (Oligotoma) nivea Phil.

I. Karachi. 3–7 fathoms, loose stones and muddy sand. A species but little understood; we place it provisionally here.

Pleurotoma (Oligotoma) pouloensis Jouss.

P.G. Shaikh Shuaib I.

M.C. Charbar.

I. Karachi.

Usually in 3–5 fathoms, amongst loose stones and muddy sand.

PLEUROTOMA (OLIGOTOMA) VIOLACEA Hinds.

I. Karachi. Inside the harbour in 3–7 fathoms, loose stones and mud.

P. vertebrata Sm., occurring also at Karachi, is perhaps only varietal.

SURCULA AUSTRALIS (Lam.).

I. South of Bombay (*Lt.-Col. H. D. Olivier*).

Some little doubt exists as to the exact locality for this species, which has its headquarters in China and the Philippine Isles.

SURCULA CATENA Reeve.

M.C. In young condition 5–10 fathoms; fine adult examples 20–30 fathoms: all on very soft mud bottom. Generally distributed.

SURCULA CINGULIFERA Lam.

P.G. Generally distributed in the Gulf, extending to the Gulf of Oman, 5–15 fathoms, sandy mud. The largest examples, $1\frac{5}{8}$ inch in length, occurred in lat. 26° 50′ N., long. 54° 50′ E.

Var. *amicta* Sm.

I. Bombay (*Abercrombie*), Bassein and Bombay Harbour as far south as Goa (*Lt.-Col. H. D. Olivier*).

We cannot separate *Pleurotoma cincta* Lam.

SURCULA JAVANA L. (=*nodifera* Lam.).

I. Karachi. Rare. Bombay (*Abercrombie*). Cast ashore very frequently, and often in good condition, after stormy weather, thence southwards to Panjim and Goa (*Olivier*).

SURCULA TORNATA Dillw.

Var. *fulminata* Kien.

M.C. Generally distributed over the Persian coasts and those of Baluchistan.

I. Karachi. Bombay (*F. W. T.*, *Abercrombie*). Bassein and Bombay Harbour southwards to Goa (*Olivier*).

SURCULA TUBERCULATA Gray.

M.C. A common species at 5–30 fathoms, soft mud; the most perfectly developed specimens coming from the greater depth.

DRILLIA ANGRIASENSIS Melv.

I. Angrias Bank (*Captain W. A. Tindall*).

DRILLIA ALCYONEA, sp. n. (Plate XXIII. fig. 21.)

D. *testa gradato-fusiformi, nitidissima, candida, unicolore; anfractibus septem, quorum apicalis ipse vitreus, lævissimus, duobus hinc proximis apud medium acuticarinatis, cæteris recticostatis, costis nitidis, spiraliter in antepenultimo bi-, in penultimo anfractu triliratis, ultimo indistincte quinque-lirato, costis ad medium evanidis, inde ad basim attenuato, multistriatulo;*

apertura oblonga, libro tenui, sinu . . . ?, margine columellari sinuoso, canali paullum producto.

Long. 12, *lat.* 4 *mm.*

Hab. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

Characteristically to be recognized by its white shining surface, and by the single acute median carination on the second and third whorls, the next whorl, in common with the rest, being longitudinally ribbed. These ribs are crossed on the fourth and fifth whorls by two spiral liræ, on the sixth by three, and on the upper part of the body-whorl by five, the ribs appearing, through a lens, senticose at the points of junction. The lower part of the body-whorl is rounded and spirally closely striate.

Drillia athyrma[1], sp. n. (Plate XXIII. fig. 22.)

D. *testa turrito-fusiformi, solidiuscula, pallide straminea; anfractibus* 10, *apicalibus tribus brevissimis inclusis, vitreis, castaneis, cæteris arcte longitudinaliter acuticostatis, costis subobliquis, spiraliter liratis, liris tenuibus, costis anfractus ultimi circa duodecim; apertura ovali; columella alba, nitida, crassiuscula, canali paullum producto.*

Long. 13, *lat.* 4·50 *mm.*

Hab. Gulf of Oman, lat. 24° 58′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

Not, perhaps, quite full-grown, as both the specimens examined have the outer lip imperfect, and it is not possible to give any particulars about the sinus. The oblique, acute, longitudinal ribs, and the incrassate, subventricose, upper whorls seem characteristic.

Drillia baynhami Sm.

P.G. Gulf of Oman, Maskat. 15 fathoms.
I. Karachi.

Drillia cecchi Jouss.

P.G. Gulf of Oman, Jask.
M.C. Local at 3–30 fathoms, muddy sand.

Drillia circumvertens, sp. n. (Plate XXIII. fig. 23.)

D. *testa ovato-fusiformi, compacta, albo-lactea, nitente; anfractibus* 8, *apicalibus duobus albis, lævibus, sub lente longitudinaliter crenelliferis, cæteris acute bi- vel tricarinatis, carinis lævibus, superficie inter carinas apud medium anfractuum excavata, oblique concentrice striata, ultimo anfractu bicarinato, infra carinam inferiorem usque ad basim spiraliter pulchre lirato, liris arctis, regularibus; apertura oblonga, albo-lactea, sinu labiali lato, brevi; columella fere recta, canali brevi.*

Long. 6, *lat.* 2·25 *mm.*

Hab. Gulf of Oman, lat. 24° 5′ N., long. 37° 35′ E. 205 fathoms, sand and mud.

[1] ἄθυρμα, a plaything.

Two examples were dredged at the above locality. A very beautiful spirally carinate and lirate *Drillia*, allied to the Mediterranean *D. loprestiana*, and not, indeed, unlike in character to certain *Surculæ*, e. g. *S. annulata* Reeve, *cincta* Lam.; but the short canal and wide sinus proclaim it rightly placed in *Drillia*, and the acute carinæ are peculiar.

Drillia clydonia[1], sp. n. (Plate XXIII. fig. 24.)

D. *testa attenuato-fusiformi, delicata, albo-straminea vel rufescente; anfractibus* 9, *quorum apicales duo perlæves, vitrei, albi vel brunneo-suffusi, cæteris angulariter prominulis, ventricosis, nitidis, longitudinaliter costatis, costis obliqui-flexuosis, leniter spiraliter sub lente striatulis; apertura oblonga, sinu perlato, labro tenui; columella recte incrassata, supra callosa, nitida, canali lato, paullum producto.*

Long. 15, *lat.* 5 *mm.*

Hab. Gulf of Oman, lat. 24° 49′ N., long. 51° 56′ E. 225 fathoms, mud.

Several examples of a shining, nearly smooth, pale, whitish, straw-coloured, or reddish-tinted shell, attenuate, graceful, nine-whorled, with longitudinal ribs, somewhat prominently twice-angled just below the middle, and obliquely flexuose, shining, and almost smooth. On the penultimate whorl the ribs number 11, on the body-whorl 10. The spiral revolving lines are discernible with a lens. The mouth is oblong, sinus very wide and somewhat shallow; outer lip thin, rounded; columella white, straight, callous above, shining; canal a little produced, broad.

Not exactly comparable with any species known to us.

Drillia crenularis Lam.

Var. *griffithii* Gray.

P.G. Gulf of Oman, Jask, on hard sand.

M.C. Charbar, at low spring-tides.

I. Karachi. Specimens washed up all along the coast. The var. *griffithii* occurs with the type near Charbar and Jask.

Var. *atkinsoni* Sm.

I. Bombay, where it appears the common form, though the type has been also recorded (*Abercrombie*). Lt.-Col. Olivier has also collected the typical form at Bassein, near Bombay.

Drillia disjecta Sm.

P.G. Gulf of Oman, Maskat. 10 fathoms, muddy sand. Akin to *D. persica* Sm., but more local.

Drillia elevata Sm.

P.G. Bushire. 10 fathoms.

Drillia flavidula Lam.

P.G. Gulf of Oman, Malcolm Inlet (Kubbatt Ghazira). Very uncommon, at 24 fathoms.

[1] κλύδων, a wave.

Drillia fucata Rve.

I. Karachi. 5 fathoms, loose stones and mud.

Drillia incerta Hinds.

P.G. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 205 fathoms, sand. Also at 37 fathoms, in contiguous sounding, sand and mud.

Drillia inconstans Sm.

P.G. Henjam Island. Shaikh Shuaib I. Gulf of Oman, lat. 24° 55′ N., long. 57° 09′ E. 37 fathoms, sand and mud.

I. Karachi. Angrias Bank and Malabar coast (*Captain Tindall*). 5 fathoms.

Drillia intertincta Sm.

P.G. Gulf of Oman, Maskat. 5–15 fathoms, sand or muddy sand. Largest examples measure 1½ inch in length.

M.C. Extends along the Mekran Coast almost to Gwadûr.

Drillia lucida G. & H. Nevill.

P.G. Tumb I. M.C. Gwadûr (*W. T. Blanford*).

Drillia nitens Hinds.

I. Lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.

Drillia obliquata Rve.

M.C. Local, but widely spread on the coast.

I. Karachi. 5 fathoms. Amongst loose stones, &c.

Drillia omanensis, sp. n. (Plate XXIV. fig. 1.)

D. *testa eleganter fusiformi, delicata, alba, pallide carnea vel brunneo-tincta; anfractibus* 9, *quorum apicales vitrei, interdum carnei, lævissimi, cæteris longitudinaliter crassicostatis, costis anfractus penultimi circa novem, ultimi decem, undique spiraliter delicatissime striatis, striis nitidis; apertura oblonga, alba, labro sinuoso, paullum effuso, sinu juxta marginem suturalem perlato; columella alba, nitida, recta, canali paullum producto.*

Long. 14, *lat.* 4·50 *mm.*

Hab. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

Three of the species of *Drillia* here described, viz. *D. athyrma*, *clydonia*, and *omanensis*, possess certain features of form in common, but entirely differ in all other particulars. The last named, now under consideration, is white, pale flesh-colour, or tinged with brown, the ribs themselves usually being white, of a very elegant fusiform contour; the whorls are nine in number, two or three being apical, colourless, and crystalline, or else brown-tinged, the remainder thickly ribbed; the chief characteristic of the species being the very fine, conspicuous, and delicate spiral liration, these liræ imparting a sericeous appearance to the whole surface. A good many examples were dredged. We may add that

D. sinensis Hinds and *D. incerta* E. Smith, species both of the same form, may be at once distinguished by greater coarseness in both sculpture and spiral liration.

Drillia persica Sm. (Plate XXI. fig. 14.)

P.G. Bushire. Henjam Island. Fao.

I. Karachi. 5–15 fathoms, in thick clayey mud. Some specimens are beautifully tinged with pink over the costal interstices.

Drillia prunulum, sp. n. (Plate XXIV. fig. 2.)

D. *testa attenuata, fusiformi, turrita, tenui, cinereo-brunnea, apud basim prunicolore; anfractibus decem, quorum apicales 2–3 pallide brunnei, vitrei, læves, cæteris apud suturas spiraliter crassijugatis, utrinque excavatis, apud medium nodulosicostatis, costis lævibus, nitidis, albescentibus, in anfractu penultimo circa sedecim, undique spiraliter crassiliratis, ad juncturas costarum gemmulatis, ultimo anfractu costis evanidis, regulariter cancellato, supra angulato; apertura ovata, paullum contracta, lacteo-purpurascente, labro tenui, sinu rotundato, lato, haud profundo, intus, cum columella nitida, prunicolore, canali brevi.*

Long. 12, *lat.* 4 *mm.*

Hab. Gulf of Oman, Maskat, 15 fathoms.

The colour of this highly sculptured, tornate, and spirally noduled species is remarkable, being an ashy brown, developing at the base, and over the greater part of the body-whorl, to deep plum-coloured purple. The noduled ribs in the centre of all excepting the apical and body whorls give an angular appearance; these disappear for the greater part on the last whorl, the beautiful cancellations being here seen with the best effect.

Drillia resplendens Melv. (Plate XXI. fig. 11.)

P.G. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E., 37 fathoms, sand and mud, only juvenile examples. On the telegraph-cable in three or four places amongst shell-growth it attains a fair size (20–22 mm.) and is very fine in colour. We figure a typical example.

Drillia robusta Hinds.

P.G. Bahrein Islands.

Drillia sacra Reeve.

P.G. Shaikh Shuaib I.

I. Karachi, local at 3–7 fathoms. Bombay (*Abercrombie*).

Drillia sinensis Hinds.

M.C. Rare, an attenuate variety occurs occasionally at 10–15 fathoms, near Gwadûr.

I. Karachi. Young examples only dredged living.

Drillia spectrum Rve.

P.G. Gulf of Oman, lat. 26° 10′ N., long. 52° 50′ E., 29 fathoms, none living, mud and rocky basis.

DRILLIA TASCONIUM[1], sp. n. (Plate XXIV. fig. 3.)

D. *testa fusiformi, sordide alba vel straminea, tenui; anfractibus* 8–10, *apicalibus in nostris speciminibus obliteratis, cæteris infra (juxta suturas) spiraliter profunde unisulcatis, superficie intermedia ad juncturas costarum nodulosa; costis longitudinalibus crassis, obliquis, lævibus, interstitialiter transversim regulariter sulculosis; apertura ovata, intus fusca, labro paullum expanso, tenui, sinu lato, parietaliter adhærente, profundo; columella alba, recta, canali paullum producto, recto.*

Long. 23, *lat.* 9·50 *mm.*

Hab. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

Allied in form to *Drillia lucida* Nevill, from the same locality, but more than twice the size, *D. lucida* being likewise much smoother-ribbed. The canal is longer, and the sinus both wider and deeper. The outer lip in both specimens dredged at the above locality has been broken and repaired; the whole build of the shell is coarse, though of a light rather than massive consistency. Particularly conspicuous are the spiral sulci deeply furrowing the summit of each whorl, leaving a narrow noduled space between them and the sutures.

DRILLIA TAYLORIANA Rve.

I. On Eastern Telegraph Co.'s Cable, 121 miles W.S.W. of Bombay.

P.G. Gulf of Oman, Maskat. 15 fathoms.

DRILLIA THEORETA Melv.

P.G. Henjam Island, 25 fathoms. Shaikh Shuaib I., one large form. Allied to *D. cecchi* Jouss., which latter, however, seems always paler in hue and more attenuate in form.

DRILLIA TOPAZA, sp. n. (Plate XXIV. fig. 4.)

D. *testa gracili, fusiformi, solida, attenuata, castanea, rubro-suffusa; anfractibus octo, quorum duo apicales mamillati, læves, vitrei, cæteris paucicostatis, costis obliquis, crassis, spiraliter undique tenuiliratis, costis anfractus ultimi ad sex; apertura ovata, carnea, labro paullum incrassato, sinu lato, brevi; columella recta, canali lato.*

Long. 11, *lat.* 3·50 *mm.*

Hab. Gulf of Oman, Maskat, 15 fathoms.

Allied to *D. theoreta* Melv. and *D. cecchi* Jouss., both of which occur in the Arabian Sea and Persian Gulf. It may be distinguished from both by its mamillate protoconch and fewer longitudinal ribs, as well as the reddish-pink coloration, with dark purple-red suffusion at the aperture round and beyond the sinus. The ribs of the lowest whorl only nnmber six; they are thickened, rounded, and crossed by close undulating liræ.

[1] *tasconium*, a yellowish-white earth, from the colour.

DRILLIA TURRIS Rve. (=*Pleurotoma pagoda* Reeve).

P.G. Gulf of Oman, Maskat.

I. Karachi, but very rarely.

DRILLIA VARIABILIS Sm.

P.G. Gulf of Oman, lat. 23° 50′ N., long. 27° 50′ E. Soft mud.

I. Karachi, smaller examples near the mouth of R. Indus, 3 fathoms, sand and mud.

This species has also been received by us from the Red Sea (*Townsend*) and the Andaman Isles (*Booley*).

DRILLIA (CLAVUS) CRASSA Sm.

I. Bombay (*Abercrombie*).

DRILLIA (CLAVUS) PRÆCLARA Melv.

I. Bombay, up the coast (*Abercrombie*).

MANGILIA AVERINA, sp. n. (Plate XXIV. fig. 5.)

M. *testa ovato-fusiformi, alba, solida; anfractibus* 7, *quorum apicales duo læves, albi, cæteris regulariter recticostatis, costis crassiusculis, in ultimo circa septem, undique spiraliter arcte liratis, liris alternatim tenuibus vel fortibus, ultimo anfractu longitudine cæteros exæquante; apertura anguste ovata, labro incrassato, sinu lato, brevi; columella fere recta; peristomate omni aurantio-suffuso.*

Long. 6, *lat.* 2·75 *mm.*

Hab. Karachi.

A stout, pure white little *Mangilia*, with strong ribs, crossed by alternate strong or thin liræ, and gemmuled at the points of junction. The lip and columellar area are beautifully suffused with orange-yellow.

MANGILIA CARDINALIS Reeve.

I. Karachi. 3 fathoms, loose stone bottom.

MANGILIA CHILOSEMA Melv.

P.G. Henjam Island. 15 to 20 fathoms, mud.

M.C. In several places off the coast at 10–15 fathoms.

I. Karachi. Exceedingly abundant among loose rocks, sand, and mud at low tide. Bombay (*Abercrombie*) is shell-sand.

The affinities of this species lie with the New Caledonian *M. himerta* and *himerodes* M. & S., and perhaps with the Mediterranean *M. vauquelini* Payr.

MANGILIA CRASSILABRUM Rve.

P.G. Gulf of Oman, Malcolm Inlet (Kubbatt Ghazira). 3 fathoms

I. Karachi.

MANGILIA DECIPIENS Sm.

I. Bombay (*Abercrombie*), in shell-sand, mostly worn.

MANGILIA FAIRBANKI G. & H. Nevill.

I. Karachi, fine and not infrequent. Bombay (*Abercrombie*).

MANGILIA FORTISTRIATA Sm.

I. Bombay (*Abercrombie*).

MANGILIA FULVOCINCTA G. & H. Nevill.

I. Bombay (*Abercrombie*).

MANGILIA GALIGENSIS Melv.

P.G. Galig Island.
Akin to *M. townsendi* Sowb.

MANGILIA LUCIDA Sm.

I. Bombay (*Abercrombie*).

MANGILIA MYRMECODES [1], sp. n. (Plate XXIV. fig. 6.)

M. *testa oblonga, solida, pallide straminea; anfractibus sex, quorum apicalis mamillatus, subvitreus, lævis, cæteris longitudinaliter crassicostatis (costis in ultimo anfractu undecim), undique spiraliter densiliratis, ad juncturas costarum noduliferis; apertura angusta, straminea, sinu lato, labro incrassato, crenulato; columella recta.*

Long. 5, *lat.* 2·55 *mm.*

Hab. M.C. Charbar. 5 fathoms, sand.
I. Karachi, not uncommon.

Associated with *Pyrgulina callista* Melv., *Cingulina isseli* Tryon, various *Turbonillæ*, *Mangilia horneana* Sm., *chilosema*, Melv., &c., at from 5–7 fathoms, this little species is probably locally abundant along the whole Mekran Coast. It is best distinguished by its noduled costæ, which are particularly well defined, and unlike any other species we know, excepting *M. bascauda* M. & S. from Lifu.

MANGILIA OPALUS Rve.

I. Lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms.
The nearest ally of this species seems to be *Drillia nitens* Hinds, into which genus we think it should be removed.

MANGILIA PELLYI Sm.

P.G. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 250 fathoms.

MANGILIA PERLONGA Melv.

I. Karachi, only once found.

MANGILIA PHÆA [2], sp. n. (Plate XXIV. fig. 7.)

M. *testa minuta, ovato-fusiformi, nigro-fusca, periostraco furfuraceo, et tenui contecta; anfractibus* 7, *quorum apicales duo nitidi, læves, brunneo-fusci, tertio arctissime longitudinaliter crenulato, cæteris paucicostatis (in anfr. ultimo sex), costis incrassatis,*

[1] *μυρμηκώδης*, warty or nodulous. [2] *φαῖος*, dusky.

spiraliter ad angulum medium et infra, in penultimo et antepenultimo biliratis, ultimo circa octo liris a peripherio usque ad basim prædito ; apertura angusta, brunnescente, labro incrassato, paullum effuso, sinu lato, brevi; columella purpureo-fusca, recta, ad basim curta.

Long. 4, *lat.* 1 *mm.*

Hab. Persian Gulf, Linjah. $3\frac{1}{2}$ fathoms, sand.

A very small, ovate, angled species, of a peculiar dark brown colour, with but few incrassate ribs, crossed by sparse liræ, commencing at the centre of each whorl.

MANGILIA PULCHRIPICTA, sp. n. (Plate XXIV. fig. 9.)

M. *testa fusiformi, parva, solida, omnino clare straminea, apud suturas et ad medium anfractus ultimi inter costas purpureo suffusa ; anfractibus* 8 (*quorum tres apicales vitrei, ochracei, perlæves*), *paucicostatis, costis ad medium angulatis, in anfractu penultimo circa* 9–10, *undique spiraliter filoliratis, liris in penultimo circa* 8, *anfractu ultimo ad peripheriam uniangulato, spiraliter ad basim lirato ; apertura angusta, oblonga, labro paullum incrassato, purpureo-fasciato, sinu lato, haud profundo ; columella fere recta, canali brevi.*

Long. 6·50, *lat.* 2 *mm.*

Hab. Persian Gulf, Bushire, towards Fao.

Brightly painted with purplish blotches interstitially in the centre of the body-whorl, as well as at the sutures, the outer lip being also fasciate. The ground-colour is clear straw; the whorls are centrally distinctly once-angled; the ribs are clearly defined, moderate in number, and crossed by revolving liræ. Mouth narrow, sinus broad but not deep, canal short, columella nearly straight. We do not know a near ally.

MANGILIA SUBULA Rve.

P.G. Gulf of Oman, lat. 26° 10′ N., long. 52° 50′ E. 33 fathoms, sand and mud.

M.C. Charbar Point, on rocks at 7–12 fathoms. Astola Island, on rocks and Algæ.

MANGILIA TERPNISMA [1], sp. n. (Plate XXIV. fig. 8.)

M. *testa fusiformi, solidula, alba, apud suturas castaneo-suffusa, et interdum ultimo anfractu spiraliter castaneo-tæniato ; anfractibus octo, ad medium angulatis, quorum apicales duo vel tres læves, castaneo-brunnei, cæteris longitudinaliter crassicostatis, costis rectis, interstitiis, simul ac ad suturas, interdum brunneo- vel castaneo-suffusis, undique spiraliter liratis, liris irregularibus, subdistantibus ; apertura cinerea, angusta, labro incrassato, tæniato, intus sanguineo ; columella suffusa, ad basim sanguinea ; canali paullulum recurvo, brevissimo.*

Long. 9, *lat.* 3 *mm.*

Hab. Gulf of Oman, lat. 24° 55′ N., long. 57° 57′ E., at 37 fathoms, sand and mud.

[1] τέρπνος, pleasing.

Characterized by its stout build, whorls once-angled, whitish, banded and filleted with chestnut, the outer lip much thickened, tæniate, within blood-red or, in one example, chestnut, columella stained at the base with the same colour. Mouth narrow, cinereous or slate-coloured within. This species would by some authors be considered a *Glyphostoma*.

MANGILIA THESKELOIDES Melv.

I. Karachi.

The nearest ally is *M. theskela* M. & S. from New Caledonia and the Loyalty Isles.

MANGILIA TOWNSENDI Sowb.

P.G. Gulf of Oman. Especially fine at Jask.

M.C. Charbar, Gwadûr, Ormara, Astola Island, &c.; met with generally along the coast from low-water mark to 15 fathoms, on muddy sand.

MANGILIA (GLYPHOSTOMA) OBTUSICOSTATA Sm. (Plate XXI. fig. 4.)

P.G. and M.C. Occasionally occurring singly, rare.

I. Karachi, local.

MANGILIA (GLYPHOSTOMA) RUGOSA Migh.

P.G. Gulf of Oman, Maskat. 15 fathoms.

I. Karachi. In 3–7 fathoms, amongst loose stones and muddy sand.

MANGILIA (GLYPHOSTOMA) SOROR Sw.

P.G. Bushire, Hindarabi I. Galig I. Kishm I.

M.C. Fairly general along the coast.

I. Karachi Harbour, where the finest specimens of all occur in 5 fathoms, among loose stones and muddy sand.

MANGILIA (GLYPHOSTOMA) SPURCA Hinds.

P.G. Linjah, $3\frac{1}{2}$ fathoms. Henjam I., 15–28 fathoms. Bahrein Islands. Gulf of Oman, Maskat, 15 fathoms.

I. Karachi.

CLATHURELLA ALBICAUDATA Sm.

I. Karachi. On rocks amongst weeds at low tide.

CLATHURELLA BICOLOR Angas.

I. Karachi.

CLATHURELLA FORAMINATA Reeve.

I. Bombay (*Abercrombie*).

Var. *camacina* Melv.

M.C. Charbar. 7 fathoms.

I. Karachi. Also lat. 18° 58′ N., long. 71° 43′ E. 40 fathoms. The variety is always larger and paler than the type.

CLATHURELLA HORNEANA Sm.

P.G. Bushire.

I. Karachi. Amongst weed and sand on rocks at low tide, locally most abundant, and probably extending to Ceylon.

CLATHURELLA O'MALEYI Melv.

P.G. Gulf of Oman. On shell-growth on telegraph-cable, lat. 25° 58′ N., long. 57° 35′ E. 55 fathoms, mud.

CLATHURELLA PERPLEXA G. & H. Nevill.

P.G. Bushire, and near Fao, at head of the Gulf.
I. Bombay (*Abercrombie*).

CLATHURELLA SMITHII G. & H. Nevill.

P.G. Tumb I. M.C. Gwadûr (*W. T. Blanford*). Near *polynesiensis* Rve.

CLATHURELLA TENUILIRATA Angas.

P.G. Gulf of Oman, lat. 26° 10′ N., long. 52° 50′ E. 33 fathoms, mud and rock.

CLATHURELLA POLYNESIENSIS Reeve.

M.C. Astola Island, in sand.
I. Karachi.

Not agreeing with Lifu specimens so named, and the species requires further study. Arabian Sea examples certainly compare more favourably with the original description (Proc. Zool. Soc. 1848, p. 119).

CLATHURELLA PYRAMIDULA Rve.

P.G. Linjah. $3\frac{1}{2}$ fathoms.
I. Karachi. 5 fathoms, mud.

CLATHURELLA THALIA sp. n. (Plate XXIV. fig. 10.)

C. testa fusiformi, gracili, multum attenuata, ochraceo-straminea, ad medium anfractuum brunneo-tæniata; anfractibus 8, *quorum duo apicales vitrei, læves, pellucidi, his proximus anfractus pulcherrime tribus gemmularum ordinibus minutis spiraliter dispositis, præditus, cœteris apud suturas impressis, tumidis, longitudinaliter costatis, costis tenuibus, flexuosis, obliquis, tribus vel quatuor liris spiraliter succinctis, ad juncturas costarum gemmuliferis, anfractu ultimo producto, attenuato; apertura anguste oblonga, labri sinu minimo, brevissimo, lato; columella recta, canali brevi.*

Long. 8·25, *lat.* 2·50 *mm.*

Hab. Mekran Coast, Charbar. 7 fathoms.

This species might stand equally as *Mangilia* or *Clathurella*: it seems impossible to draw a hard-and-fast line between such nearly allied genera, the characteristics of which are often ill-defined. *C. thalia* is a particularly graceful, attenuate species, one of its chief distinguishing peculiarities, which we have observed on no other nearly allied form, being the beautiful rows (3) of spiral small gemmæ on the whorl immediately succeeding the apical. The thin flexuose oblique longitudinal ribs, crossed by about four rows of spirals on the upper whorls, present at the point of junction with the ribs round small gemmules; the last whorl is very elongate and attenuate, just above the middle of this whorl the spirals are sparse and the colour becomes whitish, giving the shell a banded appearance. Aperture narrowly oblong: outer lip thickened, with a very shallow, small, but broad sinus; columella straight, and canal short.

Superficially like *C. polynesiensis* Reeve, but widely differing in character of ribs and greater attenuation of form.

CLATHURELLA TINCTA Rve.

I. Karachi. Occurs at very low tide, amongst mud and weed on rocks.

Var. *lemniscata* Nevill (sp.).

I. Bombay (*Abercrombie*), with the type in shell-sand.

DONOVANIA BICOLOR Melv.

Lachesis bicolor Melv. Mem. Manch. Soc. vol. xlii. part 2 (1898), no. 4, p. 14, pl. i. fig. 27.

P.G. No special locality given.

M.C. Charbar, rarely.

CYTHARA EDITHÆ, sp. n. (Plate XXIV. fig. 11.)

C. testa gracili, fusiformi, alba, castaneo-tincta; anfractibus 8–9, *quorum apicales duo vel tres calcarei, albi, læves, cæteris eleganter recticostatis, costis paucis, in antepenultimo quinque, penultimo et ultimo sex, plerumque obscure castaneo variegatis, undique spiraliter sub lente arctissime et delicatissime striatis, apud suturas multum impressis; apertura angusta, oblonga, labro extus paullum effuso, incrassato, dorsaliter pallide castaneo-maculato, intus recto; columella alba, recta, minute multidenticulata.*

Long. 10·25, *lat.* 3 *mm., sp. maj.*

Hab. Gulf of Oman, Maskat. 10 fathoms.

Allied to *C. cithara* Gould, but more graceful and fewer-ribbed; a species, too, of which we have not been able to find a description. *C. tenuilirata* Rve. is also akin to our species, we having closely compared it; but it differs in form, the number of costæ being identical.

CYTHARA GRADATA G. & H. Nevill.

I. Bombay (*Rev. S. B. Fairbank*) (*A. Abercrombie* ?).

CYTHARA HYPERCALLES Melv.

P.G. Gulf of Oman, Maskat. 20 fathoms, sandy mud.

CYTHARA TYPHONOTA [1], sp. n. (Plate XXIV. fig. 12.)

C. testa alba, solidiuscula, ultimo anfractu dorsaliter apud medium nigrescenti-tæniato; anfractibus octo, gradatis, apud suturas impressis, longitudinaliter recticostatis, costis ultimum apud anfractum 12, *fere lævibus, sub lente spiraliter obscure undique tenuistratis; apertura oblonga, labro simplice (juvenili); columella fere recta.*

Long. 8, *lat.* 1·50 *mm.*

P.G. Tumb Island. 17 fathoms, sand.

[1] τύφος, smoke; νῶτος, back.

Dredged in company with *Mangilia spurca* and *obtusicostata*, but only in juvenile condition. The gradate whorls, straight ribs (twelve in number on the body-whorl), and especially the smoky black spiral dorsal band, most conspicuous just behind the outer lip, amply characterize the species.

DAPHNELLA AXIS Reeve.

P.G. Gulf of Oman: Malcolm Inlet, 20 fathoms; Kais (or Gais) Island, 10 fathoms, amongst broken shell and coral-sand.

I. Karachi.

DAPHNELLA CECILIÆ, sp. n. (Plate XXIV. fig. 13.)

D. *testa gracillime fusiformi, albida, delicata; anfractibus* 9, *quorum apicales tres pallide straminei, supremo mamillato, nitido, lævi, duobus hinc proximis sub lente delicatissime decussatis, cæteris arctissime tenuicostatis, spiraliter undique liratis, interstitiis quadratulis, alveatis, liris ultimi anfractus circa viginti, costis longitudinalibus arctissimis, tenuibus; apertura oblonga, albescente, labro paullum incrassato, sinu haud profundo; columella recta.*

Long. 13, *lat.* 4 *mm.*

Hab. "Mekran Coast" (*F. W. Townsend* in coll. W. Neville Sturt).

A most graceful white species, resembling a *Mitra* of the section *Cancilla*. In addition to the description above given, we might point out that on the fourth and fifth whorls the longitudinal ribs are fewer and more incrassate than on the penultimate and body-whorls; the same with the spiral liræ. On the body-whorl these liræ are of varying thickness, the interstices are alveate. By some malacologists this might be termed a *Clathurella*, but the very graceful form suggests greater affinity with the genus where we have, at all events provisionally, located it. Our best thanks are due to Mr. W. N. Sturt for the loan of the species, which, with many other Mollusca of great interest, he has received direct from Mr. Townsend.

DAPHNELLA EVERGESTIS [1], sp. n. (Plate XXIV. fig. 14.)

D. *testa ovato-fusiformi, albo-straminea; anfractibus octo, quorum apicales duo subvitrei, delicatissime sub lente decussati, cæteris ad suturas multum impressis, ventricosis, arctissime longitudinaliter costulatis, costis subobliquis, ad juncturas lirarum spiralium multarum gemmulato-nitidis, anfractus ultimi costis ad sex et viginti; apertura ovata, labro incrassato, albo, nitido, sinu ad suturam lato, sed obscuro, canali paullulum recurvo, brevi.*

Long. 12, *lat.* 4 *mm.*

Hab. Gulf of Oman, lat. 24° 55′ N., long. 59° 59′ E. 37 fathoms, sand and coral-mud.

A well-sculptured *Daphnella*, whitish or straw, variegated with darker maculations on some examples, elegantly fusiform; whorls

[1] εὐέργης, bountiful.

rounded, much impressed at the sutures, the protoconch most delicately decussate, the remainder of the whorls being closely obliquely ribbed, crossed by many spirals, slightly gemmulate at the points of junction, this gives a white shining appearance to the ribs, which on the body-whorl number about twenty-six. The mouth is oval, outer lip thickened; sinus very superficial, but broad, close below the suture. Canal slightly recurved and short. We do not know a near ally to this species, though some superficial similarity in the sculpture with *Pl. mitralis* Ten.-Woods, from Tasmania, is discernible. Likewise *D. compsa* Wats., though more than twice the length, has the same costal disposition; but in this species the form, especially basally, is quite different, the canal being more prolonged, with consequent attenuation of the body-whorl.

Daphnella receptoria, sp. n. (Plate XXIV. fig. 15.)

D. *testa eleganter fusiformi, læte ochracea, multum attenuata, delicata; anfractibus septem, angulatis, apicali perlævi, vitreo, puniceo-tincto, cæteris ad suturas multum impressis, excavato-tornatis, supernis binis, penultimo trinis carinarum ordinibus spiraliter prædito, ultimo multicarinato, carinis variis, septem vel octo carinarum ordinibus; apertura lata, oblonga, intus albescente, labro extus lunulato; columella fere recta, canali brevi.*

Long. 18·50, *lat.* 6 *mm.*

Hab. Mekran Coast, Charbar.

We consider this elegant Pleurotomid to belong to the genus *Daphnella* rather than to *Clathurella*, as there is no sign of cancellation on any of the whorls. At the same time *Cl. tricarinata* Reeve, *carinulata* Souv., and *hindsii* Reeve show much structural affinity with it, both in the keels and in form. The section of *Daphnella* to which we refer it, viz. that which has for its type *D. trivaricosa* von Martens, seems almost to embrace the *Clathurellæ* we have just mentioned, and several others relegated to that genus.

One cannot help feeling, indeed, the more the Pleurotomacea are studied closely, how painfully artificial and misleading are many of the characters which are employed in differentiating the sections, so called genera, and subgenera of this vast assemblage. It is almost too large for the monographer, and so enormous are the number of species annually brought to light, especially since the abyssal forms have been sought after and procured with greater facility, that we fear confusion will soon be worse confounded, and the patience of malacologists tried too far, unless some benefactor of his race arise to study these forms *alone* as his life's work.

Daphnella trivaricosa v. Mart.

P.G. Gulf of Oman. One beautifully lamellate specimen from Malcolm Inlet (Kubbatt Ghazira), with the upper whorls varicose, may be a distinct species, the canal being slightly more prolonged than in von Martens's type.

DAPHNELLA VENERIS, sp. n. (Plate XXIV. fig. 16.)

D. *testa oblongo-gradatula, delicata, tenui, albo-lactea; anfractibus 8, quorum apicales duo depressi, vitrei, duo his proximi pulcherrime sub lente decussato-cancellati, cæteris ad suturas gradatis, ultimo excepto, irregulariter varicoso-costatis, spiraliter undique arcte liratis, liris in ultimo anfractu solum gemmulatis; apertura late oblongo-ovata, labro effuso, paullum incrassato, sinu lato, juxta suturam; columella recta, canali brevissimo.*

Long. 9, *lat.* 3·25 *mm.*

Hab. Gulf of Oman, lat. 24° 05′ N., long. 57°25′ E. 205 fathoms, mud.

A peculiarly gradate species, the sculpture being, as in most *Daphnellæ,* elaborately cancellate as regards the protoconch; the whorls next to this are irregularly varicose-costate, and are crossed by delicate non-gemmuled spirals; it is on the last whorl alone, which is slightly effusely ventricose, that these gemmules appear, which are extremely beautiful microscopic objects. The aperture is wide, outer lip effuse, the sinus, situate just below the suture, being very broad. Canal very short.

We know no member of the genus which possesses such well-defined gradate whorls, and we consider its refined beauty merits the appellation chosen for it specifically.

DAPHNELLA XYLOÏS [1], sp. n. (Plate XXIV. fig. 17.)

D. *testa delicata, eleganter fusiformi, albida, flammis longitudinalibus vel maculis castaneis decorata; anfractibus* 9½, *quorum apicales* 2½ *subvitrei, castanei, sub lente delicate cancellati, tres quoque his proximi obscure longitudinaliter varicoso-costati, cæteris planatis, undique pulcherrime et tenuissime filoso-cancellatis, ad juncturas gemmuliferis, ultimo anfractu cæteros magnitudine exæquante; apertura alba, oblonga, labro tenui, sinu (in speciminibus nostris) haud cernendo; columella tenui, canali brevissimo.*

Long. 13, *lat.* 4·50 *mm.*

Hab. Gulf of Oman, Maskat. 10 fathoms, coral-sand.

Most beautifully encircled with microscopic cancellæ, which are gemmuled at the points of junction, giving a sericeous appearance to the surface when examined with an ordinary lens of low power. Under a higher objective the protoconch is perceived to be vitreous, most delicately cancellate throughout, the next three whorls possessing coarse varicose longitudinal ribs, the remaining whorls all plane and clouded with flame-like chestnut markings.

Our specimens are probably not quite full-grown, for the sinus is not discernible. The outer lip is slightly effuse, columella thin, and canal extremely short.[2]

[1] ξύλον, wood, from the grained-like chestnut markings.

[2] Of the twenty-seven species of *Pleurotomidæ* described by Mr. Edgar Smith mainly in 1877–1888, and for which, in the earlier part of this paper, we have given most of the references, the following only do not occur in our Catalogue, all having been collected by Col. Pelly with the locality "Persian Gulf," and

This species does not seem very near, save superficially, to any variety of the protean *D. lymneiformis* Kiener, e. g. *patula* and *fragilis* Reeve, with which we have carefully compared it. In form it is unlike the elongate *D. flammea* Hinds, from New Ireland, though to some extent the disposition of the markings is identical. *D. delicata* Rve. is likewise more elongate.

Fam. CANCELLARIIDÆ.

CANCELLARIA (MERICA) ASPERELLA Lam.

Var. *elegans* Sowb. (sp.).

P.G. Gulf of Oman, Maskat. 15 fathoms.

CANCELLARIA (MERICA) BIFASCIATA Desh. (=*oblonga* Sowb.).

P.G. Gulf of Oman: Jask, Maskat. 15 fathoms.
M.C. Charbar Point.
I. Bombay (*Abercrombie*), very occasionally.

CANCELLARIA (TRIGONOSTOMA) AGALMA [1], sp. n. (Plate XXIV. fig. 18.)

C. *testa parva, oblongo-fusiformi, anguste perforata, fusca, solida; anfractibus* 7, *quorum apicales læviusculi, quatuor ultimis ad suturas multum impressis, supra angulatis, longitudinaliter obliquicostatis, costis asperis, undique spiraliter arcte rudiliratis, liris crassis, cum tenuibus alternatim dispositis, interstitiis squamato-corrugatis; apertura angusta, trigonali, labro crasso, supra recto, unangulato, deinde paullum ad basim effuso; columella biplicata.*
Long. 7·50, *lat.* 4 *mm.*

Hab. Gulf of Oman, lat. 24° 55′ N., long. 57° 59′ E. 37 fathoms, sand and mud.

Small, solid, of elegant compressedly angled and trigonous contour, the body-whorl bears eleven longitudinal ribs, thick, spirally multilirate, these liræ of varying widths alternately disposed. Allied to *C. goniostoma* Sowb., *C. antiquata* Hinds, and others of the section *Trigonostoma* Blvlle.

CANCELLARIA (TRIGONOSTOMA) BICOLOR Hinds.

M.C. Off Charbar Point. 7 fathoms, rock.

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the types presented to our National Collection, South Kensington, by the late Mr. R. MacAndrew:—

Drillia portia.
,, *pupiformis.*
Mangilia albolabiata.
,, *recta.*
,, *scitula.*
Clathurella asperulata.
,, *crebrilirata.*
Clathurella macandrewi.
,, *munda.*
,, *reticulosa.*
Daphnella arcta.
Cithara elevata.
,, *striatula.*

With the exception of these few, therefore, we believe that *all* the members of this large family that have been hitherto diagnosed as occurring within the confines of this region are enumerated in this catalogue.

[1] ἄγαλμα, a delight.

CANCELLARIA (TRIGONOSTOMA) COSTIFERA Sowb.

I. Karachi. 3 fathoms, loose stones and sandy mud.

Bombay (*Abercrombie*). "Only in one locality, washed up by heavy seas, with *C. scalarina* Lam." Bassein and southwards (*Olivier*).

CANCELLARIA (TRIGONOSTOMA) CRENIFERA Sowb.

P.G. Gulf of Oman, Maskat. 15 fathoms.

I. Karachi.

Var. *serrata* Reeve.

P.G. Gulf of Oman, Maskat, with the type.

CANCELLARIA (TRIGONOSTOMA) CRISPATA Sowb.

I. Karachi, but rarely.

CANCELLARIA (TRIGONOSTOMA) HYSTRIX Rve.

P.G. Gulf of Oman, Jask.

M.C. Generally off the Persian coast. 7–10 fathoms, in muddy bottom.

CANCELLARIA (TRIGONOSTOMA) LAMELLOSA Hinds.

P.G. Generally found 10–15 fathoms, among dead shells and mud. By some authors considered a variety of *C. crenifera* Sowb.

CANCELLARIA (TRIGONOSTOMA) PAUCICOSTATA Sowb.

P.G. Shaikh Shuaib I. Also on telegraph-cable adhering to the upper part of *Rapana bulbosa*, 30–50 fathoms. Lat. 25° 14′ N., long. 59° 45′ E., 80 fathoms.

CANCELLARIA (TRIGONOSTOMA) SCALARINA Sowb.

P.G. Found generally in 10 fathoms, mud and dead oyster-shells.

I. Karachi. Bombay (*Abercrombie*), only washed ashore in one place, after storms.

CANCELLARIA (TRIGONOSTOMA) WILMERI Sowb.

I. Angrias Bank (*Captain W. S. Tindall*).

Specimens of a *Cancellaria*, very distinct, and with *C. macrospira* Ad. & Rve. as sole ally, have lately (April 1901) been dredged by Mr. Townsend off Bombay, lat. 18° 58′ N., long. 71° 45′ E., 40 fathoms, unfortunately too late for description at the present opportunity.

Order OPISTHOBRANCHIATA.

Suborder i. TECTIBRANCHIATA.

Fam. ACTEONIDÆ.

SOLIDULA AFFINIS (A. Ad.).

P.G. and M.C. Generally found at 3–7 fathoms, muddy sand.

I. Karachi.

Var. *coccinata* Rve. (sp.).

I. Karachi.

Actæon exilis Jeffr. (=*nitidus* Verrill).

P.G. Gulf of Oman, lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms, mud.

The discovery of this species in the Persian Gulf increases the range as hitherto known. Discovered by Dr. Gwyn Jeffreys in 1870, in the North Atlantic, 227–1456 fathoms, it was subsequently found in the Bay of Biscay, Mediterranean Sea, Azores ('Challenger' Expedition), also E. coast of Florida, and Martha's Vineyard, Rhode I., U.S.A., likewise the Campeche Bank, Gulf of Mexico (*vide* Pilsbry in Man. of Conch. vol. xv. p. 156).

Our examples seem near the American variety (*A. nitidus* Verrill).

Actæon flammeus Gmel.

P.G. Gulf of Oman, Maskat. 15 fathoms.
Shaikh Shuaib Island. 10 fathoms, coral-sand.
Sometimes occurs at low-tide mark.

Actæon pudicus A. Ad.

I. Karachi.

Actæon sieboldi Rve.

P.G. Gulf of Oman. 10 fathoms, mud.
M.C. 8 fathoms, not frequent.

Leucotina amœna A. Ad. (*Myonia*).

P.G. and M.C. No exact record.
I. Bombay (*Abercrombie*).

Leucotina eximia Lischke.

I. Bombay (*Abercrombie*).

Leucotina gratiosa Melv.

P.G. Off Shaikh Shuaib I. 10 fathoms, in semifossil condition.

I. Karachi, very rarely.

Leucotina jaskensis Melv.

P.G. Gulf of Oman, Jask. Dredged at 3 fathoms, muddy sand. A very graceful species.

Bullina scabra Gmel. (= *Voluta ziczac* Muhlfeldt).

M.C. Generally occurs on the coasts of Persia and Baluchistan from low tide to 5 fathoms, sandy mud. Common at Ormara.
I. Bombay (*Abercrombie*).

Distributed through both hemispheres, though not yet found on the American coasts.

Fam. TORNATINIDÆ.

TORNATINA CRITHODES [1], sp. n. (Plate XXIV. fig. 19.)

T. *testa recta, cylindrica, fusiformi, alba, cuticulo tenuissimo contecto, straminea, spiraliter castaneo-multilineato, spira depresso-conica, apice heterostropho; anfractibus 4–5, profunde et anguste canaliculatis, ultimo recto, subprolongato; apertura supra contracta, infra effusa, labro fere recto; columella fortiter uniplicata.*

Alt. 5·50, *diam.* 2 *mm.*

Hab. Persian Gulf, Linjah. 7½ fathoms.

The straw-coloured thin cuticle or periostracum surrounding the white surface is thick with chestnut-coloured spiral lines. In this respect, judging by Mr. Pilsbry's figure (Man. Conch. xv. pl. 50. f. 38), it resembles *T. culcitella* Gould, from California. The whorls are profoundly, but narrowly channelled, form straight and cylindrical, columella strongly once-plaited. A good many examples were dredged in December 1900, at the above-named locality.

TORNATINA INCONSPICUA A. Ad.

P.G. Gais Island. 10 fathoms.

I. Bombay (*Abercrombie*).

This Erythræan species is in the British Museum (Nat. Hist.) from the Persian Gulf unnamed. With the aid of a lens delicate spiral striæ are discernible towards the base.

TORNATINA INVOLUTA G. & H. Nevill.

I. Bombay (*Abercrombie*).

TORNATINA PERSIANA Sm.

P.G. At 14 fathoms (*Col. Pelly*). In Coll. Mus. Brit.

TORNATINA TOWNSENDI Melv.

P.G. and M.C. Occasional.

I. Karachi, very abundantly dredged off Manora Point and elsewhere at 3–7 fathoms.

TORNATINA ZOË, sp. n. (Plate XXIV. fig. 20.)

T. *testa minuta, cylindrica, brevi, subpellucida, albo-lactea, apice sinistrali, mamillato, spira conica; anfractibus (apicali incluso) quatuor, ad suturas excavatis, ultimo undique spiraliter pulchre sulcato, sulculis arctis, circa octo et viginti, ad basim descendentibus; apertura pyriformi, apud basim effusa, rotundata, labro recto; columella alba, paullum callosa.*

Alt. 3·25, *diam.* 1·30 *mm.*

Hab. Karachi.

The most delicately beautiful of the genus, being distinguished

[1] κριθώδης, like barley-husks.

by its cylindrical, rather shortened spire, sinistral apical whorl, straight body-whorl, closely spirally multisulcate. The substance is subpellucid milky white; outer lip straight; columella slightly callous at the base, white, shining, not plaited.

RETUSA NITIDA (A. Ad.).

P.G. Bushire. A Bornean species.

RETUSA (PYRUNCULUS) PELLYI (Sm.).

Cylichna (Sao) pellyi Sm. Ann. N. H. ser. 4, ix. p. 354 (1872).

P.G. Gulf of Oman. Common at some depth, say from 50 to 350 fathoms; fine and large.

I. Bombay (*Abercrombie*). One of the most abundant Mollusca whose shells are cast ashore after rough weather.

VOLVULA ACUMINATA Brug.

P.G. Gulf of Oman, lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms, mud.

I. Bombay. Not in the list, though collected by Abercrombie. Probably absolutely identical with the well-known European and Mediterranean *Volvula*. It is recorded in the catalogue (revised) of the MacAndrew collection from the Red Sea and Suez by the Rev. A. H. Cooke. Probably *V. oxytata* Bush, from the Eastern United States, is the same.

Fam. SCAPHANDRIDÆ.

SMARAGDINELLA ANDERSONI Nevill (*Glauconella*).

I. Ratnagiri (*Abercrombie*).

First recorded by G. Nevill from S. Ceylon. The Rev. A. H. Cooke names it from Suez; Dr. F. Stoliczka from Penang.

ATYS (ALICULA) ALICULA A. Ad.

P.G. Gulf of Oman, Maskat. 15 fathoms.

ATYS (ALICULA) AMYGDALA Sowb.

M.C. Record a little doubtful (*F. W. T.*).

ATYS (ALICULA) CYLINDRICA Helb.

M.C. No specified locality.

Includes *A. elongata* A. Ad. and *solida* Brug.

ATYS (ALICULA) SUCCISA Ehr.

I. Karachi.

CYLICHNA BREVISSIMA A. Ad.

P.G. Gulf of Oman, lat. 25° 44′ N., long. 52° 30′ E. 40 fathoms, mud and sand, on telegraph-cable.

CYLICHNA BUSHIRENSIS, sp. n. (Plate XXIV. fig. 21.)

C. *testa subcylindrica, supra acuminata, apud basim paullulum effusa et dilatata, tenui, papyracea, nitida, cinereo-alba, transversim eleganter undulato-striata, striis supra minute punctatis,* *spira celata, apice umbilicato; apertura supra angusta, ad basim effusiore; columella simplice, paullum incrassata.*

Alt. 8, *diam.* 3·25 *mm.*

Hab. Persian Gulf. Bushire and near Fao.
Gulf of Oman, Maskat. 15 fathoms.
Gulf of Oman. 208 fathoms.

Mainly conspicuous by its fragility and delicate transverse undulating striæ, these being punctate in the upper portion of the body-whorl. The mouth is slightly dilated below, lip fairly straight, columella slightly thickened. Several examples.

CYLICHNA CRENILABRIS, sp. n. (Plate XXIV. fig. 22.)

C. *testa brevi, calcareo-alba, subperforata, bullata, ovata, crassiuscula, undique arctissime spiraliter minute punctata; apertura oblonga, supra constricta, infra paullum dilatata, labro incrassato, pulchre crenulato; columella ad basim effusa, haud plicata, simplice.*

Alt. 3·50, *diam.* 1·75 *mm., sp. maj.*

Hab. Gulf of Oman, lat. 24° 5′ N., long. 57° 25′ E. 205 fathoms, mud.

Minute, but highly sculptured with close spiral punctuation, the outer lip thickened and beautifully crenulate, a peculiarity we have seen in no other Tectibranch we can remember. Our specimens are mostly full-grown, though they be all so inconspicuous. About fifty examples were dredged at the above locality.

CYLICHNA CYLINDRACEA Pennant.

P.G. Gulf of Oman, Maskat. 15 fathoms.
Lat. 27° 18′ N., long. 51° 52′ E. 27 fathoms, mud.
Lat. 24° 05′ N., long. 57° 35′ E. 205 fathoms, mud.
I. Bombay (*Abercrombie*).

Evidently the British, European, and Mediterranean species.

CYLICHNA FAOENSIS, sp. n. (Plate XXIV. fig. 23.)

C. *testa angusta, cylindrica, tenui, alba, paullum nitente, umbilicata, longitudinaliter hic illic irregulariter indistincte striata, spiraliter apud extremitates distincte ad medium leniter sulcato-striata; apertura angusta, lunata, infra latiore, labro elliptico, crassiusculo; columella obscure uniplicata, crassiuscula, alba, nitente.*

Alt. 8, *diam.* 3·30 *mm.*

Hab. Persian Gulf, Bushire, and towards Fao.

A narrow, barrel-shaped *Cylichna*, thin, whitish, slightly shining, spirally striate, but more conspicuously so at the extremities; outer lip rising just beyond the umbilicus, scarcely angled, thence somewhat elliptic, rounded at the base; aperture narrow, columella obscurely once-plaited.

Three very minute species of *Cylichna*, *C. consanguinea*, *perpusilla*, and *pumilissima*, all of E. A. Smith, have been described (Ann. N. Hist. ser. 4, ix. pp. 352, 353) as dredged by Col. Pelly in the Persian Gulf at 14 fathoms.

Fam. BULLIDÆ.

BULLA AMPULLA L.

P.G. and M.C. Found, not uncommonly, over the coasts of Persia and Baluchistan from low tide to 10 fathoms, sandy mud.

I. Karachi.

Fam. AKERIDÆ.

HAMINEA CURTA A. Ad.

Haminea curta A. Ad. in Sow. Thes. Conch. p. 582, pl. civ. fig. 100.

Atys (*Alicula*) *isseli* H. Ad. P. Z. S. 1872, p. 11, pl. iii. fig. 13.

Haminea æquistriata E. A. Sm. Ann. N. Hist. ser. 4, ix. p. 350.

P.G. Linjah. $3\frac{1}{2}$ fathoms (December 1900).

A white, beautifully striate species, precisely similar to Erythræan specimens.

HAMINEA CROCATA Pease.

I. Karachi. Found from low-tide mark to 7 fathoms on mud. Young examples are found in myriads on mud-flats uncovered at half-tide.

HAMINEA GALBA Pease.

I. Bombay (*Abercrombie*). Not uncommon. Both these two last species were originally described from Hawaii.

AKERA SOLUTA Gmel.

I. Karachi. At low tide on clean sand.

CYLINDROBULLA FRAGILIS Jeffr.

I. Karachi.

Neither we nor Mr. Edgar Smith can disassociate the Indian examples from the European.

Fam. HYDATINIDÆ.

HYDATINA PHYSIS L.

M.C. Not infrequently occurring in 3–5 fathoms in muddy sand among loose rocks.

HYDATINA VELUM Gmel. (=*Bulla vexillum* Chemn.).

M.C. With the preceding in 3–7 fathoms, among muddy sand and loose stones.

Fam. RINGICULIDÆ.

RINGICULA ACUTA Phil.

P.G. Gulf of Oman, lat. 26° 25′ N., long. 57° 35′ E. 205 fathoms, mostly among shell-growth. Also on the cable at 50 fathoms.

M.C. Charbar. 10 fathoms, mud.

Reported from Gwadûr by Mr. G. Nevill.

Ringicula charon Hinds.

M.C. Gwadûr (W. T. Blanford, Journ. As. Soc. Beng. xliv. 2, p. 102). It is nearly allied to *R. acuta* Phil. (*cf.* Pilsbry, Man. Conch. xv. p. 407). In the Townsend collection it occurs, but in no quantity.

Ringicula prismatica Folin (=*R. apicata* Nevill).

I. Bombay (*Abercrombie*).

Often confused with *R. acuta* or *propinquans*.

Ringicula propinquans Hinds.

P.G. M.C. I.

This seems the most widely distributed species over the region now treated of. It is particularly abundant in the dredgings in the Gulf of Oman (50–300 fathoms), and occurs plentifully at Bombay (*Abercrombie*) in shell-shingle. Young examples are transversely striate, adult specimens worn nearly smooth.

Fam. Aplysiidæ.

Tethys, sp. (*Aplysia*).

I. Karachi, under rocks at low tide. May perhaps be the *T. argus* Rüpp. & Leuck., an Erythræan species.

Fam. Siphonariidæ.

Siphonaria basseinensis Melv.

I. Bombay (*Abercrombie*).

Siphonaria kurracheensis Rve.

P.G. Rishire.

M.C. Gwadûr beach.

Siphonaria lecanium Phil.

I. Karachi.

Siphonaria sipho Sowb.

M.C. Gwadûr beach.

Suborder ii. PTEROPODA.

Sect. **Thecosomata.**

Fam. Cavoliniidæ.

Cavolinia longirostris Less.

Diacria trispinosa Less.

Creseis acicula Rang.

Creseis striata Rang.

Creseis virgula Rang.

P.G. Gulf of Oman.

Lat. 24° 49′ N., long. 56° 56′ E. 225 fathoms, mud.
„ 24° 55′ N., „ 57° 59′ E. 37 „ „
„ 25° N., „ 57° 08′ E. 500 „ „

These five species occurred together, all dead, and aggregated in vast quantities at the bottom of the sea, with the Heteropod *Atlanta peronii* Less.

Order PULMONATA.

Fam. Auriculidæ.

It is not our intention to dwell on the bulk of the brackish-water species which occur intermingled often with the truly marine. We have thus passed over, in a previous part of this paper, the *Assiminieæ*, *Stenothyræ*, and *Hydrobiidæ*. At the same time, we feel it only right to give Mr. Townsend's opinion, who has studied the species so closely *in situ*, that he considers *Plecotrema lirata* Ad. and *P. sykesii* Melv., both common at Karachi, to be strictly *marine*. He adds: "The rocks they inhabit are submerged by salt-water every tide, and there is no river nor fresh water anywhere in the locality."

Class SCAPHOPODA.

Fam. Dentaliidæ.

Dentalium attenuatum Sowb.

P.G. Kais Island. 10 fathoms.

Dentalium conspicuum Melv.

I. Karachi. 3 to 7 fathoms, mud and loose stones.

Dentalium javanum Sowb.

I. Karachi.

Dentalium longitrorsum Reeve.

I. Bombay (*Abercrombie*).

Dentalium octogonum Lam.

P.G. M.C. I.

Generally distributed from Bushire to Karachi; 3–7 fathoms, mud or muddy sand bottom.

Dentalium politum L. (*eburneum* Desh.).

P.G. M.C. I.

Generally distributed at 7–60 fathoms, on mud. Those obtained at the greater depth are much the finer.

Dentalium porcatum Gould.

I. Karachi.

Dentalium pseudohexagonum Desh.

I. Karachi.

Dentalium quadriapicale Sowb.

P.G. Gulf of Oman, Maskat. 5–15 fathoms, mud.
M.C. Generally distributed.

Dentalium semipolitum Sowb.

P.G. Linjah anchorage. 5 fathoms, soft mud.

Dentalium subtorquatum Fschr.

P.G. Kais (or Gais) Island. 15 fathoms, mud; also lat. 26° 50′ N., long. 52° 50′ E.

Cadulus euloides[1], sp. n. (Plate XXIV. fig. 24.)

C. *testa alba, nitida, inflexa, lævissima, postice attenuata, antice trans medium tumidula; apertura rotunda, posteriore parva, rotunda, margine tenui, acuto.*

Long. 10, *diam. oris* 1·25 *mm. sp. maj., diam. apicalis* 0·50 *mm.*

Hab. Gulf of Oman, lat. 24° 49′ N., long. 58° 56′ E.. 345 fathoms, mud. Karachi (one example).

Larger than *C. gadus* Mont., which we have not seen north of Bombay. It is a very smooth white shell, in some examples ringed obscurely with cinereous grey, in others pure white, incurved, shining, posteriorly attenuate, from the centre to the mouth tumid, aperture round, margin acute. It was dredged very abundantly in the locality above given.

Cadulus gadus Sowb.

I. Bombay (*Abercrombie*). Extremely abundant in shell-sand.

A third species is likewise reported near Karachi that is deserving of further study.

We follow Pilsbry (Man. Conch. xvii. p. 142) in considering that *Cadulus* should stand on its own merits and not be merely subservient to *Siphonodentalium* M. Sars. In his opinion, however, it is only the anterior constriction below the aperture which can be said to separate it generically.

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[1] εὔλη εἶδος: the resemblance to a white maggot is realistic.

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NOTICE.

The 'Proceedings' for the year are issued in *four* parts, forming two volumes, as follows:—

VOL. I.

Part I. containing papers read in January and February, on June 1st.
II. " " " March and April, on August 1st.

VOL. II.

Part I. containing papers read in May and June, on October 1st.
II. " " " November and December, on April 1st.

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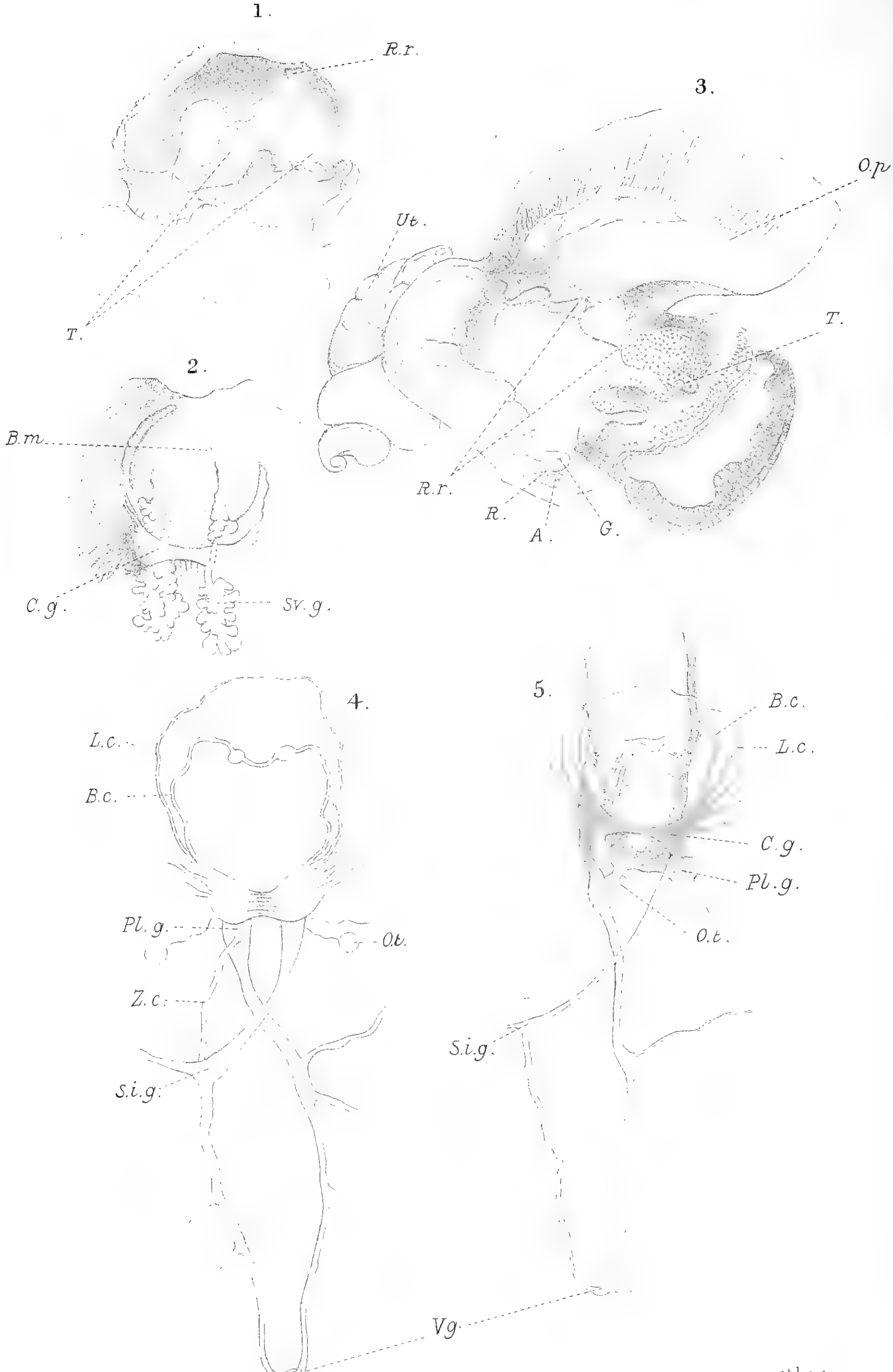

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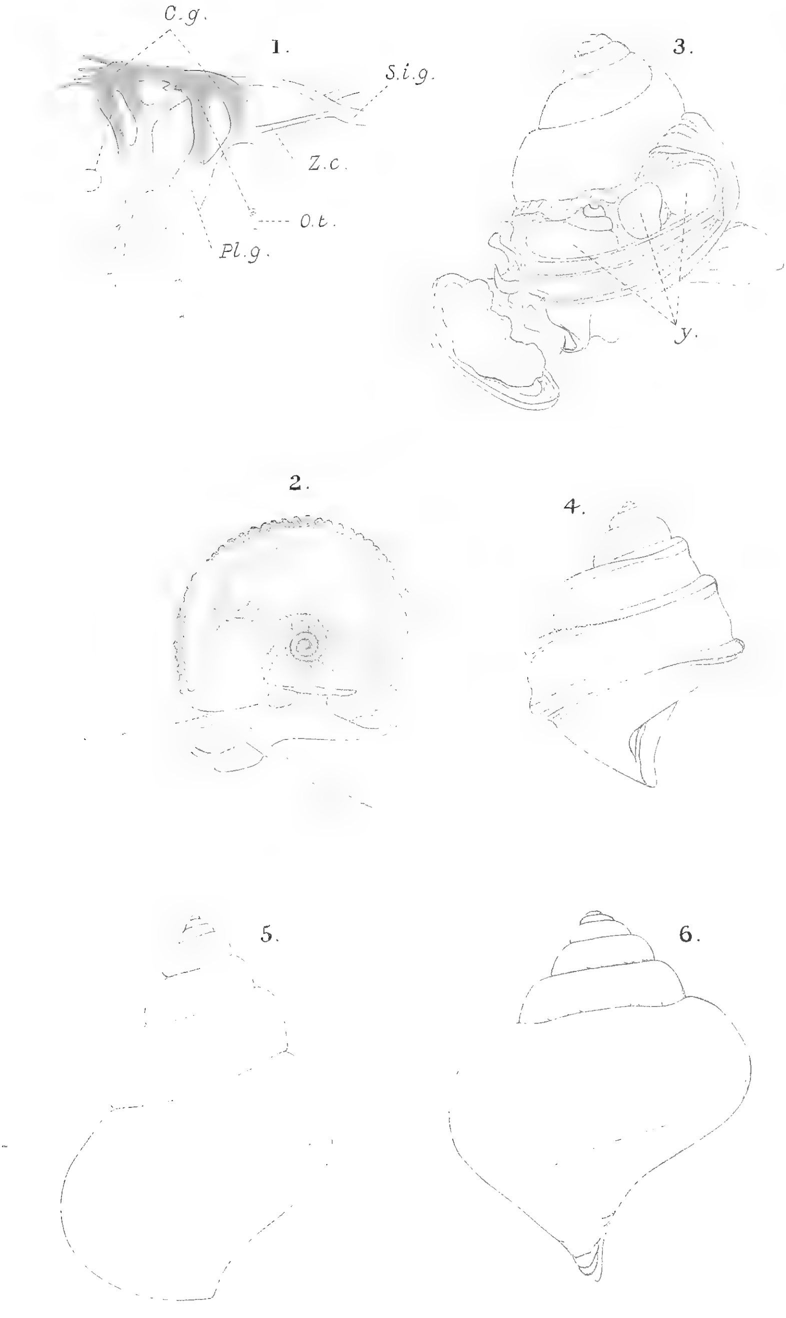
MOLLUSCA OF TANGANYIKA.
(NEOTHAUMA & VIVIPARA.)



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MOLLUSCA OF TANGANYIKA.
(NEOTHAUMA & KYTRA.)

6. Further Researches concerning the Molluscs of the Great African Lakes. By J. E. S. Moore.

[Received June 18, 1901.]

(Plates XXV. & XXVI.[1])

The interest which attaches to the Gasteropods belonging to what I have termed the *halolimnic* fauna of Lake Tanganyika lies, one may say almost primarily, in the fact that these molluscs, like the remaining organisms contained in the *Halolimnic* series, are to be found nowhere outside Lake Tanganyika, so far as is at present known.

Of these Gasteropods indigenous to Lake Tanganyika, there are now known to be at least fourteen very distinct types, and these have in consequence received the following generic and specific names:—

Typhobia Smith.
Bathanalia Moore.
Kytra Moore.
Limnotrochus Smith.
Tanganyicia Cross.
Stanleya Bourg.
Paramelania damoni Smith.
Paramelania crassigranulata Smith.
Bythoceras iridescens Moore.
Bythoceras sp. indet.
Syrnolopsis Smith.
Spekia Woodw.
Melania admirabilis Smith.
Nassopsis Smith.

The existence of so many different forms of prosobranchiate mollusca in any freshwater lake would be a most remarkable fact; but when, as in the case of Tanganyika, we find that these fourteen distinct forms are not only peculiar to Tanganyika, but that they also co-exist in that lake together with the somewhat numerous gasteropodous genera characteristic of the freshwaters of Africa in general, the subject becomes one which is of peculiar interest and worthy of the closest study.

Besides the fourteen molluscan types which I have just named, it was found, during the eleven months which I spent on or about the lake, that there exist also in Tanganyika representatives of the following gasteropodous forms:—

Ampullaria.
Lanistes.
Physopsis.
Planorbis, one or two species.
Melania, several varieties.
Neothauma.
Vivipara.

[1] For explanation of the Plates, see p. 470.

This second list of molluscs, it will be seen, constitutes a series which we might and should expect to find in any of the great lakes with which naturalists are acquainted, in any of the tropical and subtropical portions of the earth; and there is not the slightest doubt that the specific forms which now represent these typical freshwater genera of Gasteropods in Tanganyika are very closely similar to the specific forms which represent the same genera, well, let us say, in the lakes and rivers of the American continent.

On my first expedition to the African interior I spent about two months on Lake Nyasa and about a week on Lake Shirwa, and during this journey I convinced myself that these two southern representatives of the African equatorial freshwaters contained nothing but the following gasteropodous forms:—

Ampullaria.	*Limnæa.*
Lanistes.	*Melania.*
Physopsis.	*Vivipara.*
Planorbis.	*Bythinia.*
Isodora.	

Similar observations had already been made by several careful observers like Sir John Kirk, Mr. Crawshay, and others. On the second Tanganyika expedition I again visited Lake Nyasa, this time equipped with dredging- and collecting-gear of all sorts, and I was consequently able to examine the deep floor of the lake; but beyond an occasional *Melania*, generally dead, I found no life on the vast mud plains which form the floor of the Nyasa Lake, and which in some places are over a thousand feet below the level of the sea. These plains were, so far as living things go, freshwater deserts. It will thus be seen that the work accomplished in Lake Nyasa during the second Tanganyika expedition certainly extended, but at the same time entirely confirmed, the conclusions at which we had already arrived during the first.

From a comparison of these lists, it will be seen that, so far as the Gasteropods are concerned, the fauna of Nyasa and Shirwa is represented, and indeed fully repeated, in Tanganyika; and judging from these observations themselves, and from what we already knew of the freshwater faunæ in Africa, far to the south and far to the north of the zoologically unexplored equatorial regions, I felt justified in believing that the fauna of Nyasa and Shirwa is the typical fauna of the freshwaters of Equatorial Africa, of the whole of Africa for that matter; and that in Lake Tanganyika this typical African freshwater fauna has had something added to it. At the time, this conclusion was vigorously opposed during several discussions by Professor Gregory[1], who, arguing from what he believed to be the drift of geological observations made at that time in the African interior, declared his conviction that when the other great lakes, such as the Victoria Nyanza, the Albert Nyanza, and Lake Rudolf, were explored, the peculiar

[1] Moore, J. E. S.: Proc. Roy. Soc. vol. lxii. p. 451.

organisms of Lake Tanganyika, or forms closely allied to them, would be found in these lakes also. He supported this view in a discussion which followed the reading of a paper of mine at the Royal Society, by the fact that the geologists White [1] and Tausch[2] had observed that the shells of the *Paramelania* of Tanganyika were very similar to some fossil forms which occur in the Upper Cretaceous freshwater beds of North America and Southern Europe. It was from this single observation that Professor Gregory, with a certain rashness, drew the inference that the halolimnic Gasteropods of Tanganyika were the remains of an old freshwater fauna, once widely distributed in Africa, and still to be found in the more permanent great lakes. In opposition to this view, I pointed out that any conclusions respecting the similarity of a living and extinct fauna which were based upon a single conchological correspondence were so very much open to question, that zoologists in general would not accept them, whatever paleontologists might feel inclined to do; and I showed later that the comparisons of White and Tausch are thrown completely into the shade and annulled by a much more striking comparison which can be made between the whole of the halolimnic genera (with the exception of *Bythoceras*) and the shells which have become fossilized among the remains of the Jurassic seas. Whether the conchological comparison of living with extinct forms is in any case justifiable is a matter upon which I have at present no opinion; but I wish to make it clear that whatever force there may have been in the first comparison between one of the Tanganyika shells and a certain freshwater Cretaceous form is deficient when matched with the comparison between the long series of halolimnic Gasteropods and a corresponding number of the shells of those species which occur in the Jurassic Seas. In this comparison, we have evidence touching the origin and nature of the halolimnic fauna which the paleontologists at any rate must regard as weighty; for if it is not, then very many existing paleontological determinations, which rest upon a similar comparison of shells, would also be worthless.

The evidence which we require to throw further light on this most interesting matter lies along two distinct lines of investigation. We must, in the first place, ascertain fully what are the morphological attributes of all the halolimnic molluscs, so that we can form some idea as to where in the phylogenetic series these particular organisms actually stand; and, secondly, we must get to know definitely the real facts of the distribution of these forms in the African interior. After I had returned from the first Tanganyika expedition we had obtained a certain but an incomplete amount of material with which to ascertain the affinities of the halolimnic forms, but for the second line of investigation we had nothing but the meagre observations to which I have already

[1] White, C. A.: Proc. U.S. Nat. Mus. Washington, 1882, p. 98.
[2] Tausch, L.: Zeitschr. deutsch. geolog. Gesellsch, Bd. xliv. 1892, p. 697.

referred respecting the non-occurrence of any of the halolimnic molluscs in Lakes Nyasa and Shirwa, south of Tanganyika.

With respect to the actual affinities of the halolimnic molluscs, I did what I could with the material I had brought home after my first expedition, and the results of these investigations have been published in a series of papers in the 'Quarterly Journal of Microscopical Science'; but as we had no material for the investigation of the type of the genus *Paramelania* itself, and only one defective specimen of *Limnotrochus thomsoni*, no representatives of *Kytra* and *Stanleya* nor of *Melania admirabilis*, it is obvious that the investigations of these forms which have already been published were still somewhat incomplete. We have, however, now, as a result of the second Tanganyika expedition, ample material for the complete investigation of every one of the halolimnic types.

Some portion of the necessary work was accomplished while I was on Tanganyika, with fresh material, and at different times during our journey when time and opportunity arose; and although the observations upon the fuller material now acquired have tended to show that the morphological affinities of those halolimnic Gasteropods which I have already described are practically correct, yet at the same time it has become obvious that our conception of the different groups into which the halolimnic Gasteropods can be split will have to be entirely changed.

It may be remembered that, in a paper already published[1], I found that the anatomical peculiarities of *Bythoceras* were those of a fairly primitive cirithoid form, and that there were at the same time details in the radula of this animal and in certain other portions of its anatomy which proclaimed a very near affinity with the *Tympanotomus* examined by Bouvier[2]. From the minute similarity in shell-structure which subsists between *Bythoceras* and *Paramelania damoni*, I inferred that the latter had the anatomical characters of *Bythoceras*, although I had at the time no anatomical material wherewith to check this conclusion. On the present journey, however, I have obtained abundant material for the complete anatomical investigation of both *Paramelania damoni* and *Paramelania crassigranulata*, as well as of a new form the conchological characters of which lie halfway between those of *Bythoceras howesi* on the one hand and those of *Paramelania damoni* on the other. All these animals have the peculiar cirithoid organization in general, and the particular features appertaining to their radulæ and nerves, which are to be found in *Tympanotomus*, and which seem to indicate that all these forms have direct phylogenetic relationships with that marine type.

These forms, then, *Bythoceras iridescens*, *Paramelania damoni*, and *Paramelania crassigranulata*, constitute a group of closely related forms which are distinguished from all the other members of the halolimnic series, and may be described as the *Paramelania group*.

[1] Moore, J. E. S.: Journ. Micr. Sci. vol. xli. p. 314, and vol. xlii. p. 155.
[2] Bouvier, E. L.: Ann. Sci. Nat. Zool. iii. 1877, pp. 125–131.

Not very far removed from this group, and standing somewhat in the manner of a stepping-stone between it and *Typhobia*, we have the genera *Tanganyicia* and *Giraudia*, both molluscs which have a cirithoid organization, and the only members of the halolimnic group which could be considered under any circumstances as nearly related to *Melania*; that is, if the organization of *Melania amarula*, Lamarck's type of the genus, is considered typical of that group. *Tanganyicia* and *Giraudia* are, however, not so closely related to *Melania amarula* as *Cerithium* [1] *vulgatum* is, for they possess the remarkable brood-pouches which I have described, features which are quite peculiar to themselves and to certain widely divergent molluscan types. Their stomachic apparatus is also characterized by the presence of crystalline style-sacs and crystalline styles. These molluscs form, then, a second subgroup of the halolimnic series which we may call the *Tanganyicia group*.

Next to them we come to the unique Typhobias, the anatomy of which I have described fully in the case of *Typhobia hoarii* [2] and *Bathanalia howesi*. Their organization is unquestionably similar to that of the Aporrhaidæ, the Strombidæ, and the Xenophoridæ, all typical and fairly old marine molluscan types, which are closely connected together, although *Xenophora* has probably, from conchological considerations, not hitherto been regarded as nearly approaching either *Aporrhais* or *Strombus*. Like the marine types, the Typhobias are characterized by their radulæ, their nervous system, and the presence of crystalline styles and style-sacs in their stomachic apparatus, as well as by their reproductive organs. But it will be observed that they lack the peculiar specialization of shell, foot, and operculum which characterize the modern representatives of this great group in the sea, such as *Strombus*, *Pteroceras*, *Aporrhais*, and *Xenophora*.

During the second Tanganyika expedition, I obtained for the first time abundant material for the study of the two unique shells *Limnotrochus thomsoni* and *Kytra kirki* (Pl. XXVI. fig. 2); and it is extremely interesting to find that these two utterly enigmatical Lake-forms are both close allies of the Typhobias themselves. The genus *Typhobia*, together with the genera *Bathanalia*, *Limnotrochus*, and *Kytra* (Pl. XXVI. fig. 2), therefore make up a fourth group, which I shall speak of as the *Stromboid section* of the halolimnic molluscs.

The remaining halolimnic genera are *Spekia* and *Nassopsis*. The first of these, *Spekia*, is, as I have shown, a Naticoid, which appears from the minute details of its nervous system to be a simplified *Lamellaria* without the specialization of the shell and mantle peculiar to that form. *Spekia*, then, constitutes in itself a *Naticoid section* of the halolimnic molluscs. We have then lastly *Nassopsis*; and this form, as I have shown, bears no proximate relationship either to any forms living in the sea or to the Architænioglossate types, such as *Vivipara*, which inhabit fresh-

[1] Proc. Roy. Soc. vol. lxii. p. 451.

[2] Moore, J. E. S.: Qu. Journ. Micr. Sci. vol. xli. p. 181

water. It is, however, in its organization, as I have already shown, an extremely primitive Tænioglossan, and forms in itself one of the few Architænioglossates of which we have any knowledge. From anatomical considerations alone it would be extremely difficult to discover the nearest allies which *Nassopsis* has or did possess; and the only clue we have to its past ancestry is the highly remarkable and interesting fact that the numerous varieties of its shell, for which the genus is famous, correspond in a specific sense with the different species of *Purpurina* of the old Jurassic seas. From the primitive anatomical characters of *Nassopsis* and from the correspondence of its shell with those of the Purpurinas, it would appear probable that this mollusc is the sole survivor of a primitive and extinct marine stock.

Lastly, we have to consider that peculiar mollusc from Tanganyika which Smith described under the name of *Neothauma*. Is *Neothauma* (Pl. XXV. figs. 1, 4, & Pl. XXVI. figs. 1, 3, 4, 5, 6) a *Vivipara* or not? When first examined, this mollusc would certainly be taken for a *Vivipara*, and there is no question that it is a close ally of those Viviparas with which we are anatomically acquainted, but it differs in one very remarkable feature from all the Viviparas which have hitherto been examined. It may be remembered that Bouvier has described the Viviparas as being characteristically dyaloneurous in the arrangement of their nervous system (Pl. XXV. fig. 5)—that is, the pallial nerve, which springs from the supra- and sub-intestinal ganglia, unites with a branch emanating from the right and left pleural ganglia; and it may be remembered that the deviations that Bouvier noticed from this type of arrangement were constituted in different molluscs by a direct union of the nerve springing from the right pleural ganglion not with the pallial nerve in the body-wall, but with the sub-intestinal ganglion itself. This zygoneurous deviation from the dialoneurous condition of things in the ordinary *Vivipara* has hitherto, invariably I believe, been found either only on the right side or on both sides of the nervous system; and it is therefore extremely interesting to note that *Neothauma* presents us with a *Vivipara* possessing a single zygoneurous connection on the left and the normal dialoneurous relationship of the nerves upon the right (compare Pl. XXV. figs. 4 & 5).

So much for the affinities of the halolimnic molluscs as proclaimed by their anatomy. It will, I think, be readily conceded that, after what has been said, it is difficult, or, I may say, impossible, to view these extraordinary molluscs as either the forerunners or the derivatives of the freshwater molluscs which we find in the lakes and rivers all over the world today. They are, however, readily intelligible if we regard them as the forerunners of several marine groups, such as the Strombidæ, the Naticas, and the early Ciriths, to which I have referred. They have the organization which we should ascribe to the ancestors of these groups, and their ancestors lived some time or other in the sea before their present representatives took shape. So far, then, as the first line of investigation is concerned, which I indicated as probably able to throw light upon the validity of the comparison of the halolimmic molluscs with those of the Jurassic seas, we see that the results of the morphological examination of the halolimmic molluscs are in exact accordance with such a view; they are, in fact, exactly what we should expect if the comparison be sound.

It now remains therefore to follow out the second line of investigation, and to study the observations which have been made during the second Tanganyika expedition respecting the Mollusca which are to be found in the other great African Lakes besides Tanganyika and Nyasa. I may preface this part of the enquiry with the remarks, that if, according to Professor Gregory's supposition, the halolimnic fauna is the relic of an ancient freshwater fauna, this old fauna ought to appear in some of the other lakes besides Tanganyika, or we shall be forced to suppose that it has been destroyed in every other African lake by catastrophes of one sort or another, a supposition which is sufficiently improbable. But even supposing such a series of catastrophes to have occurred, it is quite clear that the halolimnic fauna, if it is the ancient freshwater fauna of the continent, will be found in the old lake-deposits which are met with all over the African interior. If it does not occur in any of the other African lakes, and is not to be found in the old lake-deposits, then we may dismiss the idea of its being an old freshwater fauna on this account alone, as such a supposition is in that case void of any evidence whatever.

In order to examine as many lakes as possible, the second Tanganyika expedition, after visiting Nyasa and Tanganyika, passed northward to Lake Kivu. During this journey it was found that Tanganyika had at one time extended far beyond its present northern limit, for the floor of the great valley was composed of old lake-deposits, containing the fossilized remains of shells similar to those now living in Lake Tanganyika itself. Beyond these deposits, the floor of the valley was greatly raised and was found to be composed of old eruptive granitoid rock-ridges; on these there were no traces of any lake-deposit ever having rested, and beyond these ridges, at an altitude of four thousand eight hundred and odd feet above the level of the sea, there exists Lake Kivu, the outlet of which flows over the top of the ridges in question into Lake Tanganyika, in the shape of the Rusisi river. In Kivu we found no traces of the halolimnic molluscs, or indeed of any of the halolimnic animals whatever, the fauna being simply that of a typical tropical pond, the gasteropodous section of it being represented by the following generic forms :—

Bythinia.
Melania.
Planorbis.
Limnæa.

At the north end of Lake Kivu the great valley of the lakes is blocked again by a high transverse dam running from east to west, which is formed by the active volcanoes of the Mfumbiro range. On the northern slopes of this range there are to be found in places underlying the modern ashes and lava, which have been piled upon them, old lake-deposits, and in these there are shells specifically identical with those in Lake Kivu. Northward, these old lake-deposits run under and become the floor of the Albert Edward Nyanza, and in this lake there are to be found among the Mollusca the following gasteropodous forms :—

Vivipara.
Melania.
Planorbis.
Limnæa.
Bythinia.

And to these there is here added one small shell which at first sight I took to be a heavily-built *Planorbis*, but which is in reality a modified *Melania*. The Albert Edward Nyanza is on the Nile watershed, and the outlet of the lake appears as the Semliki river, along the whole course of which there are old lake-deposits, containing shells which are specifically identical with those living in the Albert Edward Nyanza. The Semliki river flows into the Albert Nyanza, and in this lake there appear the following gasteropodous molluscs :—

Vivipara.
Melania.
Planorbis.
Limnæa.
Bythinia.

The planorbid-looking *Melania* of the Albert Edward Nyanza is here wanting, but it is probably actually replaced by a keeled melanoid.

It is thus obvious that from Tanganyika throughout the long series of lakes north of it, as far as the waters of the Upper Nile, there are no traces whatever of the halolimnic fauna. And when we turn from this series of lakes east and traverse the steppes of Uganda to the Victoria Nyanza, we find that this lake also tells the same story, the gasteropodous genera which have hitherto been recorded in it being the following :—

Vivipara.	*Lanistes.*
Melania.	*Ampullaria.*
Planorbis.	*Ancylus.*
Limnæa.	*Physopsis.*
Bythinia.	*Isodora.*
Cleopatra.	

Passing to the east of the Victoria Nyanza, the Tanganyika expedition crossed the Mau Plateau and again descended into the lesser and more eastern series of faulted valleys in which Lakes Baringo, Naivasha, Rudolf, and several minor pools and marshes occur. The fauna of Lake Baringo had already been examined by Dr. Gregory, and the molluscan fauna in this and the minor lakes which occur in the same district are similar in kind to those which are to be found in the Victoria Nyanza itself. So also with respect to the larger lakes Stephanie and Rudolf, which lie to the north, we have now the evidence of various explorers which makes it quite certain that nothing of the nature of the remarkable halolimnic Gasteropods occurs in either of them.

To sum up, all the evidence which has recently been collected with respect to the following lakes—Shirwa, Nyasa, Rukwa, Bangweolo, Moero, Tanganyika, Kivu, the Albert Edward Nyanza, the Albert Nyanza, the Victoria Nyanza, Lake Baringo, and Lake Rudolf—declares in the most emphatic manner that the halolimnic Gasteropods, and, indeed, the whole halolimnic fauna, is found nowhere beyond the confines of Lake Tanganyika itself, nor have the prolonged and tedious examinations which I have made among the numerous old lake-deposits, like those which occur at a considerable elevation north and west of Nyasa, all about Lake Kivu, on the plains between Kivu and the Albert Edward Nyanza, in the Semliki Valley, and in the neighbourhood of the Albert Nyanza, revealed any traces whatever of the past existence of these forms. On the other hand, a very superficial examination of the old lake-beds which have been at one time part of Tanganyika itself, like those which occur near the outlet of the lake, at Masswa on the west coast and beyond its northern extremities, is all that is needed to demonstrate the former presence of these forms in abundance in such districts. I think therefore that I am now justified in putting it forward as a demonstrated conclusion, that the halolimnic fauna neither is, nor ever has been, present in any of the districts surrounding the numerous and widely separated lakes which I have just named. The recently accumulated facts regarding the distribution of the African freshwater mollusca show that there is in the lakes which now exist, and has been in those lakes and rivers which have long since vanished, a fauna similar to that which now generally survives; and thus the evidence which the facts of distribution reveal is in no way opposed to the view that the halolimnic fauna is something exotic which has been added to the ordinary freshwater fauna in the case of Tanganyika. It offers no support whatever to the view that the halolimnic fauna is the relic of an old freshwater stock. On the other hand, the facts directly militate against this view, with the cumulative force of negative appearances. They are in no way opposed to our acceptance of the clue which is afforded as to the nature and origin of the halolimnic fauna by the similarity of the halolimnic shells to those which occur in the Jurassic Seas. On the other hand, they are exactly in accord with such a view.

EXPLANATION OF THE PLATES.

Plate XXV.

Fig. 1. The mantle-cavity of *Neothauma* seen from front and showing contents. The ridge marked *R.r.* is very strongly developed and functions as a protection to the gill during the partial occlusion of the gill-chamber during the development of the relatively enormous young. Compare Plate XXVI. fig. 3.

Fig. 2. The buckle-mass and salivary glands of *Neothauma*. ×4.

Fig. 3. Dissection of the mantle of *Vivipara vivipara* female, made to show the presence of the less-developed ridge *R.r.*, homologous with that of *Neothauma*. ×2.

Fig. 4. The nervous system of *Neothauma* dissected from above and showing the zygoneurous connection between the pleural ganglion and the supra-intestinal ganglion on the left. ×4.

Fig. 5. Dissection of the nervous system of *Vivipara vivipara*, showing the normal dyaloneurous condition of the nerves on both sides. ×6.

Plate XXVI.

Fig. 1. Lateral view of the nervous system of *Neothauma*, showing the zygoneurous connection and the generally detatched condition of all the ganglia, viewed from the left.

Fig. 2. Living specimen of *Kytra kirki*, dredged in Tanganyika, at Masswa, in twenty-five fathoms of water.

Fig. 3. Partially dissected female *Neothauma*, showing young being developed *in situ*.

Figs. 4, 5, & 6. Three marked varieties of the shell *Neothauma*, which are found—(4) at the south, (5) in the middle, and (6) at the north end of Tanganyika. Natural size.

Reference letters to figures in the Plates.

A. Anus.
B.c. Buckle-commissure.
B.m. Buckle-mass.
C.g. Cerebral ganglion.
L.c. Labial commissure.
O.t. Otocyst.
O.s. Osphradium.
Pl.g. Pleural ganglion.
R. Renal aperture.
R.r. Respiratory ridge.
S.i.g. Supra-intestinal ganglion.
T. Tentacle.
V.g. Visceral ganglion.
Y. Young of *Neothauma*.
Z. Zygoneural commissure.

November 19, 1901.

William Bateson, Esq., M.A., F.R.S., Vice-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, 1901:—

The number of registered additions to the Society's Menagerie during the month of June was 418, of which 85 were by presentation, 86 by birth, 11 by purchase, and 236 were received on deposit. The number of departures during the same period, by death and removals, was 172.

The number of registered additions to the Society's Menagerie during the month of July was 255, of which 96 were by presentation, 23 by birth, 8 by purchase, 14 were received in exchange and 114 on deposit. The number of departures during the same period, by death and removals, was 247.

Amongst the additions special attention may be called to the large series of Indian Birds new to the Collection, lately presented by Mr. E. W. Harper, F.Z.S., of which a fresh consignment was received on the 27th July.

The registered additions to the Society's Menagerie during the month of August were 173 in number. Of these 62 were acquired by presentation, 10 by purchase, 18 were born in the Gardens, and 83 were received on deposit. The number of departures during the same period, by death and removals, was 183.

The number of registered additions to the Society's Menagerie during the month of September was 273, of which 121 were by presentation, 1 by purchase, 3 were born in the Gardens, and 148 were received on deposit. The number of departures during the same period, by death and removals, was 159.

Amongst the additions attention may be called to another consignment of Indian Birds, presented by Mr. E. W. Harper, F.Z.S., on Sept. 21st, and to a Nilgiri Thar (*Hemitragus hylocrius*) and two Malayan Wrinkled Hornbills (*Rhytidoceros undulatus*), deposited Sept. 24th, both of which are new to the Collection.

The number of registered additions to the Society's Menagerie during the month of October was 177, of which 27 were acquired by presentation, 22 by purchase, 62 were received on deposit and 66 in exchange. The number of departures during the same period, by death and removals, was 172.

The Secretary stated that Col. B. Mahon, the Governor of the Anglo-Egyptian Province of Khordofan, had kindly offered to present to the Society a pair of young Giraffes (*Giraffa camelopardalis*), which at the time of his last letter (Sept. 15th) were at El-Obeid, but which he was ready to send to Khartoum for the Society's convenience. At Khartoum Mr. A. L. Butler, F.Z.S., Superintendent of the Sudan Wild Animal Department, had kindly offered to take charge of the Giraffes for the winter, and arrangements were now being made to bring them home next spring, either *via* Suakim or *via* Cairo. As regards the Cairo route there was some difficulty at present, because the importation of live ruminants into Egypt from the Sudan was prohibited on account of cattle-plague.

Mr. Sclater also mentioned that he had lately seen in the Imperial Menagerie at Schönbrun (near Vienna) a young male and two young female Giraffes from the Sudan, which had been presented to that Menagerie by Sir Rudolf Slatin, K.C.M.G., and forwarded by Suakim, and that Herr Menges the dealer (of Limburg) had also received a pair of young Giraffes by the same route last year, so that it was evident that the supply of Giraffes from the Sudan, which had been so long stopped, was again commencing.

The Secretary laid on the table a small collection of Mammals in spirit presented to the Society by M. Constantin Satunin, C.M.Z.S., which it was proposed to transfer to the British Museum (Natural History), and read the following note on it prepared by Mr. Oldfield Thomas, F.Z.S.:—

The collection of Mammals from Mt. Ararat and the Caucasus, presented to the Society by M. C. Satunin, consists of examples of *Erinaceus calligoni* Satunin and *Allactaga aralychensis* Sat., from Aralych, near Mt. Ararat; examples of *Mesocricetus koenigi* Sat. and *Allactaga williamsi* Thos., from the Ararat Range; and of *Allactaga elater caucasica* Nehr., *Allactagulus acontion* Pall., *Cricetulus phœus* Pall., *Ellobius lutescens* Thos., and *Mesocricetus raddei* Nehr., from various localities in the Caucasus.

All these specimens will be very acceptable to the Museum, especially those that represent species described by M. Satunin, these being all new to the collection.

Mr. Sclater exhibited and made remarks on some mounted heads of Antelopes obtained by Sir William Garstin in the Sudan and belonging to the following species:—*Gazella rufifrons*, *Cobus maria*, and *Tragelaphus decula*: also a fine mounted head of the Red-necked Gazelle (*Gazella ruficollis*) (probably from Dongola) belonging to Major Wilkinson, the first head that he had seen of this species acquired in recent times.

Mr. Lydekker, on behalf of the President, exhibited a photograph in illustration of the fact that the stags of Père David's Deer (*Elaphurus davidianus*) shed and renew their antlers twice annually. One pair of these appendages was stated to be grown in the breeding-season, and the other pair half a year later.

Prof. E. Ray Lankester, M.A., LL.D., F.R.S., Director of the Natural History Departments of the British Museum, read a paper "On *Okapia*, a new Genus of Giraffidæ, from Central Africa."

The author described the circumstances under which Sir Harry Johnston had obtained the skin and two skulls which formed the subject of the present memoir. One of the skulls undoubtedly belonged to the skin—since the lower jaw corresponding to it was still attached to the integument when received by Sir Harry. The specimens had been received at Entebbe (Uganda) in March 1901, and arrived in this country in July, a few days before Sir Harry Johnston himself returned from Uganda. They were then briefly described by Professor Lankester at a meeting of this Society held on June 18th (see above, p. 279), and the genus *Okapia* was instituted.

The present memoir contained a more complete description of the skin, accompanied by a coloured figure of the animal as mounted for the Natural History Museum by Mr. Rowland Ward.

The two skulls were also fully described, and figured in careful drawings prepared under Prof. Lankester's direction by Mr. Gronvold.

It was pointed out in the memoir that while the skin alone would not justify the assumption that the Okapi was a member of the Giraffidæ, the skulls left no manner of doubt upon that question. This was, indeed, perceived at once by Sir Harry Johnston on receiving the specimens in Uganda. He wrote home without delay describing the Okapi as a hornless Giraffe, and suggesting its affinity to the extinct *Helladotherium* described by Gaudry some years ago from the Miocene strata of Pikermi.

The Okapi could not, however, be referred to the genus *Helladotherium*, as it differed in several important respects, which had been determined by Prof. Lankester after an examination of the original specimens of that extinct form preserved in the Museum of Natural History at Paris.

The characters of the genus *Okapia* as indicated by the skull were given in full in the memoir; and a curious and important minute point of agreement with *Giraffa* was described, viz., the resemblance of the canine tooth (lower jaw) of the two forms. In both genera the canine was bilobate, *i. e.* consisted of a fang supporting two broad laminæ or folia, lying side by side in the same plane. No other member of the Pecora had a canine of this form.

The absence of horns in *Okapia* was discussed at some length by the author. It appeared, from a comparison of the dentition with that of the Giraffe, that the specimen to which the skin and larger skull belong was about two-thirds grown. There was nothing in the skin to indicate whether the specimen was a male or a female. The specimen measured six feet from the occiput to the root of the tail, and stood four feet ten inches measured along the vertical from the fore foot to the dorsal mid-line, the neck from this point on the dorsum to the occiput measured two feet five inches, and the head from the occiput to the end of the snout measured twenty inches. A full-grown specimen would probably be half as large again in all these measurements: thus nine feet from head to tail, and seven feet high at the shoulder.

It was pointed out by the author that it was therefore possible that the present specimen might be a female two-thirds grown, and that there was nothing, so far as the specimens went, to forbid our supposing that the adult male might be provided with a pair of bony outgrowths on the frontal region similar to those of *Giraffa*. On the other hand, there did not appear to be any statement on the part of the natives who know the animal that it possessed horns; and we had no reason to consider it improbable that a hornless member of the Giraffidæ should exist at the present day as in the past, since hornless genera and species allied to horned forms were known among the Cervidæ, and hornless females and varieties amongst the Bovidæ.

The author briefly discussed the nature and origin of the bony growths on the skull of the Giraffes, to which the name "horn" was commonly applied. He was of opinion that they were multiple in origin, comprising occipital, parietal, and orbital pairs, as well as a median series. The Giraffidæ were in this respect, as in some others, more primitive than either the Cervidæ or Bovidæ, in which a single pair of these bony growths has become greatly specialized, and either developed as naked antlers, freed from integument (Cervidæ), or cased over by a protective corneous product of the epidermis (Bovidæ). There was no sufficient reason for regarding the horns of the recent Giraffe as degenerate, or for supposing the Okapi, if hornless, to have descended from horned ancestors. The continuity in one plane of the basi-cranial and basi-facial axes, instead of the meeting of the planes of these two axes at an angle, was a primitive character presented by the Okapi and in a less degree by the Giraffe. This coincidence of the plane of the base of the skull and of the face was found also in the more primitive Cervidæ (e.g. *Alces*), but not in any of the Bovidæ, where the angle was very strongly marked. The absence of the canine tooth in the upper jaw of the Okapi and the Giraffe might be adduced as ground for supposing that the horns had been at one time more largely developed than at present, since in those Ruminantia which were admittedly in a primitive condition in regard to defect of horns, the upper canine teeth were large and effective weapons (*Moschus*, *Tragulus*, *Camelus*). It was, however, maintained by the author that it did not appear to be a legitimate inference that the upper canine teeth could only disappear when horns had taken their place as weapons, since there were many instances to the contrary in the mammalian series, and it would hardly be justifiable to suppose that *Okapia* must have descended from a horned ancestor because the upper canines had disappeared, although due weight should be given to this argument.

This memoir will be published entire in the Society's 'Transactions.'

The following papers were read:—

1. On the Five-horned Giraffe obtained by Sir Harry Johnston near Mount Elgon. By Oldfield Thomas, F.R.S., F.Z.S.

[Received November 19, 1901.]

(Text-figures 42–48.)

Shortly after his discovery of the Okapi, Sir Harry Johnston made an exploring trip to the Guas' Ngishu Plateau, just south-east of Mount Elgon, and found it to be extremely rich in large game of all sorts. Among other animals he saw Giraffes of an unusually large size, and on killing some specimens for the National

Museum he was struck by the presence in them of peculiar projections on the sides of the occiput between the ears, on which account he called the animal a Five-horned Giraffe, and by this name it has been frequently spoken of in popular periodicals.

To examine the systematic position of this Giraffe, and to study the origin and homologies of its cranial protuberances is the object of the present paper.

Sir Harry Johnston obtained, and has generously presented to the Museum, skulls of two males and two females, with their accompanying head-skins, and these make a series of remarkable value, as it seldom happens that such large animals are represented in our Museums by more than one or two specimens from any one place.

The character of the markings in these specimens is on the whole very similar to that found in the Northern Giraffe, and wholly unlike that of the Somali and Galla form (*Giraffa c. reticulata* de Wint.). The blotches in young specimens are reddish fawn, darkening in the centre to deep blackish brown, and this darkening spreads outwards in old specimens, until the blotches are wholly blackish.

The colouring is thus essentially similar to that found in both the Nubian and Southern Giraffes, which in this respect do not differ materially from each other. In the Southern animal the darkening of the centres of the blotches may be seen in Harris's figure of the Giraffe, while their total blackening has been again and again observed[1].

The anterior median horn is heavily developed in the males, and even in one of the female skulls a separate ossification is present. From this point of view the animal is distinctly "northern" rather than "southern."

The main horns are large, and quite normal in position.

The posterior pair of "horns"—and I use this term because if not developed enough to be properly called horns in themselves, they apparently correspond to what are undeniably horns in their fossil relations—prove unexpectedly to be of no importance from the systematic standpoint. For in some degree, as will be seen further on, they are present in all male Giraffes, although hardly perceptible in the Southern form. Their development goes *pari passu* with that of the anterior median horn, least developed in *G. capensis*, most in *G. reticulata* and in true *G. camelopardalis*, of which latter the Elgon Giraffe is a particularly fine representative.

The net result, from the specific standpoint, of my observations is that the Elgon Giraffe cannot be separated from the Nubian form, *Giraffa camelopardalis*; that this latter grades, in the development of its anterior and posterior horns, southwards through "*G. tippelskirchi*" and "*G. schillingsi*"[2] to the Southern Giraffe, which may therefore prove to be only a subspecies of it. On the

[1] *Cf.* Bryden in Ward's 'Large Game of Africa,' p. 498 (1899).
[2] Matschie, SB. Ges. nat. Fr. Berl. 1898, p. 78.

other hand, I find that de Winton's *G. c. reticulata*[1] does not appear to intergrade with the ordinary one at all, and should therefore be called a species, *G. reticulata*, confined to Somali, the Rudolf region, and Northern British East Africa. I may also add

Text-fig. 42.

Head of old male Five-horned Giraffe, showing the position of the mizen horns. Sir H. Johnston's Collection.

that the more skulls of Giraffes that I examine the more distinct does the Western form, *G. c. peralta*, appear to be; but having no further material than the typical skull, I can as yet add nothing to my original account.

[1] In Mr. de Winton's admirable paper on Giraffes (P. Z. S. 1897, p. 273) all the notes and descriptions of the "Northern Giraffe" based on Mr. Neumann's Lorogbi Giraffe really refer to *G. reticulata*, which was described later as a subspecies (Ann. Mag. N. H. (7) iv. p. 211, 1899). The asserted absence of intergradation in East Africa between the "Northern" and Southern Giraffes is therefore to be understood as an absence of intergradation between *G. reticulata* and the ordinary form.

The following are the measurements in millimetres of the four Elgon skulls, which being all perfect, wild-killed specimens, fully adult, may afford a standard for comparison with specimens from other localities :—

	♂ (old).	♂ (adult).	♀.	♀.
Extreme length (mesially)	688	681	642	622
Basal length	593	598	577	564
Greatest breadth	321	273	279	277
Nasal opening, length from gnathion to junction of nasals with premaxilla	157	174	174	161
Do. breadth	72	70	69	65
Muzzle to orbit	386	386	375	359
Distance between tips of horns (centres)	157	176	83	135
Muzzle to front of anterior premolar.	247	247	240	243

Secondly as to the structure, homologies, and evolution of the posterior horns, which, as already said, are present in some degree in all Giraffes, or at least in all male Giraffes. These structures, on the analogy of the masts of a ship, it may be convenient to speak of as "mizen" horns [1].

Externally, although of no great length, even where most developed, they yet show a certain community of structure with the other horns, as the hairs are similarly whorled around and over them, and in colour, like the other three, they are yellowish below, crowned with black terminally.

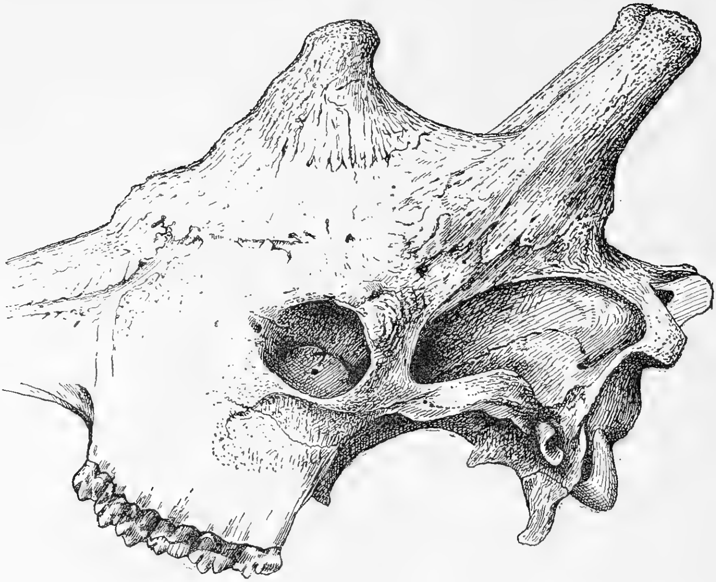
Turning to the skull, the first drawing (text-fig. 43, p. 478) shows the back part of the oldest male cranium of the Johnston series (that belonging to the head shown in text-fig. 42, p. 476). A section has been made through the posterior projection to show its thickness and the extent to which the cranial vacuities penetrate it.

Here it will be seen that the mizen horn is placed behind the end of the masseteric fossa of the parietals, in front and quite clear of the supraoccipital one for the attachment of the nuchal tendons and muscles. The horn is always just in this position; and when examined in a young specimen (text-fig. 44, p. 478) appears to be on the antero-external angle of the combined interparietal and supraoccipital, close behind the parietal suture. But in old animals it no doubt trespasses on the latter bone.

Some sort of a swelling may be perceived at this point in every male Giraffe's skull, even in such as would be at once said to have no mizen "horns." Taking, for instance, an old male skull from

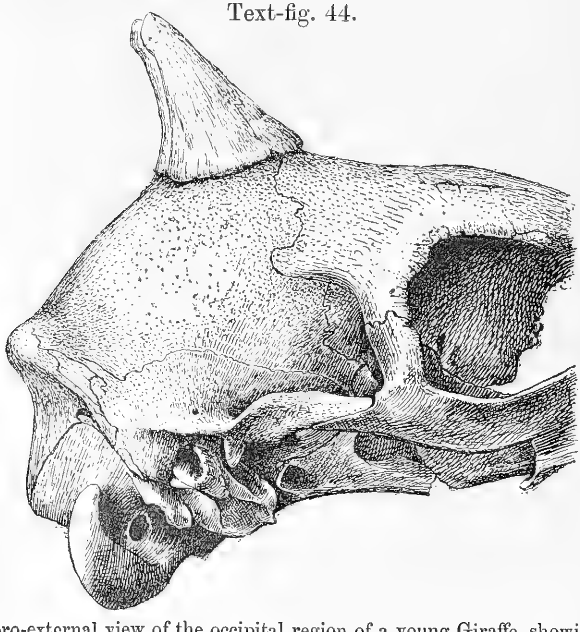
[1] The word "posterior" would be fruitful of confusion with the main horns, which are the posterior ones in animals without mizen horns; "occipital" is equally objectionable, on account of the varying position with regard to the cranial bones of all three pairs of horns; "fore," "main," and "mizen" can give rise to no ambiguity.

Text-fig. 43.



Posterior part of the skull of an old male Five-horned Giraffe. Johnston Collection. A section has been made of the nearer mizen horn, so as to show the extent to which the cranial vacuities penetrate it.

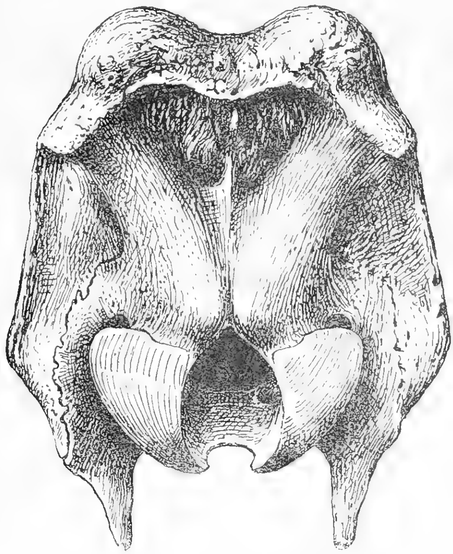
Text-fig. 44.



Postero-external view of the occipital region of a young Giraffe, showing the swelling which represents the mizen horn.

South Africa, belonging to *G. c. capensis*, the least horned of all, we shall find, if we look at it from the occipital aspect, that even in this there is a swelling which cannot be considered as any part of a muscular ridge or accessory projection (this aspect in the five-horned Giraffe is shown in text-fig. 45)[1], and to which no homologue can be found in the Ungulates other than the

Text-fig. 45.



Occipital view of skull of old male Five-horned Giraffe.
Johnston Collection.

Giraffidæ. In the Cervidæ and Bovidæ, however largely the bony ridges may be developed, there is just as much bony surface as may be required for the attachment of the nuchal tendons and muscles, but no more[2], the rounded projection above the muscular fossa in Giraffidæ being therefore of a different nature to these bony ridges and, as I believe, representing the mizen horns. In the Okapi again, while nothing of the sort can be made out in the larger of the two known skulls (of the sex of which we have as yet

[1] The surface of old male Giraffe skulls is always largely covered with an accessory osseous outgrowth, having a stalagmitic appearance, which cements the horns to the skull, covers the face with roughening, makes accessory lumps on the top of the nose and above the orbits, closes up the anteorbital vacuities, and everywhere greatly increases the weight and strength of the skull. But I am satisfied by the appearances in youth that the mizen horns are essentially different from these bony secretions.

[2] Literally speaking *Bibos* forms an exception to this statement, but the projection above its occipital fossa is obviously of an entirely different nature.

no certain evidence), there is in the smaller one (text-fig. 46) an unusual thickening of the posterior crest which may possibly be an indication of the mizen horns.

Text-fig. 46.

Young Okapi. Postero-external view of the occipital crest.

In reference to the position of the mizen horns close to or near the junction of two bones, it is to be noted that all Giraffes' horns are so situated, the fore one on the naso-frontal [1], and the main pair on the fronto-parietal suture. Now it has been very definitely said both by Owen [2] and Nitsche [3] that the main horns are primarily on or at least over the frontal, and only secondarily trespass on the parietal; but the youngest horned skull that I have seen (that given in text-fig. 44, p. 478), shows clearly the horns situated as much on the parietals as on the frontals, so that there would appear to be some variation in this respect.

On the analogy of other horned Ungulates, it has naturally been thought that the relationship that the horns bear to particular bones was of much essential importance when estimating their homologies. But I would submit that in the Giraffidæ this importance may readily be overrated, for in them the horn is a separate dermal ossification, developed in the skin over the skull, and at early stages movable on it [4]. Thus it may surely with equal ease settle on and anchylose with any bone of the skull it may form over, or on the junction of two of them. On the other hand, with the Bovidæ, where the horns, though equally separate and dermal in the beginning, have been long associated with the frontal only, and with the Cervidæ, where they are actually outgrowths of that bone, the matter is different, and in estimating

[1] In young Giraffes the swelling for the horn is more frontal than nasal, but the corresponding convexity in the Okapi is more nasal than frontal.

[2] Trans. Zool. Soc. iii. p. 26 (1842).

[3] Studien über Hirsche, p. 68.

[4] *Fide* Owen, *l. c.*

homologies stress must necessarily be laid on the particular bones associated with the horns.

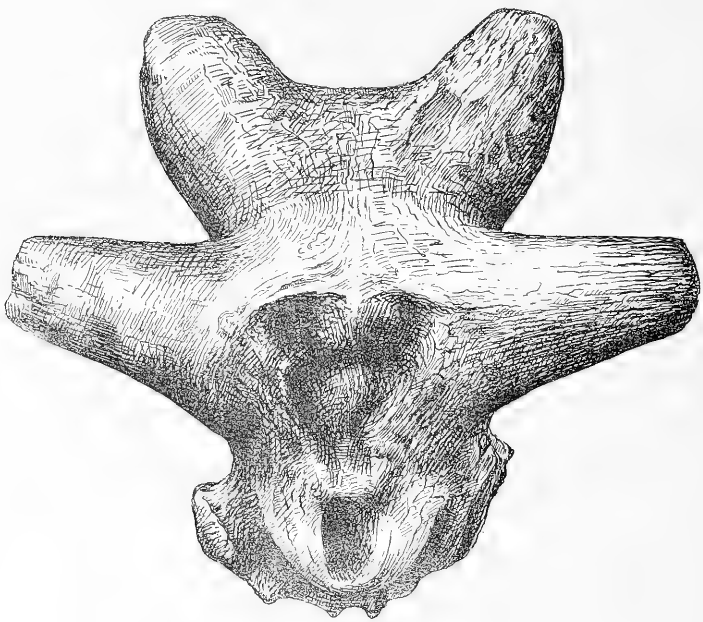
These remarks of course apply primarily to the fore and main horns, of which the *os cornu* is known. Whether any such separate bone is contained in the mizen horns we are as yet unable to state.

Text-fig. 47.

Bramatherium perimense. Diagrammatic side view of the skull, showing the position of the horns.

But although no similar horns to the mizen pair can be found in any living non-Giraffine animal, among the fossil members of the group there appear to me to be undeniable homologues, or rather representatives of them. For in *Bramatherium* (as is shown in text-figs. 47 & 48) the posterior horns are in so precisely similar a position that it seems incredible that they should not directly correspond to them, all the more that both animals are admittedly members of the same family. The admission of such a correspondence would agree with and confirm the more recent views held about the relationships of the anterior and posterior horns of *Giraffa*, *Bramatherium*, and *Sivatherium*. For whereas at one time it was thought that the anterior horns of *Bramatherium* corresponded to the posterior pair of *Sivatherium*, more recently [1] both Lydekker and Forsyth Major have held that the anterior horns of these two were homologous with each other, and corresponded to the main pair of *Giraffa*, no homologue being supposed to exist for the posterior pair. Now the present discovery fills this lacuna, and finds a pair of horns in *Giraffa* which may be homologized with the posterior horns of the fossil genera [2].

Text-fig. 48.



Bramatherium perimense. Diagrammatic back view of the skull.

Moreover, in *Samotherium* also, although the type skull [3] is imperfect in that region, a photograph of the posterior cranium of another male, kindly communicated to me by Dr. Major, shows a general projection exactly in the required position, and one

[1] Lyd. Pal. Ind. (10) ii. p. 130 (1883); Maj. P. Z. S. 1891, p. 322.

[2] At the best, however, the homologies of the horns of *Sivatherium* must remain rather doubtful, and an alternative arrangement might be that its small anterior horns should correspond to the fore, the long pair to the main horns, and either there be no homologue to the mizen, or the small posterior tine on the base of the long antler should correspond to it.

[3] In this type skull, as is shown in the original figure (P. Z. S. 1891, p. 318), there is also a small and hitherto unnoticed lateral projection anterior to the

therefore that it would be natural to homologize with the mizen horns of the modern Giraffe.

I would therefore submit that possibly the large antler-like posterior horns of *Sivatherium*, and more certainly the thick divergent ones of *Bramatherium* and the mizen horns of *Giraffa*, and perhaps certain low projections in *Samotherium* and *Okapia*, are all different phases of one and the same development. No doubt, strictly speaking, one cannot say that the low projections of the last three are *homologous* with the actual horns of the first two, for, so far as we yet know, they are without that *os cornu* which may be presumed to have been present in the fossil, and would have been the true homologue. But just as the rounded swelling on the nose of a female Giraffe may be said to correspond to the fore horn of the male, so these low projections may equally be held to represent the true horns of the allied animals.

The last question to be considered is as to whether, if these homologies be admitted, we should look upon the mizen horns of the Giraffe as representing an early stage in the development of larger horns, or as the degenerate descendants of horns which have been of full size in the Giraffe's ancestors.

I myself believe that the latter is the true explanation, and that in these horns we have the degenerate descendants of larger ones, not necessarily as large or highly specialized as those of *Sivatherium*, but still of great use at the time when the Giraffe's ancestors, like Deer and Antelopes, used their horns and not their hoofs as their primary means of defence. With the lengthening of the legs and the utilization of the hoofs as weapons [1], the functional importance of the horns would naturally diminish, a suggestion which would account for the degeneration in *Giraffa* of organs which in all other groups appear to have continuously increased in size and complexity as time has gone on. It must be admitted that this easy explanation will not give us a clue to the history of the Okapi, but, so far as we know, that animal is unusually free from enemies against which it would have to defend itself, so that at the present time it would appear to have no need for functional horns. Whether its hornless [2] condition is a remnant of an early stage of evolution, or is an evidence of degeneration, opinions are much divided, and owing to the difficulty or impossibility of satisfactorily proving the correctness of either view, the expressing of an opinion is rather a fruitless amusement. But if I were to venture on an opinion, it would be rather on the side of the degeneration theory, although I necessarily take this view with the greatest hesitation, owing to the absence of any real evidence bearing one way or the other.

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main horns, which while possibly, indeed probably, due merely to distortion, may conceivably represent the fore horns of *Giraffa*. If this is the case, it would effectually dispose of the suggestion that the long horns of *Samotherium* correspond to the fore horns of the Giraffe.

[1] *Cf.* Bryden, *t. c.* p. 500; and de Winton, P. Z. S. 1897, p. 283.

[2] Horns may yet be found to occur in the old male.

2. On the Male Genito-Urinary Organs of the *Lepidosiren* and *Protopterus*. By J. Graham Kerr.

[Received November 19, 1901.]

(Plates XXVII. & XXVIII.[1])

(Text-figures 49–54.)

There is nothing more needed in regard to the group of Dipnoan Fishes than a correct and modern description of the male genital organs, the current descriptions of these organs being either incomplete or to a great extent erroneous. As some time must elapse before I can deal with them in my detailed account of the embryology of *Lepidosiren*, I have thought it worth while to write out a short and concise account of the main features in this system of organs in the two Dipnoans of which I have had specimens at my disposal. I am the more moved to do so at this juncture, because I feel that the conditions prevailing in the Dipnoans throw an important light on the relations of the testis and its duct in *Polypterus* as recently described independently by Jungersen and Budgett.

I propose, then, in this communication to give first a brief description of the conditions holding in *Lepidosiren*, then to summarize the main points of difference found in *Protopterus*, and to conclude by pointing out a general bearing which the facts mentioned may be regarded as having.

The only at all modern account of the male genital organs in *Lepidosiren* is that contained in Ehlers's description of the viscera published in the 'Göttingen Nachrichten,' 1895. This account I am able to confirm, from my own investigations, in some important particulars, and also, to a certain extent, to amplify, from my being in possession of males actually obtained during the breeding-season.

Lepidosiren.

The *testis* proper in the mature *Lepidosiren* is a very elongated structure, rounded in section, and running in slight curves along a great extent of the dorsal wall of the cœlom just ventral to the coal-black kidney. It is almost completely hidden away in a fat-laden fold, which is developed to a special degree just before the commencement of the dry season, and which has to be carefully dissected away before the organ can be properly displayed. In an adult male *Lepidosiren* (No. 666) measuring 719 mm. in total length the testis proper, or, as I shall rather call it, the sperm-producing portion of the testis (text-fig. 49 A, T_1), measured 175 mm. in length by about 4 mm. in diameter. Anteriorly and posteriorly this portion of the testis has a rounded end. From the posterior end and from its inner aspect a flat tubular-looking structure is continued backwards closely apposed to the surface of the kidney, and so imbedded in dense connective tissue that it is difficult to make out its precise relations by mere dissection. This

[1] For explanation of the Plate, see p. 498.

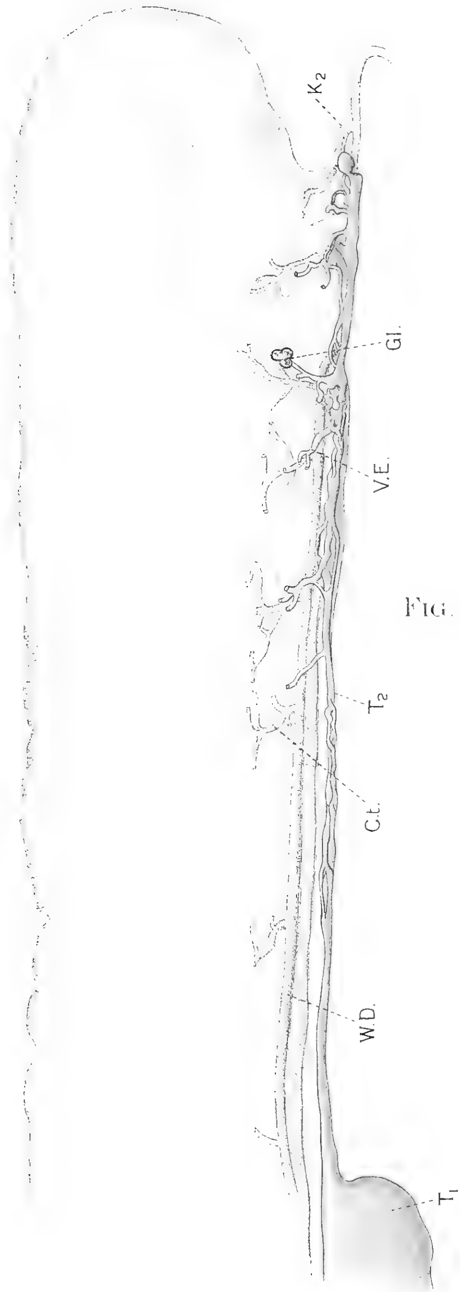


FIG. 1.

Edwin Wilson, Cambridge.

GENITO-URINARY ORGANS OF MALE
LEPIDOSIREN.

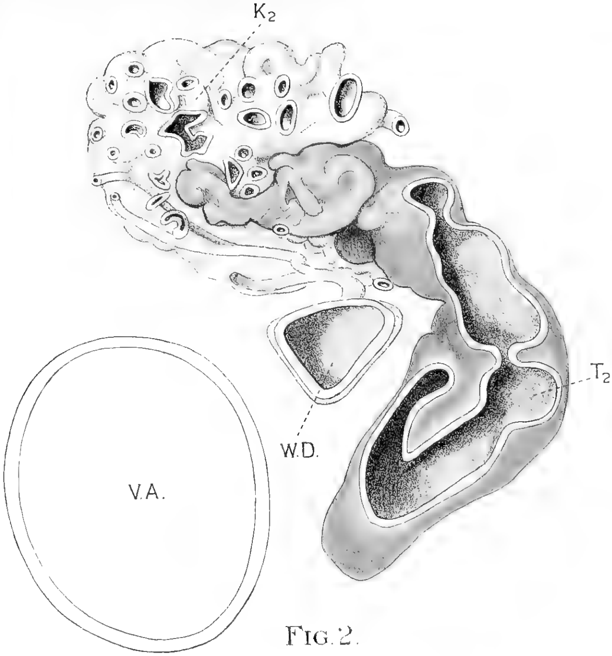


FIG. 2.

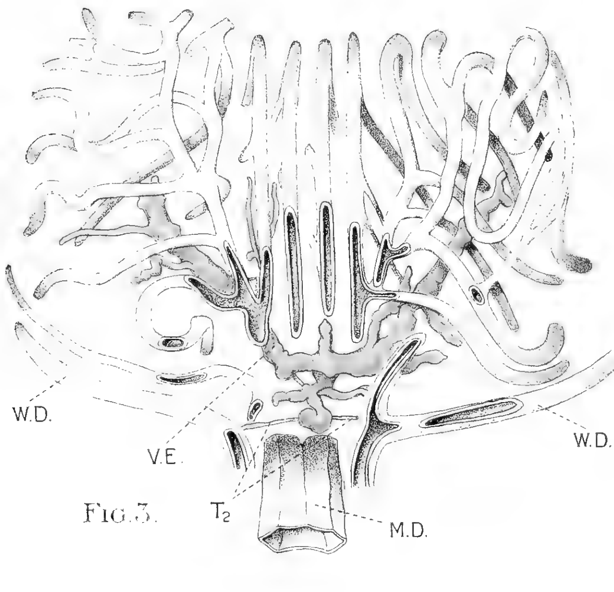
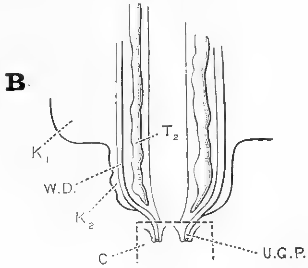


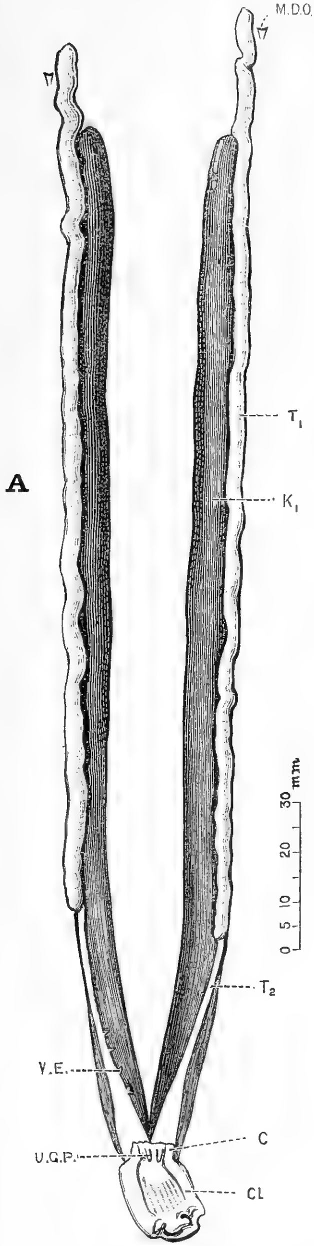
FIG. 3.

Edwin Wilson, Cambridge.

GENITO-URINARY ORGANS OF MALE
LEPIDOSIREN AND PROTOPTERUS

Text-fig. 49.





A. View of the genito-urinary apparatus of a male *Lepidosiren* (adult, but not breeding), as seen in a dissection from the ventral aspect. The greater part of the cloacal cæcum has been cut away. Some of the vasa efferentia of the right side are seen entering the kidney.

B. Semi-diagrammatic figure to show the relations of the posterior portions of the genito-urinary complex.

C. Dorsal wall of cloacal cæcum.
Cl. Dorsal wall of cloaca.
K_1. Kidney (mesonephros).
K_2. Posterior portion of kidney.
M.D.O. Persistent funnel of the Müllerian duct.
T_1. Formative region of testis.
T_2. Vesicular region of testis (in **A** concealed in connective tissue).
U.G.P. Urogenital papilla.
V.E. Vas efferens.
W.D. Wolffian duct.

The genito-urinary apparatus of the male *Lepidosiren*.

backward prolongation of the testis figures in the current descriptions of *Protopterus* as the vas deferens; while for *Lepidosiren* Ehlers has denied the existence of any opening to the exterior at its hind end. I will describe it as the vesicular region of the testis [1] (text-fig. 49, T_2 p. 145).

The vesicular portions of the two testes run backwards, gradually converging towards a point in the region of the genito-urinary openings. These openings, which become during the breeding-season marked each by a prominent papilla, are situated on the dorsal wall of the cloacal cæcum just within its opening into the cloaca. The cloacal cæcum of *Lepidosiren* and *Protopterus*, whose morphological nature has hitherto been uncertain, I may mention parenthetically, arises in ontogeny in the following way:—In stage 35 [2] the kidney-ducts open separately into the cloaca just within its external opening, one on each side. In stage 36 the two ducts have united distally, and their united portion is beginning to project slightly forwards. Later still the fused portion becomes much dilated and its projection forwards forms a large pocket—the cæcum. The cæcum is then to be looked on as a projection forwards of the urino-genital sinus, and is probably morphologically comparable with the sperm-sacs of the Selachian—the forward projection in this latter case being deeply bifid—and with the urinary bladder of Ganoids and Teleosts.

On examining transverse sections, the sperm-producing region of the testis is seen to be composed of numerous rounded ampullæ disposed in a somewhat radial fashion in a stroma of dense connective tissue. The ampullæ open into a longitudinal canal which posteriorly approaches the dorso-median surface of the testis, and is continued back as the cavity of what I have termed the vesicular portion of the testis. In this region the functional seminiferous ampullæ disappear, though there may be present one or more little aggregations of these, as mentioned by Ehlers, behind the main body of the testis.

Throughout about the first quarter of its extent the vesicular region of the testis is a simple tube with fairly smooth outer surface, its cavity lined by cubical epithelium, and broken in upon by trabeculæ passing inwards from the wall. Traced backwards, however, the wall of the tube becomes irregular, longitudinal ridges and other projections appear which sometimes leave the surface of the testis and run backwards in bridge-like fashion to rejoin it later on (*cf.* Plate XXVII. fig. 1, T_2). The lumen of the tube becomes correspondingly broken up, and the dorsal portion of this region of the testis assumes the character of an irregular sponge-work with hollow trabeculæ, which contain prolongations of the central lumen. In its most posterior portion the testis is closely applied to the ventral edge of the kidney, and the trabeculæ of the testicular

[1] Ehlers also emphasizes this division of the testis into two regions (*op. cit.* p. 12).

[2] *I. e.* the stage represented by figure 35 of my paper "On the External features in the Development of *Lepidosiren*," Phil. Trans. vol. 192 B. p. 299.

sponge-work which has been described pass in and out of the kidney, the dorsal portion of the sponge-work being completely imbedded in the kidney substance. In the breeding male the cavities of the trabeculæ are greatly distended and full of spermatozoa, so that in the kidney of the male during the breeding-season we find that region of the kidney which lies on the mesial surface of the organ and ventral to the hilus traversed by large cavities packed with spermatozoa.

The most regular of these function as vasa efferentia, and their general relations may best be gathered from such a figure as I exhibit (see fig. 1, Plate XXVII., which represents a reconstruction of kidney and testis from longitudinal vertical sections, viewed from its inner or mesial aspect). The vasa efferentia (V.E.) are seen as irregular tubular structures which from their point of origin slope forwards and dorsalwards. They pursue this direction for a short distance until they come into proximity with a clump of Malpighian capsules. They then break up into branches which open into the Malpighian capsules. Some of the branches of the vasa efferentia appear to end blindly, or are continued by very fine cavities which I have not been able to trace throughout. The Malpighian capsules in the adult *Lepidosiren* are arranged in clumps and a single vas efferens may supply either a single capsule or more of the clump: it may also send prolongations to capsules of other clumps. It is noteworthy that the Malpighian capsules into which the vasa efferentia open are, as is also the case with other capsules in the same region of the kidney, lined by cubical epithelium instead of by the flattened form more familiar in adult animals. In the text-figures 50 and 51 (pp. 488, 489) I show sections through such Malpighian capsules, in one of which the lumen of the capsule is seen to be packed with spermatozoa.

The communications between kidney and testis are confined to the vesicular region of the testis and to the posterior portion of this region. This has been demonstrated by the examination of complete series of sections through the whole length of the genito-urinary complex. In the specimen shown in Plate XXVII. fig. 1, the vasa efferentia are confined to the posterior *half* of the vesicular region of the testis. They may, however, extend further forwards.

In two specimens in which I have counted them, the number of vasa efferentia numbered six and five respectively [1].

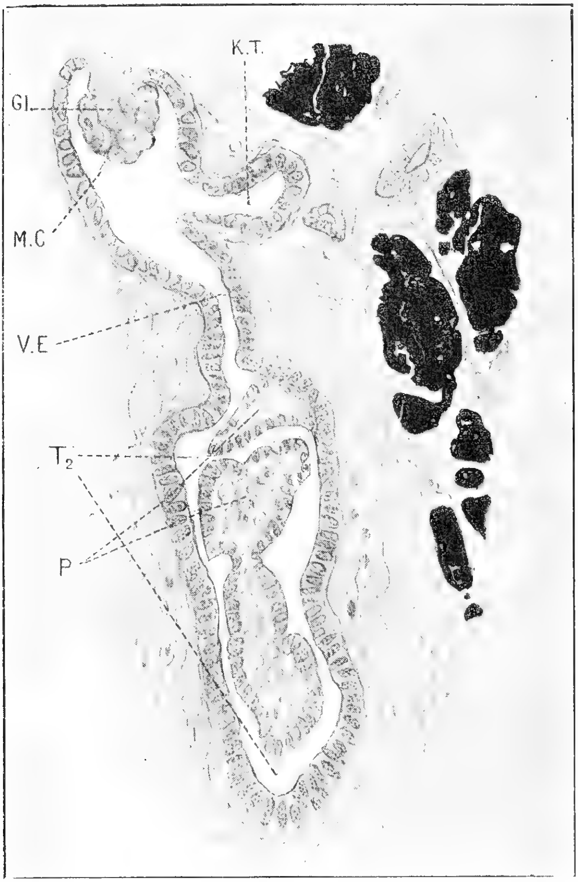
In the specimen in Plate XXVII. fig. 1, it will be noticed that each one occurs roughly at the same level as one of the large collecting-tubes opens into the kidney-duct. Their segmental arrangement corresponds with that of the collecting-tubes.

The spermatozoa finally reach the kidney-duct by the last few of the collecting-tubes that drain into the duct. In the breeding

[1] Ehlers found "one communication between testis and kidney-tubules" (no doubt one of the vasa efferentia, which I have described) and also posteriorly several *direct* connections between testis and kidney-duct. This latter point I have not been able to confirm—much as, for theoretical reasons, I should like to have done so.

specimen sectioned, the last five (possibly six?) showed spermatozoa, and these collecting-tubes were distinguished from those further forwards by their larger calibre (·17 mm. as against ·09 mm.).

Text-fig. 50.



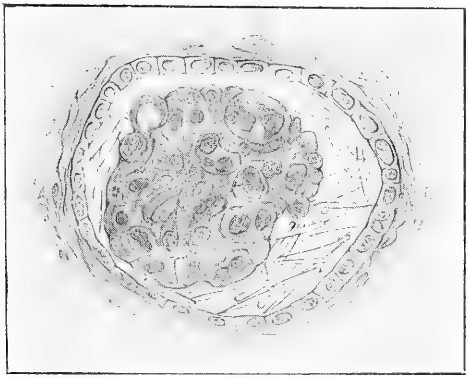
Transverse section of the genito-urinary apparatus of *Lepidosiren*.

Portion of a transverse section of the genito-urinary complex of an adult, but not breeding, male *Lepidosiren*, showing a particularly short vas efferens through the whole of its extent.

Gl. Glomerulus.
K.T. Kidney-tubule.
M.C. Malpighian capsule.
P. Projections from wall of testis into its lumen.
T_2. Vesicular region of testis.
V.E. Vas efferens.

It will be noticed in the specimen of which my drawing (see fig. 1, Plate XXVII.) is a reconstruction, that the last two collecting-tubes are relatively small. This was not a breeding specimen. In the breeding male which was sectioned the posterior tubes, on the other hand, were very large, much dilated with sperms, and the tubules opening into them formed a special little mass projecting towards the middle line and extending back in the connective-tissue sheath which contains the hind end of the testis and the Wolffian duct (T_2 in text-fig. 49). We have here an indication of the separating off of a posterior specially genital region of the kidney comparable with the familiar epididymis of the *anterior* end of the mesonephros. It is this posterior portion of the kidney which is seen in the reconstruction given in the figure now exhibited (see Plate XXVIII. fig. 2, K_2). In the non-breeding male it is much less conspicuous.

Text-fig. 51.

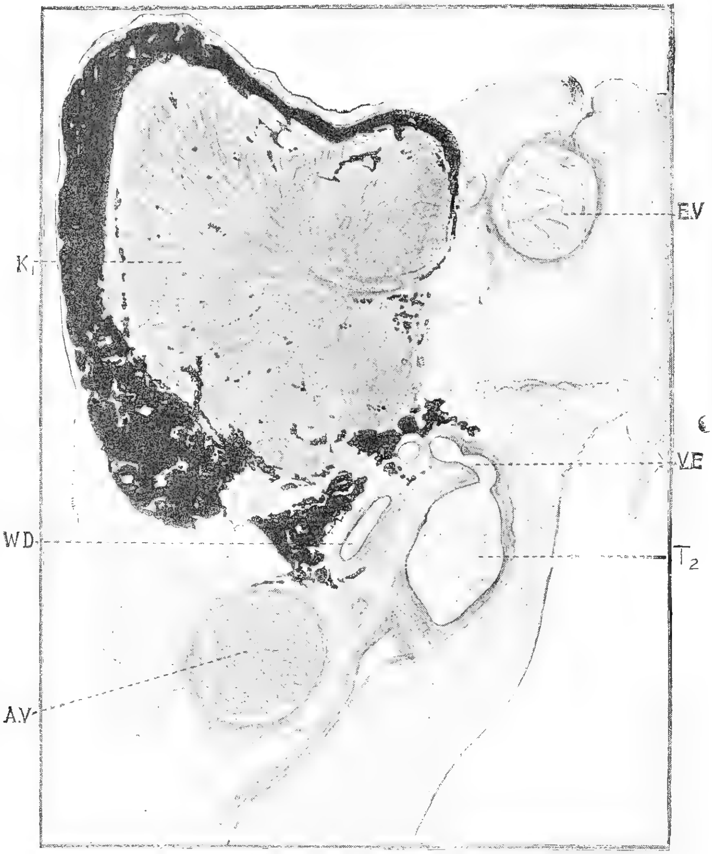


Section through the Malpighian capsule of *Lepidosiren*.

Section through the Malpighian capsule, into which a vas efferens opens, showing spermatozoa in the cavity of the capsule.

Spermatozoa first begin to appear in the kidney-duct of the breeding male at a point about 7 mm. in front of the hind end of the main testis. In front of this the lumen of the duct was, in the breeding specimen examined, occluded for a distance of 12 mm. by a plug composed of curious spherical saccular bodies. A few spermatozoids had penetrated about halfway through this, but none appeared to have got right through. From this plug backwards the kidney-duct was packed full of sperms, and was rounded in section, instead of flattened and collapsed as it was further forwards. The first open communication between the testis and the kidney was found in this specimen about 12·5 mm. behind the end of the sperm-forming testis, where a small tube (text-fig. 52, V.E.) was seen to arise from the dorsal wall of the vesicular part of the testis, to arch outwards and sink into the kidney-tissue, to approach the kidney-duct and run back parallel to it on its inner side for a

Text-fig. 52.



Transverse section through the genito-urinary complex of left side of a breeding male *Lepidosiren.*

A.V. Afferent vein of kidney.
E.V. Efferent vein.
K_1. Kidney (mesonephros) with black pigment in its cortical layer.
T_2. Vesicular region of testis.
V.E. Vas efferens.
W.D. Wolffian duct.

The kidney and testis are seen to be imbedded in fatty tissue. The peculiar fibrous appearance of the contents of the large veins is due to the presence of crystals of hæmatein.

distance of 1·9 mm., and there to communicate with a Malpighian capsule by a short channel. Beyond this point it still continued backwards for 1·8 mm., and then opened back again into the cavity of the testis. The tube in question may be described as a vas efferens with a double origin from the testis. The next vas efferens was found to arise from the testis about 7 mm. further back, and this one only had a single origin. Another occurred 5 mm. further back, again with a double root, the two roots this time, however, only ·3 mm. apart, and again another at a distance of 3 mm. from this one [1].

Müllerian ducts.—In a second-year male, vestiges of the Müllerian duct were distinctly present. In the adult they disappear completely, except for the funnel at their anterior end, as described by Ehlers (text-fig. 49, M.D.O.).

Protopterus.

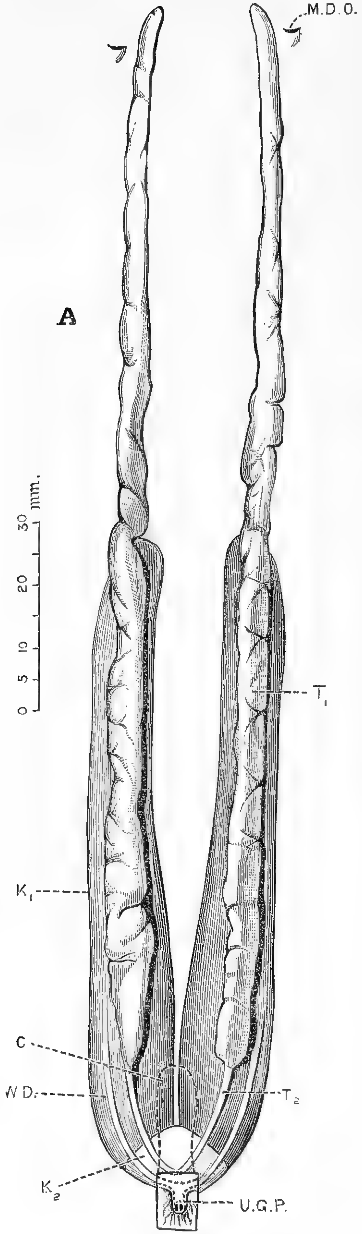
I have always found myself confronted by great difficulties in endeavouring to understand the meaning of the male genital organs of *Protopterus* as described by W. N. Parker. I was, therefore, very glad of the opportunity of clearing my ideas on the subject given by Mr. Budgett's kind permission to examine some of his specimens of *Protopterus*. These I have examined by dissection and by the preparation of continuous series of sections through the posterior region of the genito-urinary complex. In the following pages I endeavour to give a short and concise account of the more important points of resemblance and difference to the corresponding structures in *Lepidosiren*.

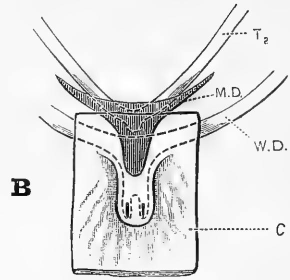
The *testis* proper differs from that of *Lepidosiren* in its much greater thickness. The formative region of the testes of a breeding *Lepidosiren* 72 cm. in length measured 4 mm. in diameter, that of a breeding *Protopterus* only 56 cm. in length measured 5 mm. In section this difference is seen to be due to the much greater length of the ampullæ of the testis. Another striking difference is that the vesicular region of the testis is much shorter, measuring only about one ninth the length of the testis instead of about a quarter, as in *Lepidosiren*. Parker, as is well known, described this part of the testis as a vas deferens opening into the "urogenital sinus." No such opening exists here any more than in *Lepidosiren*, even during the breeding-period. The condition is, in fact, as in *Lepidosiren*, except that in *Protopterus* the vesicular portions of the two testes fuse together at their posterior ends (T_2, text-fig. 53, & Plate XXVIII. fig. 3).

Just as in *Lepidosiren*, a genital region of the kidney or posterior epididymis tends to be formed; but here the separation has become much more complete, and the posterior epididymis is at once recognizable in an ordinary dissection from the absence of the

[1] In tracing out the route of the spermatozoa within the kidney, I find it convenient to double stain with thionin and eosin, the heads of the spermatozoa being stained an intense blue, which makes them extremely conspicuous against the red ground-colour.

Text-fig. 53.





A. View of the genito-urinary apparatus of a (breeding) male *Protopterus annectens*, as seen from the ventral aspect. The greater part of the cæcum has been cut away, and, for the sake of clearness, the posterior portion of the vestigial Müllerian ducts is omitted in the figure.

B. Figure on larger scale, showing the relations of the vestigial posterior end of the Müllerian ducts.

C. Cloacal cæcum.
K_1. Kidney (mesonephros).
K_2. Posterior genital region of kidney.
M.D. Conjoined posterior ends of Müllerian ducts.
M.D.O. Cœlomic funnel of Müllerian duct.
T_1. Formative region of testis.
T_2. Vesicular region of testis.
U.G.P. Urogenital papilla, with the slit-like openings of the Wolffian ducts.
W.D. Wolffian duct.

The genito-urinary apparatus of *Protopterus*.

coaly-black pigment, which is so characteristic of the rest of the kidney. The epididymes of the two sides are completely fused in the middle line, as is shown by the reconstruction in Plate XXVIII. fig. 3, where also it is seen that there is no crossing of collecting-tubes across the median plane. That the posterior epididymis is really the posterior end of the kidneys is shown by the examination of young stages. In male specimens of *Protopterus* of 90 mm. in length I find the posterior ends of the kidneys fused, but not differing in structure from the remainder of the organ.

Testicular network.—As in *Lepidosiren*, there are distinct remains of a testicular network, only here it is reduced still further, being represented merely by communications between testis and kidney at the extreme hind end of the testis.

From the hind end of the united vesicular portions of the testes a sinus passes dorsalwards on each side through the substance of the epididymis. Here it becomes very irregular in shape, sending out various irregular projections and fine prolongations which communicate with the kidney-tubules. Each of the large sinuses mentioned must be looked upon as a large vas efferens, the last of the series.

The cavities of the vas efferens and its prolongations as well as those of the large collecting-tubes in the epipdidymis are in breeding males packed with spermatozoa.

I have not, so far, been able to make out glomeruli in any of the sperm-containing cavities in *Protopterus*, and it is possible that here, as in the case of *Rana fusca*, they have degenerated in the Malpighian capsules connected with the testis. The spermatozoa reach the kidney-duct by the last few main collecting-tubes (three in a breeding specimen examined).

Müllerian ducts.—In the adult male the posterior portion of the Müllerian duct persists as well as the cœlomic funnel (*cf.* text-fig. 53 B, M.D.). The two ducts unite posteriorly, and then end blindly within the base of the urogenital papilla. I can find no patent communication with the vesicular region of the testis such as Parker describes.

Ceratodus.

I have unfortunately not had any adult specimens of *Ceratodus* at my disposal. But there can be little doubt from Günther's description, and from Semon's statement that he has found spermatozoa in the Malpighian capsules, that the conditions here are similar in all essentials to what I have described in the other two Dipnoans. The "vasa deferentia" described by Günther are pretty clearly the Müllerian ducts, which retain their embryonic condition even more clearly in *Ceratodus* than in *Protopterus*, remaining in the adult with patent lumen along their whole length.

The fact that there exists in *Lepidosiren* and *Protopterus* a definitely developed testicular network connecting the testis and kidney must be held, I think, to constitute weighty evidence in favour of the view that the possession of such a network is a very ancient characteristic of the gnathostomatous Vertebrata. Known long to exist in Selachians, and in the Amphibia and Amniota, it is now known to exist also in Ganoids (*Lepidosteus*, *Acipenser*, *Amia*) and in the Dipnoi. It exists, in fact, in all the main divisions except the Crossopterygians and Teleosts. Surely it is more easy to believe that a secondary condition has come about in the last-mentioned two groups than that the same condition should have arisen secondarily in every one of the other groups mentioned! The probability of this being the case is, I believe, much increased by considerations which will become apparent later on.

The points in the structure of the genito-urinary apparatus of the Dipnoi that appear to me to have a general bearing on the morphology of the male genital ducts in other fishes are two:—

(1) The testis, of a primitive very much elongated shape, has become divided into two regions:—an anterior sperm-producing portion, and a posterior portion which has lost its sperm-producing function, has become simplified in structure, and serves with its widely expanded cavities merely as a vesicula seminalis and as a duct.

(2) The testicular network has vanished throughout the anterior sperm-producing portion; the posterior vesicular portion, on the other hand, retains its communication with the kidney apparatus near its posterior end.

In these two features I believe we have a condition which throws much light upon the condition found in Teleostean Fishes and in *Polypterus* (as described by Budgett[1] and Jungersen[2]), which, as Jungersen pertinently points out, leads up to the Teleostean condition.

In *Polypterus* the testis is described as being continued back into the testis-ridge (Budgett), containing the main testis-duct, and associated with this a network of irregular cavities lined by cubical epithelium and giving off here and there a cæcal projection. At its hinder end the main cavity of this ridge communicates with the kidney-duct near its posterior termination.

Similarly in Teleostei Jungersen[3] points out:—

(1) That the genital duct of the male develops in complete continuity with the testis;

(2) That the genital duct in the male develops usually not as a simple tubular cavity as does the oviduct, but that a network of anastomosing cavities is formed; and

(3) That the genital duct in the male usually develops its opening into the distal portion of the kidney-duct.

Now the theoretical interpretation of the male genital ducts of Crossopterygians and Teleosts is, I think, greatly facilitated by the conditions which I have described as holding in *Lepidosiren* and *Protopterus*.

[1] Trans. Zool. Soc. vol. xv. Read May 8, 1900, published April 1901.
[2] Zool. Anzeiger, June 14, 1900.
[3] Arb. Zool.-zoot. Inst. Würzburg, ix. 1889, p. 179.

I start from the standpoint of one who believes that the two great products of the cœlomic lining (*i. e.* the genital and the excretory products) made their way originally to the exterior by the same mode of exit—by the nephridial openings [1], and that the general course of subsequent evolution has probably as regards the genital products been such as to keep or make their mode of exit as direct and simple as possible, rather than such as to make their exit more and more complicated and difficult as some zoologists would have us believe.

The condition in *Lepidosteus* or *Acipenser* may be looked upon as relatively primitive amongst fishes. Here testis and kidney are alike elongated and vasa efferentia pass off along the whole length of the testis to the greater part of the length of the kidney.

In *Lepidosiren*, as above described, the testis has become divided into two regions, a formative and a vesicular, and the connection between testis and kidney has become restricted to the posterior portion of the vesicular region.

In *Protopterus* we find again the division of the testis into formative and vesicular regions, but now the communication of testis-cavity with kidney is still further restricted to the extreme hind end of the testis.

This, it seems to me, is but a step from what has been described for adult Crossopterygians, where again we find a division of the testis into a formative and a conducting region, the latter communicating at its extreme hinder end with the kidney-duct, no longer, however, through complicated kidney-tubules but by a simple direct opening [2].

Finally, as Jungersen has well pointed out and has been shown *in résumé* above, the Teleostean condition is naturally derivable from that in *Polypterus*.

According to the facts and views expressed in this paper [3], the genital ducts of male Ganoids, Dipnoans, Crossopterygians, and Teleosts would fall into some such scheme as that expressed in the accompanying rough diagram (p. 496).

In conclusion, it is only fair to state that while the facts described above are in great part new, the morphological hypothesis which they are held to support was suggested long ago by Semon [4]

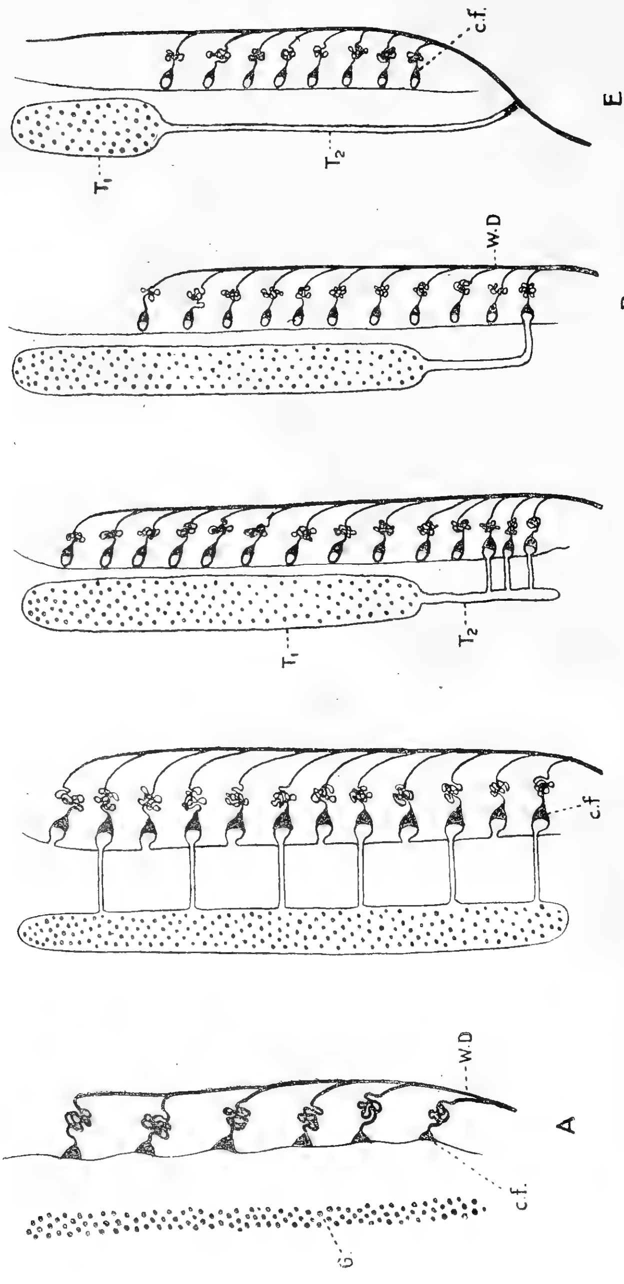
[1] Budgett is led by his studies on *Polypterus* to believe that the arrangement there is a primitive one, and to side with those who believe that the connection between gonad and kidney is secondary. Trans. Zool. Soc. vol. xv. p. 330.

[2] Exactly as has apparently come about in *Discoglossus* amongst anurous Amphibians—the surviving connection being, however, in this latter case, anterior instead of posterior.

[3] It will be seen that this view of the morphology of the Teleostean male genital duct differs in some essential particulars from that of Jungersen. He points out that in *Lepidosteus* and *Acipenser* the testicular network opens into the Malpighian capsules, in *Amia* into the tubule below the capsule or into the kidney-duct direct. In *Amia*, as compared with *Lepidosteus* and *Acipenser*, the openings of the testicular network into the kidney-system may be regarded as having migrated down the tubule in the direction of the external opening. Let such migration continue until they opened close to the exterior, and a condition resembling that of Teleosts would be reached. (Zool. Anz. Bd. xxiii. p. 332.)

[4] Bauplan des Urogenitalsystems der Wirbelthiere: Jena, 1891.

Text-fig. 54.



Diagrammatic sketch of the genito-urinary system in certain Fishes.
(For description see opposite page.)

Rough diagram to illustrate the view taken in the accompanying paper of the morphological relationships of the male genito-urinary system in certain fishes.

c.f. Cœlomic funnel of kidney-tubule.	T_1. Formative region of testis.	W.D. Wolffian duct.
G. Germinal area of cœlomic lining.	T_2. Vesicular region of testis.	

A. Hypothetical primitive condition, where the genital products are shed freely into the general cœlom and carried to the exterior through the nephridial funnels.

B. The portions of cœlom round the nephridial funnels are constricted off from the general cœlom as Malpighian capsules, which still, however, communicate with the general cœlom. The genital portion of the cœlom is also shut off from the general cœlom as the cavity of the testis. The genital cœlom still remains in communication with the cœlom of certain Malpighian capsules through transverse channels—the vasa efferentia. *Acipenser* and *Lepidosteus* show an essentially similar distribution of vasa efferentia to this. Anastomoses between the vasa efferentia are omitted in the diagram.

C. The capsular portions of the cœlom are now completely cut off from the general cœlom. The testis shows a division into two regions, formative and vesicular, and the vasa efferentia have disappeared, excepting a few towards the hind end of the vesicular region. (*Lepidosiren.*)

D. The communication of the testis with the kidney-system is reduced to a single vas efferens at the extreme hind end of the vesicular region of the testis. (*Protopterus.*) In actual fact the vas efferens communicates with *several* kidney-tubules.

E. Similar to D, but the communication between the vesicular region of the testis has become more direct by a single wide tubular channel. (*Polypterus*, Teleostei.)

as affording a possible explanation of the conditions occurring in Teleosts.

Summary.

The more important features in the morphology of the male urogenital system of *Lepidosiren* and *Protopterus* may be summarized as follows:—

1. The testis is very much elongated and is divisible into an anterior formative and a posterior vesicular and conducting region.
2. The posterior part of the vesicular region is connected with the tubules of the hind end of the mesonephros, which serve for the passage of the genital products.
3. In *Protopterus* the testis is connected with the kidney only at its extreme tip; in *Lepidosiren* there is a series of about half a dozen segmentally arranged *vasa efferentia* which open into Malpighian capsules.
4. In *Protopterus* the hind genital region of the kidneys is clearly marked off from the rest, and in this region the kidneys are fused across the middle line; in *Lepidosiren* there is only a slight attempt at this differentiation, and the kidneys of the two sides are posteriorly, as elsewhere, quite distinct.
5. The Wolffian ducts open in the adult male by a common (*Protopterus*) or by two separate (*Lepidosiren*) papillæ into the distal portion of the cloacal cæcum, which is morphologically a urogenital sinus formed in ontogeny as a dilatation of the fused, but originally separate, posterior portions of the Wolffian ducts.

EXPLANATION OF THE PLATES.

The lithographic illustrations on Plates XXVII. and XXVIII. have been drawn by Mr. E. Wilson from reconstructions by the author of his camera-drawings according to the method described in Quart. Journ. Micr. Sci. vol. xlv. p. 5.

Plate XXVII.

Fig. 1. View from mesial aspect of reconstruction of the hind end of testis and kidney of an adult, but not breeding, *Lepidosiren*. The testis is shown yellow, the kidney blue. (In breeding specimens the testis extends much further back.)

C.t. Collecting-tube of kidney. Gl. Malpighian body. K_2. Portion of kidney which becomes enlarged during breeding-season (posterior epididymis or *hypodidymis*). T_1. Formative region of testis. T_2. Vesicular region of testis. V.E. Vas efferens. W.D. Wolffian duct.

Plate XXVIII.

Fig. 2. View from behind of a thick slice of the hinder portion of the vesicular region of the testis of a breeding male *Lepidosiren* with its accompanying mass of kidney-tubules.

K_2. Kidney. T_2. Testis. V.A. Afferent vein. W.D. Wolffian duct with collecting-tube opening into it.

Fig. 3. Corresponding view of fused posterior portions of kidneys (*hypodidymis*) of *Protopterus*—collecting-tubes &c. of kidney coloured blue, testis and vasa efferentia yellow.

M.D. Fused hind part of Müllerian ducts. T_2. Posterior ends of testes meeting in mid-line. V.E. Vas efferens. W.D. Wolffian duct.

3. Field-notes on the Antelopes obtained during a Journey in Somaliland and Southern Abyssinia in 1900–1901. By Alfred E. Pease, M.P., F.Z.S.

[Received July 8, 1901.]

Bubalis swaynei. Swayne's Hartebeest.

Galla name, *Korki*. Abyssinian name, *Gedempsa* or *Gedemfsa*. Somali name, *Sieg*.

I was rather surprised to find Swayne's Hartebeest on the west side of the Hawash River: we saw them between the Hawash and Awaramulka. Major Gwynn, R.E., D.S.O., killed one on the march near the Hawash, and I saw them in the foothills and bush near Tadijunulka, but did not shoot any. I was, however, still more astonished to find them on the Upper Hawash, west of Sequala, also south of the Gueragué range (Gifursa), and in the neighbourhood of the Meki River and Lake Zwai, where they were numerous. I shot two bulls, one near Bogra and one near Aila (Upper Hawash, west of Sequala). The better head was $15\frac{1}{4}$ in. long, 10 in. in circ., and $17\frac{1}{2}$ from tip to tip. One of these I killed whilst it was being closely pursued by a Serval, which I also shot. It is remarkable that so small an animal as the Serval should attack a Hartbeest.

Cephalophus sp. inc. Duiker.

Abyssinian name, *Midakwa*.

The only specimen I obtained of this was a female, caught by some Gallas on Mt. Sequala and brought to our camp in January. It was quite small, about 20 days old, and had been for 10 days nursed at the breast of the Galla woman that brought it to me. In *colour* it resembled the grizzly grey of a young Klipspringer, but not in the texture of its coat: it was decidedly dark in colour, with tan round the ears, eyes, and muzzle, and a very dark band from the poll to the nose, and similar bands down the fore legs. It was perfectly tame, and we kept it in health till the end of March. It throve well on small quantities of bread and biscuit with goat's milk, but would eat if it got the chance any kind of food (except meat); it ate grass very sparingly, but would eat dry leaves, twigs, bits of bark, and the stalks and leaves of certain plants and bushes, but when this diet failed, as it did in Somaliland, it ate too much bread and plum-pudding one day and died. It was such a bereavement to Mrs. Pease, that we had not the heart to skin it, and buried it. I saw many other Duikers at various times, but only springing in and out of the thick jungle, giving no chance for a rifle. I never had one in sight for half a second. I met with them on the Entoto Hills, Sequala, &c.; I also saw them on the hills at the base of Assobôt Mountain in the Danakil Country.

OREOTRAGUS SALTATOR. Klipspringer.

The Klipspringer was seen on Entoto Mountain and in Somaliland.

OUREBIA MONTANA. The Abyssinian Oribi.

Abyssinian name, *Miwaka.*

The Ourebi is not common on the plateau in the neighbourhood of Adis Ababa, but we found it sometimes near the road after passing Balchi on our way up to the capital. Captain A. Duff killed one at Jeffi Dunsa two days east of Adis Ababa. After we left Adis Ababa we saw the first in the Akaki Valley, and frequently met with them on the lower ground below Sequala (the great extinct volcano). I shot the first I obtained near Delato, north of Sequala above the Dahom River; it was one of three (one buck and two does). Near the Hawash they were more numerous, and on crossing the Hawash we found them plentiful in the country around Lake Ailan, several small bands of twos and threes up to seven and even nine being seen together. They were feeding either on the fresh grass where the bush had been burnt, or near and on the cultivated patches close to the Galla villages, which are very numerous. On the Upper Hawash I often observed them, and have seen them feeding with the Reed-bucks in the grass near Aila and in the neighbourhood of the Meki River and Lake Zwai. I also saw them all down the Hawash Valley to Tadijunulka and Awaramulka. When I had shot five specimens in the early part of my trip I never molested them further. I noticed that they fed and wandered at all hours of the day, occasionally lying down, and I did not see any female with more than one young one.

The best head I obtained measured $5\frac{5}{8}$ inches on the curve.

The name *Ourebia montana* is rather a misnomer, as I found most of them in the flat low country between the Hawash and Zwai.

MADOQUA PHILLIPSI. Phillips's Dik-Dik.

Somali name, *Sakákaro Golass.*

The common Somali Dik-Dik was the only one of which I shot any specimens. It extended all the way up the Hawash Valley. I saw a larger Dik-Dik occasionally, but never got a shot at it. This was probably *M. saltiana.*

COBUS DEFASSA. Water-buck.

Abyssinian name, *Defassa.* Somali name, *Balango.* Galla name, *Warabôd,* which is also used by the Abyssinians and Danakils.

The five specimens of the Water-buck were all obtained in the Hawash Valley. I saw Water-bucks or their tracks on many parts of the Hawash Valley and also on the Meki River, but they are not common in the higher parts of the Hawash Valley.

I have seen them usually in small herds never more than eleven together, more commonly only three or four, Cervicapra bohor. Reed-buck.

Abyssinian name, *Bohor* or *Behor*. Somali name, *Dol.* Galla name, *Boroufa.*

I never observed any Reed-bucks till we got south of the Hawash River, though I noticed their tracks on the banks of the Hawash. I saw Reed-bucks at Aila (N. of the Meki River), but did not shoot one till I got to Lake Zwai, where they were numerous but never more than two or three together. There were great numbers of these Antelopes in the Hawash Valley at a place called Goraboutha, two days S.E. from Sequala, a very marshy country, with high grass near the river and thick scrub inland. One evening I saw 23 in one compact herd; there were five bucks, and I killed the three best. I shot one the following day on the march to the Moggoi River, but, having five specimens, never shot any more. I saw them west of Fantalli Mountain and near Tadijunulka.

Gazella granti. Grant's Gazelle.

Abyssinian name, *Midafihel.* Galla name, *Hedi.*

The only specimens of Grant's Gazelle that I obtained or saw were around the northern shores of Lake Zwai, where they were very numerous and tame. I saw a solitary one a day north of this along with Swayne's Hartebeest close to the Meki River. I do not know of any previous mention of this Antelope so far north.

Gazella sœmmerringi. Sœmmerring's Gazelle.

Abyssinian name, *Meidafihel.* The natives do not discriminate between Grant's and Sœmmerring's. Galla name, *Hedi.* Somali name, *Aoul.*

These Antelopes were common on the Maritime Plain of Somaliland, and occasional on the low ground up to Tadijunulka. We saw large numbers of them on the Danakil plains and in the bush around Mt. Assobôt and the Lower Hawash Valley, also near Mt. Fantalli and El Toki there were large numbers, but I never saw any higher up the Hawash than just E. of Sequala. All the heads I saw were very small compared with Somali heads.

Gazella pelzelni. Pelzeln's Gazelle.

I shot two on the Maritime Plain. I also saw many Gazelles on the hills near Araweina, among the mountains, which were not Speke's Gazelle, but I am not positive that they were Pelzeln's.

Lithocranius walleri. Gerenuk.

Somali name, *Gerenuk.*

Very plentiful all over the country below the Abyssinian escarpment (and, of course, throughout Somaliland), till you pass a little valley beyond Arbawun, when they are no more met with. The Danakil and these western Gerenuks carry heavier heads than the Gerenuk of Somaliland proper.

ORЕОTRAGUS MEGALOTIS. Baira.

Somali name, *Baira*.

I saw plenty of Baira on the road up, and they were apparently common in the Araweina Mountains. I shot only one female.

ORYX BEISA. The Beisa.

Abyssinian name, *Sala*. Somali name, *Beit*.

We came across the Oryx on the maritime plain of Somaliland, but never in large numbers till we crossed the Hawash, as throughout the lower Danakil Country it is constantly hunted by the natives on horseback with spears. We saw a considerable number on the foot-hills below the Abyssinian escarpment near Marko and Deladi, a few near the Moulou River, Mt. Assobôt, and Kattyinwaha. After crossing the Hawash I observed some large herds of from 40 up to 80; these were mostly cows. I noticed that they carried much longer horns than the average Somali heads that I had seen on the Haud and elsewhere in my previous journeys. I shot very few, not requiring them as trophies, and certainly did not get anything like the longest horns. My best were 36 inches long.

I also saw Oryx near Tadijunulka, and an occasional one between the Hawash and Lake Zwai.

STREPSICEROS CAPENSIS. Greater Kudu.

Somali name, *Aderyu*, and *Godir* for the male. Abyssinian name, *Agazin*.

Found in small and ever diminishing numbers on the higher mountains of the Hawash borders of the Danakil Country. I saw seven on the Meki River banks, and my shikari saw some at the foot of Mt. Bossette. There are a few near Tadijunulka and along the Abyssinian escarpment. I also saw some at Hulul in the mountains not far from Harrar.

STREPSICEROS IMBERBIS. Lesser Kudu.

Somali name, *Arrhe* (or *Godir yer*, literally "little male Kudu").

The Lesser Kudu is common through the Gourgara and Somali, Danakil, and Galla countries just below the Abyssinian escarpment, and very numerous on the Lower Hawash. I saw plenty near Mt. Fantalli; I shot two bulls near El Toki; I never saw the Lesser Kudu beyond, *i. e.* west of Sequala, but it may well be common up the Meki River. I saw plenty near Melkadegaga on the Hawash.

J. Smit del. et lith.

Mintern Bros. imp.

EQUUS GRANTI.

December 3, 1901.

W. T. Blanford, Esq., LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions made to the Society's Menagerie during the month of November 1901:—

The number of registered additions to the Society's Menagerie during the month of November was 112, of which 29 were by presentation, 42 by purchase, 38 were received on deposit, and 3 were bred in the Gardens. The number of departures during the same period, by death and removals, was 182.

Amongst the additions special attention may be called to:—

A young male Zebra, sent as a present to H.M. The King from the Emperor Menelek, and, by His Majesty's orders, placed under the care of the Society, and now lodged in the New Zebra House next to the Grèvy's Zebra.

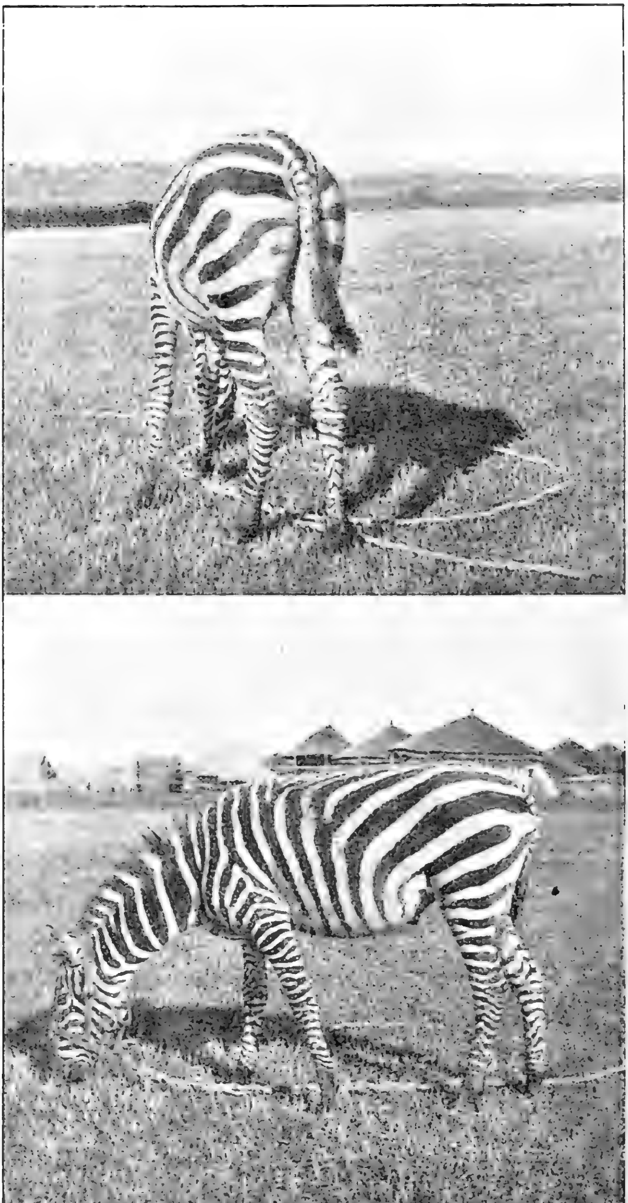
Before it arrived at Abbis Abeba this animal was supposed to be a male Grèvy's Zebra; but some photographs of it which were kindly forwarded to me by Col. Harrington, and which I now exhibit (text-fig. 55, p. 504), showed at once that this was not the case. The animal, of which I exhibit an excellent coloured drawing (Plate XXIX.), prepared by Mr. J. Smit, is decidedly not a Grèvy's Zebra, but belongs to the series of Burchell's Zebra which is so widely diffused from North to Southern Africa. After carefully going into the literature of the subject, I have come to the decision (in which I am happy to say that Mr. Oldfield Thomas and Mr. de Winton agree with me) that this Zebra is most probably the same as that described by Mr. de Winton (Ann. & Mag. Nat. Hist. (6) xvii. p. 319, 1896) as *Equus burchelli granti*[1]; but I am not sure that it will not be better to class it as a full species and to call it *Equus granti*, under which term I have had it labelled in the Society's Gardens. As will be seen by the drawing, its small ears and different system of striping, not to speak of its much inferior size, at once separate it from *E. grevyi*, and another distinguishing feature is the pure black of its stripes and the entire absence of what have been termed shadow-stripes.

Its height is 46 inches at the withers, whereas the height of the female *E. grevyi* is 50 inches.

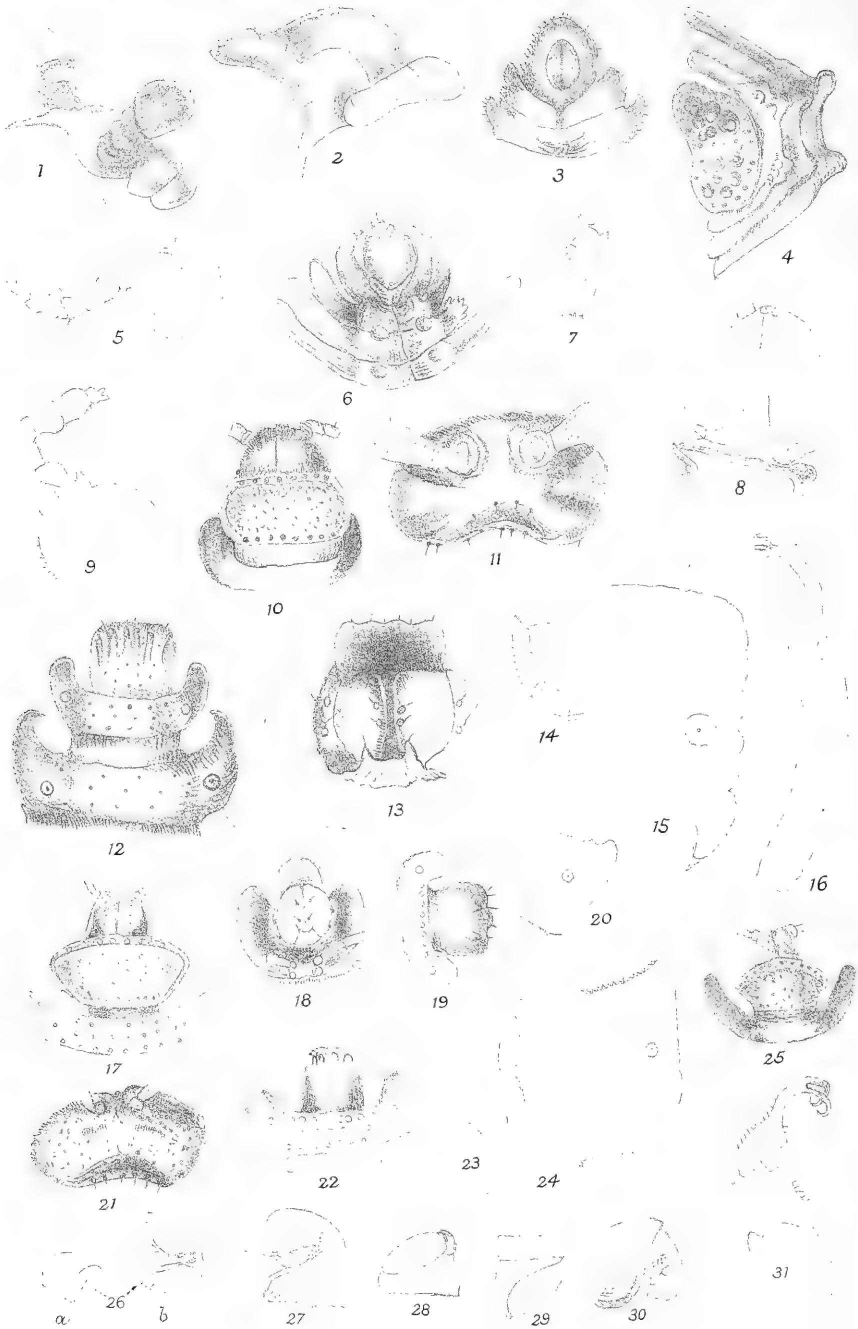
I regret that I have not been able to ascertain from Col. Harrington or Capt. Duff in what part of the Abyssinian dominions this beautiful animal was obtained; but I have little doubt that it is from Lake Rudolf, in which district it has been stated by several observers that herds of the larger and smaller Zebras are in some

[1] Mr. R. I. Pocock has given a list of the subspecies of *Equus burchelli* in his article "On the Species and Subspecies of Zebras," published in the 'Annals & Magazine of Natural History' for July 1897 (Ann. & Mag. Nat. Hist. (6) xx. p. 33). Two other forms of *E. burchelli* have been since described, viz., *Equus burchelli zambesiensis* (Trouess., Bull. Mus. d'Hist. Nat. iv. p. 64, 1898) and *E. b. foæ* (Prazak et Trouess., Bull. Mus. d'Hist. Nat. v. p. 352, 1899).

Text-fig. 55.

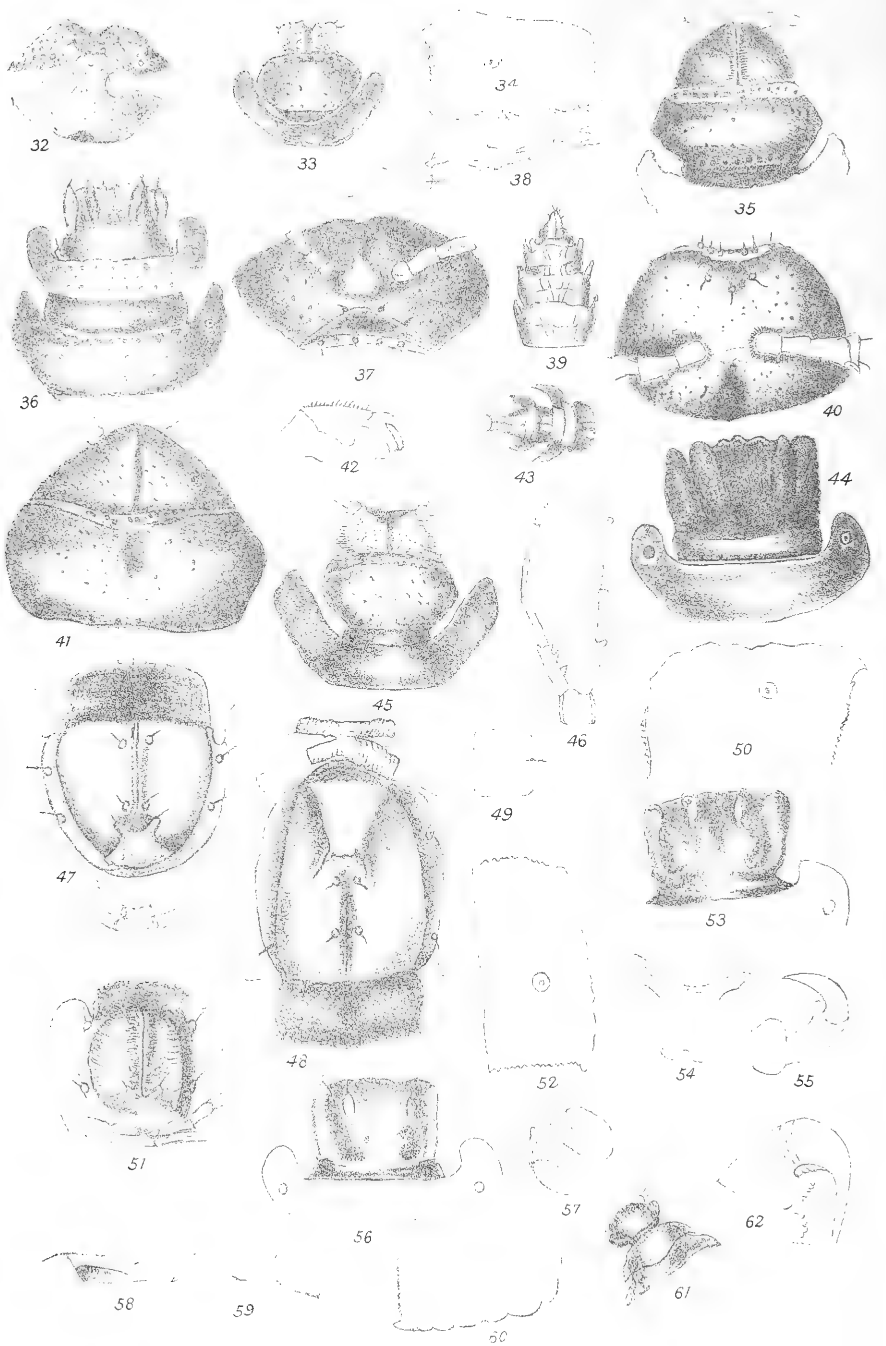


Grant's Zebra.
(From photographs taken at Abbis Abeba.)



Bale & Danielsson L.td lith.

MYRIAPODA FROM THE MALAY PENINSULA.



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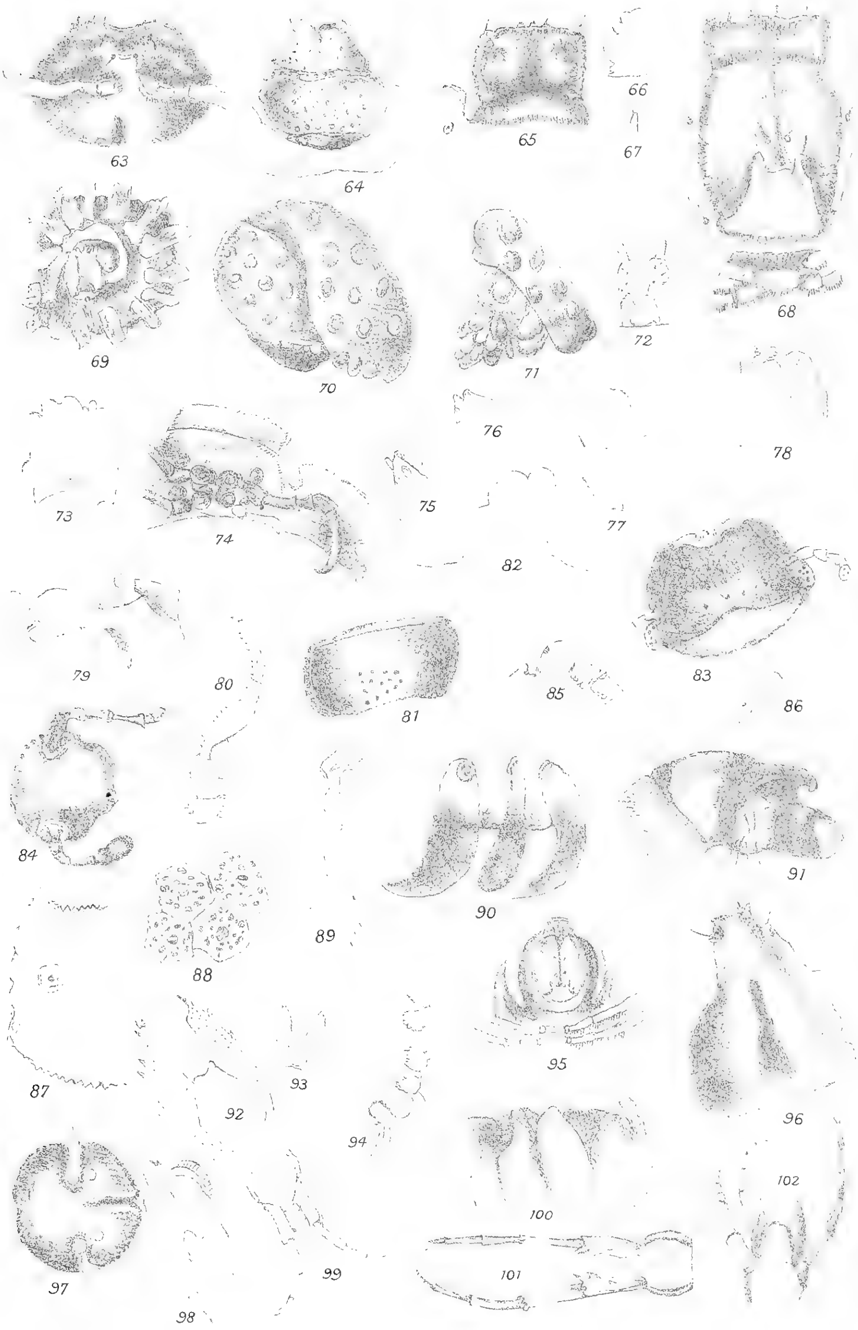
MYRIAPODA FROM THE MALAY PENINSULA.



Bale & Danielsson L.td lith.

MYRIAPODA FROM THE MALAY PENINSULA.

spots found intermixed. I have also been informed that in the bales of flat native Zebra-skins lately imported from Abyssinia or Somaliland, examples of the skins of these two species may be found in the same bale, showing that they inhabit the same country.

Mr. Sclater stated that, on the kind invitation of the President, he had inspected the fine herd of Prjevalsky's Horse (*Equus prjevalskii*) lately received at Woburn through Mr. Carl Hagenbeck. The herd was 12 in number—5 males and 7 females. Mr. Sclater was of opinion that Prjevalsky's Horse was a true wild species of typical *Equus*, with chestnuts on both fore and hind legs, as in the domestic Horse. The animals at Woburn were all quite young, apparently yearlings. Mr. Sclater announced that the Council had arranged with Mr. Hagenbeck for the purchase of a pair of this animal, which might be expected to arrive in London shortly after Christmas.

Mr. W. E. de Winton, F.Z.S., exhibited a remarkably large specimen of the Grey Mullet (*Mugil chelo*), weighing 12 lbs. and measuring 2 ft. $7\frac{1}{2}$ in. in length, with a girth of 1 ft. 6 in. This was one of five which were exhibited on a fishmonger's stall; the smallest specimen weighed $9\frac{1}{2}$ lbs., the largest 14 lbs. They were said to have been taken in the North Sea.

The following papers were read:—

1. On the Myriapods collected during the "Skeat Expedition" to the Malay Peninsula, 1899–1900. By F. G. Sinclair (formerly F. G. Heathcote), M.A., F.L.S., Trinity College, Cambridge.

[Received June 20, 1901.]

(Plates XXX.–XXXII.[1])

When my friend Mr. Harmer asked me to report on this collection of Myriapods, I hesitated to undertake the task on account of my want of experience in species-work. I could not, however, resist the temptation of making acquaintance with several forms that I have long wished to examine, so I acceded to his request, and have found the work most interesting.

The fact that the places from which the specimens were collected are all new ground, renders it necessary to describe many forms as new species; but where it seemed at all possible to me to do so, I have described specimens as varieties rather than species, and this I have done deliberately, because a study of the literature has

[1] For explanation of the Plates, see p. 532.

convinced me that our knowledge of the Indo-Australian Myriapods is very fragmentary, and does not as yet suffice to allow of a satisfactory division of the groups into species.

Attems, in his excellent work on the Myriapods collected by Prof. Kukenthal in the Malay Archipelago, says that in most Myriapods there is a want of characteristic distinctions confined to a species, and in this I thoroughly agree with him. The only species-character which at present seems satisfactory is the form of the copulatory apparatus. There is, however, much practical inconvenience in resting too much upon a single character which is confined to one sex; and our knowledge of the differences between male and female is at present so imperfect, that it is easy to see how much confusion may arise. Moreover, we see from Verhoef's investigations that there may be considerable variations in the copulatory apparatus at different ages. Pocock too, in his work on the Myriapoda of the Mergui Archipelago, has pointed out that other characteristics vary extremely with age. Under these circumstances, I rather hope that my descriptions and figures may be of use to future observers than expect that my species may prove permanent. The consideration that we can have no satisfactorily defined species of Indo-Australian Myriapods until we have a better acquaintance with their numerous variations of form, and especially some knowledge of the differences due to different ages of individuals, must be my excuse for extending the present paper to what seems an undue length. It will be observed that I have described one or two peculiarities that are evidently individual malformations. Some of the questions raised by Mr. Bateson's book on Variation ('Materials for the Study of Variation,' 1894) seem to me to render any such peculiarities worth recording, and, so far as I know, very few such have been noticed by authors.

This collection contains examples of 40 species, of which 16 are already known, 15 are varieties of known species, and 9 are new. The Polydesmoidea are the most numerous, and the number of species of Chilopoda are few. This may be partly due to the difficulty of capturing the latter. As I know, from personal experience, it is no easy matter to collect a large and lively *Scolopendra*. The manner in which some of them have been taken is shown by a noose of thin grass round the neck of one specimen. The way in which another has been taken may be guessed from the fact that it is completely flattened.

The specimens were collected in the months of May, June, August, and September at the following places:—

April.

Patalung State....	Koh ha.
	Pătălung (on shore of "Inland Sea").
	Tapelung.
Patani (District of Patani State).	Patāni.

May.	
Jalâ (District of Patani State).	Bukit Bĕsar or Indragiri (mountain, about 3000 ft.).
	Bukit Jalâ (hills near Biserat).
	Gua Gambar (*lit.* "Image Cave," in hills near Biserat).
June.	
Raman (District of Patani).	Kĕkābu, Bukit Balor.
	Gua Glap, or "Dark Cave," near Biserat, Bukit Grib (?).
Patani (District of Patani State).	Gua Tanan.
August.	
Kĕlantan State....	Kuala Aring.
December.	
Perak State	Gunong Inas (mountain, a little under 6000 ft.).

Examples of the following species were collected at :—

Patalung State	Koh ha	*Rhyncoproctus proboscideus.*
	Patalung..............	*Spirobolus sanguineus.*
	Tapelung	*Platyrhacus beccarii.*
		P. subalbus.
		P. setosus.
		Strongylosoma skeatii.
		Sphæropœus modigliani.
Patani (District of Patani State).	Patani............	*Spirostreptus sanguineus.*
Jala (District of Patani State).	Bukit Besar	*Platyrhacus pfeifferæ.*
		Strongylosoma nodulosum.
		Spirostreptus sanguineus.
		Otostigma aculeatum.
	Bukit Jalâ...........	*Platyrhacus kelantanicus.*
		P. malaccanus.
		P. xanthopus.
	Gua Gambar	*Cambala calva.*
Raman (District of Patani State).	Kekabu, Bukit Balor.	*Scutigera longicornis.*
	Gua Glap, Bukit Grib (?).	*Doratonotus cavernicola.*
Patani State	Gua Tanan	*Doratonotus cavernicola.*
Kelantan State	Kuala Aring	*Siphonophora longirostris.*
		Platyrhacus kelantanicus.
		Thryropygus javanicus.
		T. weberi.
		Spirostreptus rubripes.
		Otostigma orientale.
		O. aculeatum.
		Mecistocephalus punctifrons.
Perak State	Gunong Inas	*Platyrhacus humberti.*
		P. marginellus.
		Strongylosoma bipunctatum.
		S. coarctatum.
		Julus birmanus.
		Glomeris infuscatus.
		Scolopendra aringensis.
		Otostigma orientale.
		Scutigera longicornis.

I have used Silvestri's names for the parts of the under-lip, thinking them the clearest and most convenient.

DIPLOPODA.

Order HELMINTHOMORPHA.

Sub-Order Colobognatha.

Siphonophora longirostris Silvestri. (Plate XXX. figs. 1–3, 5.)

From Kuala Aring, Kelantan State.

Silvestri's description is very short, but I think that this species must be identical with the one from New Guinea described by him, or, at any rate, very closely allied.

Length 45 mm., width 3 mm. Number of somites 93.

Colour red-yellow, shading into pale yellow from the sixth somite to the head; legs pale yellow.

Head with long, slender, curved beak. Antennæ a little longer than the beak; terminal joint large and rounded, other joints equal. Antennæ and head covered with close-set hairs.

1*st tergite* curved where it joins the head, broad, about double the length of the succeeding tergite. Keeled like the others.

Pores situated on the keel. The side below the keel runs straight down to join the pleuræ at a fairly sharp angle, thus making the shape of the body rather square than cylindrical.

Legs very short and thickly haired; joints about equal, ending in a blunt claw.

Anal valves rather small, one sternite behind the anus without legs and divided by a median longitudinal furrow. Body tapering very gradually before and behind.

Platydesmus kelantanicus, sp. nov. (Plate XXX. figs. 4, 6–9.)

From Kuala Aring, Kelantan State.

Colour dirty brown; head clear yellow; legs and sterna pale yellow.

The largest specimen has 79 somites; length about 50 mm. by 5 mm.

The smallest 77 somites; length 43 by 4½ mm.

Head heart-shaped, small, covered with very fine short hairs. Antennæ (fig. 9) short and thick, nearly equal joints, the second being a little the longest.

The hypostoma (fig. 8) has the maxillæ large, inframaxilla single, large at base, contracting rapidly to a spike-shaped elongation, which extends almost the whole length of the hypostoma; galeæ small; small cardines; basals normal; maxilla furnished with a few bristles at the anterior edge.

Mandible with a long slender shaft, then a short movable joint, then a pectinated terminal portion (see fig. 7) consisting of a row of bristles supported by a slender shaft which has a ring at some distance from the end which looks like a joint, but is, I believe, immovable.

1st tergite. Differs much from the others, it is longer than the head, roughly semicircular in shape, not so broad as the others, and without keels; it is covered with large wart-like tubercles and smaller granules. The larger tubercles are arranged in two groups, so as to leave a clear space free in the direction of the longitudinal furrow.

2nd tergite. Prolonged into two keels, which are, however, shorter than the succeeding ones. Like the first tergite it shows a disposition to be tuberculated, as in addition to the two dorsal tubercles which enclose the dorsal furrow there are a number of smaller tubercles near the large ones. This arrangement of the tubercles forms an interesting gradation between the third tergite, smooth but for the two large dorsal tubercles, and the first tergite with its two groups of tubercles arranged in the same position as the two dorsal ones in the other somites.

The remainder of the somites resemble one another closely. The keels are long and bluntly pointed, the posterior angle being the most acute; they cover the short legs completely. The shape of the body rises with a steep slope to the back, where there are two large tubercles with a wide depressed space between them, along which there runs a deep longitudinal furrow. Each tubercle has a small tubercle projecting from its base (pores ?). The bases of the legs are close together and are attached to a free sternal plate. Outside the legs are the spiracles, each on a small tubercle. The median dorsal furrow is continued right up to the tail, and the dorsal tubercles, though smaller in the last two somites, are still present.

Sub-Order POLYDESMOIDEA, Pocock.

Family POLYDESMIDÆ.

Genus PLATYRHACUS C. Koch.

PLATYRHACUS HUMBERTI, var. nov. (Plate XXX. figs. 10–13, 15.)

Label: "Gunong Inas, Perak. A scent of HNC. The palest coloured of the three largest specimens squirted out fluid from inter-segmental pores; all emitted."

There are three female specimens of this species, all from the same locality, and differing considerably in size and colour. I have no doubt that they are a variety of the species described by Pocock as *humberti*, but as they do not correspond exactly, I will give a full description.

Length 107 mm., greatest breadth 14 mm.

Body narrowed anteriorly and posteriorly.

Colour very deep chocolate, extreme edges of keels and of anal plate flavous. Legs and sterna same chocolate-colour but lighter.

Head thickly granular; shallow frontal furrow; upper lip with row of bristles, each proceeding from a small tubercle.

1st tergite slightly wider than head, the lateral contour of the latter forming one curve with sides of tergite. Anterior border nearly straight, sides of tergite rounded; anterior edge raised into a ridge along which a row of tubercles is arranged, the ridge is carried round the side of the tergites; posterior margin with eight tubercles arranged in a row; at the lateral margin there are more tubercles, but flattened and irregular. The surface of the tergite is covered with smaller tubercles arranged irregularly, and there is an irregular transverse row of some larger tubercles.

2nd tergite is narrow and curved forward and downward, the edge of the keel being rounded.

3rd tergite does not project so much downward and forward; the anterior and lateral margins meet so as to form a fairly acute point, the posterior margin rounding-off into the lateral.

4th tergite. Anterior margin nearly straight; forms a subacute angle with the lateral, the posterior forming an obtuse angle with the latter. On this tergite one can see the first beginning of the basal shoulder.

5th to 10th tergites: the angle formed by the anterior and lateral margins becomes gradually more of a right angle.

11th tergite. From the 11th tergite the posterior angle begins to project, and at the 15th it has the form of a spine.

12th tergite. From the 12th the lateral edge of the keel shows signs of being lobed.

16th tergite. At this somite the lateral edge of the keel shows five lobes, which are distinct on the 17th. The last three tergites show three rows of tubercles; on the 15th the third row becomes confused with the smaller tubercles which cover the surface, but the two posterior rows may be traced more or less easily up to the first.

The *stigmata repugnatoria* are placed nearly in the middle of the keel at a distance of about 2 diameters from the edge.

The *anal plate* is rounded posteriorly, and shows six raised longitudinal ridges differing in length and arranged symmetrically.

The *sub-anal plate* is triangular, and is armed near the apex with two long papillæ, each of which bears a long seta. The edges of the anal valves are not very strongly marked, and have two pairs of setiferous tubercles near the margins. Outside of the valve are two more setiferous tubercles, arranged symmetrically with the internal ones.

Sterna are coriaceous, and without spines or furrows.

At the base of each leg there is one tubercle on the internal side and two on the external side. In the anterior region of the body these tubercles (the external ones) show an irregularity of arrangement; the two posterior ones are arranged in a straight line from the base of the leg to the under surface of the keel; the anterior two are arranged parallel to a line connecting the bases of the legs.

The legs and antennæ are hairy.

Another specimen is $82\frac{1}{2}$ mm. long and $12\frac{1}{2}$ mm. broad.

The third specimen is $87\frac{1}{2}$ mm. long and $12\frac{1}{2}$–$15\frac{1}{2}$ mm. broad. Colour dirty brown on dorsal surface, with semicircular patch of pale testaceous colour on the dorsal margin of the last eleven somites (probably due to injury). Legs, antennæ, and sterna are pale testaceous, with some darker markings on the antennæ and legs.

PLATYRHACUS MARGINELLUS Silvestri. (Plate XXX. figs. 14, 17, 18, 20, 22.)

From Gunong Inas, Perak State.

This is probably the species described by Silvestri, and found in Sumatra; but as his description is very short, it will be better to give a full account of the animal. The specimens are two, a male and a female. The latter is considerably the largest.

Colour dark brown, almost black, the extreme edges of the keels and of the anal sternite being pale; the antennæ and legs yellowish brown, but darker than the edges of the keel, probably in the living animal they might answer to Silvestri's description of "rufescentibus."

Length 52 mm.; length of antennæ about 5 mm.

			mm.				mm.
Breadth of	1st	tergite	$4\frac{1}{2}$–5	Breadth of	6th	tergite	$7\frac{1}{2}$
,,	2nd	,,	6 –$6\frac{1}{2}$	,,	15th	,,	7
,,	3rd	,,	$6\frac{1}{2}$–7	,,	17th	,,	$6\frac{1}{2}$
,,	4th	,,	7 –$7\frac{1}{2}$	,,	18th	,,	5
,,	5th	,,	$7\frac{1}{2}$–8	,,	19th	,,	$4\frac{1}{2}$

Head narrow; antennæ long; frontal sulcus deep, extending from between the antennæ to the margin of the first somite.

1*st tergite* elliptical in shape, the lateral edges of the somite extending considerably beyond the sides of the head. Anterior margin with tuberculate ridge, which extends round a considerable part of the sides of the tergite. A row of tubercles along the posterior margin, and two distinct rows across the middle.

2*nd tergite* projects hardly at all forward or downward; anterior, posterior, and lateral margins distinct; three distinct rows of tubercles.

The shoulder of the keel quite distinct on the third somite; in the ninth the anterior angle is acute, while it is obtuse in the tenth. The pores lie nearly in the middle of the keel and at a considerable distance ($1\frac{1}{2}$ diameters) from the margin.

Edges of keels with a distinct margin. Posterior margin of keels not clearly serrated before the 15th somite. The posterior angle forms a very short tooth which does not reach the anterior surface of the succeeding keel. The anal sternite is much rounded, and shows little trace of the longitudinal ridges. Sterna smooth.

The copulatory foot of the male shows the two claws opposed to one another, one being longer than the other. The copulatory foot is long and slender. The shape of the body is rather convex, and the keels slightly upturned.

PLATYRHACUS KELANTANICUS, sp. nov. (Plate XXX. figs. 19, 21, 24, 25, 31.)

From Kuala Aring, Kelantan State.

Length 80 mm., greatest breadth 12 mm. Length of antennæ 8 mm.; space between antennæ $1\frac{1}{2}$ mm.

	mm.		mm.
Breadth of 1st tergite	8	Breadth of 16th tergite	$11\frac{1}{2}$
,, 2nd ,,	11	,, 17th ,,	$10\frac{1}{2}$
,, 3rd ,,	11	,, 18th ,,	9
,, 4th ,,	12	,, 19th ,,	$7\frac{1}{2}$
,, 5th ,,	12		

As may be seen from the measurements, this Myriapod tapers abruptly before and behind.

Colour. The colour (in spirit) is very peculiar, being a reddish brown, almost like brick-dust. In the centre of each prozonite there is a thick, well-defined, longitudinal black line. This line does not extend the whole length of the prozonite, but there is anteriorly a narrow space free from black. In the tergum, between the keels, the black spreads out into a sort of blotch, extending from the base of one keel to the base of the other; leaving, however, the posterior part of the keel almost free. The legs and sterna are the same colour, but lighter.

Head rather narrow; the frontal furrow deep and wide, extending between the antennæ. Upper lip indented in the middle and armed with six bristles, each arising from a tubercle. Just above the upper lip is a deep semicircular compression with four setiferous tubercles on its upper edge. The whole head is rough and densely granular. The space between the antennæ is narrow; the antennæ are thickly covered with hair; first two joints less hairy and lighter in colour; end joint blunt and smooth; frontal furrow extends back to margin of first tergite.

1st tergite. Anterior margin rounded, with ridge, along which are arranged ten very distinct tubercles and more tubercles which are not distinct, but are mixed up with the smaller tubercles with which the rest of the tergite is studded. Behind the ridge there is a depression. The ridge is not carried round the lateral edges. The posterior margin is furnished with twelve very distinct tubercles. The margin is rather rounded-off, but there is an approach to a straight line on the surface that goes to meet the curve from the anterior margin in a blunt point. On the prozonite between the first and second keels there is a thin black line which extends from the posterior margin to the anterior.

2nd tergite projects forward and downward. Points of keels rounded. Row of twelve distinct tubercles on hinder margin; two fairly distinct rows in front of hinder row.

3rd tergite does not project so far forward and downward; lateral margin of this tergite straight, making an acute angle with the anterior margin. Two rows of tubercles can be made out.

4th tergite. Posterior margin of the keel is distinct, making an obtuse angle with the lateral margin, which makes an acute angle with the anterior. There is only one row of tubercles.

5th tergite. First trace of shoulder; keel almost carries on the slope of the tergum. The keel starts from very high up, so that the whole surface makes a very gentle curve.

8th tergite. The anterior angle is acute, in the next somite it is obtuse. The little teeth on the posterior margins of keels are visible on the 9th somite. On the last two somites the posterior margin of the tergite is elevated into a ridge. The anal tergite shows little trace of the longitudinal ridges so conspicuous in some other species, its margin is also little lobed. The anal valves are very flat, and are provided with the usual setiferous tubercles. The sterna are coriaceous and without furrows. The posterior keels are very slightly bilobed.

PLATYRHACUS: var. of KELANTANICUS. (Plate XXXI. figs. 32–34, 42, 56.)

From Bukit Jalã, Jalã District.

Length 83 mm. Length of antennæ 10 mm.; space between bases of antennæ a little over 1 mm.

		mm.			mm.
Breadth of	1st tergite	7	Breadth of	8th tergite	$12\frac{1}{2}$
,,	2nd ,,	$10\frac{1}{2}$	,,	13th ,,	12
,,	3rd ,,	11	,,	14th ,,	$11\frac{1}{2}$
,,	4th ,,	12	,,	16th ,,	11
,,	5th ,,	12	,,	17th ,,	10
,,	6th ,,	$12\frac{1}{2}$	,,	18th ,,	9
,,	7th ,,	$12\frac{1}{2}$	,,	19th	8

Colour dark chocolate-brown, with broad longitudinal pale stripe along centre of back, including prozonites and extending on to first tergite. Keels pale, legs pale, sternites rather darker than legs, edge of anal plate and antennæ pale.

Head rather narrow; space between antennæ very narrow. Upper lip indented in the middle and armed with five bristles. A depression between the antennæ. A deep semicircular pit just above the upper lip, with four bristles along the edges. The frontal furrow does not come to the level of the antennæ. The antennæ are long, darker in colour near the end, and densely covered with short hairs, less densely at the 1st and 2nd joints. Surface of head covered with small tubercles. Frontal furrow comes to edge of first tergite.

1st tergite. Anterior edge straight with ridge followed by furrow, the ridge bearing twelve tubercles which do not extend to the angle of the tergite. The posterior margin is straight and bears ten tubercles; the margins both anterior and posterior are rounded-off at the sides to meet in a rounded angle. The width of the tergite is considerably greater than that of the head.

2nd tergite. Keels widely open, almost semicircular, ends projecting forward and downward, ends of keels rounded; two rows of tubercles distinct.

3rd tergite. Lateral margin of keel a straight line, angle rounded, keel with a straight narrow margin.

4th tergite. Posterior margin of keel distinct; anterior angle acute, only slightly rounded.

5th tergite. Anterior angle less acute, first shoulder.

8th tergite. In this tergite the anterior angle is nearly a right angle. The teeth on the posterior edge of the keels are first distinct on the 11th somite; on the anterior they are not distinct till the 15th. The anal tergite shows four longitudinal ridges, but they are not very distinct; the two external ones are only a thickening of the margin. The end of the plate is rounded and very indistinctly lobed, edges of anal valves very prominent.

Sterna smooth, but punctated. The tubercles on the external sides of the bases of the legs have a furrow between them which runs to the base of the keel.

Platyrhacus beccarii, var. nov. (Plate XXXI. figs. 35, 36, 51, 60.)

From Tapelung, Patalung State.

A variety of the species described by Silvestri as *beccarii* from Sumatra.

There are three specimens of different ages forming an interesting series. The oldest is a female, and measures 85 mm.; greatest width 11 mm.

Body narrows somewhat abruptly in front of the 4th somite, more gradually behind.

Colour black in the middle of the body; keels, legs, and antennæ yellow; sterna yellow between the legs, darker under the keels.

Head granulated; frontal furrow deep. Space between antennæ 5 mm. Length of antennæ 7 mm.

1st tergite. Anterior and posterior margins straight; the anterior with a slight irregularity of the tubercles on the ridge, giving the appearance of a median indentation. Anterior margin with a ridge which is not carried round the edge; ridge studded with tubercles; posterior margin straight, with row of nine tubercles, with smaller ones in between. Centre of tergite nearly smooth, more tuberculous near the edge.

2nd tergite projecting forward and downward, narrow, with row of ten large tubercles on the posterior edge. Lateral margins rounded.

3rd tergite broader, and not projecting forward and downward so much; posterior row of tubercles not so marked. Antero-lateral angle of keel acute, but slightly rounded; postero-lateral obtuse.

4th tergite hardly points down at all. First beginning of shoulder.

5th tergite. Shoulder well-marked; anterior angle hardly acute.

7th tergite. The anterior angle of this tergite is a right angle, and behind this somite the anterior angle becomes more obtuse and the posterior more acute.

12th tergite. The 12th keel has the posterior angle produced into a spine, though not a long one. The postero-lateral margin of the keels is finely serrated after the 10th somite.

Anal tergite. The anal tergite is rounded at the posterior edge, and shows long longitudinal elevations resembling those on the anal tergite of *P. humberti*, but differently arranged. They each end posteriorly in a tubercle, which bears a seta. The edge of the tergite is indistinctly divided into five lobes.

Sterna. The sterna are non-sulcate, and slightly marked with wrinkle-like elevations. The anal sternite is triangular, with two long setiferous tubercles; the anal valves have strongly marked edges, with a single setiferous tubercle on the edge of each. There are no setiferous tubercles on the outside of the anal valves.

There is a single tubercle at the base of each leg on the internal side, and on the external side there are three in a row, the posterior tubercle being partly divided into two.

2nd specimen. 19 somites. Length 72 mm., width 19 mm.

The teeth on the posterior margin of the keels are visible on the 8th somite. The lobes on the keels and the marks on the anal sternite are all more prominent than in the older specimen.

3rd specimen. This specimen has only 18 somites. Length 62 mm., width $8\frac{1}{2}$ mm.

Colour clear brown-yellow; prozonites darker, almost chocolate; the colour of the whole body is darker anteriorly. The lobes of the keels are much more clearly marked, and the rows of tubercles more distinct. The markings on the anal tergite less ridged, and more like tubercles. The five lobes of the keels can be traced even on the 2nd somite. The pore is placed just interior to the second posterior lobe of the keel (that is, rather more posteriorly than in the older specimens).

PLATYRHACUS PFEIFFERÆ Humbert & Saussure. (Plate XXXI. figs. 37, 44, 45, 48, 50.)

From Bukit Besar, Jalā District.

Length 112 mm.

	mm.		mm.
Width of 1st tergite	$9\frac{1}{2}$	Width of 16th tergite	$15\frac{1}{2}$
,, 2nd ,,	13	,, 17th ,,	$14\frac{1}{2}$
,, 3rd ,,	$13\frac{1}{2}$	,, 18th ,,	$12\frac{1}{2}$
,, 4th ,,	14	,, 19th ,,	$8\frac{1}{2}$
,, 5th ,,	16		

Colour black, shading into testaceous at edges of keels and margin of anal tergite. Antennæ, legs, sterna, and most of the under surface of the keels chocolate.

Head rough, and covered with small tubercles. Frontal furrow deep, and widening out to a semioval depression between the antennæ. Upper lip with a semicircular depression above it, and four bristle-bearing tubercles along its edge. Length of antennæ $10\frac{1}{2}$ mm.

1st tergite. Anterior margin straight, with ridge but no distinct tubercles; the ridge and whole tergite wrinkled and rough. The ridge is not produced along the lateral margin. Posterior margin straight and without a row of tubercles, but, like the anterior margin, wrinkled and rough. Lateral margins somewhat rounded, and coming to a blunt point nearer to the anterior than the posterior margin.

2nd tergite projects downward and forward; point rounded.

3rd tergite. Lateral margin nearly straight, forming an acute angle with the anterior and an obtuse with the posterior margin.

4th tergite more square, the anterior angle still rather obtuse.

5th tergite. Lateral margin still forms an acute angle with the anterior. The keel no longer points downward and forward, the keel arises high up so that the back is little convex.

6th tergite. The beginning of a shoulder appears.

7th tergite. A distinct shoulder; the antero-lateral angle nearly square.

The little teeth on the posterior margin of the keel can be observed in the 9th somite, but do not become conspicuous till the 13th. The posterior margin is never very much prolonged; it forms a short tooth but hardly a spine. The edge of the keel never becomes very distinctly lobed, though a trace of lobes can be observed in the posterior somites. The anterior angle of the keel only differs much from a right angle in the last four somites. The upper surface of the anal shield is marked with longitudinal ridges, as in *Pl. beccarii*, but the arrangement is somewhat different. The sub-anal region shows the six tubercles along the line of the valves, but only three outside the valves; the absence of the third is probably an individual variation.

PLATYRHACUS INSULARIS Humbert & Saussure, var. nov. (Plate XXXI. figs. 40, 41, 47, 52, 53.)

I believe this to be a variety of the species described by these authors, although it differs considerably from their description.

Length 95 mm. Length of antennæ $9\frac{1}{2}$; distance between bases of antennæ 2 mm.

		mm.			mm.
Width of	1st tergite	9	Width of	16th tergite	$14\frac{1}{2}$
,,	2nd ,,	11	,,	17th ,,	13
,,	3rd ,,	12	,,	18th ,,	11
,,	4th ,,	13	,,	19th ,,	8
,,	5th ,,	15			

Colour dark chocolate-brown, shading into lighter brown on the edges of the keels. Ends of antennæ rather darker than the bases. The extreme edge of the anal plate light-coloured. Beneath the keels, light near the edge, darker on the sides of the body; sterna and bases of legs light chocolate-colour; ends of legs darker.

Head covered with small smooth tubercles. Upper lip indented in the middle, and furnished with a row of six bristles. Just above the upper lip there is a triangular depression with three bristles at the edges. The deep frontal sulcus does not quite reach to the level of the antennæ. Antennæ short.

1*st tergite.* Anterior margin very slightly indentate, straight, and furnished with a ridge with tubercles, but the tubercles are not very prominent or very distinct; the furrow behind the ridge is carried out into a depression which is bluntly triangular, and extends to near the middle of the tergite. The posterior margin is straight with some large tubercles on it, but, as in the anterior margin, the tubercles are confused and not prominent. The sides of the tergite are rounded-off so as to make a blunt point nearer the anterior than the posterior margin. The tergite is about the same breadth as the head, the curve of the head being continuous with that of the tergite.

2nd tergite. Is prolonged downward and forward so as to form an open V embracing the first tergite; the ends are rounded so as to form blunt points. On the posterior margin there is a short ridge covered with tubercles.

3rd tergite less prolonged forward and backward than the 2nd. The lateral margin is distinct and makes an acute angle with the anterior, though the point is rounded-off.

4th tergite. A trace of shoulder is apparent.

5th tergite. The shoulder is apparent, and the anterior angle is less acute.

6th tergite. Anterior angle nearly a right angle.

12th tergite. The minute teeth are visible on the posterior margin of the keel, those on the anterior margin are not visible distinctly till the 15th. After the 15th the keels begin to be directed backward, and there is a small tooth on the posterior angle, but this is never very big.

Anal tergite. The anal tergite shows only four of the longitudinal ridges in place of the six possessed by most of the other species. The sterna are smooth, though examination with a lens shows numerous small granules.

PLATYRHACUS MALACCANUS Peters. (Plate XXXII. figs. 63-65, 68, 87, 88.)

From large cave, Bukit Jalâ, Jalâ District.

Two perfect specimens and one broken, all female.

Length 80 mm. Length of antennæ 8 mm.; distance between bases of antennæ barely 2 mm.

			mm.				mm.
Width of	1st	tergite	8	Width of	6th	tergite	13
,,	2nd	,,	19	,,	16th	,,	12
,,	3rd	,,	11	,,	17th	,,	11
,,	4th	,,	12	,,	18th	,,	10
,,	5th	,,	11	,,	19th	,,	8

Colour coffee-brown at edges of keels and anal tergite. Sterna and legs same colour but lighter.

Head. Upper lip with median indentation, three stiff bristles on each side of the indented part. Just above the upper lip there is a roughly triangular depression with four bristles at the edges. The frontal furrow does not come to the level of the antennæ. The surface of the head is covered with granules and tubercles. Posteriorly the frontal sulcus comes close to the edge of the 1st tergite.

1st tergite. Anterior border curved, marginal ridge covered with tubercles, depression behind it. There are twelve distinct tubercles on the ridge, towards the sides the tubercles become confused and indistinct. The tergite is wider than the head. The posterior margin has eight distinct tubercles; it is slightly indented in the middle. The marginal ridge does not extend to the sides. The lateral margins are cut so as to make the shape of the tergite roughly hexagonal. The whole surface of the tergite is covered with irregular tubercles.

2nd tergite widely opened, and not coming much below the first. Three irregular rows of tubercles can be distinguished. The ends of the keels are bluntly rounded.

3rd tergite projects less downwards than the 2nd, no regular rows of tubercles can be distinguished except at the posterior edge, where there are fourteen tubercles arranged somewhat irregularly. The lateral edge of the keels begins to be straight instead of curved.

4th tergite. There are nineteen tubercles on the posterior margin. Anterior angle still acute. No trace of shoulder.

5th tergite. Shoulder present; anterior angle still acute. The anterior angle is not quite a right angle till the 8th. The anterior edge of the keel is very slightly if at all convex; in the 9th the posterior edge begins to be concave. The first beginning of the posterior hook is just visible in the 6th somite. The teeth on the posterior margin are first visible on the 10th, those on the anterior not till the 13th. The posterior hook is never very pronounced.

The *anal sternite* is indistinctly 5-lobed; the longitudinal ridges, of which only four are present, are not very pronounced. The sterna are smooth and granulated, without a transverse furrow.

PLATYRHACUS SUBALBUS Pocock.

From Tapelung, Patalung State.
Length 84 mm., greatest width 11 mm.

PLATYRHACUS XANTHOPUS Pocock.

From Bukit Jalã, Jalã District.

Genus STRONGYLOSOMA Brandt.

STRONGYLOSOMA NODULOSUM Attems, var. nov. (Plate XXXII. fig. 89.)

From Bukit Besar, Jalã District, and Kuala Aring, Kelantan State.

Length 33 mm., width 3 mm.

This species closely resembles the one from Borneo described by Attems under the name *nodulosum*. There are, however, some important differences in the Malay specimens.

Colour and shape as in Attems's description. The furrow between the pro- and metazonites, which Attems describes as "deutlich geperlt," shows no signs of any pearls or tubercles even under a high power. Neither can I identify the "kleine kurze Wülste" on the pore-bearing segments, though there are certain pores or marks in the chitinous integument which may possibly represent them. Neither can I find any sign of the cross-shaped impression in the ventral plate.

The sub-anal plate has two setiferous tubercles in the same place as in Platyrhacidæ and the two pairs of setiferous tubercles at the sides of the anal valves. The copulatory foot is shown in the figure.

STRONGYLOSOMA (ORTHOMORPHA) FUSCOCOLLARIS Pocock. (Plate XXX. fig. 23, and Plate XXXII. fig. 81.)

From Gunong Inas, Perak State. Male.

This specimen is, I think, identical with that from Tenasserim described by Pocock. The colour is, however, slightly different. The last joint of the antennæ is dark brown; the head, antennæ, and first tergite yellow-brown; extreme edge of first tergite pale. On each somite just above the keel there is a cluster of small pale spots. The rest of Pocock's description applies.

STRONGYLOSOMA BIPUNCTATUM, sp. nov. (Plate XXX. fig. 16, Plate XXXI. figs. 43, 61, and Plate XXXII. figs. 90, 95.)

From Gunong Inas, Perak State, and Kuala Aring, Kelantan State.

Length 52 mm., width 6 mm.

Colour of head dark brown, shading into yellow on the upper lip; under part of head yellow; a patch of yellow just behind each antenna. Antennæ yellow, with the distal parts of the joints shading into brown; last joint dark brown.

1*st somite* dark chocolate-brown, ends of keels and posterior margin of tergite yellow; ventral parts yellow.

2*nd somite* same, but with brown patch on lower ventral part of keel. Two pale spots on the prozonite.

The 3*rd & 4th somites* resemble the 2nd. On the 5th the pale posterior margin is wanting, the chocolate-brown extending to the edge. On the cylindrical prozonite there are two large pale spots separated by a dark line. These spots are shaped like the half of an oval and extend from the anterior margin of the prozonite for about two-thirds of its length; they are visible up to the 18th somite.

The *tail* is pale at the posterior end, while at the anterior it shows a pale band divided by a median longitudinal dark stripe. At the sides of the anterior end it is chocolate. The ventral surface of the tail is pale and the anal valves chocolate.

The body tapers anteriorly and posteriorly.

Head. Upper lip with a semicircular indentation, edged with small tubercles. Surface of head covered with short stiff hairs, especially towards the upper lip. Frontal furrow deep, reaching from posterior of head to the level of antennæ. Antennæ reaching to 3rd tergite.

1st tergite 2 mm. long by 5 mm. broad. Keels well developed; angle sharp, about on a level with the keel. Edges of keel not so much bent upwards as those of the 2nd somite. The anterior margin of the keel is rounded-off, following the curve of the anterior margin of the tergite.

2nd tergite barely $1\frac{1}{2}$ mm. long by $5\frac{1}{2}$ broad. Keel much pointed posteriorly, the point reaching to about the middle of the succeeding somite. Edge of keel more turned up than in the first.

3rd & 4th tergites. Length $1\frac{1}{2}$ mm., breadth $5\frac{1}{2}$. External edges of keels curve upward; traces of the strong thick margin appear.

5th tergite. This tergite shows the shape and dimensions of the remaining ones. Its length is 2 mm. and breadth 6 mm. The contrast between it and the preceding ones is very great. Keels turned up at the edges and a thick margin on the anterior border. The tergite is divided by a well-marked transverse furrow reaching to the bases of the keels.

The *pleural keels* have the form of a ridge in the first four somites; in the fifth they become a tubercle.

The *anal tergite* has the form of a truncated cone, with two very prominent tubercles at the two corners.

The amount of taper towards the tail may be judged from the following measurements:—

16th tergite	6 mm.
17th ,, ...	$5\frac{1}{2}$,,
18th ,, ...	5 ,,
19th ,, ...	$3\frac{1}{2}$,,

Sterna smooth; the basal elevated portion, from which the legs arise, has a strongly marked median longitudinal furrow, which is still apparent in the last somite. The femur is $2\frac{1}{2}$ times as long as the trochanter.

STRONGYLOSOMA SKEATII, sp. nov. (Plate XXXI. fig. 39, and Plate XXXII. figs. 96, 97, 100.)

From Tapelung, Patalung State.

Length about 22 mm., breadth $3\frac{1}{4}$ mm.

The specimens are difficult to measure, as they are tightly curled up; I do not, however, think the error is great.

Colour a dark ferruginous brown. Head, 1st somite, and the greater part of the antennæ almost black. Sterna, legs, keels, and two small circular spots just above the antennæ yellow. The back is ornamented with two pale stripes, which, in the keeled part of the somite, diverge, so that the posterior ends are considerably more separated than the anterior. On the cylindrical part they are parallel. The tail is yellow, with a median band of the ferruginous ground-colour. The anal valves are dark-coloured.

Head with indented upper lip; surface covered with short stiff hairs. Frontal furrow well marked. The small circular pale spots above the antennæ are very conspicuous. Antennæ covered with short fine hairs.

1*st tergite* nearly semicircular in shape, very little keel. The margin is higher than that of the second, which it partly overlaps. The pale streaks are as clearly marked in the 1st somite as in the others, but anteriorly they converge and join at the extreme anterior edge.

2*nd tergite* has the posterior angle just marked, but not acute like the 3rd.

3*rd tergite*. Posterior angle acute and prolonged into a spine.

Pleural keels not much developed, distinguishable on the first three somites and dying away about the fifth.

There is no abrupt transition between the anterior somites and the rest of the body, but the somites increase gradually in size.

The keels are small, rounded anteriorly, and sharply spiniform posteriorly. The spine, however, does not surpass more than the half of the cylindrical part of the next somite. The sternum is smooth and without furrows in the cylindrical part of the somite, but has a median longitudinal furrow dividing the bases of the legs including the last pair. The sub-anal plate and valves have the usual tubercles and setæ. The tail has the form of a truncated cone with two small tubercles at the two posterior corners; also two tubercles and setæ a little before the end of the tail.

STRONGYLOSOMA COARCTATUM Saussure.

From Gunong Inas, Perak.

STRONGYLOSOMA SETOSUM Pocock.

A young animal with only 19 somites. From Tapelung, Patalung State.

Genus DORATONOTUS Pocock.

DORATONOTUS CAVERNICOLA, sp. nov. (Plate XXXI. fig. 54, and Plate XXXII. figs. 69–71, 73, 74, 78, 82.)

From Gua Glaf, dark region of cave, Bukit Grib, Raman District, and from Gua Tanan, Patani State.

Bears a great resemblance to the species described by Pocock as *armatus*.

Colour light brownish yellow throughout. Legs, sterna, and antennæ lighter.

The head and antennæ as in Pocock's species; the sixth joint of the antennæ is much the longest joint. The maxillæ (Silvestri) of the hypostoma are provided with two long appendices maxillares, each with about six spikes at the end. The external margins of the keels, including the second, are divided into five clearly marked lobes, and after the 4th have a high raised tubercle, resembling a median keel. This keel is divided into three lobes when viewed from the side, and when looked at from the front is bifid. These lobes differentiate the species very clearly from *armatus*. The last tergite, too, does not project over the tail as it does in the latter species. The openings of the tracheæ are on small tuberculiform elevations just behind the bases of the legs. I have not been able to distinguish the pores, but have no doubt that they are as in *armatus*. The amount of material was too small to make so full an examination as I should have liked.

Sub-Order JULOIDEA Pocock.

CAMBALA CALVA Pocock, var. nov. (Plate XXXII. fig. 84.)

From Gua Gambar near Biserat, Jalâ District.

These specimens differ from the *Cambala calva* of Pocock in the absence of "the one complete and two very short crests above" the margin of the first tergite. The material being abundant, I was able to take off the first tergite and examine under a high power, but could not see any crest. The size of the largest specimen was about 35 mm. by $3\frac{1}{2}$. The specimens were too much curled to allow of the longitudinal measurements being very exact.

Number of somites 58. The 2nd and 3rd tergites fully crested, as described by Pocock. Five crests on dorsal surface between the two that bear the pores; 16 below them. In all about 23, but the most ventral are hard to make out as they are very feebly marked. The antennæ are situated on a slight elevation shown in the figure.

TRACHYJULUS CEYLANICUS Humbert, var. nov.

From about 5000 ft., Gunong Inas, Perak State.

The colour differs somewhat from Humbert's description, as there is no dark line visible; also the pore-bearing tubercles are not black but dark brown. The tubercles forming the ridges are not so sharp as in his figure, and the ridges on the first tergite are not quite so strongly marked.

Family SPIROSTREPTIDÆ.

Genus RHYNCOPROCTUS Pocock.

RHYNCOPROCTUS PROBOSCIDEUS Pocock.

From Koh ha, Patalung State.

Genus THYROPYGUS.

THYROPYGUS JAVANICUS Brandt.

From Kuala Aring, Kelantan State.

THYROPYGUS WEBERI Pocock, var. nov.

From Kuala Aring, Kelantan State.

The principal differences are in size and colour.

Somites 86. Length 115 mm. by 6 mm.

Colour piceous above, shading into clear yellow on the edge of the upper lip. Antennæ dark yellowish brown, with yellow rings at the joints. Somites piceous behind, the anterior part being dark greyish yellow. Legs fuscous. Valves black. Labrum indented, with six pores above the indentation. Eyes separated by a diameter and a half. Antennæ extending to the hind border of the second tergite. Frontal furrow extending to the level of the points of the eyes. Collum wide laterally, posterior angle slightly produced, inferior and anterior border with sulcus. Two short but deep sulci on the posterior border. Anal ring produced into a straight, short, blunt point.

SPIROSTREPTUS SANGUINEUS C. Koch.

From Patani District; Bekit Besar, Jalâ District; Tapelung, Patalung State; and Bukit Jalâ, Jalâ District.

SPIROSTREPTUS ATERRIMUS Pocock.

From Kuala Aring, Kelantan State.

A larger specimen than Pocock's. Length 319 mm. by 15 mm. 68 somites.

SPIROSTREPTUS RUBRIPES, sp. nov. (Plate XXX. figs. 29, 30.)

From Kuala Aring, Kelantan State.

Colour black with red legs.

Head. Frontal furrow to level of eyes. Distance between angle of eyes less than a diameter. Antennæ short, the second joint longest. Eyes about 55. Superior crenulate ridge at back of head.

1*st tergite* comes to level of 2nd. Three striæ on posterior lateral margin. Anterior margin with ridge and furrow from level of eyes. Anterior angle obtuse, posterior slightly acute, posterior edge slightly emarginate. Three pores on upper lip.

In the other somites the striæ come close to the pore. The pore is situated close to the raised (posterior) part of the segment, which just in front of the pore juts out forwards and is slightly elevated. The anal tergite is produced into a short blunt point which does not project beyond the valves and curves downwards, following the curve of the valves.

This species seems to resemble *Thyropygus inferorum* of Silvestri, but far surpasses it in size and in the number of its somites.

SPIROSTREPTUS DORSO-LINEATUS, sp. nov. (Plate XXX. fig. 26.)

There are three female specimens of different ages. I shall describe the smallest first.

Length about 75 mm.

45 somites. Body tapering rather abruptly behind the head.

Colour. Head castaneo-piceous; 1st somite the same, growing lighter towards the inferior angle, where it is almost yellow. Other somites: in front a greyish yellow, shading into a light ash-grey as far as the transverse furrow; after that the grey is darker, becoming almost black posteriorly. This dark grey behind the furrow is only continued down to the pores. Below the pores the colour behind the furrow is ferruginous, with a tinge of grey on the most anterior half. Legs and antennæ clear orange-yellow. There is a fine dorsal median longitudinal line of yellow along the whole back. End of anal spike and edges of valves orange-yellow.

Head. Frontal furrow to level of eyes; five labial pores. Space between eyes $1\frac{1}{2}$ diameters. Antennæ long, passing edge of 2nd tergite; second joint longest, last two shortest.

1st tergite. Postero-lateral edge striated; five striæ. Anterior edge rounded and distinctly emarginate. Lateral edge very narrow. Posterior edge straight. Other somites striated to level of pore. Concentric markings anteriorly. Transverse furrow well marked.

Anal spike short, sharp, and much upturned.

Specimen with 51 somites. The colouring is not so bright. The greys are not so dark and the ferruginous yellow is much more marked, the head especially being almost castaneous. The antennæ are longer, reaching the 4th somite.

Specimen with 53 somites. I believe this to be adult. Length 215 mm. by 13 mm. The colouring is not so bright as either of the first two specimens. The head is more black, the anterior part of the somites is more yellow-grey. The black-grey of the posterior part of the somite is continued further ventrally. Behind the posterior part of the somite there is a very narrow ring of castaneous. The thin line on the back is still apparent, but is black instead of yellow. The narrowing of the body behind the head is more apparent. The anal spike is somewhat blunter though still upturned. The antennæ are dark brown, with a pale yellow ring at the articulations. The legs are clear yellow, with a black patch on the anterior and posterior aspects of each joint, extending almost the whole length of the joint. The last joint is black all round. The effect of this is curious. If a leg is looked at from behind or from the front, it appears black with yellow rings at the articulations and the last joint black; when viewed from the side, it appears altogether yellow with a black top joint. The antennæ reach to the hind edge of the 2nd tergite. The second joint is the longest, the third longer than the fourth, the fourth longer than the fifth, and the last two are the shortest. The ventral grooves reach to the second joint of the legs.

Altogether this Myriapod must resemble *Sp. oatesii* Pocock rather closely. The points in which it differs are: the length of the antennæ; the number of ridges on the 1st tergite, though I suspect this to be a peculiarity which differs in different individuals; the length of the ventral grooves; and the anal process, which is distinctly upturned in this animal. The legs are fairly long, but there is one conspicuous seta on the lower surface of each joint as described in *oatesii*.

Spirostreptus vittatus Pocock. (Plate XXX. figs. 27, 28.)

The colour of this specimen differs from that described by Pocock, especially in the legs, but the resemblances are so great that I think it must be regarded as a variety only, and not as a new species. I shall, however, give a fairly full description, as the points of difference may seem more considerable to others than they do to me.

Length 220 mm. by $12\frac{1}{2}$ mm. Somites 85.

Colour. Head castaneo-piceous. 1st tergite castaneo-piceous; antennæ same. Other somites castaueo-piceous behind, paler, almost ochraceous in front. Anal somite and valves the same ochraceous colour, with the anal spike darker. Legs dark castaneous, but lighter than the head.

Head. Nearly smooth, slightly wrinkled below. Labial pores six, somewhat irregularly placed. Frontal furrow terminating at level of eyes. Eyes less than 60 but over 50, arranged in seven transverse series. Space between eyes a little less than a diameter. Antennæ reaching to end of 1st tergite; second joint the longest, the two end-joints slightly shorter than the third and fourth. Elevated striated ridge just below the edge of the 1st tergite; where the frontal furrow joins this ridge, the ridge projects a little to meet it and is cut away on each side of the projection so that the margin of the ridge is sinuous in the middle of the head.

1st tergite. Large and smooth, narrowed laterally, both borders being distinctly emarginate. The marginal sulcus extends to the eye; the anterior and posterior angles are rounded. It seems to me that the posterior angle is a little more rounded than in Pocock's figure. On the posterior edge there are three clear striæ and two more indistinct. Other somites with the transverse furrow very distinct, the portion of the somite behind it being very slightly higher than in front. Pore just behind the sulcus, the latter being sinuate at this point. The longitudinal striæ extend nearly but not quite up to the pore. Concentric markings on the front part of the somite. Ventral grooves small and short. Anal somite moderate in size, the projection coming to the level of the valves but not surpassing them. It is marked off from the rest of the tergite by a distinct constriction.

Legs long; one seta above and one below the claw; a few hairs on the lower surface of the joints.

There are five immature specimens of *Spirobolus* from Gunong Inas, Perak. It is not possible to determine the species without a greater knowledge than I possess.

Julus birmanus Pocock.

Two specimens. I do not think either of them is full-grown.

57 somites. About 40 mm.

Colour in male rather brown than grey, fine line down back. Head same colour; antennæ same colour; legs yellow.

Immature female lighter in colour, yellow, with the brown only showing at the top of the segments. Head and first few somites darker; antennæ dark.

Head with two pores on forehead. Eyes about seven rows. Lateral margin of 1st tergite rounded. The rest of Pocock's description answers, with the exception of the hinder border of the tergites, which is not pectinated so far as I can see.

As there is only one male example, I did not feel myself at liberty to dissect out the copulatory apparatus.

Order **ONISCOMORPHA** Pocock.

Sphæropœus evansi, sp. nov. (Plate XXXI. fig. 57, and Plate XXXII. figs. 79, 80, 83, 91.)

Length 40 mm. by 20 mm.

Colour. Head and 1st somite piceous; rest of body piceo-castaneous on upper part of somites, shading into clear testaceous, with a green tinge irregularly blotched with black so as to have the appearance of tortoise-shell. Legs and antennæ the same greenish testaceous when seen by transmitted light. When seen as an opaque object, the hairs with which they are clothed give them a dull greenish-brown appearance.

Head somewhat conical in shape. On the upper lip there is a raised, smooth, black plate, cut out in the centre so as to form a single tooth with a depression on each side (fig. 20 *a*). The surface of the head is rough, punctuated and covered with bristles. There is an indentation in the middle of the forehead where it joins the middle of the 1st tergite. Eyes in a large round cluster. Antennæ with the last joint largest, and a large punctated pad at the end.

1st tergite smooth, curved, and not surpassing the eyes in breadth.

2nd tergite large, with straight anterior and posterior borders. There is a strong ridge on the anterior margin, accentuated from the level of the eyes, and becoming broader at the base posteriorly where it forms a broad depression, thickly covered with hairs. The raised smooth part of the tergite near the lateral extremity is emarginate and ends in a fairly sharp point. The depressed extension of the border furrow curves backwards beneath the 2nd tergite.

3rd tergite small and with a lancet-shaped extremity.

4th tergite with the anterior border cut away by a groove or depression which, like that of the second, is full of hairs, leaving the smooth part lancet-shaped.

5th tergite. The depression is more cut away so as to leave the lancet-point directed more backwards. In the 11th it is less cut away, and the point is rather square and truncated. In the 12th there is no depressed groove; the terminal plate is large, rounded, and almost entirely of the peculiar tortoise-shell appearance.

The legs terminate in a strongly formed hook on one side of the truncated top and a blunt strong spine on the other. Along the internal side of the tarsal joint, below the hook, there are five strong spines. The legs are hairy.

Copulatory feet of the male (Pl. XXXII. figs. 79, 91). Posterior foot: The movable dactylus is long and slender, and composed of two segments of which the proximal is the longest. There is a pad beneath the proximal end of the terminal joint and beneath the distal end of the proximal joint. The immovable dactylus is broad and thin, not so long as the movable, and narrower at the proximal end. Anterior foot: Both movable and immovable feet are single-jointed. The immovable is thin and broad; the movable is stout and curved. There is a soft, hairy pad between them.

The *vulva* of the female consists of two parts on each side, one heart-shaped (see Pl. XXXI. fig. 57), with a slit from the upper end to near the middle; the other a short, stout cap. The copulatory apparatus seems to show a strong resemblance to that of *Sp. hercules*.

SPHÆROPŒUS HERCULES Brandt.

SPHÆROPŒUS MODIGLIANI Silvestri.

The fact of the copulatory feet and vulva corresponding to those drawn by Silvestri, together with the general resemblance to his description of the species from Sumatra, suffices to identify the species; but as his account of the animal shows some points of difference from the Malay specimen, I think the latter must be put down as a new variety.

Length 30 mm. by 16 mm.

Colour castaneous, with slight tinge of green in some lights. Antennæ and legs lighter.

Head broad; upper lip very slightly indented; antennæ very short and thick, with dotted pad at end, punctuated and hairy, especially on lower parts. Forehead with sinuous indentation where the edge of the 1st tergite fits in. Eyes in large circular spot.

1st tergite smooth, not very long; the raised part slopes down to meet the depressed part at a steep angle. In the middle of the back of the tergite, where this slope meets the marginal rim at the sides, there is a flat space between the slope and the marginal rim. The raised part has the shape of a very blunt lancet at the sides. The lower depressed part is bounded by the marginal rim.

3rd tergite. The 3rd tergite is very short and ends in a sharp lancet-point. On the 4th the edge of the lateral extremity is cut away by the lateral groove. The ventral groove is continued up to the penultimate tergite. The surface of the grooves is rough and covered with small tubercles, but is without hairs. The last tergite is smooth and polished like the others.

SPHÆROPŒUS EXTINCTUS Silvestri. (Plate XXXII. fig. 77.)

From Tapelung, Patalung State.

A much mutilated male specimen.

The correspondence of the copulatory feet with those drawn by Silvestri establishes the identity of the species. The colour, however, is different. It is completely black, the legs and antennæ alone having a slight tinge of brown. There is besides no trace of the five striæ described by Silvestri on the 2nd tergite. This and the last species seem to me to be very closely related.

GLOMERIS INFUSCATA Pocock.

From Gunong Inas, Perak State.

CHILOPODA.

SCOLOPENDRA SUBSPINIPES Haase. (Plate XXXII. figs. 66, 72, 75, 76, 99.)

There can, I think, be no doubt that the specimens belong to the species *subspinipes*; but, as in many of the Myriapods in this collection, there are small differences which need a description.

Length about 120 mm. by $7\frac{1}{2}$ mm.

Colour ochre, shading into faint orange on the underpart of the head and at the end of the body, and into dark dull green at the ends of the somites.

Head round, narrowed in front and cut off behind. Antennæ of 20 joints, reaching to the 4th somite. Maxillary coxæ with plates in contact, each with five teeth—two very small, one large and rounded, another two of medium size and well defined. The basal projection stout and without teeth. The two dorsal furrows are discernible on the 3rd somite.

The dorsal plates are margined after the 5th, but the margin is not strongly marked till the 8th. The pleural appendages have two sharply distinct spines, but on examination with a higher-power lens one sees another dark-coloured elevation at the side, which is an imperfect spine. The projection on the anal femur has four spines, two sharp and two not much elevated. The femoral spines are arranged on the internal and under sides of the femur, the two other sides being without them. They are arranged in longitudinal rows. Looking at the under surface and beginning from the outside, one counts 2, then 3, then 3; then passing to the inside beneath the spur there are 2 and 2. Besides the ones just described there are nine others. Of these two are small, two medium-sized, and five large. Both the small ones show the condition of the pleural appendages possessed by the specimen just described, viz., more than two spines at the end. In the case of these small young specimens there are two large spines and two small ones. In all the larger specimens there are only two spines. In all of them there are five maxillary teeth, except in one specimen, where there is another doubtfully distinguishable. The anal femoral spine also shows in the small specimens four spines at the end, while in the larger there are but two. In the larger animals the colour somewhat resembles a dull ochre or olive-brown, while the first two somites are clearer in colour. In the largest the green tinge of the end of the somites is almost gone. The length of the largest specimen is 130 mm. without the anal legs; the length of the anal legs 25 mm. Smallest specimen 65 mm.; anal legs 15 mm. The number of spines on the legs varies from five to thirteen; there are, however, always two in a line beneath the femoral spine, looking at the animal from above, giving the appearance shown in Haase's plate.

Scolopendra hardwickii Haase, var. nov. (Plate XXXII. figs. 101, 102.)

Two specimens, the structure of which corresponds so closely with that described by Haase, that they must be put down as a variety of that species in spite of the great difference in colour.

Colour. A dark copper-colour all over, a little lighter on the ventral surface. Claws black.

Head broad and round, narrowed in front. Depression in front between the eyes, resembling a frontal furrow. Antennæ with 19 joints reaching to the 3rd somite. Poison-claws strong, with rather inconspicuous basal projection which has two small prominences. Maxillary teeth six, clear and regular. The plates on which the teeth are placed have a transverse furrow at their base. The top of the head is slightly punctated. The dorsal furrow begins from the 3rd somite. The margins of the dorsal plates begin from the 5th somite and are clear and prominent. Ventral furrows distinct. The rest of Haase's description applies, with the exception of the spine on the first metatarsal of the præanal legs. I can find no such spine in these specimens. Also the pleural appendages have two spines at their points.

The length of this specimen is 140 mm. by 12 mm. Anal legs 23 mm.

The second specimen is curiously malformed. The præanal leg on one side has the first two joints about the normal length, but thin and flat; they are followed by three very short thick joints. The anal leg on the same side is small and slender, smaller than any of the other legs and without any spines.

Scolopendra aringensis, sp. nov. (Plate XXXI. fig. 46, and Plate XXXII. figs. 67, 85, 86, 93.)

From Kuala Aring, Kelantan State.

This species bears a great resemblance to *Sc. meyeri* Haase, and I think is closely related to it. The points of difference are, however, sufficient to make it necessary to describe it as a new species.

Length 80 mm. by 8 mm. Anal claws 25. Antennæ 20-jointed. Length of head 7 mm.; breadth of head $6\frac{1}{2}$ mm.

Colour dark olive-green. Head and 1st somite dark brown with greenish tinge. The middle part of the tergites is rather brown than green, the green tinge being more apparent on the edges. The antennæ and legs are clear yellow-brown, but the anal legs are olive-brown with a green tinge after the first joint. The sternal plates are olive-brown.

Head smooth, slightly punctated, narrowed in front. Antennæ with 19 joints, extending to 4th somite. Maxillary teeth five on each plate, distinct. Basal projection with two black protuberances running into one another near the point and a distinct one near the base, at some distance from the other two. The maxillary palp with one centre claw and two small spines. The ventral furrows begin on the 3rd somite, the margins of the dorsal plates are distinct on the 8th. The long pleural appendages have two small spines one above the other, so that when looked at from above there seems to be a single spur. The anal legs are long and slender. The femoral spur is long and, like the pleural appendages, has two spines one above the other. Just posterior to the spur there is a single spine; posterior and inferior to that there is another, and two more on the other side. The præanal legs are without spines. The anal dorsal plate is 4 mm. broad and 5 mm. long, with a strong margin and cut away above the anal femora.

OTOSTIGMA ORIENTALE, var. nov. (Plate XXXI. figs. 49, 55, 58, 59, 62.)

From Kuala Aring, Kelantan State; and Gunong Inas, Perak State.

This beautiful little Myriapod seems to me to stand between *Ot. orientale* of Pocock and *Ot. nemorensis* of Silvestri.

Length 45 mm. by 4 mm. Anal legs 21 mm. Head $3\frac{1}{2}$ mm. by 4 mm. Anal dorsal plate $2\frac{1}{2}$ mm. by 2 mm.

Colour. Head and 1st somite reddish brown with green tinge at anterior edge of 1st somite and anterior end of head. Other somites metallic green, except last two somites, which have the same tinge as head. Legs pale green. Underside of head and pleural appendages red-brown. Anal legs with first joint pale green; next joint pale bluish green with dark blue band; 3rd, 4th, and 5th joints the same; end joint pale blue-green. Præanal with the first two joints pale green; next two pale bluish green with dark blue band; end joint pale green. Other legs with dark blue band on last two joints.

Head rather oval in shape, slightly punctated. Antennæ with 21 joints. Maxillary teeth three; two of these are close together, the third more remote. Basal protuberance with five small distinct teeth. Poison-claws long and thin. Margins of dorsal plates distinct on 9th plate; ventral furrows on 3rd. Anal dorsal plate with median longitudinal indentation. Pleural appendages with two spines at the end and one more remote. Anal legs long and thin; 4 spines in transverse row, then 3, then 3.

OTOSTIGMA ACULEATUM, var. nov. (Plate XXXI. fig. 38, and Plate XXXII. figs. 92, 94, 98.)

From Kuala Aring, Kelantan State.

This specimen agrees in many points with *Ot. aculeatum* of Haase, but has some differences.

Length about 50 mm. by 5. Anal legs 25. Head 4 mm. by $4\frac{1}{2}$.

Colour. Head and first segment ferruginous; rest dull olive-brown. Legs very pale, almost white. Pleural appendages ferruginous. Sterna pale.

Head. Length and breadth almost equal. Surface slightly punctated. Antennæ seventeen joints, reaching to four somites; end joints rather large, very distinct and pearl-like. The left-hand antenna shows an individual malformation. The first four joints are thick, then the antenna suddenly diminishes in size. In the right antenna the diminution in size is gradual.

Maxillary teeth. The outside one on each coxal plate is large and distinct; inside there are two fused and indistinct, and showing further imperfect division. The basal projection is indistinctly toothed and somewhat cut away at the base. The maxilipede shows a ridge edged with bristles from the claw to halfway up the first joint; the second joint has a projection on the underside (Pl. XXXII. fig. 94).

The pleural appendages are long and show three spines at the end and two some way down. The anal legs have spines 4, 5, 1, 5. The last four sternal plates are prolonged in the middle over the succeeding ones. The differences in the colour and proportion (great length of the anal legs) and in the arrangement of the spines render it questionable whether this specimen should not be regarded as a separate species.

There are two much younger specimens of the same species from Tapelung and Bukit Besar. The anal legs of one have a faint livid tinge at the end; the other has a dark greenish line down its back.

MECISTOCEPHALUS PUNCTIFRONS Newp.

From Kuala Aring, Kelantan State.

SCUTIGERIDÆ.

SCUTIGERA LONGICORNIS Haase.

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EXPLANATION OF THE PLATES.

Plate XXX.

Fig. 1. *Siphonophora longirostris.* Head from side, p. 508.
2. ,, ,, Head and first tergite from above.
3. ,, ,, Tail from below.
4. *Platydesmus kelantanicus.* Segments 1, 2, 3, p. 508.
5. *Siphonophora longirostris.* Leg, p. 508.
6. *Platydesmus kelantanicus.* Tail, p. 508.
7. ,, , Mandible.
8. ,, ,, Hypostoma.
9. ,, ,, Antenna.
10. *Platyrhacus humberti*, var. Head and first tergite, p. 509.
11. ,, ,, ,, Front of head.
12. ,, ,, ,, Tail from above.
13. ,, ,, ,, Tail from below.
14. ,, *marginellus.* Copulatory foot, p. 511.
15. ,, *humberti.* Keel, p. 509.
16. *Strongylosoma bipunctatum.* Copulatory foot, p. 519.
17. *Platyrhacus marginellus.* Head, first and second tergites, p. 511.
18. ,, ,, Tail from below, p. 511.
19. ,, *kelantanicus.* Tail from above, p. 512.
20. ,, *marginellus.* Sixteenth keel, p. 511.
21. ,, *kelantanicus.* Forehead, p. 512.
22. ,, *marginellus.* Tail from above, p. 511.
23. *Strongylosoma fuscocollaris.* Copulatory foot, p. 519.
24. *Platyrhacus kelantanicus.* Seventeenth keel, p. 512.
25. ,, ,, Head and first tergite.
26. *Spirostreptus dorso-lineatus.* *a.* Tail; *b.* Head, p. 523.
27. ,, *vittatus.* Head, p. 525.
28. ,, ,, Tail.
29. ,, *rubripes.* Tail, p. 523.
30. ,, ,, Head.
31. *Platyrhacus kelantanicus.* Copulatory foot, p. 512.

Plate XXXI.

Fig. 32. *Platyrhacus kelantanicus*, var. Forehead, p. 513.
33. ,, ,, ,, Head and first tergite.
34. ,, ,, ,, Seventeenth keel.
35 ,, *beccarii.* Head and first tergite, p. 514.
36. ,, ,, Tail from above.
37. ,, *pfeifferæ.* Forehead, p. 515.
38. *Otostigma aculeatum.* Anal leg, p. 530.
39. *Strongylosoma skeatii.* Tail from above, p. 520.
40. *Platyrhacus insularis.* Forehead, p. 516.
41. ,, ,, Head and first tergite.
42. ,, *kelantanicus*, var. Copulatory foot, p. 513.
43. *Strongylosoma bipunctatum.* Tail from above, p. 519.

Fig. 44. *Platyrhacus pfeifferæ.* Tail from above, p. 515.
45. ,, ,, Head from above.
46. *Scolopendra aringensis.* Legs from dorsal, p. 529.
47. *Platyrhacus insularis.* Tail from below, p. 516.
48. ,, *pfeifferæ.* Tail from below, p. 515.
49. *Otostigma orientale.* Anal tergite, p. 530.
50. *Platyrhacus pfeifferæ.* Seventeenth keel, p. 515.
51. ,, *beccarii.* Tail from below, p. 514.
52. ,, *insularis.* Sixteenth keel, p. 516.
53. ,, ,, Tail from above.
54. *Doratonotus cavernicola.* Median tubercle from front, p. 521.
55. *Otostigma orientale.* Maxillipede, p. 530.
56. *Platyrhacus kelantanicus*, var. Tail from above, p. 513.
57. *Sphæropæus evansi.* Vulva, p. 526.
58. *Otostigma orientale.* Anal leg, p. 530.
59. ,, ,, Pleural appendage.
60. *Platyrhacus beccarii.* Fifteenth keel, p. 514.
61. *Strongylosoma bipunctatum.* Head and first tergite, p. 519.
62. *Otostigma orientale.* Poison-claw, basal projection, and maxillary teeth, p. 530.

PLATE XXXII.

Fig. 63. *Platyrhacus malaccanus.* Forehead, p. 517.
64. ,, ,, Head and first tergite.
65. ,, ,, Tail from below.
66. *Scolopendra subspinipes.* Maxillary teeth, p. 528.
67. ,, *aringensis.* Femoral appendage, p. 529.
68. *Platyrhacus malaccanus.* Tail from below, p. 517.
69. *Doratonotus cavernicola.* Whole animal, p. 521.
70. ,, ,, First two segments.
71. ,, ,, Tail.
72. *Scolopendra subspinipes.* Anal legs from below, p. 528.
73. *Doratonotus cavernicola.* Keel, p. 521.
74. ,, ,, Sterna and spiracles.
75. *Scolopendra subspinipes.* Femoral appendage, p. 528.
76. ,, ,, Pleural appendage.
77. *Sphæropæus extinctus.* Anterior copulatory foot, p. 527.
78. *Doratonotus cavernicola.* Part of hypostoma (maxilla and maxillary appendages), p. 521.
79. *Sphæropæus evansi.* Anterior copulatory foot, p. 526.
80. ,, ,, Leg.
81. *Strongylosoma fuscocollaris.* Segment showing patch, p. 519.
82. *Doratonotus cavernicola.* Median tubercle from side, p. 521.
83. *Sphæropæus evansi.* Front of head, p. 526.
84. *Cambala calva.* Head, p. 522.
85. *Scolopendra aringensis.* Basal projection and maxillary teeth, p. 529.
86. ,, ,, Maxillipede.
87. *Platyrhacus malaccanus.* Keel, p. 517.
88. ,, ,, Hexagonal markings of surface magnified.
89. *Strongylosoma nodulosum.* Copulatory foot, p. 518.
90. ,, *bipunctatum.* First three keels from below, showing pleural keels, p. 519.
91. *Sphæropæus evansi.* Posterior copulatory foot, p. 526.
92. *Otostigma aculeatum.* Pleural appendage, p. 530.
93. *Scolopendra aringensis.* Pleural appendage, p. 529.
94. *Otostigma aculeatum.* Maxillary teeth and basal projection, p. 530.
95. *Strongylosoma bipunctatum.* Tail from below, p. 519.
96. ,, *skeatii.* End of tail from above, magnified, p. 520.
97. ,, ,, Forehead.
98. *Otostigma aculeatum.* Maxillipede, p. 530.
99. *Scolopendra subspinipes.* Anal legs from above, p. 528.
100. *Strongylosoma skeatii.* Head and three tergites from side, p. 520.
101. *Scolopendra hardwickii.* Normal anal legs, p. 529.
102. ,, ,, Malformed anal legs.

2. On the Crustacea collected during the "Skeat" Expedition to the Malay Peninsula, together with a Note on the Genus *Actæopsis*. By W. F. Lanchester, M.A., King's College, Cambridge[1].

Part I.—BRACHYURA, STOMATOPODA, and MACRURA.

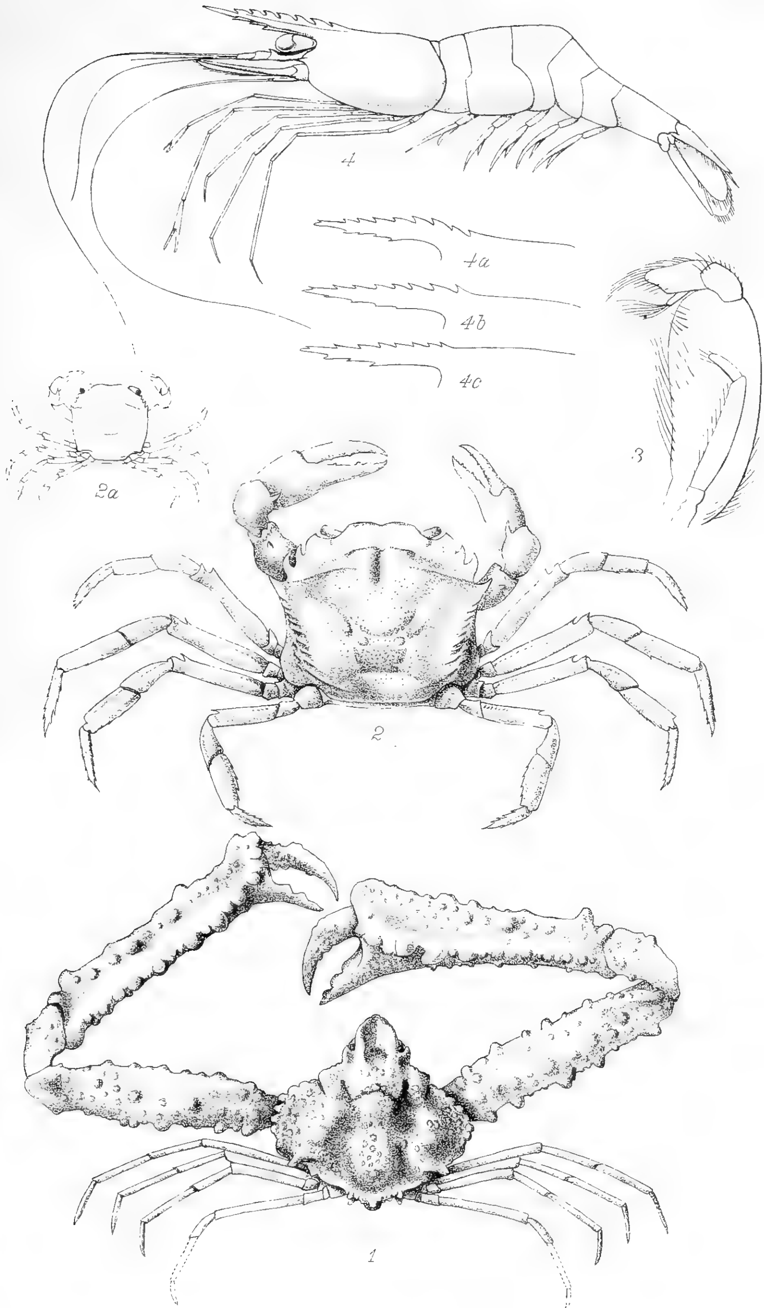
[Received November 15, 1901.]

(Plates XXXIII. & XXXIV.[2])

Owing to the number of species that are represented, through the different groups, in the Crustacea collected by the "Skeat" Expedition, I have thought it best to divide the account of them into two parts: the present paper dealing with the groups mentioned above, the second paper to deal with the remaining groups—namely, the Anomura, Arthrostraca, and Cirripedia.

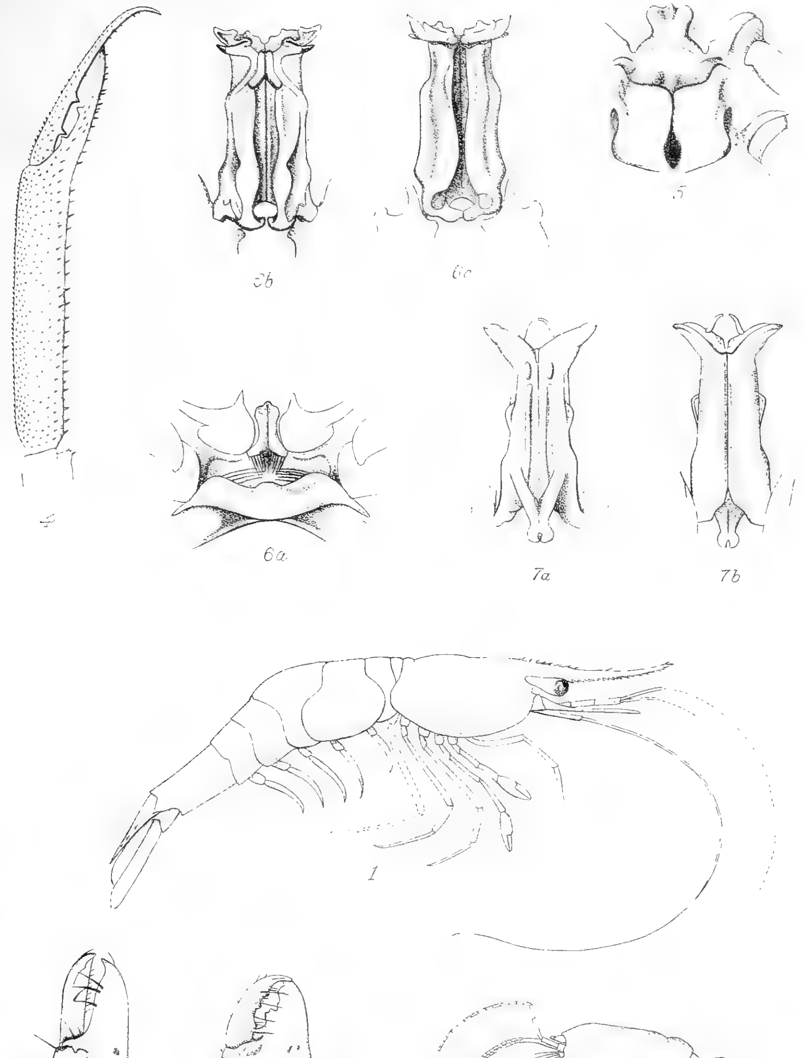
The present part deals systematically with 90 species, comprised in 48 genera, so that the collection may be seen to be very fairly representative; though the Oxyrhyncha, among the Brachyura, are represented but poorly and the Leucosiid group of the Oxystomata not at all. Of these 90 species, moreover, I have found it necessary to describe 6 as new—2 among the Brachyura, 4 among the Macrura,—and to refer 2 forms among the Macrura to new varieties of already-known species. Further, I will note that 50 of the species were obtained from localities on the east coast of the Peninsula, 29 from the west coast, 5 from localities on either coast (*i. e.*, common to both), and 6 of uncertain locality. The small number of forms common to both coasts is not surprising; from two more closely situated localities, Singapore and Malacca, I myself only succeeded in obtaining 12 common forms out of 120 species of crabs, and this I believe to be due very largely to the differing nature of the sea-bottom, currents, &c., in different parts of the same large area. Not that I wish to give undue prominence to this particular reason: the amount of time spent or the facilities available in different localities are varying; and, if I may judge from my own experience, there is a disposition in the collector not to overload his probably limited stock of bottles with specimens he remembers to have already collected elsewhere. These causes may easily bring it about that the number of "common" forms is apparently so small. Notwithstanding this, however, I am inclined to think that the smallness of the number is not entirely apparent, but in part real; and what I would point out is that the value of any collection from a given area would be greatly enhanced were a species, or better a group of species, dealt with distributionally, so that each specimen, or group of specimens, collected might be accompanied by notes on the points I have mentioned above (*i. e.*, all details of habitat), in addition to the note of simple locality. For, besides the broad areas of distribution that may be peculiar to a species, there are again

[1] Communicated by Dr. S. F. Harmer, F.Z.S.
[2] For explanation of the Plates, see p. 574.



Edwin Wilson, Cambridge.

CRUSTACEANS FROM THE MALAY PENINSULA.



Edwin Wilson, Cambridge.

CRUSTACEANS FROM THE MALAY PENINSULA.

smaller areas within the broad areas, and still smaller areas (habitats) within these, peculiar to that species; and it is these smallest, quite local, areas to which attention needs to be directed in order to elucidate the causes of confinement to a special habitat, or, on the other hand, to answer the question: Does the same species adopt the same habitat in different distributional areas? I have already noted (P. Z. S. 1900, "On Crustaceans from Singapore and Malacca") how certain Leucosiids were obtained there from mud which had been found by Adams and White ('Samarang' Crustacea) in the China Sea on a clean sandy or rocky bottom. Such a difference of habitat is most striking and seems to me to require explanation: this explanation, however, can hardly be arrived at until more data of a similar kind are forthcoming.

I have taken my measurements of length and breadth in a similar way to those given in my paper already cited (*vide* P. Z. S. 1900, p. 720). In those cases, however, in which no supraocular or præocular spine is present (Macrura &c.) I have measured from the upper internal angle of the orbit. The units are in millimetres, and the first figure given in each case stands for the breadth.

I. Genus Doclea Leach.

1. Doclea canalifera Stimpson.

Doclea canalifera, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 217 (1857); Alcock, Journ. As. Soc. Beng. lxiv. 2, p. 228 (1896).

Loc. Pulau Bidan, Penang.

A single male; all the legs absent.

This individual agrees closely with Major Alcock's description; but there are two small points which may be noticed in connection with it, as neither Major Alcock nor Stimpson make any mention of them. On the gastric region are "some minute tubercles followed by a spine." The number of the tubercles here in front of the spine is five, of which the two anterior lie transversely close to each other, exactly at the level of the back of the orbits, each tubercle corresponding to one of the posteriorly coalesced rostral spines, the distinction of the two being still indicated at this level.

Besides the oblique line of tubercles on the hepatic region, moreover, there may be seen three more in front of this line, one in front of, and the other two (transversely placed) behind, the level of the first lateral spine.

Dim. 23 × 25·5.

II. Genus Schizophrys White.

2. Schizophrys aspera M.-Edw.

Mithrax aspera, M.-Edw. Hist. Nat. Crust. i. p. 320 (1834).

Dione affinis, de Haan, Crust. Japon. p. 94, pl. xxii. fig. 4 (1839).

Schizophrys aspera, A. M.-Edw. Nouv. Arch. Mus. viii. p. 231, pl. x. fig. 1 (1872); Hasw. Cat. Austr. Crust. p. 22 (1881).

Loc. Pulau Bidan, Penang.

A female.

The points of the rostral horns are sharply curved upwards and inwards in this specimen. A typical form, with a single spinule at the base of each rostral spine.

Dim. 22 × 25.

Breadth taken between bases of *penultimate* lateral teeth.

III. Genus Hyastenus White.

3. Hyastenus diacanthus de Haan.

Pisa (*Naxia*) *diacantha*, de Haan, Crust. Jap. p. 86, pl. xxiv. fig. 1 (1839).

Hyastenus diacanthus, Miers, 'Alert' Crust. p. 194 (1884); de Man, Arch. f. Naturg. liii. i. p. 220 (1887); Alcock, Journ. As. Soc. Bengal, lxiv. 2, p. 210 (1896).

Loc. Trengganu.

A fine female with ova.

Carapace creamy-coloured, splashed with red; two, quite low, tubercles on the gastric eminence, one in front of the other, and a very low one, hardly distinct, on the uro-cardiac region. Also another low tubercle, situate on the anterior branchial region a little in front of a line joining the epibranchial spine and posterior gastric tubercle, and lying a little nearer the former than the latter.

Dim. 26·5 × 34·5.

IV. Genus Micippa Leach.

4. Micippa mascarenica Kossmann.

Micippa philyra, Leach, Zool. Misc. iii. p. 16 (1817) (nec *M. philyra*, Herbst).

Micippa philyra, var. *mascarenica*, Kossm. Zool. Ergebn. p. 7, pl. iii. fig. 2 (1877).

Micippa mascarenica, Miers, Ann. Mag. Nat. Hist. (5) xv. p. 7 (1885); Lanchester, P. Z. S. Lond. p. 725 (1900).

Loc. Pulau Bidan, Penang.

A full-grown male; of the legs only one chelipede remains. There are six teeth present behind the postorbital tooth. Mobile portion of antenna a little less than half the length of the carapace, second joint just one-quarter breadth of rostrum at its own point of origin. The single chelipede is quite smooth, except for a few separate and minute granules on the distal portion of the upper margin of the arm. The fingers meet along their distal half.

Dim. 24 × 28.

Breadth taken between bases of *penultimate* lateral teeth.

V. Genus Lambrus Leach.

5. Lambrus longimanus Linn.

Cancer longimanus, Linn. Syst. Nat. (ed. xii.) p. 1047 (1766).

Lambrus longimanus, M.-Edw. Hist. Nat. Crust. i. p. 354 (1834); Miers, Ann. Mag. Nat. Hist. (5) iv. p. 20 (1879); Alcock, Journ. As. Soc. Beng. lxiv. 2, p. 260 (1896).

Loc. Kota Bharu, Kelantan.
Two males.
Dim. 2 ♂♂ 28·5 × 25.

6. Lambrus lippus, sp. n. (Pl. XXXIII. fig. 1.)

Loc. —— ? A male.

A *Lambrus* with the walking-legs perfectly smooth, merus and carpus rounded, propodus flattened. Carapace raised into four prominences—one on the gastric region, one on the cardiac, and one on each branchial. The gastric prominence is flattened above; the cardiac is rather globular, bluntly pointed above; each branchial forms an oblique ridge with very rounded upper edge. Each of these prominences is covered with flattened raspberry-like granules; and each branchial bears, moreover, a large rounded tubercle at the middle of its upper edge and a tall pedicled tubercle, quite smooth, at the hinder portion of its upper edge where the prominence ends, falling quite abruptly straight down to the postero-lateral border of the carapace above the base of the third pair of walking-legs. The depressions between these prominences are deep, rather smooth, with scattered similar granules. The rostrum is very prominent, vertically thick, with the tip slightly deflexed, its upper surface deeply excavate as far back as the gastric prominence, its sides coarsely wrinkled. Sides of carapace edged with low raspberry-like tubercles, which are more distinct behind; just in front of the middle of the border is a deepish cleft, which continues on to the carapace as a shallow basin-like hollow. Pterygostomian regions flattened and smooth, but with a line of tubercles parallel with, and similar to, those on the antero-lateral border.

Chelipedes very long, with prominent granular tubercles, of varying size, on their anterior and posterior borders, and much lower similar tubercles on their lower borders. Upper surface of arm with a prominent row of these tubercles, nearer the posterior margin than the anterior; proximal half of the upper surface of the hands with a similar row in a similar position, continued distally, quite suddenly, as a double row of small tubercles. General upper surface otherwise smooth; general under surface also smooth, but with more frequent separate tubercles, which tend to be arranged in longitudinal rows.

Sternal surface with irregularly scattered smooth granules, one much larger on each side at the base of the chelipedes. Abdomen with occasional smooth granules and a conical spine on the penultimate joint.

Dim. 40 × 34.

VI. Genus Cryptopodia M.-Edw.

7. Cryptopodia fornicata Fabr.

Cancer fornicatus, Fabr. Ent. Syst. ii. p. 453 (1781).

Cryptopodia fornicata, M.-Edw. Hist. Nat. Crust. i. p. 362 (1834); de Haan, Crust. Japon. p. 90, pl. xx. fig. 2 (1839); Hasw. Cat. Austr. Crust. p. 37 (1882).

Loc. Kota Bharu, Kelantan.

A female with ova. The posterior portion of the upper and under surfaces of the carapace are covered by an encrusting Polyzoon, and the tube of a worm is to be seen on the under surface about the level of the chelipedes.

Dim. 54·5 × 31·5.

VII. Genus Atergatis de Haan.

8. Atergatis integerrimus Lam.

Cancer integerrimus, Lam. Hist. An. sans Vert. v. p. 272 (1818).

Atergatis integerrimus, de Haan, Crust. Japon. p. 45, pl. xiv. fig. 1 (1839); Alcock, Journ. As. Soc. Bengal, lxvii. 2, p. 95 (1898).

Loc. Pulau Bidan, Penang.

Four males and a female.

The characters given by Major Alcock as distinguishing this species from *A. dilatatus* de Haan are not entirely satisfactory. I have examined two dried specimens in the Natural History Museum, however, which exhibited this distinction of characters very well, excepting that both species possessed comb-like bristles on the ischia and meri of the legs. Major Alcock's four examples, moreover, of *A. dilatatus* were quite distinct. But in dealing with the present individuals, although I can unhesitatingly refer them to Lamarck's species, still I find them in some instances presenting characters referred by Major Alcock to *A. dilatatus*. Of these characters two are very well marked. The one is the presence of the comb-like bristles to which I have referred in the case of the Natural History Museum specimen, which occurs in four out of the five individuals; the other is the dense hairiness of the outer surface of the third maxillipedes, which is found in two instances, while in two others I should describe this surface as moderately hairy.

I was able to find only one specimen of *A. dilatatus* at the Natural History Museum, judging from which I should say that the most marked points of difference between the two species were the much closer pitting of carapace and legs, amounting even to faint rugosity, and the crowded confluent granules on the sternum in *A. dilatatus*; the greater relative breadth of the latter may also be taken into account. As regards the greater or less definition of the cardiac region, it may be said that there is a slight variation in this respect in these examples, though in none is the region really well defined.

Dim. ♂ 40 × 24. ♂ 34 × 20·5. ♂ 33 × 20. ♂ 30·5 × 18·5. ♀ 41 × 25.

9. Atergatis floridus (Rumph.).

Cancer floridus Rumph., D'Amboin. Rariteitkamer, p. 16, pl. viii. fig. 5 (1741); de Haan, Crust. Japon. p. 46 (1839).

Atergatis floridus, de Man, Merg. Crust. p. 24 (1888); id. Zool. Jahrb. Syst. viii. p. 498 (1895).

Loc. One very damaged male, just moulted, from Kelantan. One male and three females from Pulau Bidan, Penang.

Dim. ♂ 24 × 34·5. ♀ 30·5 × 44. ♀ 28 × 40·5. ♀ 20 × 28.

Breadth taken is *greatest* breadth.

10. Atergatis roseus Rüpp.

Carpilius roseus, marginatus, Rüpp. Beschreib. 24 Krabben, p. 13, pl. iii. fig. 3 (1830).

Atergatis roseus, Kossm. Zool. Ergebn. pp. 19–21 (1877); Lanchester, P. Z. S. Lond. p. 730 (1900).

Loc. Pulau Bidan, Penang.

Four males.

These all belong to Kossmann's variety *scrobiculatus.* In the two smallest the white portion is margined with a red line close to and in line with the external edge of the sides and front; in the other two this line is present but very faint. In the two smallest examples the red colour of the carapace is lighter, with a tendency to cream-yellow.

Dim. 19·5 × 12. 15 × 9. 14 × 7·75. 5·5 × 3.

Breadth taken is *greatest* breadth.

VIII. Genus Chlorodius Rüpp.

11. Chlorodius niger Forskål.

Cancer niger, Forsk. Descr. Anim. p. 89 (1775).

Chlorodius niger, de Man, Merg. Crust. p. 32 (1888); id. Zool. Jahrb. Syst. viii. p. 519 (1895).

Loc. Kelantan.

A male, damaged; only carapace and right chela present. There are five teeth on the antero-lateral margins, including the external orbital angle; the last of these is obtusely spiniform on the left side, but not on the right.

Dim. 12 × 8.

IX. Genus Chlorodopsis.

12. Chlorodopsis melanochirus A. M.-Edw.

Chlorodopsis melanochirus, A. M.-Edw. Nouv. Arch. Mus. ix. p. 228, pl. viii. fig. 5 (1873); de Man, Arch. Naturg. liii. i. p. 281 (1887); Hasw. Cat. Austr. Crust. p. 55 (1882).

Loc. Kelantan.

Five males and four females, the latter all bearing ova. They are in a very broken state, a great many of the legs being missing. Six of the chelipedes are present, three from the right and three from the left side, and in these I note the following two points:—

a. The presence, in all, of 4–5 whitish spines on the posterior border of the arms. These are closely similar to those on the antero-lateral borders; they are, however, easily overlooked while the chelipedes are yet attached to the carapace, both through the nature of the background and the presence of longish brown hairs on the border.

b. In only one does the black colour of the fingers extend laterally and beneath to the neighbourhood of the carpal articulation; in the others it reaches quite a little way on to the lower border of the hand.

Dim. ♂ 10 × 7. ♂ 10·25 × 7. ♂ 10 × 7. ♂ 9·5 × 6·5. ♂ 7×5. ♀ 10×7. ♀ 10×7. ♀ 7·5×6. ♀ 8×5·5.

X. Genus LEPTODIUS A. M.-Edw.

13. LEPTODIUS EXARATUS M.-Edw.

Chlorodius exaratus, M.-Edw. Hist. Nat. Crust. i. p. 402 (1834).

Xantho affinis, de Haan, Crust. Japon. p. 48, pl. xiii. fig. 8 (1839).

Leptodius exaratus, A. M.-Edw. Nouv. Arch. Mus. ix. p. 222 (1873); de Man, Zool. Jahrb. viii. p. 521 (1895).

Loc. Pulau Bidan, Penang.

Two males and a female.

Dim. ♂ 16×10·5. ♂ 14·5×10. ♀ 10×7.

14. LEPTODIUS CAVIPES Dana.

Chlorodius cavipes, Dana, U.S. Expl. Exp. p. 212, pl. xii. fig. 1 (1852); de Man, Mergui Crust. p. 34 (1888); Alcock, Journ. As. Soc. Bengal, lxvii. 2, p. 122 (1898).

Loc. Pulau Bidan, Penang.

A male and a small female.

The "wrinkling" on the chelipedes in the male tends to the formation of deepish wide-mouthed pits on the carpus and to a slight degree on the upper margin of the hand. In the female the two lobes of the front are much more prominent near the middle line than at the sides, giving it a cupid's-bow-shaped appearance; the grooves, too, on the sides of the carapace are more marked than in the male.

Dim. ♂ 20·5×13·5. ♀ 13·5×9.

XI. Genus XANTHO Leach.

15. XANTHO SCABER Fabr.

Cancer scaber, Fabr. Ent. Syst. Suppl. p. 336 (1798).

Xantho scaber, M.-Edw. Hist. Nat. Crust. p. 390 (1834).

Loc. Kelantan.

One male.

This single individual agrees entirely with the descriptions cited, so far as they go. The tubercles on the middle regions of the carapace are smooth and rounded, on the sides and front they become conical; those on the outer faces of the wrists and hands are rounded, but larger than those on the middle regions of the carapace, and pointed tubercles are present on the upper borders of the carpus and propodus of the walking-legs. The pterygostomian regions are covered with rather flattened granules and are deeply grooved, the grooves being continuous with those between the ill-defined lateral teeth; these latter are four in number, of which the last is more pointed and more clearly defined than the others. The carapace and the outer face of the wrists and hands of the chelipedes are clothed with short bristles between and around the tubercles, thickly on the chelipedes, but very scantily on the carapace; these bristles are also placed rather thickly on the upper borders of the carpus and propodus of the walking-legs. Other finer and somewhat longer hairs are scattered over the whole animal, noticeably on the upper borders of the meropodites of all the legs. The inner faces of the chelipedes and lower faces of the legs are quite smooth, except for a few hairs. General colour, in formol, pinkish red blotched with bluish white.

Dim. 35 × 27.

XII. Genus Epixanthus Heller.

16. Epixanthus frontalis M.-Edw.

Ozius frontalis, M.-Edw. Hist. Nat. Crust. i. p. 406 (1834).

Epixanthus frontalis, A. M.-Edw. Nouv. Arch. Mus. ix. p. 241 (1873); Alcock, Journ. As. Soc. Bengal, lxvii. 2, p. 185 (1898).

Loc. —— ?

Two males.

Dim. 29·5 × 18. 20·5 × 13.

XIII. Genus Actumnus Dana.

17. Actumnus setifer de Haan.

Cancer (Pilumnus) setifer, de Haan, Crust. Japon. p. 50, pl. iii. fig. 3 (1839).

Actumnus setifer, A. M.-Edw. Nouv. Arch. Mus. i. p. 287, pl. xviii. fig. 5 (1865); Miers, 'Alert' Crust. p. 225 (1884).

Loc. Pulau Bidan, Penang.

A male.

Dim. 20 × 15.

XIV. Genus Pilumnus Leach.

18. Pilumnus vespertilio Fabr.

Cancer vespertilio, Fabr. Ent. Syst. Suppl. p. 338 (1798).

Pilumnus vespertilio, M.-Edw. Hist. Nat. Crust. i. p. 418 (1834); Alcock, Journ. As. Soc. Bengal, lxvii. 2, p. 192 (1898).

Loc. Kelantan. Two from Pulau Bidan, Penang.

Twenty males and twenty-four females, one of the latter with ova.

Dim. ♂ 19·5 × 15. ♂ 24 × 19. ♂ 23 × 17. ♂ 18 × 4. ♂ 13·75 × 10. ♂ 10 × 7. ♀ 20 × 15·5. ♀ 18 × 13. ♀ 16 × 12. ♀ 16 × 11·5. ♀ 13·5 × 9. ♀ with ova 20 × 15·5.

19. Pilumnus sluiteri de Man.

Pilumnus sluiteri, de Man, Weber's Zool Ergebn. ii. p. 283, pl. i. fig. 2 (1892); Alcock, Journ. As. Soc. Bengal, lxvii. 2, p. 194 (1898).

Pilumnus forskalii, de Man (nec Edw.), Arch. f. Naturgesch. liii. p. 295, pl. xii. fig. 1 (1887).

Loc. Pulau Bidan, Penang.

A male and a female.

The carpopodites of the last four pairs of legs in these two individuals have each a shallow, but very distinct, groove on their upper outer surfaces.

Dim. ♂ 31 × 24. ♀ 30·5 × 23·5.

20. PILUMNUS LÆVIMANUS Dana.

Pilumnus lævimanus, Dana, U.S. Expl. Exp. Crust. i. p. 237, pl. xiii. fig. 11 (1852); A. M.-Edw. Nouv. Arch. Mus. ix. p. 250, pl. x. fig. 4 (1873); de Man, Arch. f. Naturg. liii. i. p. 301 (1887).

Loc. Kelantan.

A small damaged male.

The right chelipede only is present; on the proximal half of the anterior border of the merus are three or four minute, but sharp, teeth as in *P. nitidus*, but none on the posterior border, which, however, terminates in a very blunt low tooth a little before the carpal articulation. The hairy growth on the proximal portion of the hand is continued over the joint on to the external surface of the carpus.

Dim. 5·5 × 3.

21. PILUMNUS NITIDUS A. M.-Edw.[1]

Pilumnus nitidus, A. M.-Edw. Nouv. Arch. Mus. ix. p. 249, pl. x. fig. 2 (1873); de Man, Arch. f. Naturg. liii. i. p. 305 (1887).

Loc. Kelantan.

A single female, rather damaged.

Besides the granular teeth on its anterior margin, the meri of the chelipedes bear on their rather sharp posterior margin 4–5 inconspicuous blunt teeth, the most distal of which is sharper and more prominent than the others, and is placed about 1 mm. behind the carpal articulation.

Dim. 10 × 7·5.

XV. Genus ERIPHIA Latr.

22. ERIPHIA LÆVIMANA, var. SMITHII McLeay.

Eriphia smithii, McL. Annulosa in Smith's Illustr. Zool. S. Afr. p. 60 (1838).

Eriphia lævimana, var. *smithii*, Hilg. Monatsber. Ak. Berlin, p. 797 (1878); Miers, Ann. Mag. Nat. Hist. (5) v. p. 237 (1880).

Loc. Pulau Bidan, Penang.

Seven males and twelve females.

Dim. ♂ 52·5 × 38. ♂ 51 × 38. ♂ 51 × 37. ♂ 49·5 × 37·5.

[1] I have since found that this form should be referred to Dana's *Pseudozius dispar*, with which *P. nitidus* is synonymous (*vide* Calman, Trans. Linn. Soc. ser. 2, Zool. viii. p. 14, 1900).

♂ 47×34. ♂ 47×33. ♂ 40×28. ♀ 60×43·5. ♀ 58×42·5. ♀ 57×43. ♀ 46×34. ♀ 43×30·5. ♀ 32·5×23.

Breadth taken is *greatest* breadth.

XVI. Genus Cymo de Haan.

23. Cymo andreossyi Aud.

Pilumnus ? andreossyi, Audouin, Descr. de l'Egypte, p. 86, pl. v. fig. 6 (1815).

Cymo andreossyi, de Haan, Crust. Japon. p. 22 (1839); Alcock, Journ. As. Soc. Beng. lxvii. 2, p. 173 (1898).

Loc. Kelantan.

A female, rather damaged.

Dim. 10×8·5.

Breadth taken is *greatest* breadth.

XVII. Genus Thalamita Latr.

24. Thalamita crenata Latr.

Thalamita crenata (Latr.), M.-Edw. Hist. Nat. Crust. i. p. 461 (1834); de Man, Merg. Crust. p. 79 (1888); Lanchester, P. Z. S. 1900, p. 748.

Loc. Pulau Bidan, Penang.

Five males and two females.

The following table serves to show the variation in respect to the denticulation of the posterior border of the penultimate joint of the natatory legs:—

		♂.	♀.
Non-denticulate		1	0
Denticulate	Right side only	1	1
	Left side only	1	1
	Both sides	2	0

The number, position, and size of these denticles is quite inconstant.

Dim. ♂ 71 × 46. ♂ 68 × 45. ♂ 63 × 40. ♂ 55·5 × 36. ♂ 49×32. ♀ 57×37. ♀ 55×35·5.

25. Thalamita danæ Stimpson.

Thalamita crenata, Dana, U.S. Expl. Exp., Crust. i. p. 282, pl. xvii. fig. 7 (1852).

Thalamita danæ, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 37 (1858); de Man, Mergui Crust. p. 78 (1888).

Thalamita stimpsoni, A. M.-Edw. Arch. Mus. x. p. 362, pl. xxxv. fig. 4 (1861).

Loc. Pulau Bidan, Penang.

A male of the species and a female of the variety *stimpsoni* In the latter the denticulations on the posterior border of the penultimate joint of the natatory legs are more regular and more marked, and the lobes at the upper internal angle of the eye are straighter and more transverse.

Dim. ♂ 39×25. ♀ 41×25.

XVIII. Genus Neptunus de Haan.

26. Neptunus pelagicus Linn.

Cancer pelagicus, Linn. Syst. Nat. (ed. xii.) p. 1042 (1766).
Portunus (Neptunus) pelagicus, de Haan, Crust. Japon. p. 37, pls. ix., x. (1839).

Loc. Kota Bharu, Kelantan ; Trengganu.

Five males and four females. Of the latter one bears ova, and in another the presence of a parasite in the left branchial cavity goes with an abdomen approaching the male in form.

Dim. ♂ 121·5 × 65. ♂ 98 × 53. ♂ 83 × 45·5. ♂ 83 × 45. ♂ 57 × 31·5. ♀ 100·5 × 55. ♀ 125 × 68. ♀ 66·5 × 37. ♀ 53 × 28.

27. Neptunus (Amphitrite) gladiator Fabr.

Portunus gladiator, Fabr. Ent. Syst., Suppl. p. 368 (1798).
Lupea gladiator, M.-Edw. Hist. Nat. Crust. i. p. 456 (1834).
Neptunus gladiator, A. M.-Edw. Arch. Mus. x. p. 330 (1861); de Man, Mergui Crust. p. 70 (1888).

Loc. Trengganu.

A very large male and a small female, in which the swimming-legs only are present.

In the male the median teeth of the front are much smaller than the submedians, and the lowest external carina on the hand is very strongly developed, forming an obtuse ridge proximally; the ridges on the second and third abdominal segments are also very strong; in these three points it resembles *N. argentatus* White. In the female the abdominal ridges are moderately prominent, and the median frontal teeth, though smaller in size than, are equal in length to, the submedians. In both there is a short blunt spine over the eye as in *N. gladiator*, and there are no traces of the silver sheen found in *N. argentatus*. They certainly belong to *N. gladiator* Fabr., and it seems very possible that *N. argentatus* White is no more than a variety of this species.

The male bears on the legs, first two abdominal segments, and the base of the left antenna some pedunculate Cirripedes, all belonging to the genus *Dichelaspis*, and comprising two or possibly three species.

Dim. ♂ 68 × 43. ♀ 23 × 14.

XIX. Genus Goniosoma A. M.-Edw.

28. Goniosoma natator Herbst.

Cancer natator, Herbst, Naturg. d. Krab. p. 156, pl. xl. fig. 1 (1795).
Goniosoma natator, A. M.-Edw. Arch. Mus. x. p. 370 (1861); de Man, Arch. f. Naturg. liii. i. p. 334, pl. xiii. fig. 5 (1887).

Loc. Pulau Bidan, Penang.

A male, of which the chelipedes are lost.

This individual belongs, without doubt, to Herbst's species. I may note, however, that the frontal lobes are comparatively sharp, though still with blunt points, and separated by rather deep wide fissures—a character apparently correlated with age (*vide* de Man, *t. c.* p. 335).

Dim. 80 × 53·5.

29. GONIOSOMA ORNATUM A. M.-Edw.

Goniosoma ornatum, A. M.-Edw. Arch. Mus. x. p. 376 (1861); Henderson, Trans. Linn. Soc. (2) Zool. v. p. 376 (1893).

Loc. Kota Bharu, Kelantan.

Two males and two females, each with ova.

In one of the females with ova the second antero-lateral tooth on the left side is very rudimentary, being only one-third the size of the first and third.

Dim. ♂ 35 × 24. ♂ 35 × 24. ♀ 32 × 22. ♀ 29·5 × 20.

30. GONIOSOMA AFFINE Dana.

Charybdis affinis, Dana, U.S. Expl. Exp., Crust. p. 286, pl. xvii. fig. 12 (1852).

Goniosoma affine, A. M.-Edw. Arch. Mus. x. p. 384 (1861); de Man, Merg. Crust. p. 80, pl. v. fig. 2 (1888).

Loc. Trengganu.

A male. All the legs absent.

Dim. 21·5 × 14·5.

31. GONIOSOMA CRUCIFERUM Fabr.

Portunus crucifer, Fabr. Ent. Syst., Suppl. p. 364 (1798).

Goniosoma cruciferum, A. M.-Edw. Arch. Mus. x. p. 371 (1861); de Man, Merg. Crust. p. 79 (1888)

Loc. Trengganu.

Three males and a female with ova.

Dim. ♂ 110 × 71. ♂ 40·5 × 27. ♂ 36 × 24·5. ♀ 90 × 60.

32. GONIOSOMA CALLIANASSA A. M.-Edw.

Goniosoma callianassa, A. M.-Edw. Arch. Mus. x. pp. 382, 385 (part.) (1861); Alcock, Journ. As. Soc. Beng. lxviii. 2, p. 57 (1899).

Loc. Kota Bharu, Kelantan.

A female with ova.

The last antero-lateral spine is fully twice as long as that in front of it.

Dim. 22 × 15.

XX. Genus POTAMON Sav.

33. POTAMON (PARATHELPHUSA) SINENSE M.-Edw.

Parathelphusa sinensis, M.-Edw. Arch. Mus. vii. p. 173, pl. xiii. fig. 1 (1854); Henderson, Trans. Linn. Soc. (2) Zool. v. p. 386 (1893).

Loc. Singora; Tale Sap.

Thirteen males and four females.

The rostrum projects less beyond the level of the external orbital angles in the younger individuals, and its margin is a little straighter.

One individual, from Kampong Pateling, is called, according to the label on it, by the name "Ketam Kertak." "Ketam" is the ordinary word for crab; I am unable to find a meaning for the word "Kertak"[1].

Dim. ♂ 47·5 × 39. ♂ 43 × 34. ♂ 43 × 35. ♂ 33·5 × 28. ♂ 27 × 23. ♂ 20·5 × 18. ♀ 40 × 34. ♀ 40 × 33·5. ♀ 22·5 × 19·5.

34. Potamon (Parathelphusa) improvisum[2], sp. n. (Plate XXXIII. fig. 2.)

Loc. —— ?

One female.

In this species the carapace is very depressed posteriorly behind the postfrontal ridge, but in front of this ridge it slopes down rather steeply towards the frontal and antero-lateral margins. The actual front, however, is directed nearly horizontally, and presents a faintly concave upper surface; its anterior margin is rather sharp and its course sinuous, this latter being due to the presence of a broad and shallow notch in the median line, and to the sloping away of its outer angles into the upper orbital borders. The latter are very slightly swollen, noticeably at their internal angles, hardly at all at their external angles, where these run into the extra-orbital teeth; a shallow notch is discernible under the lens at the middle of the border. The orbits themselves are deep, their width is a little more than half that of the front, which is, in turn, one-third of the width of the carapace at its widest point (viz., between the last epibranchial teeth). The lower orbital border, seen under the lens, is crenulate, and presents at its inner angle a distinct tubercular tooth with *two* rounded heads, which are placed so that the one lies *above* the other in the natural position of the animal, and which are separated by a shallow groove, the said groove being continued downwards and backwards nearly to the anterior buccal angles.

The antero-lateral borders are about as long as the front is wide, or two-thirds the length of the postero-lateral, and are armed with four teeth, including the extra-orbital. Of these teeth the 1st is forwardly directed, triangular, blunt, and broad at the base; the 2nd, separated by a very short rounded interval from the 1st, is the smallest of all, forwardly curved, sharp, and conical; the 3rd, separated from the 2nd by a slightly greater rounded interval, is closely similar to the latter, but twice as big; while the 4th, whose tip is as far from that of the preceding tooth as the latter is from the tip of the extra-orbital, is more outwardly directed, its anterior

[1] "Kertak," Mr. Laidlaw informs me, is an orthographical error; the word should have been written "Katak," meaning "a frog."

[2] A similar abbreviated metamorphosis is known for *Potamon fluviatile*, *Dilocarcinus*, and *Trichodactylus* (*cf.* Ortmann, Bronn's Thierreich, v. 2, p. 1098).

border being only slightly curved, and its posterior border practically straight and in line with the postero-lateral border of the carapace; it is also sharp, and a little smaller than the tooth in front of it. The postero-lateral border is straight, inwardly directed, and scored with irregular oblique rugosities, which extend only the least distance on to the carapace.

The frontal ridge is very prominent and sharp, and composed of two quite distinct portions: an outer, starting from the last epibranchial tooth, and extending inwards and slightly forwards, with a faintly sinuous course, to within 2–3 mm. of the mesogastric suture; and an inner, lying as far in front of the outer as this does from the mesogastric suture, and starting internally from the fore part, here rather deep, of the mesogastric suture, and extending, faintly crescent-shaped with forwardly directed concavity, to the level of the external angle of the front, its anterior border shelving very sharply down to the front.

The surface of the carapace is everywhere punctate, the punctæ being distinct and fairly disparate; the cardiac suture is well defined, and the gastric region in front of it is slightly tumid, and a very broad distinct uro-cardial suture is also present. The mesogastric suture starts at the level of the inner frontal ridges, and disappears just behind the level of the outer frontal ridges.

The chelipedes are quite smooth, with a small spine near the distal end of the upper margin of the merus, and a strong spine at the upper inner angle of the carpus; the fingers are as long as the palm, and slightly gaping, with a row of tubercular teeth on their inner edges, two or three of which are bigger than the rest; their tips are somewhat hooked and cross each other.

The four posterior legs present no noteworthy features, excepting that the meri of all bear a fairly strong spine at the distal ends of their upper edges, and the carpi carry a ridge along the middle of their hinder surfaces; in the last pair, however, this ridge is rounded and inconspicuous.

Special interest attaches to this species from the fact that this individual carries beneath the abdomen, attached to the swimmerets, a number (about 100) of young, all of which are fully formed, *i. e.* present the structure of the adult. Such an occurrence has, I believe, never been observed in any other crab, and it points to a quite unusual abbreviation of the metamorphosis, though to what exact extent it is, at present, impossible to say; while the causes of the abbreviation in this case are equally unknown.

Dim. $37 \times 21{\cdot}5$.

35. POTAMON (POTAMONAUTES) STOLICZKANUM W.-Mason.

Telphusa stoliczkana, W.-Mason, Journ. As. Soc. Beng. xl. p. 199, pl. xii. fig. 8 (1871).

Loc. Lacom.

Five females and a smaller male.

I have only to notice that the "baying" of the front is quite inconsiderable in these specimens, though more apparent in some than the others; this, however, appears to be a sexual difference, as Wood-Mason, in giving dimensions of a male and female respectively, adds "the greater difference between the length and breadth in the male specimen is only apparent, being entirely due to the greater mesial excavation of the front." I may add, however, that in this male the front is hardly, if at all, more excavate than in the females.

Dim. ♂ 14·75 × 12. ♀ 31·5 × 23·5. ♀ 30·25 × 23. 2 ♀ ♀ 29·5 × 22·5. ♀ 28·5 × 22·25.

Breadth taken is *greatest* breadth.

XXI. Genus Ocypode Fabr.

36. Ocypode ceratophthalma Pallas.

Cancer ceratophthalmus, Pal. Spicil. Zool. ix. p. 83, pl. v. fig. 17 (1772).

Ocypoda ceratophthalma, Miers, Ann. Mag. Nat. Hist. (5) x. p. 379, pl. xvii. fig. 1 (1882).

Loc. Trengganu; Kelantan.

Eight males and four females.

In two males of dimensions 27·5 × 23 the ocular styles are from 3–4 mm. in length; but in a female of 27 × 20·5 they are barely 1 mm.

Dim. ♂ 44 × 37·25. ♂ 43·5 × 39. ♂ 43 × 39. ♂ 42·5 × 38. ♂ 40·5 × 36·5. ♂ 35 × 30. 2 ♂ ♂ 27·5 × 23. ♀ 40 × 35. ♀ 35 × 30·5. ♀ 27 × 20·5. ♀ 20·5 × 16.

37. Ocypode cordimana Latr.

Ocypoda cordimana (Latr.), M.-Edw. Hist. Nat. Crust. ii. p. 45 (1837); de Man, Notes Leyd. Mus. iii. p. 248 (1881); Miers, Ann. Mag. Nat. Hist. (5) x. p. 387, pl. xvii. fig. 9 (1882).

Loc. Trengganu; Kelantan.

Three females.

Dim. ♀ 20 × 16. ♀ 18 × 15. ♀ 15 × 12.

38. Ocypode convexa Quoy et Gaimard.

Ocypoda convexa, Quoy et Gaim. Voy. 'Uranie,' Zool. p. 525, pl. xvii. fig. 2 (1824); Nobili, Ann. Mus. Civ. Stor. Nat. Genova, (2) xx. p. 518 (1900).

Loc. Trengganu.

Four males and four females.

Dr. Nobili has recently (*l. c.*) amplified the original description of this species; and in order to assure myself of the identity of the present form with that species, I sent examples to Dr. Nobili, who very kindly compared them for me with the specimens he had described from Sarawak, and informs me that they are identical. "The only difference," he adds, "is that the greater hand is a little more swollen, and the finger a little shorter, in the specimen (♂) from Sarawak, which is somewhat smaller."

One of the females varies in that both the hands are of the same size and shape, resembling the smaller chelipedes of the other individuals, and I will also call attention to the rather noticeable variation in the relative proportions of length and breadth.

Dim. ♂ 26×21. ♂ 26·25×22. ♂ 27·5×21. ♂ 15×11. ♀ 27×21. ♀ 28·5×21·25. ♀ 25·5×20. ♀ 24×19.

XXII. Genus Uca Leach.

39. Uca annulipes M.-Edw.

Gelasimus annulipes, M.-Edw. Hist. Nat. Crust. ii. p. 55, pl. xviii. figs. 10–13 (1837); de Man, Merg. Crust. p. 118, pl. viii. figs. 6–7 (1888).

Loc. Singora; Trengganu.

Thirty-two males and three females.

Of the males sixteen have the large chela on the right side, and the other sixteen on the left.

Dim. ♂ 19×11·5. ♂ 17·5×11. ♂ 17×10. ♂ 16·5×10. ♂ 16·5×9. ♀ 12·25×8. ♀ 11·5×7. ♀ 11·5×8.

40. Uca tetragonon? Herbst.

Cancer tetragonon, Herbst, Naturg. d. Krab. i. p. 257, pl. xx. fig. 110 (1790).

Gelasimus tetragonon, M.-Edw. Ann. Sci. Nat. (3) xviii. p. 147, pl. iii. fig. 9 (1852); Kingsley, Proc. Ac. Nat. Sci. Philad. p. 143, pl. ix. fig. 11 (1880).

Loc. Trengganu.

A single female, which I refer rather doubtfully to this species.

Dim. 17·5×12.

XXIII. Genus Varuna M.-Edw.

41. Varuna litterata Fabr.

Cancer litteratus, Fabr. Ent. Syst., Suppl. p. 342 (1798).

Varuna litterata, M.-Edw. Hist. Nat. Crust. ii. p. 95 (1837); Hasw. Cat. Austr. Crust. p. 103 (1882).

Loc. Kota Bharu, Kelantan.

Two males and a female.

Dim. ♂ 20·5×19·5. ♂ 21·5×21. ♀ 26·5×25·5.

XXIV. Genus Grapsus Lam.

42. Grapsus strigosus Herbst.

Cancer strigosus, Herbst, Naturg. d. Krab. iii. p. 55, pl. xlvii. fig. 7 (1799).

Grapsus strigosus, A. M.-Edw. Nouv. Arch. Mus. ix. p. 286 (1873); Hasw. Cat. Austr. Crust. p. 97 (1882).

Loc. Pulau Bidan, Penang.

Five males and a female.

Dim. ♂ 49×43·5. ♂ 41×37. ♂ 30 5×28. ♂ 24×21·5. ♀ 45×40.

XXV. Genus Metopograpsus M.-Edw.

43. Metopograpsus maculatus M.-Edw.

Metopograpsus maculatus, M.-Edw. Ann. Sci. Nat. (3) xx. p. 165 (1853); de Man, Mergui Crust. p. 145, pl. x. figs. 1–3 (1888).

Loc. Singora.

A single male, which accords in all points with Dr. de Man's description.

Dim. 27 × 22.

Width of front 18 mm.

XXVI. Genus Sesarma Say.

44. Sesarma (Sesarma) lafondii Jacq. et Lucas.

Sesarma lafondii, Jacq. et Luc. Voy. Pôle Sud, Crust. p. 70, pl. vi. fig. 4 (Hombron et Jacq. t. iii.) (1853); de Man, Zool. Jahrb. Syst. ii. p. 639 (1887).

Loc. Singora.

A female.

Dim. 28 × 25.

45. Sesarma (Parasesarma) quadrata Fabr.

Cancer quadratus, Fabr. Ent. Syst., Suppl. p. 341 (1798).

Sesarma aspera, de Man, Mergui Crust. p. 169 (1888).

Sesarma quadrata, id. Weber's Zool. Erg. v. 2, p. 328 (1892); id. Zool. Jahrb. Syst. ix. p. 182 (1897).

Loc. Trengganu.

One male and two females.

The pectinated ridges are less developed in the females, and without black tips to the teeth. In the larger female, of which only the right chelipede is present, the tubercles on the finger are rather worn, and seem, in consequence, a little more confluent than usual; they are 11–12 in number, the first two at the base of the finger being very small. The carapace, moreover, in this individual has a generally smoother aspect than in the other two, due to the relative scantiness of the small hairs, notably on the fore part of the carapace.

(N.B.—In regard to the wearing of the tubercles in the female, compare de Man, Zool. Jahrb. ix. p. 183.)

Dim. ♂ 16 × 12. ♀ 16 × 13. ♀ 15 × 11.

46. Sesarma (Geosesarma) maculata de Man.

Sesarma maculata, de Man, Weber's Zool. Erg. v. 2, p. 347, pl. xxi. fig. 19 (1892).

Loc. Lacom.

Four males and two females, one of the latter with ova. I have little to add to Dr. de Man's very complete description. One of the larger males only shows *ten* sharp tubercles on the upper margin of the movable finger of the right side (that on the left being absent); the other has only *seven* on each side. In the two smaller males these tubercles are very indistinct, and I can only discern *six* or, perhaps, *seven*. In cases where these teeth number less than ten, they occur on the proximal half, and cease at the middle, of the finger.

Dr. de Man has noted the presence of fewer tubercles in the female, and the two females here present accord with this feature. Further I note that the dark spots described as occurring on the chelipedes are present also on the abdomen and uncovered surface of the sternum; in the female they even extend, on the sternum, a little way under cover of the abdomen.

As regards the ova, I am able to confirm Dr. de Man's reference of the species to his subgenus *Geosesarma*; the eggs are few in number (30–40) and rather large, being a trifle more than 1 mm. in diameter. They tend to a coloration such that one hemisphere is white, the other brown.

Dim. ♂ 11·5 × 11·75. ♂ 10 × 10. ♂ 7·5 × 7·5. ♂ 6 × 6. ♀ with ova 11 × 11·25. ♀ 9·75 × 9·75.

XXVII. Genus Pinnotheres.

47. Pinnotheres socius. (Plate XXXIII. fig. 3.)

Cf. *Pinnotheres cardii*, Bürger, Zool. Jahrb. Syst. viii. p. 367, pl. ix. fig. 4, pl. x. fig. 4 (1895).

Loc. Pulau Bidan, Penang.

One female with ova.

I find the following note in the bottle with this specimen: "This little crab was found inside the infra-branchial chamber of a bivalve, the mantle of which fuses in the mid-ventral line."

Cephalothorax, chelipedes, and legs in all respects as in *P. cardii*, except that the posterior border of the cephalothorax is faintly hollowed. But the external maxillipedes differ in (*a*) their much narrower meral joint and (*b*) the hollowing of the distal extremity of the propodus (*vide* fig. 3).

XXVIII. Genus Matuta Fabr.

48. Matuta victrix Fabr.

Matuta victor, Fabr. Ent. Syst., Suppl. p. 369 (1798).

Matuta victrix, Miers, Trans. Linn. Soc. (2) Zool. i. p. 243, pl. xxxix. figs. 1–3 (1877).

Matuta victor, Alcock, Journ. As. Soc. Beng. lxv. 2, p. 160 (1896).

Loc. Pulau Bidan, Penang.

Fourteen males and eleven females.

Of the males, one (dim. = 29·5 × 27) shows the female characteristic pointed out by Major Alcock (*t. c.*), viz. a more prominent ridging in the case of the second than of the third segment of the abdomen. One female carries a stalked cirripede, of the genus *Dichelaspis*, on the carapace just behind the front.

Dim. ♂ 49 × 45. ♂ 43·5 × 40. ♂ 39 × 36. ♂ 39 × 36. ♂ 35 × 32·5. ♂ 29·5 × 27. ♀ 35 × 32·25. ♀ 35 × 32·5. ♀ 33·5 × 31·5. ♀ 30 × 28. ♀ 29 × 27·75. ♀ 22 × 21.

49. MATUTA BANKSII Leach.

Matuta banksii, Leach, Zool. Misc. iii. p. 14 (1817); Miers, Trans. Linn. Soc. (2) Zool. i. p. 245, pl. xl. figs. 1–2 (1877); Lanchester, P. Z. S. 1900, p. 762.

Matuta picta, Hess. Arch. f. Naturg. xxxi. p. 158 (1865).

Loc. Pulau Bidan, Penang.

Seven males and nine females.

I have already (*t. c. supra*) noted the absence, in some females of this species from Malacca, of the crimson patches on the 1st, 2nd, and 4th pairs of ambulatory legs. Here, too, they are absent in the females; but yellow patches, more or less distinct, may be seen in the same positions; so that it seems possible that the crimson coloration fades in spirit more readily, for some reason, in the females than in the males. One of the females shows the reticulate markings, characteristic of *M. picta* Hess., very clearly; there is a slight tendency in another female and a male to reticulation anteriorly. The strongly reticulated female has the six tubercles on the carapace more rounded and obscure; the others, too, show variation in a similar direction of this character.

The front I should still describe (*vide t. c.*) as distinctly emarginate.

Major Alcock has identified *M. picta*, in his synonymy of *M. banksii*, with the latter species (J. A. S. B. lxv. 2, p. 158). Dr. de Man (Notes Leyd. Mus. iii. 1881, p. 116) has noted the close similarity of the two species, apart from their coloration, and has further mentioned the still closer similarity of female *M. picta* with female *M. banksii*; and Dr. Nobili considers *M. picta* as a variety of *M. banksii* (Ann. Mus. Civ. Stor. Nat. Genova, xx. p. 251, 1899).

From what these authors have remarked with respect to the markings of the carapace, it is evident that they are variable—simple spots, groups of two or three spots, spots arranged in curved lines, and so to definite reticulations. And the crimson patches on the legs, which seem to be characteristic of *M. banksii*, are also variable, the variation, however, being apparently confined to the females, and perhaps not extending further than a relatively readier solubility of the pigment under certain conditions—that, at least, is as far as the evidence goes. I do not know how far the sharpness or obtuseness of the fourth spine on the outer ridge of the hand is a definite character (*vide* de Man, *t. c.* p. 116 and p. 120); but the relative length of this spine to the second, and consequently its own relative obtuseness, is distinctly different in the different individuals of this series.

For these reasons, then, I have included *M. picta* under *M. banksii*, following Major Alcock and Dr. Nobili.

I should add that there is a marked tendency of the epibranchial spines in these specimens to be bent slightly backwards in their outer third.

Dim. ♂ 37×36. ♂ 35×34. ♂ 35×33·75. ♂ 34×33·5. ♂ 31×29·75. ♂ 30·5×29·75. ♀ 31×30. ♀ 31×29·5. ♀ 29×28. ♀ 28×27. ♀ 26·75×25·5. ♀ 19×18·5.

XXIX. Genus Dorippe Latr.

50. Dorippe dorsipes Linn.

Cancer dorsipes, Linn. Syst. Nat. (ed. xii.) i. 2, p. 1053 (1766).

Dorippe quadridens, de Haan, Crust. Japon. p. 121, pl. xxxi. fig. 3 (1839).

Dorippe dorsipes, Alcock, Journ. As. Soc. Beng. lxv. 2, p. 277 (1896).

Loc. Pulau Bidan, Penang.

Two males and a female.

Dim. ♂ 24×21·5. ♂ 24·5×22·75. ♀ 16×15.

51. Dorippe facchino Herbst.

Cancer facchino, Herbst, Naturg. d. Krab. i. 6, p. 190, pl. xi. fig. 68 (1785).

Dorippe sima, M.-Edw. Hist. Nat. Crust. ii. p. 157, pl. xx. fig. 11 (1837).

Dorippe facchino, Alcock, Journ. As. Soc. Beng. lxv. 2, p. 278 (1896); Lanch. P. Z. S. 1900, p. 768.

Loc. Patani.

A small male.

This individual bears a small anemone on its back with a bivalve shell and ? Gastropod operculum interposed (*cf.* Lanch. *t. c.* p. 769).

Dim. 11×8·5.

XXX. Genus Squilla Fabr.

52. Squilla raphidea Fabr.

Squilla raphidea, Fabr. Ent. Syst., Suppl. p. 416 (1798).

Squilla harpax, de Haan, Crust. Japon. p. 222, pl. li. fig. 1 (1839).

Singora; Kota Bharu.

Two males; length 10 in. and 6 in.

53. Squilla nepa Latr.

Squilla nepa, Latr. Encycl. Méth. x. p. 471 (1825); Miers, Ann. Mag. Nat. Hist. (5) v. p. 25 (1880).

Patani; Trengganu; Kota Bharu.

Numerous examples, from 3–4 in. in length.

54. Squilla scorpio Latr.

Squilla scorpio, Latr. Encycl. Méth. x. p. 471 (1825).

Patani ? or Trengganu ?

A male and a female; length about 3 in.

XXXI. Genus Lysiosquilla Dana.

55. Lysiosquilla spinosa W.-Mason.

Lysiosquilla spinosa, W.-Mason, Journ. As. Soc. Bengal, p. 222 (1875); Miers, Ann. Mag. Nat. Hist. (5) v. p. 12, pl. i. figs. 10–12 (1880).

Squilla indefensa, Kirk, Ann. Mag. Nat. Hist. (5) ii. p. 466 (1878).

Pulau Bidan, Penang.

Five young specimens; length about $\frac{3}{4}$ in.

These small individuals seem to belong to this species; the form of the telson is quite in accordance with Mr. Miers's description. There are from twelve to fourteen spines on the dactyls of the raptorial claws; and a minute spine on the posterior part of the base of each of the last three thoracic legs.

Exposed thoracic and abdominal segments suffused with rosy-red, aggregated on the posterior segment into minute red spots; raptorial limbs with black spots; body with black spots, lying superficially to the red coloration and tending to mass at the postero-lateral angles of the abdomen; they form, in particular, two conspicuous black marks on the telson just over the submedian marginal spines. The gut appears through the body-wall, in three individuals, as a median black line.

XXXII. Genus Chloridella Miers.

56. Chloridella chlorida Brooks.

Squilla chlorida, Brooks, 'Challenger' Stomatopoda, p. 40, pl. ii. figs. 1–5 (1886).

Kelantan.

A male; length about 3 in.

I note the presence in this specimen of submedian carinæ on *all* the abdominal segments, fainter on the front segments than on those behind, those of the sixth ending in a small sharp spine; the inner margin of the inner spine of the ventral prolongation of the uropods carries seven, instead of four or five, spines; the tubercles on the telson are clearly arranged in three curved rows on each side of the dorsal median carina; the carapace bears a very faint median carina. I will also add that the penultimate joint of the exopodite of the uropods bears on its outer margin seven strongly curved spines, of which the most distal is about twice as long as the others.

XXXIII. Genus Gonodactylus Latr.

57. Gonodactylus chiragra Fabr.

Squilla chiragra, Fabr. Ent. Syst. p. 513 (1793).

Gonodactylus chiragra, Latr. Encycl. Méth. x. p. 473 (1825); Miers, Ann. Mag. Nat. Hist. (5) v. p. 118 (1880); Borradaile, P. Z. S. 1898, p. 34.

Loc. Pulau Bidan, Penang; Kota Bharu, Kelantan.

A male and two females from Palau Bidan; four males and seven females from Kelantan. A single male of the var. *smithii* Pocock from Kelantan.

Although the general colour of the latter has been much darkened by the formol in which these specimens were preserved, it is still quite possible to discern the five dark spots on the sides of the abdomen that Borradaile has noted in his examples of var. *smithii*.

Length: ♂ $2\frac{1}{4}$ in., ♀ $4\frac{1}{4}$ in., ♀ $2\frac{3}{4}$ in., the smaller examples ranging from $\frac{1}{2}$ to 1 in.

58. Gonodactylus cultrifer White.

Gonodactylus cultrifer, White, P. Z. S. 1850, p. 96 (Annulosa), pl. xvi. fig. 1; Miers, Ann. Mag. Nat. Hist. (5) v. p. 117 (1880).

Loc. Kota Bharu, Kelantan.

A male without the raptorial limbs. Length $4\frac{1}{4}$ in.

I may note that the rostrum does not nearly reach the base of the eye-peduncles as it appears to do in White's figure. Further, the number of spines on the outer edge of the penultimate joint of the exopodite of the uropods is eight; White's figure represents eight only, but both he and Mr. Miers give the number as nine in the text.

The submedian spines of the telson consist of a short, fixed, basal portion bearing a slightly longer movable spine.

XXXIV. Genus Gebiopsis A. M.-Edw.

59. Gebiopsis intermedia de Man.

Gebiopsis intermedia, de Man, Mergui Crust. p. 256 (1888).

Loc. Pulau Bidan, Penang.

Numerous examples; ranging from 42 mm. in length downwards. The long hairs on the lower margins of the meropodites of the first two pairs of legs would appear to act as a sifting (? sensory and selecting) apparatus for food; for if these legs be thrust somewhat forwards and at the same time flexed upwards at the mero-carpal joint, these hairs will be found to form a complete guard to the buccal cavity.

XXXV. Genus Callianassa.

60. Callianassa secura, sp. n. (Plate XXXIV. fig. 2.)

Loc. Kota Bharu, Kelantan.

A female.

This species is closely related to *C. pachydactyla* A. M.-Edw. (*cf.* Nouv. Arch. Mus. t. vi. p. 86, pl. ii. fig. 1), while presenting at the same time several differences which clearly mark it off as a distinct species. It resembles that species chiefly by the extreme shortness of the carpal joint in the 1st pair, and the general smoothness of surface in that pair, and, as well, in the fairly strong development of the telson; but differs notably in the fact that the external maxillipedes are even more pediform, and that the merus of the 1st pair is *quite unarmed*, no trace of denticulation being found anywhere on the leg.

The rostrum and eyes are as in *C. pachydactyla*, though the point of the rostrum appears blunter in our species.

The eyes reach beyond the middle of the 1st antennular joint; the 3rd joint of the antennular peduncles is barely twice as long as the 2nd, and their flagella 2–3 times as long as the 3rd joint and about two-thirds the length of the carapace.

In the antennal peduncles, the 3rd joint is twice as long as the 2nd, and the latter twice as long as the 1st; the flagellum is a little longer than the carapace. The 3rd maxillipedes are pediform, the carpal joint alone being slightly dilated; the ischium is regularly and evenly denticulated on its inner edge; the denticulations being very small and best seen with a lens.

The larger chelipede is entirely smooth, except for a well-marked line of hairs on the inner upper edge of the hand and dactyl, a few more scattered hairs on their under edge and outer surface, the coarse denticulation of the fingers, on each of which one tooth is more prominent than the rest, and a very short, bluntly 3-toothed, forwardly directed ridge on the under distal angle of the carpus. The ischium and merus are the same length (4 mm.); the ischium long and narrow, the merus broad and swollen, with a very blunt, but still distinct, ridge on its outer surface. The carpus is much shorter than the palm (carpus 1·75–2 mm., palm 5 mm.), but of nearly the same depth vertically, = 3 mm.; the fingers are a little shorter than the palm, = 4 mm. In the smaller chelipede, which is longer and slender, the carpus is 3 mm. long, the palm 4 mm., and the fingers 2 mm.; this appendage also is quite smooth. The 2nd pair are as in *C. pachydactyla*; in the 3rd pair, however, the posterior edge of the propodite is not scooped out as in that species, rather the joint is barrel-shaped (see fig. 2).

Of the abdominal segments, the 1st is the shortest, the 2nd and 3rd the longest, equal or nearly so, the 4th, 5th, and 6th a little shorter than those preceding; the telson is the same length as the 1st abdominal segment, rounded and smooth above, and somewhat shorter than the uropods, the inner joints of which bear a longitudinal ridge down the middle of their upper surfaces.

From *C. amboinensis* de Man (*cf.* Arch. f. Naturg. liii. i. p. 480, pl. xx. fig. 4), which is, again, a closely allied species, *C. secura* differs: (*a*) in its much shorter carpus; (*b*) in the much shorter 3rd joint of the antennular peduncle; (*c*) in the ridged surface of the inner uropodal joint. It resembles it in the general smoothness of the chelipedes, the length of the telson, and apparently the shape of the propodite of the 3rd pair of legs (*t. c.* p. 482, "Das vorletzte Glied des dritten Fusspaarer ist oval.")

Length of animal 31·5 mm.; length of carapace 7·25 mm.

XXXVI. Genus Arctus Dana.

61. Arctus tuberculatus Sp. Bate.

Arctus tuberculatus, Sp. Bate, 'Challenger' Macrura, p. 70, pl. x. figs. 1–2 (1888).

Loc. Kelantan.

A male and a female, quite agreeing in general with the original description and figure; but the following points may be noted:—The tubercle on the 3rd abdominal segment is not quite so clearly separated from its base as it is in Spence Bate's figure; the coxal plates of abdominal segments 3–5 bear a low ridge, lying transversely to the long axis of the body—this is found down the middle of the plate in segment 5, but in the anterior half in segments 3–4, and divides an anterior smooth from a posterior, short-hairy, surface. The smooth anterior surface plays under the posterior surface of the preceding segment, and the ridge determines the limit within which this play is possible in complete flexion of the tail. In the 2nd abdominal segment this ridge is represented by a short line of low tubercles, and the whole surface is hairy.

XXXVII. Genus Thenus Leach.

62. Thenus orientalis Fabr.

Scyllarus orientalis, Fabr. Ent. Syst., Suppl. p. 399 (1798); Milne-Edwards, Hist. Nat. Crust. ii. p. 286 (1837).

Loc. Kelantan; Trengganu.

Two males and a female; all three are infested with a stalked Cirripede on the mouth-parts, notably on the exopodites of the 2nd maxillipedes. This Cirripede belongs to the genus *Dichelaspis*, and will be described, as a new species of that genus, in the second part of this paper.

Length: ♂ 134 mm., ♂ 120 mm., ♀ 104 mm.

XXXVIII. Genus Senex Pfeffer.

63. Senex ornatus Fabr., var. nov. lævis.

Cf. *Senex ornatus*, Ortmann, Zool. Jahrb. vi. p. 34 (1892).

Loc. Singora.

One full-grown male, just over 1 foot in length.

Although undoubtedly referable to this species, this specimen presents such well-marked differences that I have thought it worth while detailing them and attaching a varietal name thereto. The amount of variation in the species of this genus is evidently very considerable, and it is therefore difficult to satisfactorily determine the value of differences such as occur, as in the present instance, in a single individual. But where the points of difference are as distinctive as they are here, it does seem to me justifiable to put forward a provisional name, rather as an expression of the occurrence of such variations, than as a definite opinion on the constancy of these variations. For, after having served the purpose of calling the attention of future systematists to the variation noted, the name may readily be dropped or retained according to the results arrived at by the study of more ample material.

Most noticeable, then, in this specimen is the smoothness of the carapace, a smoothness due to the general absence of teeth thereon; such teeth as are present are placed as follows:—Two large supraorbitals, each with a smaller tooth, about one-quarter the size, close behind at the base; behind these again are six teeth, quite rudimentary, forming the angular points of three contiguous transverse squares on the slightly swollen gastric region. Four transverse teeth, just behind the broad and deep cervical suture, in pairs, *i. e.* two close together on each side. Two strong teeth, one-third size of supraorbitals, on the anterior margin of the carapace on each side, above and below the attachment of the first antennæ; behind the lower of these there is a small tooth on the carapace, and behind and above the upper of these, and a little further back on the carapace, another small tooth. Posterior to these is an oblique furrow formed by a lateral extension of the cervical suture, which is continued downwards and then forwards to a point just below the antero-lateral angle of the carapace, and is here very deep. On the oblique posterior border of this furrow may be seen two small teeth some distance apart.

The abdominal segments are quite smooth, except for some strong punctæ, the first segment only bears a furrow, broad and shallow, with faint traces of hairs. The telson is marked, as customary in the group, with thick longitudinal ridgings, like the rays of a fish's fin, in its distal two-thirds; anterior to this are many small horny spinules arranged in the arc of a circle, the circumferential portion of which is delimited by a white line. The uropods are armed with horny spinules on the posterior margin of their proximal joints; and small closely-set horny spinules are ranged also along the posterior margin of the sixth abdominal segment.

As regards the colour (in formol) it may be noted that the general basis is white, on the carapace, with regular brown patches, which are again marbled with white. Down the middle and on each side the white basis forms three distinct white stripes; these are parallel and do not form a **W** as in *S. demani* Borrad. (*vide* Willey's Zool. Res. iv. p. 418, and *S. polyphagus* Ortmann, Semon's 'Forschungsreise,' v. p. 19). The general basis of the abdomen is a somewhat deeper white; the furrow of the first segment is brown marbled with white; the hind borders of segments 1–4 have a broad brown band with two narrow white bands which are nearly rectilinear; on segments 5–6 there is only one white band, which in the latter is convex to the hind margin in the middle line. The legs are longitudinally striped with white.

This individual presents all the characteristics of *S. ornatus* as defined by Dr. Ortmann (*l. c.*); the points of difference may be grouped under three headings:—

a. The small number of spines on the carapace.

b. The coloration, *i. e.*, the three distinct white bands, running longitudinally on the carapace and parallel to each other. Here, too, I may note that the coloration of the abdomen and legs is that of *S. fasciatus* de Haan, but the number of teeth on the antennal segment is that of *S. ornatus*, viz. four.

c. A point I have not mentioned above, viz., that the inner antennæ exceed the outer *considerably* in length, namely, by the last joint and one-third of the penultimate joint. In regard to this. Dr. Ortmann says: "Stiele der inneren Antennen etwas länger oder so lang wie die der aüsseren."

XXXIX. Genus Atya.

64. Atya armata A. M.-Edw.

Atya armata, A. M.-Edw. Ann. Soc. Entom. France, (4) iv. p. 149 (1864); Lanchester, Ann. Mag. Nat. Hist. (7) vi. p. 262 (1900).

Atya moluccensis, de Man, Weber's Zool. Ergebn. p. 357, pl. xxi. fig. 20 (1892).

Loc. Selama River, Perak. An adult male.

Belimbing. Three males and three females, all young.

The young forms agree entirely with the description given by Dr. de Man (*t. c.* p. 358); but the adult presents points of difference, in regard to the spines on the last three legs, from the individual examined by Dr. de Man. In the 3rd pair, the merus of the right (larger) leg only bears a blunt tubercle near the carpal joint, and the carpus bears on its under surface a much smaller tubercle, which, in flexion, nearly meets that on the merus. In the 4th pair, the merus of the right leg bears only one spine instead of two, and the carpus one. The left leg has one on the merus, none on the carpus. The 5th pair are as described by Dr. de Man.

The teeth on the under surface of the rostrum number as follows:—

Adult ♂ 9.

Young ♂ 10, 13, 11; ♀ 9, 13, 10.

The length of the adult is 81 mm.; the young specimens range between 57 mm. to 47 mm.

XL. Genus Caridina.

65. Caridina multidentata Stimpson.

Caridina multidentata, Stm. Proc. Ac. Nat. Sci. Phlad. p. 29

(1860); de Man, Weber's Zool. Ergebn. p. 380, pl. xxii. fig. 26 (1892).

Loc. —— ?

A single female with ova; length 16 mm.

Of the teeth on the upper edge of the rostrum in this specimen, only the proximal eight and distal three are clearly separate, the intermediate teeth being represented by a rather ill-defined serrated ridge; on the under edge are nine distinct teeth. The whole rostrum is slightly curved downwards, and the tip is abrupt and blunt. The eggs moderately large, about 1 mm. in length and oval.

66. Caridina wyckii Hickson.

Caridina wyckii, Hickson, Ann. Mag. Nat. Hist. p. 357, pls. xiii.–xiv. (1888); de Man, Weber's Zool. Ergebn. p. 386, pl. xxiv. fig. 29 (1892).

Loc. River Petwi, Tale Sap.

Two specimens, very damaged, one without antennæ, eyes, and only one or two pereiopods, the other without pereiopods.

These two individuals seem to belong pretty certainly to this species, though their mutilated condition causes some difficulty in deciding their identity.

The rostrum reaches nearly to the end of the antennary plates; its proximal portion is straight, its distal portion deflexed, rising again at the tip; above are 15 small forwardly inclined teeth, of which to or three are on the carapace, while the 15th stops short of the tip by a considerable interval which is unarmed; the tip itself is markedly bifid, and the under edge bears 6 teeth. Antennary peduncle barely reaching the middle of scaphocerite; the antennary tooth double, the lower portion being more prominent and spiniform. The carpus of the 2nd leg is much longer than broad and a little longer than the hand; the other legs are unfortunately broken at the carpus. The telson appears to have only four spines on its hinder edge, of which the two outer are much smaller than the two inner.

67. Caridina gracillima sp. n. (Plate XXXIV. fig. 1.)

Cf. *Caridina gracilirostris*, de Man, Weber's Zool. Ergebn. p. 399, pl. xxv. fig. 31 (1892).

Loc. Inland sea near Singora. 250–300 individuals, mostly females with ova.

In regard to the locality it is necessary to add that the label in this instance was almost undecipherable, sufficient indications alone remaining to show that the specimens came from either Tale Sap or Tale Nawi. Tale Sap is an inland sea just above the town of Singora, Tale Nawi a lake at the head of Tale Sap, and connected with the latter by a small strait. As regards the salinity of the water, Mr. Laidlaw informed me that Tale Nawi is quite sweet, but that Tale Sap, though quite or nearly sweet at its head, increases gradually in salinity towards the mouth, where it is quite salt. In view of the differences between this species and *Car. gracilirostris* it is peculiarly unfortunate that the exact record of the locality should have become, by mischance, obliterated.

The only distinction between this species and *Car. gracilirostris* is found in the rostrum (and, in a small degree, in the telson and 1st two pairs of legs). The structure and relations of antennules, antennæ, maxillipedes, and legs are the same as in *C. gracilirostris*, save only that the 1st pair reach, not to the *end* of the penultimate joint of the antennæ, but barely to the middle of that joint, and similarly the 2nd pair reach barely beyond the end of the penultimate joint instead of nearly to the end of the last joint. The telson again, though exactly similar in all other points, presents only four pairs of teeth on the upper surface, not five or six.

The rostrum, however, is markedly different. Dr. Nobili has recently described (Ann. Mus. Civ. Stor. Nat. Genov. xx. p. 477, 1900) a new species, *C. modiglianii*, and the rostrum in our species appears intermediate between those of this latter species and *C. gracilirostris*. The number of the teeth on the upper margin is nearly the same as in *C. gracilirostris*, viz. 6–9; these teeth are, however, not nearly so widely separate distally, though the most distal tooth is sometimes placed at a considerable distance from the rest. At the same time the interspaces do increase distally, probably more than in *C. modiglianii* ("sono *fitti* e *avvicinati* nella mia nuova specie"). The number of the teeth on the lower edge approaches that of Dr. Nobili's species, ranging from 12–23 as extremes, 16–18, however, being the most common number; in Dr. Nobili's single specimen they numbered 17. As in his species, too, the proximal teeth are better defined than the distal. The rostrum also agrees with those in both these species in being slender and upwardly curved towards the tip; the amount of this curve, however, varies from nearly straight to a strong upward bend. The tip bears mostly a small tooth that gives it a bifid appearance; in a few cases, however, there are two such teeth, making it trifid.

But it is in the *length* of the rostrum that this variety shows its distinctness, as the following table will show:—

	Rostrum. mm.	Carapace. mm.
C. gracilirostris	8	4
C. modiglianii	7	4
C. gracillima	3–6	4

That is, although in a few cases it exceeds the carapace by half its length only (instead of being double, or nearly so, the length of the carapace), it generally exceeds it by only one-quarter, or equals it; while in a few cases yet it even falls short of it. I give measurements (p. 562), taken from twenty-one individuals picked out at random, together with the number of rostral teeth.

These resemblances and differences are, within the limits of

Table of measurements in millimetres.

Rostral formula.	Length with rostrum.	Length of rostrum.	Length of carapace.
$\frac{9+1}{19}$	24	5	4
$\frac{8+1}{15}$	22	4	4
$\frac{7+1}{20}$	21	5	4
$\frac{8+1}{18}$	19·5	5	3·5
$\frac{8+1}{17}$	25	6	4
$\frac{6+1}{19}$	21·5	4	3·5
$\frac{7+1}{17}$	23·5	4	3·5
$\frac{6+1}{14}$	20	4	3·5
$\frac{8+1}{17}$	20	4·25	3·25
$\frac{9+1}{17}$	19·5	4	3·5
$\frac{6+1}{18}$	22·25	4·25	3·75
$\frac{8+1}{13}$	20·5	4	3·5
$\frac{7+1}{16}$	20·5	4·5	3·5
$\frac{7+1}{12}$	18·5	4	3
$\frac{7+1}{23}$	21·5	5	3·5
$\frac{8+1}{14}$	16	2·5	2·5
$\frac{7+1}{20}$	..	4·5	4
$\frac{7+1}{18}$	..	5·25	4·5
$\frac{5+1}{14}$	..	4	4
$\frac{5+1}{14}$	..	3	4
$\frac{7+1}{12}$	..	3	3

Proportions of joints in first two pairs.

1st leg.	2nd leg.
Ischium 2.	Ischium 3.
Merus 4·25–4·5.	Merus 4.
Carpus 3.	Carpus 5.
Hand 2·25.	Hand 2.
Fingers 2·65.	Fingers 2·5.

variation I have indicated, quite constant in the numerous specimens under review. The typical specimens of Dr. de Man's species were obtained from a tidal river at Balangnipa in Celebes; other typical specimens were also obtained from brackish water in Sumatra, and from fresh water at Maros in Celebes, and Pampanua in Celebes. Fifteen *young* individuals from the river Lapa-lupa in Celebes agree with the present form in the number of teeth $=\frac{(5-7)+(1-2)}{18-25}$, but "Sie Stimmen, was Form und Länge des Rostrums betrifft, mit den von Balangnipa überein," *i.e.* typical; so, too, with a *young* specimen from Mbawa in Flores, with formula $\frac{6+1}{21}$. The number here seems to vary with age; the relative length of the rostrum seems to be characteristic. In view of this latter fact, and in view of the fact that Dr. de Man had specimens from both brackish and fresh water which agree in this particular character, in view, moreover, of the fact that the nature of the water in the present case is uncertain, it seems necessary to dismiss the possibility that this form is a variety of *C. gracilirostris*, characterized by a rostrum shortened through relation to a somewhat different environment, and to regard it as a distinct species, closely allied to *C. gracilirostris*, but differing in (*a*) a shorter rostrum, with a consequent diminishing of the lower row of teeth; (*b*) a fewer number of teeth on the dorsum of the telson; and (*c*) having the legs of the 1st and 2nd pair relatively slightly shorter.

XLI. Genus Hippolysmata Stimpson.

68. Hippolysmata vittata Stimpson.

Hippolysmata vittata, Stm. Proc. Ac. Nat. Sci. Philad. p. 26 (1860); de Man, Arch. f. Naturg. liii. i. p. 494 (1887).

Loc. Pulau Bidan, Penang.

Five males and six females, length from 25 mm. to 10 mm. The rostral teeth are evidently very variable in this species. I give the formula in each case; in all but one the first tooth on the carapace is separated from the second by a distance double that between the other teeth, but in that one (a female with ova) all the teeth are equidistant.

Rostral formulæ :— $\frac{8}{4}, \frac{8}{4}, \frac{8}{3}, \frac{8}{3}, \frac{7}{3}, \frac{7}{3}, \frac{7}{2}, \frac{7}{2}, \frac{7}{1}, \frac{6}{2}, \frac{6}{2}$.

XLII. Genus Alpheus.

69. Alpheus lobidens de Haan.

Alpheus lobidens, de Haan, Crust. Jap. p. 179 (1839); Ortmann, Zool. Jahrb. v. p. 474, pl. xxxvi. fig. 13 (1891).

Loc. Pulau Bidan, Penang; Kelantan. Sixteen individuals from Pulau Bidan, three from Kelantan.

Length from 67 mm.

70. ALPHEUS PARVIROSTRIS Dana.

Alpheus parvirostris, Dana, U.S. Expl. Exp., Crust. p. 551, pl. xxxv. fig. 3 (1852); Ortmann, Zool. Jahrb. v. p. 483 (1891).

Loc. Great Redangs.

One small female with ova; length 14 mm.

71. ALPHEUS ACANTHOMERUS Ortmann, var. INERMIS nov.

Cf. *Alpheus acanthomerus*, Ortmann, Zool. Jahrb. v. p. 474, pl. xxxvi. fig. 12 (1891); Coutière, Notes Leyd. Mus. xix. p. 202 (1899).

Loc. Kelantan. Four females, three with ova.

These specimens present all the characters of Dr. Ortmann's species, except one, which is the presence (in the species) of a spine at the distal and inner under angle of the merus of the 1st pair. This spine is absent in the only one of these specimens in which the legs are present, and the difference is so marked that it seems necessary to regard it as probably varietal. In this respect it resembles *A. hippothoe* de Man; but may be easily distinguished from that species by the different proportions of the carpal joints of the 2nd pair, and by the presence of a small pleurobranch above the arthrobranch of the 3rd maxillipede (*cf.* Coutière *l. c.*). The outer surface of the hand of the large chelipede is smooth, but the inner surface is slightly granulated, with longish, somewhat scattered hairs.

Length: ♀ 19 mm., ♀ 15 mm., ♀ 13 mm., ♀ 12 mm.

72. ALPHEUS CRINITUS Dana.

Alpheus crinitus, Dana, U.S. Expl. Exp., Crust. p. 548, pl. xxxiv. fig. 8 (1852); Ortmann, Zool. Jahrb. v. p. 479 (1891).

Loc. ——? A male; length 16·5 mm.

This specimen is without legs, but the same bottle contains also a single large chelipede and two small chelipedes. The spine on the under edge of the merus is situated at the middle of that edge and not at the distal angle.

XLIII. Genus AUTOMATE de Man.

73. AUTOMATE DOLICHOGNATHA de Man. (Plate XXXIV. fig. 3.)

Automate dolichognatha, de Man, Arch. f. Naturg. liii. i. p. 529, pl. xxii. fig. 5 (1887).

Loc. Pulau Bidan, Penang.

A single small example; length 20 mm.

In the same tube with this specimen are a pair of chelipedes which I have little doubt belong to it. They conform to the Alpheid type, and present no remarkable features; but, as they were wanting in Dr. de Man's single specimen, I append a brief description and figure. They are unequal in size; the ischium, merus, and carpus generally similar in both (for differences *vide* figs. 3, 3 *a*), quite smooth; ischium and carpus equal in length, merus one and a quarter times the length of these joints. Carpus and merus each with a blunt tooth on the lower margins. The hands, too, are generally similar, but that of the smaller chelipede is more narrowed distally, owing to the greater obliquity of its lower margin; the fingers of both are short, but the dactyl of the larger hand is more curved than that of the smaller; a few scattered longish hairs are found on the fingers of both hands. The outer and inner surfaces of both carpi and propodi have a brownish-red basis of colouring (in formol) with white blotches or spots, the white parts appearing under a lens rather as an incrustation on the general surface.

XLIV. Genus Anchistus Borradaile.

74. Anchistus inermis Miers.

Harpilius inermis, Miers, 'Alert' Crustacea, p. 291, pl. xxxii. fig. B (1884).

Anchistus inermis, Borradaile, Ann. Mag. Nat. Hist. (7) ii. p. 387 (1898)

Loc. Pulau Bidan, Penang.

A female with ova; length 24 mm. A note in the bottle with this specimen states that it was taken from the infra-branchial chamber of a large Gastropod.

XLV. Genus Palæmon Fabr.

75. Palæmon carcinus Fabr.

Palæmon carcinus, Fabr. Ent. Syst., Suppl. p. 404 (1798); Ortmann, Zool. Jahrb. Syst. v. p. 700 (1891).

Loc. Singora, twelve males, ranging from 150 mm. in length. Kelantan, two males, length 90 mm. and 73 mm. Tale Sap, a male, length 104·5 mm.

P. carcinus, var. *lamarrei*. Loc. ?—A male of 43 mm. in length, in which it is noticeable that the inner lateral spines of the telson are longer than the tip of the telson itself. The tip is rounded, and probably broken short at some period, but in any case the lateral spines would be the same length as the tip. Carpus of 2nd pair as long as hand; surface of 2nd pair smooth, punctate, with short hair at intervals.

76. Palæmon equidens Dana. (Plate XXXIV. fig. 4.)

Palæmon equidens, Dana, U.S. Expl. Exp., Crust. p. 591, pl. 39. fig. 2 (1852); de Man, Weber's Zool. Ergebn. p. 453, pl. xxvi. fig. 36 (1892).

Loc. Kelantan, two males; length 100 mm. and 78·5 mm.

The larger male exhibits what is possibly a deformity of the fingers of the 2nd pair. The index of the right hand is broken off near the tip, but shows the regular light *concavity* of the lower border; that of the left hand, however, is only two-thirds the length of the dactyl and is moderately *convex* along its lower border, its tip overlapping the dactyl when the fingers are closed. In both hands the dactyls are strongly bent—almost to a right angle—at their tips. The fingers in the other male are normal, the tips being slightly bent and just crossing.

The rostrum of the larger male is broken off near the carapace; that of the smaller bears 12 teeth above and 4 below: in both the first four teeth lie on the carapace. The latter is thickly covered with small spines. The tips of the fingers are (in formol) violet-coloured.

77. PALÆMON NIPPONENSIS de Haan.

Palæmon nipponensis, de Haan, Crust. Japon. p. 171 (1839); Ortmann, Zool. Jahrb. Syst. v. p. 713, pl. xlvii. fig. 4 (1891).

Loc. Tale Sap.

Four adult males and two adult females; ten young specimens. Length from 37 mm. to 17 mm.

I have not seen specimens of the *P. acanthurus* Wiegmann from Brazil and Haiti, but, to judge from the description of this species, it is a form very closely allied to that of de Haan (vide *P. forceps*, M.-Edw. Hist. Nat. Crust. p. 397; v. Martens, Arch. f. Naturg. xxxv. p. 28; and *P. acanthurus*, Ortmannn, *t. c.* p. 720). In comparing the specimens here dealt with with the different descriptions of the two species it appears that the chief specific differences may be arranged under four heads, thus:—

	P. nipponensis.	*P. acanthurus.*
i.	2–4 teeth on under edge of rostrum.	4–7 such teeth.
ii.	2nd legs in adults with irregular small teeth; fingers hairy.	2nd legs in adults with small teeth tending to be ranged in rows; fingers with thick pubescence.
iii.	Telson with 2 lateral spines, of which the inner is about 5–6 times as long as outer; between the inner spines 2 feathered hairs.	Inner lateral spines not more than 3 times as long as outer; between these several non-feathered hairs.
iv.	*Distr.* Japan, China.	*Distr.* Brazil, Haiti.

I will take the first three points in order in their relation to these specimens; the distribution, of course, agrees with that of *P. nipponensis*.

i. I give the tooth-formula of the rostrum in each case, giving that of the adults first:—

$$\frac{11}{6}, \text{ two } \frac{11}{5}, \text{ two } \frac{11}{4}, \frac{10}{5}; \ \frac{6+1}{5}, \frac{7+1}{4}, \text{ three } \frac{6+1}{3}, \text{ two } \frac{6+1}{4}, \frac{5+1}{4}, \text{ two } \frac{5+1}{3}.$$

From these formulæ it may be seen that the number of teeth on the under edge is variable as between the two species, and does not form any specific criterion. It also appears, and this does not seem to have been mentioned by earlier authors, that in the younger individuals the full number of teeth on the upper edge is not always developed, there being an unarmed gap between the tooth near the tip and a varying number proximally.

ii. Two of these individuals only show small teeth on the 2nd legs; in one they are irregular (? showing a tendency to linear arrangement), in the other they are clearer and sharper, and show an obvious arrangement in lines. In regard to this point I quote from v. Martens (*l. c.*): "Scheeren . . . , Carpus . . . , beide bei erwachsenen Exemplaren mit Dornen besetzt, welche sich namentlich an der Beugeseite in einer regelmässige Längsreihe ordnen." Also Ortmann (*l. c.*): "bei den übrigen ♂ werden die Dornen immer kräftiger und zeigen eine für diese Art charakteristische Anordnung in Längsreihen." Both these descriptions refer to *P. acanthurus.*

Also the 2nd leg of this same individual is covered with a fine pubescence, which is dense and thick round the fingers in a little more than half of their proximal portion, a character recognized in *P. acanthurus.*

Here, then, it may be noted that in one out of sixteen chance individuals the 2nd leg presents the characters of that of *P. acanthurus.*

I will add that in one of the larger examples and in all the smaller the palm of the hands is slightly swollen.

iii. In all these specimens the inner lateral spines of the telson are from 4–5 times the length of the outer, and are relatively longer in the younger individuals. All the latter have two feathered plumes; but in the adults there is this difference, that the two biggest have six plumes, the two next in size four plumes.

I note here, then, that the inner lateral spines are generally as in *P. nipponensis*, but perhaps a little shorter relatively to the outer.

P. nipponensis and *P. acanthurus* live in fresh water: these particular individuals were captured in an inland sea, of which the upper end, I am informed, is quite fresh, the lower brackish to salt; unfortunately there is no record as to the part of the sea in which they were captured.

78. PALÆMON PILIMANUS de Man.

Palæmon pilimanus, de Man, Notes Leyd. Mus. p. 181 (1879); id. Weber's Zool. Ergebn. p. 471, pls. xxvii. & xxviii. fig. 44 (1892); Ortmann, Zool. Jahrb. Syst. v. p. 735, pl. xlvii. fig. 9 (1891).

Loc. Aring, Kelantan, ten individuals; Belimbing River, one male. Length from 44 mm. to 30 mm.

Rostral formulæ:—2 ♂ $\frac{13}{2}$; 1 ♂ and 1 ♀ $\frac{14}{3}$; 1 ♂ and 1 ♀ with ova $\frac{11}{2}$; the rest $\frac{12}{2}$.

In Dr. Ortmann's figure of the telson the plumes between the lateral spines are shown as being a little shorter than the inner laterals; in these individuals they are longer, being in one instance (= the largest male) nearly twice as long. Three specimens only possess the 2nd pair of legs; in two of these the fingers are longer than the palm, in the other the fingers are shorter and the hand less compressed.

79. Palæmon sundaicus Heller.

Palæmon sundaicus, Heller, SB. Ak. Wiss. Wien, xlv. 1, p. 415 (1862); Ortmann, Zool. Jahrb. Syst. v. p. 719 (1891); de Man, Weber's Zool. Ergebn. p. 437, pl. xxvi. fig. 35 (1892).

Loc. River Patalong.

A male and a female with ova. Length, ♂ 24·5 mm., ♀ 28 mm.

The 2nd legs are quite smooth, without any signs of teeth even at the base of the fingers.

80. Palæmon lampropus de Man.

Palæmon lampropus, de Man, Weber's Zool. Ergebn. p. 493, pl. xxix. fig. 49 (1892).

Loc. Aring, Kelantan.

A large female with ova; length 63 mm.

A male, length 38 mm.; and a male, length 28 mm.

Some slight differences may be noted between these specimens and the species as described (*t. c. supra*). The rostrum in the female has 13 teeth only above, 5 below; in the larger male 12 only above, 4 below; in the smaller male it is broken off at the 9th, but the 1st tooth is seen to be a little separate from the rest. Moreover, while in the female the rostrum conforms to Dr. de Man's description in regard to its length, in the larger male it reaches quite as far as the scaphocerites, and considerably beyond the peduncle of the 1st antennæ.

Of the legs, the 1st pair shows this difference, that the carpal joint is quite twice as long, or even a little more than twice as long, as the hand. Only the larger chelipede of the larger male is present, and in this I note that the carpus equals the merus in length, and bears, in addition to the spinules on the upper and lower borders, a few similar spinules on its outer surface. There is also considerable grooving of the carpus and hand in this instance, but this, I have no doubt from its appearance, is due to mechanical compression only. The under edges of the carpi of the last 3 legs are armed with 10–12 spinules, of unequal size, and somewhat widely separate.

81. Palæmon paucidens, sp. n. (Plate XXXIII. fig. 4.)

Cf. *Palæmon idæ* (Heller), de Man, Zool. Jahrb. Syst. ix. p. 767 (1897); and *P.* cf. *idæ* (Heller), Ortmann, Semon's Forschungsreise, v. i. p. 18 (1894).

Loc. Singora; numerous individuals of both sexes.

This species is a small form, allied to *P. idæ* Heller by the relative shortness and the slightly raised upper margin of the rostrum, by the greater length of the carpus of the 2nd pair relatively to the merus and chela, and the shortness of the fingers relatively to the palm.

The rostrum, however, bears fewer teeth above, and the actual relative proportions of the joints of the 2nd pair are notably different.

The rostrum, then, is short and just reaches to the ends of the antennal scales, or even falls a little short of them.

On its under edge it bears 3–4 teeth ; on its upper edge from 5–8 teeth, not including a very small tooth, which gives to the tip a bifid appearance. In most cases the upper line of these teeth is straight, but in a few cases it is markedly convex, owing to the teeth that lie over the eyes (teeth 2–4) being raised above the level of those before and behind them ; and in yet other cases the upper line is curved, but not nearly so markedly. I summarize these characters in 50 individuals :—

	Upper line straight.	Upper line convex.	Upper line very moderately convex.
8 teeth....	1 specimen	1 specimen	0 specimen
7 "	7 "	0 "	4 "
6 "	21 "	2 "	5 "
5 "	8 "	1 "	0 "

Thus it appears that out of 50 individuals, 28 have 6 teeth, 11 have 7 teeth, 9 have 5 teeth, and 2 have 8 teeth ; so that 6 teeth may be considered the normal number for the species, but a number tending to vary on either side of the norm ; and similarly with the straightness of the upper line of the teeth, this character, however, varying only on one side of the norm. The outer maxillipedes reach beyond the antennal peduncles by the last joint or nearly the last joint ; the 1st pair of legs reach beyond the scaphocerites (*i. e.* beyond the anterior angle of their outer border) by the last joint, the 2nd pair by the last joint and nearly half the carpus. The carpus of the 2nd pair is thickened at its distal articulation, and the proportions of the different joints are as follows (in an individual 40 mm. long) :—

	Merus.	Carpus.	Palm.	Fingers.
Right leg....	5 mm.	7 mm.	3·25 mm.	2·25 mm.
Left leg	5 "	8 "	3·25 "	2·25 "

The greater length of the carpus of the left side in this specimen is, however, abnormal ; in other specimens the proportions are the same on both sides. The last three legs increase in length from before backwards, the 4th pair reaching beyond the 3rd pair quite by the last joint, and the 5th pair reaching beyond the 4th pair barely by the last joint ; the 5th pair, moreover, exceed the scaphocerites by the last joint and a third of the penultimate joint. All the legs are slender and quite smooth ; the fingers of the 2nd pair are unarmed.

The internal antennæ are a little longer than the animal itself (47 mm.) and about half the length of the external antennæ. The telson ends in a sharp point, which is much shorter than the internal of the two lateral teeth, the external of which is very small.

Dr. Ortmann (*l. c. supra*) has given a very brief description of a female, which he considers to be a young form of Heller's species; and, from the description, I judge him to have been dealing with a form the same as that here under consideration.

While not denying the possibility of this form being the young of *P. idæ*, I still think there is a strong probability that it is a distinct species, on the ground of the following considerations. There are, in this instance, quite 100 individuals before me, all agreeing in the possession of characters distinct from those of the *adult P. idæ*; all were collected from the same locality, and there are no specimens showing the size or characters of the adult *P. idæ*; moreover, in several instances, the females bear numerous well-developed ova, these females ranging in length from about 25–35 mm. These facts, indeed, are not sufficient to create certainty; I have at times noticed, for example, the comparatively small size of ova-bearing females in a species in which a much greater size is the general adult condition, so that physiological puberty may not necessarily indicate an arrival at the morphological adult stage. But they do seem to point to a very strong probability that we are dealing here with a distinct specific form, and not merely with the young of an allied species.

XLVI. Genus Penæus.

82. Penæus semisulcatus de Haan.

Penæus semisulcatus, de Haan, Crust. Jap. p. 191, pl. xlvi. fig. 1 (1839); Ortmann, Zool. Jahrb. Syst. v. p. 450 (1891).

Loc. Patani, six males and one female. Kelantan, two males. Singora, one male.

Length from 7·5 in. to 3·5 in.

Rostral formula in all but two $\frac{7}{3}$; in these two, which are males, one has formula $\frac{6}{2}$, the other $\frac{8}{3}$. In the two (smaller) males from Kelantan the rostrum is markedly deflected downwards at its point, and does not curve up again as in those from Patani. The ridge of the 6th abdominal segment is transversely notched just behind the middle in one of these males.

83. Penæus velutinus Dana.

Penæus velutinus, Dana, U.S. Expl. Exped., Crust. p. 604, pl. xl. fig. 4 (1852); Sp. Bate, 'Challenger' Macrura, p. 253, pl. xxxiii. fig. 1 (1888); Ortmann, Zool. Jahrb. Syst. v. p. 452, pl. xxxvi. fig. 6 (1891).

Loc. Pulau Bidan, Penang.

A young male; length 41·5 mm.

Rostral formula $\frac{8}{0}$. To the youth of this individual may perhaps be ascribed the two following points:—Firstly, the crest on the last four segments of the abdomen is very strong and *blunt*, that part of it which lies on the first of these four segments being grooved on its upper surface, those parts which lie on the last three ending each in a very distinct tooth. Secondly, there are only three lateral spines on the telson, of which the posterior two are nearly three times as long as the first.

84. PENÆUS CANALICULATUS Olivier, var.? (Plate XXXIV. fig. 5.)

Penæus canaliculatus, Oliv. Encycl. Méth. viii. p. 660 (1807); Sp. Bate, 'Challenger' Macrura, p. 243, pl. xxxii. fig. 1 (1888).

Loc. Pulau Bidan, Penang.

Two females and a male. Length: ♂ 58 mm., ♀ 59 mm., ♀ 50·5 mm.

The form of the petasma agrees with that of the species, but the form of the thelycum differs from that of the species and of the varieties figured by Spence Bate (*t. c.* pl. xxxii. figs. 3 and 4). The thelycum proper is nearly like that of the species, but there is an additional plate between the 4th pair of legs and no plate between the 3rd pair (*cf.* fig. 5). I have not given a distinct name to this form, as it has seemed to me that too little is known about the thelycum, and its possibly seasonal varieties within the same species, to justify the founding of a new variety on this character.

The telson in these specimens is armed laterally with three teeth, as in *P. caramote* Risso, and in the varieties *japonicus* and *australiensis* Spence Bate; but the absence of a strong spine on the 3rd pair of legs distinguishes it from *P. caramote*, and the form of the thelycum from Spence Bate's varieties.

85. PENÆUS BREVICORNIS M.-Edw.

Penæus brevicornis, M.-Edw. Hist. Nat. Crust. ii. p. 417 (1837); Sp. Bate, Ann. Mag. Nat. Hist. (5) viii. p. 180, pl. xi. fig. 2 (1881).

Loc. Patani. A female; length 70 mm.

86. PENÆUS sp.? (Plate XXXIV. fig. 7.)

Loc. Patani.

A male, of 56 mm. length, whose specific position I cannot determine with any certainty; for, though agreeing remarkably with the last species (*P. brevicornis*), it still presents two features which would seem sufficient to separate it from the latter. Its general form and the shape of the petasma, which agrees with the figure given by Spence Bate of that of *P. brevicornis* (l. c. supra), led me at first to regard it as belonging to that species, but a closer examination showed the following notable distinctions:—(*a*) the rostrum barely reaches the tips of the eyes, instead of being just a little longer than these, and it is less raised in its proximal portion over the base of the eye; (*b*) the peduncles of the antennules reach to the ends of the antennal scales, and their flagella are quite as long as the peduncles. In these respects it more resembles the *P. lysianassa* de Man (Mergui Crust. p. 291), but in that species the rostrum is even shorter, nor do the antennulary peduncles reach the ends of the antennal scales; moreover, the petasma, though somewhat similar, is still distinctly different.

87. PENÆUS AFFINIS Sp. Bate.

Penæus affinis, Sp. Bate, Ann. Mag. Nat. Hist. (5) viii. p. 179, pl. xii. fig. 6 (1881).

Loc. Pulau Bidan, Penang.

A female; length 38 mm.

The apex, *i. e.* anterior edge, of the heart-shaped thelycum in this specimen is, as it were, frayed out into very minute teeth, only visible under a lens.

88. PENÆUS MUTATUS, sp. n. (Plate XXXIV. fig. 6.)

Cf. *Penæus monoceros* (Fabr.), de Man, Weber's Zool. Ergebn. p. 513, pl. xxix. fig. 54 (1892); and *P. lysianassa*, id. Mergui Crust. p. 290, pl. xix. fig. 1 (1888).

Loc. —— ? A male and a female.

This species, although showing close affinities with *Penæus monoceros* by its general structure, yet presents in the male certain modifications (in the form of the petasma, 5th pair of legs, and telson) that closely resemble similar modifications in *P. lysianassa*; while the thelycum in the female, though very like that in *P. monoceros*, yet again shows a modification in structure which, so far as I know, has hitherto been described in only one other species.

In regard to its general structure it agrees, as I have said, closely with *P. monoceros*, and the description given by Dr. de Man (*t. c. supra*) for a female of that species applies equally well to these two individuals; with the exception that the legs are shorter, so that the 1st pair reach barely to the ends of the eye-stalks (*i. e.* the eyes not included), the 2nd pair reach only to the middle of the scaphocerites, the 3rd only to the tip of the spine at the outer distal angle of the scaphocerites, the 4th are as long as the 1st; the 5th, however, are *longer* than the 2nd by their last joint.

The petasma is remarkably like that in *P. lysianassa*, and so peculiar that I refer to the figure for its structure; it appears to differ chiefly in the structure of its anterior surface, which, instead of bearing two pairs of dentiform prominences, one at its base and one at its distal extremity, bears one pair at the base directed towards the ventral surface of the abdomen, and just above this pair another pair of low, bluntly triangular, prominences directed inwardly towards each other (*vide* fig. 6 *b*).

The thelycum is shaped much as in *P. monoceros* (*cf.* de Man, *l. c.* fig. 54 *a*; Ortmann, Zool. Jahrb. v. pl. xxxvi. fig. 3 *b*), with some slight differences best brought out by the figure. But, in addition to this, there are also a pair of small plate-like structures which abut against the outer sides of that grooved part of the thelycum which extends forwards towards the bases of the 4th pair of legs, which structures are formed as a backwardly directed process of the coxæ of the 4th legs, and are freely movable with them, as opposed to the fixity of the thelycum proper. A possibly (? and see below) analogous structure has been described by Spence Bate (Chall. Macr. p. 247, pl. xxxii. fig. 4) in the var. *japonicus* of *P. canaliculatus*, as to which he says: "A large thelycum....which extends forwards as far as the base of the antepenultimate pair of pereiopoda, whence project two large leaf-like appendages." In this variety they are, however, very large and foliaceous, and so quite different in appearance to the small plate-like structures in the present species; moreover, Spence Bate adds the following remark to this description: "They appear to be connected with the internal organs by means of foramina in the floor of the capsule, and have no connection whatever with the 5th pair of pereiopoda." I can find no trace of any connection between the internal organs and this structure in the present instance—the structure being, as I have said, freely movable and apparently nothing more than an outgrowth of the coxa of the 4th pair instead of the 3rd; its analogy, therefore, in the two forms seems doubtful.

XLVII. Genus Sicyonia M.-Edw.

89. Sicyonia lancifer Olivier.

Palæmon lancifer, Olivier, Encycl. Méth. vi. p. 664 (1807); Ortmann, Zool. Jahrb. Syst. v. p. 453 (1891).

Loc. Pulau Bidan, Penang.

A male; length 40 mm.

XLVIII. Genus Stenopusculus Richters.

90. Stenopusculus crassimanus Richters.

Stenopusculus crassimanus, Richters, Beitr. z. Meeresfauna d. I. Maurit. u. Seychellen, p. 168, pl. xviii. fig. 27 (1880); de Man, Arch. f. Naturg. liii. i. p. 565 (1887).

Loc. Pulau Bidan, Penang.

A male and four females (two with ova). Length from 12 mm.

Note on the Genus Actæopsis *Lanchester.*
(*Vide* P. Z. S. 1900, p. 741.)

In this note I have corrections to make in regard to both species and genus; and I will take the species first.

I. In the paper cited above I referred the specimens on which this genus was founded to a form that Mr. Borradaile was describing at the same time under the name *Carpilodes pallidus*. In doing this I erred, for the two forms are quite distinct, as may be readily seen on comparing the two figures (*l. s. c.* & Borr. P. Z. S. 1900, pl. xl. fig. 3). It is due to Mr. Borradaile to say that this mistake, which I regret exceedingly having made, was entirely mine.

II. I have since found that the name *Actæopsis* has already been used to designate a fossil genus (Carter, Q. J. Geol. Soc. liv. 1898), and must therefore be dropped. Under these and the above circumstances, I propose to rename the form *Actites erythrus*[1].

Although, as Dr. de Man has kindly pointed out to me in correspondence, this form is remarkably like the *Carpilodes lophopus* of Alcock (Journ. As. Soc. Bengal, 1898, p. 84, and Illustr. Zool. 'Investigator,' 1899, pl. xxxvi. fig. 2), I still feel that I was right in separating it from the genus *Carpilodes*.

It most obviously resembles *Carpilodes* in the smooth and even lobulation and grooving on the carapace; but it also most obviously differs from that genus in its prominent front, shape of lateral margins, and carinated legs. At the time I also saw what I thought were palatal ridges, but, as Dr. de Man has since pointed out to me, these are not true palatal ridges, but the "usual crests situated at the antero-external angles of the endostome, as in other species." Even so, however, the points I have enumerated above would still prevent me from considering the species as a *Carpilodes*, the prominence of the front and the shape of the lateral margins contribute to a *facies* so remarkably unlike that of a true *Carpilodes*. As to whether Major Alcock's species should also be included in my genus, I am unwilling to express a definite opinion, as I have not seen the type specimens; but, judging from the description and figure given, it would seem to be not unlikely.

EXPLANATION OF THE PLATES.

Plate XXXIII.

Fig. 1. *Lambrus lippus* (p. 536), dorsal view.
2. *Potamon improvisum* (p. 546), dorsal view.
2 *a*. Young from beneath abdomen.
3. *Pinnotheres socius* (p. 551), 3rd maxillipede.
4. *Palæmon paucidens* (p. 568), from left side.
4 *a*, 4 *b*, 4 *c*. Different types of rostrum.

Plate XXXIV.

Fig. 1. *Caridina gracillima* (p. 560), from right side.
2. *Callianassa secura* (p. 555), from right side.
2 *a*. Front of carapace.
3. *Automate dolichognatha* (p. 564), larger chelipede.
3 *a*. Smaller chelipede.
4. *Palæmon equidens* (p. 565), abnormal chelipede.
5. *Penæus canaliculatus* var.? (p 571). Thelycum.
6. *Penæus mutatus* (p. 572). Petasma, anterior and posterior views.
6 *a*. Thelycum.
6 *b*. Anterior, 6 *c*. Posterior views of petasma.
7. *Penæus* sp. (p. 571). Petasma, anterior and posterior views.
7 *a*. Anterior, 7 *b*. Posterior views of petasma.

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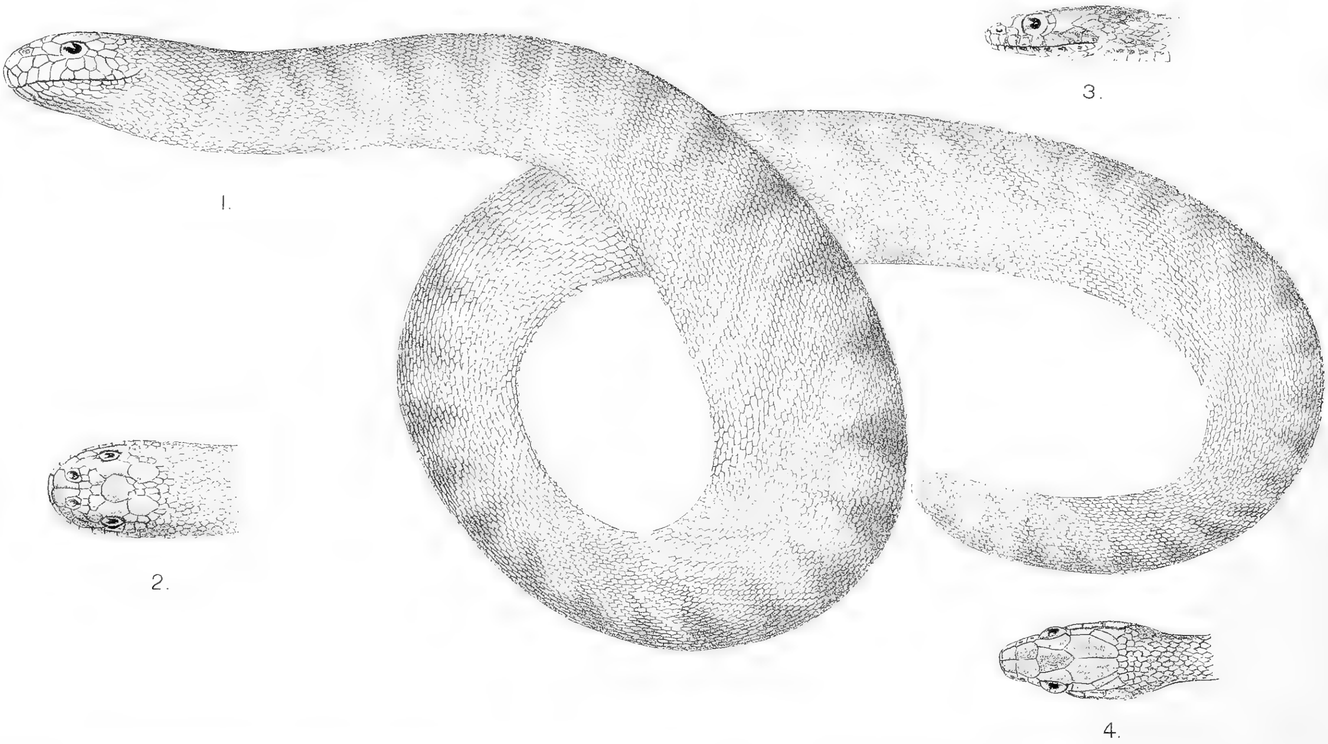
[1] *Actites*, = "a dweller by the shore," will also, I hope, indicate the close position of this genus to the Actæids.



Edwin Wilson, Cambridge.

SNAKES FROM THE MALAY PENINSULA.

3. List of a Collection of Snakes, Crocodiles, and Chelonians from the Malay Peninsula, made by Members of the "Skeat Expedition," 1899–1900. By F. F. Laidlaw, B.A., Assistant Lecturer and Demonstrator at Owens College. With an Appendix containing a list of the names of the places visited by the "Skeat Expedition." By W. W. Skeat.

[Received November 25, 1901.]

(Plate XXXV.[1])

Order OPHIDIA.

Fam. Typhlopidæ.

1. Typhlops braminus Daud.

2. Typhlops nigroalbus Dum. et Bibr.[2]

Typhlops nigroalbus, Boulenger, Cat. Snakes, i. p. 24; S. S. Flower, P. Z. S. 1899, p. 653.

Several specimens, agreeing closely with the example described by Boulenger in the 'Catalogue,' from Jalor and Kuala Aring. In none of these, however, does the rostral shield extend to the level of the eye. In this respect it agrees with *T. muelleri* Schleg. from Sumatra, but differs from this latter in having the breadth of the rostral shield as in *T. nigroalbus*. Our specimens seem, then, to be intermediate between these two species. Largest specimen 424 mm. in total length.

Fam. Boidæ.

3. Python reticulatus (Schneid.).

Fam. Ilysiidæ.

4. Cylindrophis rufus (Laur.).

Cylindropis rufus, Boulenger, Cat. Snakes, i. p. 135; id. Faun. Brit. Ind., Rept. p. 250; S. S. Flower, P. Z. S. 1899, p. 656, pl. xxxvii. fig. 3.

One specimen from Biserat, lacking the vermilion colour on the tail. Called "Ular gelenggang" (sugar-mill snake).

Fam. Xenopeltidæ.

5. Xenopeltis unicolor Reinw.

Xenopeltis unicolor, Boulenger, Cat. Snakes, i. p. 168 (skull

[1] For explanation of the Plate, see p. 583.

[2] Since this paper was read I find that Werner (Zool. Jahrb. Syst. xiii. p. 488) is of opinion that *T. nigroalbus* D. et B. = *T. muelleri* Schleg.

figured); id. Faun. Brit. Ind., Rept. p. 276; S. S. Flower, P. Z. S. 1899, p. 657.

Two specimens from Kuala Aring. One, an adult, had devoured another snake (*Lycodon laoensis*, apparently) about as long as itself. The other, immature, had the head of a pale yellowish colour. Malay name: "Ular ekor merak" (peacock's-tail snake).

Fam. Colubridæ.

Series **Aglypha.**

Subfam. Acrochordinæ.

6. Acrochordus javanicus Hornstedt.

Acrochordus javanicus, Boulenger, Cat. Snakes, i. p. 173; S. S. Flower, P. Z. S. 1899, p. 658.

A female from Biserat. Total length 1700 mm. Called by the Malays the elephant's-trunk snake ("Ular belalei gajah").

Subfam. Colubrinæ.

7. Polyodontophis geminatus (Boie).

8. Tropidonotus trianguligerus Boie.

9. Tropidonotus piscator (Schneid.).

10. Tropidonotus inas, sp. n. (Plate XXXV. fig. 2 *a*, *b*.)

Internasal shield broadly truncate, hinder maxillary teeth gradually enlarged, anal shield divided, one anterior temporal scale; nine upper labials, 143 ventrals, 96 subcaudals; outer scales smooth. Colour above brownish black; a lateral line of ill-defined yellowish spots on either side; ventrals white, with a square black spot on the outer margins. Head dull brown above, with a yellowish-white streak running from under the eye on either side, passing back into the lateral lines. Allied to *T. conspicillatus* of Borneo. A single specimen from Gunong Inas. Length: body 272 mm., tail 125.

11. Tropidonotus subminiatus Schl.

Biserat.

12. Macropisthodon rhodomelas Boie.

Kuala Aring.

13. Lycodon laoensis Günth.

Lycodon laoensis, Boulenger, Cat. Snakes, i. p. 354; S. S. Flower, P. Z. S. 1899, p. 665.

A specimen from Kota Bharu, Raman, found under a charred log. Called "Ular kapak malas" (lazy axe-snake; any snake with the head well defined is called an axe-snake).

14. ZAMENIS KORROS Schleg.

Zamenis korros, Boulenger, Cat. Snakes, i. p. 384; id. Faun. Brit. Ind., Reptiles, p. 324; S. S. Flower, P. Z. S. 1899, p. 666.

Very common near Kota Bharu, Raman, and all over the State of Patani. It is called "Ular liar" (the wild snake). Its food consists largely of frogs.

15. COLUBER TÆNIURUS (Cope).

Coluber tæniurus, Boulenger, Cat. Snakes, ii. p. 47; id. Faun. Brit. Ind., Reptiles, p. 333; S. S. Flower, P. Z. S. 1899, p. 668.

This species is the cave-snake of Selangor and Johor. Two specimens were caught by Mr. Annandale in a cave near Biserat, about a quarter of a mile from its mouth. They were quite purblind in a bright light.

16. COLUBER RADIATUS Schleg.

Coluber radiatus, Boulenger, Cat. Snakes, ii. p. 61; id. Faun. Brit. Ind., Reptiles, p. 333; S. S. Flower, P. Z. S. 1899, p. 669.

Common in houses in Patani, where it is called the rat-snake, "Ular tikus."

17. DENDROPHIS PICTUS (Gmel.).

Dendrophis pictus, Boulenger, Cat. Snakes, ii. p. 78; S.S. Flower, P. Z. S. 1899, p. 669.

This species seems to make considerable leaps from branch to branch. Mr. Annandale caught a specimen at Kuala Aring in a butterfly-net, in the act of jumping.

18. DENDROPHIS FORMOSUS Boie.

Kuala Aring.

19. DENDROLAPHIS CAUDOLINEATUS (Gray).

20. SIMOTES PURPURASCENS (Schleg.).

Kota Bharu, Raman.

21. ABLABES TRICOLOR (Schleg.).

Kuala Aring.

22. CALAMARIA PAVIMENTATA Dum. et Bibr.

Kota Bharu, Raman.

Series **Opisthoglypha.**

Subfam. HOMALOPSINÆ.

The members of this subfamily are commonly known to the Malays as "Ular ayer," or water-snakes; they appear to leave the water frequently and are often found some distance from it, especially *Hypsirhina enhydris*, which I found on Gunong Inas far away from the river.

23. Hypsirhina plumbea (Boie).

Biserat.

24. Hypsirhina enhydris (Schneid.).

Biserat, Kekabu, Gunong Inas.

25. Hypsirhina bocourtii Jan.

Hypsirhina bocourtii, Boulenger, Cat. Snakes, iii. p. 10; S. S. Flower, P. Z. S. 1899, p. 676.

At the hottest part of the year this snake, according to the Malays, leaves the swamps and goes out to deep water. A specimen was taken at Biserat along with *Acrochordus javanicus*.

26. Homalopsis buccata (Linn.).

27. Cerberus rhynchops (Schneid.).

Malacca.

Subfam. Dipsadomorphinæ.

28. Dipsadomorphus dendrophilus (Boie).

Dipsadomorphus dendrophilus, Boulenger, Cat. Snakes, iii. p. 70; S. S. Flower, P. Z. S. 1896, p. 889; id. P. Z. S. 1899, p. 680.

This species is nocturnal and much feared by the Malays, who at the same time do not consider it particularly poisonous. In the stomach of one of our specimens another snake was found, a second had been feeding on large slugs. The Malays call this species "Ular katam tebu" ("katam tebu" are the little pieces of sugar-cane peeled and stuck on skewers for sale in the markets); the name obviously refers to the yellow rings on the body. Mr. Annandale tells me that the same name is given to *Bungarus fasciatus* and sometimes to the sea-snake. Common at Patalung, Jalor, and Kuala Aring. It thumps the ground with its tail when alarmed, making a loud knocking sound.

29. Dipsadomorphus cynodon (Boie).

Kuala Aring.

30. Dryophis prasinus Boie.

Biserat, Kuala Aring, Ulu Selama.

31. Psammodynastes pictus Ptrs.

Bukit Besar.

32. Chrysopelea ornata (Shaw).

Chrysopelea ornata, Boulenger, Cat. Snakes, iii. p. 196; id.

Faun. Brit. Ind., Reptiles, p. 371; S. S. Flower, P. Z. S. 1896, p. 890; id. P. Z. S. 1899, p. 682.

Malay name "Ular jelotong" ("jĕlotong-coloured snake")[1].

Var. A. 1 from Biserat.
1 from Penang.
Var. D. 1 from Singgora.
3 from Naun Chik.

Series **Proteroglypha.**

Subfam. Hydrophinæ.

All the sea-snakes mentioned below were collected by Mr. Annandale at Patani from the seine-nets of the fisher-folk, with the exception of two, which he picked up on the beach at Singgora. The collection at Patani was made within a week, and the large numbers of some of the commoner species, especially *Enhydrina valakadien*, show how very numerous these creatures are in the Malayan waters. A single specimen of a species hitherto undescribed, to which I have given the name of *Distira annandalei*, is of interest on account of the way in which the scales on the head are subdivided, and also because of the great number of rows of scales round the body; in these respects it is the most specialized member of the genus known. The water from which these specimens from Patani were taken was fresh to the taste. The Malays informed Mr. Annandale that during the monsoon, when the salt water is blown across the bar and into the estuary of the river, they are far more poisonous than at other times. Three men were said to have died from bites of sea-snakes recently in a single monsoon-season. They are so abundant that one or more are taken in every haul of the net. The native name for the snakes belonging to this family is "Ular bērang," or "gērang," and sometimes the rough-keeled larger species are known as "Ular gelireh."

33. Hydrophis nigrocinctus Daud.

34. Distira ornata (Gray).

35. Distira jerdonii (Gray).

Distira jerdonii, Boulenger, Cat. Snakes, iii. p. 229; S. S. Flower, P. Z. S. 1899, p. 688.

Several specimens of this very handsome species were collected. It appears to be rare.

36. Distira wrayi Boulenger.

37. Distira annandalei, sp. n. (Plate XXXV. fig. 1 *a*, *b*.)

Body short, much compressed; head moderate; scales juxtaposed,

[1] The "jĕlotong" is a kind of tree with slate-coloured bark; = *Dyera maingayi* or *D. costulata*.—F. F. L.

smooth or feebly tuberculate anteriorly, very small; 76 rows round the neck, 89–90 round the body. One pair of chin-shields; frontal shield longer than broad, longer than the parietals, which are separated from the frontal and from each other by small scales. Rostral broader than deep; prefrontals small. The front end of the frontal is segmented off to form a small median scale; 10 or 11 labials, fifth in contact with the orbit on one side, but not on the other; one or two preoculars, a subocular, and two or three post-oculars. Ventral shields feebly enlarged, 310 in number.

Colour olive-grey above, with transverse bands of a darker shade, broadest above, fading away on the sides, which, like the belly, are yellowish white.

Total length 500 mm., tail 70.

One specimen from Patani.

38. Enhydris curtus.

Enhydris curtus, Boulenger, Cat. Snakes, iii. p. 300; id. Faun. Brit. Ind., Reptiles, p. 396.

Apparently not recorded hitherto from these waters. Two specimens from Singgora.

39. Enhydris hardwickii (Gray).

40. Enhydrina velakadien (Boie).

Subfam. Elapinæ.

41. Bungarus fasciatus (Schneid.).

Bungarus fasciatus, Boulenger, Cat. Snakes, iii. p. 366; id. Faun. Brit. Ind., Reptiles, p. 388; S. S. Flower, P. Z. S. 1899, p. 689.

The Malays of Biserat call this snake by the same name as *Dipsadomorphus dendrophilus* (*i. e.*, "Ular katam tebu). They appear, however, to distinguish between the two to some extent, regarding *Dipsadomorphus* as non-poisonous, or at any rate not so poisonous as the *Bungarus*.

42. Naia tripudians Merr.

Naia tripudians, Boulenger, Cat. Snakes, iii. p. 380 (skull fig. p. 372); id. Faun. Brit. Ind., Reptiles, p. 391; S. S. Flower, P. Z. S. 1899, p. 690.

Malay name "Ular tedong sendok"=turmeric-coloured spoon-snake. A young specimen from Biserat belonged to var. B of the 'Catalogue,' having dark rings on a dark brown ground-colour. An adult specimen from Raman agrees in colour with the specimen described by Mr. Flower from Perak, except that its under surface has no darker markings.

43. Callophis maculiceps Günth.

Biserat, Gunong Inas.

44. Doliophis bivirgatus (Boie).

Raman, Kelantan, Gunong Inas.

Fam. Amblycephalidæ.

45. Amblycephalus lævis Boie.

Amblycephalus lævis, Boulenger, Cat. Snakes, iii. p. 441; id. Faun. Brit. Ind., Reptiles, p. 415; S. S. Flower, P. Z. S. 1899, p. 694.

Mr. Annandale collected a single specimen of this rare snake on the boundary between Ligeh and Raman. In colour it is greyish brown above, with darker, almost black, cross-bars, which run down the sides; the sides between these are dull orange. Lower parts yellowish, thickly dusted over with brown spots. The orange and dark markings on the sides of the body account for the native name "Ular kapak rimau," or tiger axe-snake.

46. Amblycephalus moellendorffii (Boettg.).

Amblycephalus moellendorffii, Boulenger, Cat. Snakes, iii. p. 443; id. Faun. Brit. Ind., Reptiles, p. 415; S. S. Flower, P. Z. S. 1899, p. 694.

An adult female and a young individual from Biserat. Called "Ular kapak" by the Malays. The name "Ular kapak," or axe-snake, is given to any small snake with a well-marked neck. This species has not, I believe, been recorded hitherto south of Tenasserim.

Fam. Viperidæ.

Subfam. Crotalinæ.

47. Lachesis gramineus (Shaw).

Gunong Inas.

48. Lachesis wagleri (Boie).

Lachesis wagleri, Boulenger, Cat. Snakes, iii. p. 552; S. S. Flower, P. Z. S. 1899, p. 696.

Singapore. A young individual of var. A. Perhaps this variety is merely the young stage of var. D.

Order EMYDOSAURIA.

Fam. Crocodilidæ.

1. Crocodilus porosus Schn.

2. Crocodilus palustris Lesson.

Crocodilus palustris, Boulenger, Cat. Chel. &c. p. 285; id. Faun.

Brit. Ind., Rept. p. 5 (fig. p. 2); S. S. Flower, P. Z. S. 1899, p. 625.

A single small specimen, some 7 feet long, from Biserat in Jalor. This species is apparently very rare in the Peninsula, and it does not range further east.

Order CHELONIA.

Fam. TESTUDINIDÆ.

1. DAMONIA SUBTRIJUGA (Schleg. & Müll.).

Damonia subtrijuga, Boulenger, Cat. Chel. &c. p. 94; S. S. Flower, P. Z. S. 1899, p. 610.

Several young from Lampan in Patalung and an adult from Biserat. The length of the carapace of the latter following the curve is 165 mm.

2. BELLIA CRASSICOLLIS Gray.

Patalung, Raman.

3. CYCLEMYS PLATYNOTA Gray.

Belimbing in Legeh.

4. CYCLEMYS AMBOINENSIS (Daud.).

Cyclemys amboinensis, Boulenger, Cat. Chel. &c. p. 133 (skull fig. p. 128, shell fig. p. 129); id. Faun. Brit. Ind., Reptiles, p. 31; S. S. Flower, P. Z. S. 1899, p. 614.

Our largest example of this species, from Biserat, had no nuchal plate.

5. GEOEMYDA SPINOSA Gray.

Geoemyda spinosa, Boulenger, Cat. Chel. &c. p. 137; id. Faun. Brit. Ind., Reptiles, p. 25; S. S. Flower, P. Z. S. 1899, p. 614.

One specimen from a hill near Kuala Aring and several from the flat swampy country round Kota Bharu, the capital of Kelantan. It would seem thus to inhabit plains or hills up to 2000 feet or so indifferently.

6. GEOEMYDA GRANDIS Gray.

Biserat.

7. TESTUDO EMYS Schleg. & Müll.

Testudo emys, Boulenger, Cat. Chel. &c. p. 158 (skull fig. p. 150); id. Faun. Brit. Ind., Reptiles, p. 22; S. S. Flower, P. Z. S. 1899, p. 616.

Native name (Kelantan) "Kura kura anam kaki" (six-legged tortoise). This name is easily intelligible if the hind legs of a living example be examined. The Malays say that this species is only found in the hills, that the male can roar loudly like a tiger, and that the female buries her eggs under a mound of dead leaves and soil. Mr. Annandale obtained a very fine specimen at Biserat. Its carapace was 500 mm. long, following the curve; he was told that still larger specimens are to be met with.

8. Testudo elongata Blyth.

Fam. Chelonidæ.

9. Chelone mydas (L.).

Fam. Trionychidæ.

10. Trionyx subplanus Geoffr.

Trionyx subplanus, Boulenger, Cat. Chel. &c. p. 246 (skull fig. p. 247); S. S. Flower, P. Z. S. 1899, p. 619, pl. xxxvi.

Fairly common in the Krian River of Upper Perak. The specimens obtained were caught in fish-traps in a place where the river was practically a cataract.

Malay name "Labi-labi" (applied also to the next species).

11. Trionyx cartilagineus (Boddaert).

Kelantan and Patani Rivers.

EXPLANATION OF PLATE XXXV.

Fig. 1 *a*. *Distira annandalei*, p. 579.
1 *b*. Head of do. from above.
2 *a*. Side view of head of *Tropidonotus inas*, p. 576.
2 *b*. View of do. from above.

APPENDIX.

List of Place-names in the Siamese Malay States visited by Members of the "Skeat Expedition"[1].

The following List, comprising the names of places at which collecting was done in the course of the recent Malay-States Expedition, has been compiled by request, in the hope that it may afford some sort of a guide to the localities in which the collecting was carried out and at the same time make it easier to arrive at uniformity in the matter of spelling.

The accented, or "stressed," syllable is, *as a rule*, the penultimate (in the case of words of more than one syllable).

The vowels and diphthongs are pronounced much as in Italian, the diphthongs being, if anything, a trifle shorter. The chief exception to this rule (in standard Malay) is the sound written "ĕ," which represents what is called the "indeterminate" vowel. The

[1] Drawn up by Mr. W. W. Skeat (June, 1901).

following is a general list of the letters here used and their equivalents:—

A. *Vowels and diphthongs*:—

ā as in Eng. "faç*a*de."
ă as in last syllable of Eng. "Afric*ă*."
ē as in Eng. "f*ê*te."
ĕ as in Eng. "the" when unaccented, *e. g.* "thĕ man," or = short ă in "m*ă*chine."
ī as in Eng. "mach*i*ne."
ĭ as in Eng. "*i*t."
ō as in Eng. "n*o*te."
ŏ as in Eng. "g*o*t."
ū as in Eng. "r*u*le."
ŭ as in Eng. "b*u*ll."
au as *ou* in Eng. "l*ou*t."
ei as in Eng. "h*ei*ght."

B. *Consonants*:—

B, D, P, T, H, J, L, M, N, R, as in English.
CH always as in Eng. "church"; S as in Eng. "sin" (never as z); G always hard; medial NG always as in Eng. "singer," never as in Eng. "stronger," "longer," which sound is always written NGG.
K initial as in Eng. "kite," but at the end of a word it is always a "click," formed by sharply closing the throat.

The place-names which follow are taken in order, commencing at the northernmost point of the East Coast visited by us and working southwards.

I. Ligor (called in Siamese "Lakhawn"). Small East Coast State, S. of 9° 20′ (N. latitude).
Chief village: Ligor.
(Part of the Tălē Noi or Little Lake at the N. end of the Inland Sea is in Ligor.)

II. Singgora (correctly as spelt, but often written Singora). Small East Coast State lying S. of 7° 20′ parallel of N. latitude; headquarters of the Siamese High Commissioner for the East Coast States.
Chief village: Singgora (called in Siamese "Sung-Klā"), situated at the entrance to the Tălē Sāp, or "Inland Sea."
Other village visited: Lam Lom.
Inland Sea, or Big Lake, called Tălē Sāp.
Little Lake (at N. end of Tălē Sāp) called Tălē Noi ("Nawi").
Islands in Inland Sea: "Birdsnest Islands" (Ko Si Ha).

III. Pătālung. Small East Coast State, S. of 7° 50′ (N. latitude).
Chief village: Lampam (also occasionally called "Patalung").
Other villages visited: Ban Nah, Ban Kong Rak, Ban Kong Kram, Ko Mu Rah, Ko Tom, Ko Nam Kam (all in the interior).

IV. [Chana and Tepa, two small districts lying between Singgora and Patani, were not visited.]

V. Pătāni. Formerly the most important and flourishing of the Malay East Coast States. Subdued by Siam and subdivided into seven provinces or districts under separate Governors, as follows:—

(1) *District of Pătāni.* S. of 6° 55′ (N. latitude).
Chief town: Pătāni (seat of a Siamese Governor and Malay Raja).

(2) *District of Nawng Chik.* S. of 6° 55′ (N. latitude); north of Patani District.
Chief village: Ban Nawng Chik (lit. "N. Ch. Village").
Mountain visited: Būkit Bĕsār (*i. e.* Big Mountain) or Indragiri ("Nĕgiri"); villagē at foot, Ko Sai Khau.

(3) *District of Jering.* S. of 6° 55′ (N. latitude); south of Patani District.
Chief village: Jambu.
Other village visited: Pĕngārik.

(4) *District of Teluban* or *Sai* (lit. = "sands"). S. of 6° 55′ (N. latitude); south of Jering District.
Chief village: Tĕlūban.
Chief river: Tĕlūban.

(5) *District of Jālā* (often written Jālor). S. of 6° 40′ (N. latitude); west of Patani District.
Chief village: Bisĕrat, on the left bank of the Patani.
Limestone Caves: Gua Gambar, or "Image" (*i. e.* "Statue"), "Cave"; Gua G'lap = "Dark Cave," and others.

(6) *District of Raman* (or Rĕman). S. of 6° 35′ (N. latitude); south of Jālā District.
Chief village: Kōta Bhāru or "New Fort."
Other village visited: K. Kĕkābu.
Chief river: Patani.

(7) *District of Ligeh* (called in Siamese "Ranga"). S. of 6° 30′ (N. latitude); south of Raman District.
Chief village: Tanjong 'Mas (lit. "Golden Cape").
Other village visited: Trĕmangan; Tomoh; Bĕlimbing.

VI. Kĕlantan. Now the largest and most important of the East Coast States. S. of 6° 15′ (N. latitude); south of Teluban and Ligeh.
Chief town: Kōta Bhāru (lit. New Fort), seat of the Sultan of Kelantan.

Chief river: the Kĕlantan.

Tributaries of the Kĕlantan: the Pergau (the village at confluence with the Kelantan R. is "Kuala P."); the Gālas; the Lĕbih (village on the Lebih R.—Aur Gading); the 'Sam.

Tributary of the Lĕbih: the Aring.

N.B.—The village at the mouth of the Aring was called Kampong Kuala Aring; that upstream was Kampong Buntal.

VII. TRENGGĀNU. S. of 5° 50′ (N. latitude); south of Kelantan.

Chief town: Trenggānu, on a river of the same name.

Coral Islands off the coast: the Redangs, called in Malay "Pulau Rĕdang Besar," or the "Great Rĕdang," and P. Pinang (S. of 5° 50′); visited by Messrs. Evans and Yapp.

West Coast.

VIII. KĔDAH, or SAI BŬRĪ. S. of 6° 40′ (N. latitude): Siamese Dependency on mainland, running N.E. from the Island of Penang, which is leased from its Sultan.

Chief town: Ālor Sĕtar ("S'tar"), on the Kedah River.

Mountains: Gunong Jĕrai or "Kedah Peak" and Bukit Perak ("Silver Mountain").

Islands: Pulau Bīdan, one of the "Nine Islands" group off the coast of Kedah (visited by Mr. Evans only).

[N.B.—Two small districts N. of Kĕdah were called Sĕtul[1] (S. of 7° 8′) and Perlis (S. of 6° 55′).]

IX. PĒRAK. S. of 6° (N. latitude). Northernmost British Possession, forming part of the Federated Malay States.

Chief town: Taiping.

Mountain visited: Gunong Īnas (visited by Messrs. Yapp and Laidlaw). Encampment at foot, Sīra (not *Sirih*) Rimau.

River: the Sĕlama River ("Sungei Sĕlāma").

Villages visited: K. Selama and K. Ulu Selama.

Notes on the prefixes to Malay place-names:—

Gūnong: a "crag" or rocky peak; a hill with crags or boulders.

Būkit: a forest-clad hill or mountain (with few or no exposures); called "Kō" in Siamese.

Sungei: a river or stream.

Tanjong: a cape or point of land.

Tĕlok: an inlet or bay.

Ulu: the headwaters or upper reaches of a river.

Kuala (pr. Quolla): the mouth or estuary of a river; the point of confluence of two rivers or streams.

Kampong: a (Malay) village or hamlet, called "Ban" in Siamese.

Pūlau: an island.

Sira: a "salt lick" (formed by hot springs). W. W. S.

[1] Not Sĕtal, as previously printed.

4. Notes upon the Anatomy and Systematic Position of *Rhynchæa*. By Frank E. Beddard, M.A., F.R.S., Vice-Secretary and Prosector to the Society.

[Received November 19, 1901.]

(Text-figures 56–63.)

The acquisition by the Society of three living examples of the "Indian Painted Snipe" and the death of them has enabled me to add something to the existing knowledge of *Rhynchæa*. This bird is usually arranged by authors of to-day in the immediate neighbourhood of the Snipes and Woodcocks. It is so placed, for example, by the late Mr. Seebohm[1] and by Dr. Blanford[2]. Those who know the bird wild are often disposed to deny its Snipe-like characters, while Dr. Elliott Coues regards it as "exactly between the true Snipe and the Godwits." Prof. Fürbringer[3], influenced mainly by the condition of certain muscles of the wing, by the number of the rectrices, and by the form of the wing and its capabilities of flight, is inclined to place the bird nearer to the Parridæ, and, in fact, to make for it a special subfamily of Limicoline birds—Rhynchæinæ, equivalent to his two other subfamilies, viz. Charadriinæ and Scolopacinæ. The last-mentioned author points out that others have been struck with certain Rail-like characters in this, at least aberrant, genus of Scolopacidæ. My own investigations into the anatomy of this bird lead me in the first place to entirely deny any close affinity to the Scolopacinæ (in the sense adopted by Dr. Blanford, *i. e.* as including *Rhynchæa*, *Gallinago*, and *Scolopax*), and to agree to some extent with Dr. Fürbringer's opinion that an alliance with the Parridæ is not at all unreasonable. As a matter of fact, Fürbringer does not seem to be correct in his statement as to the rectrices. But I shall consider this matter under the

External Characters.

Nitzsch, who examined the pterylosis of this bird, found it to differ in a number of peculiarities from the Woodcock. He stated, among other facts, that the number of *rectrices* was only 10, the prevalent number being 12 to 16 and even more in the Snipes. Dr. Blanford allows no less than 14 rectrices. I can only find 12 in the two examples which I have examined for this purpose. A special resemblance therefore to the Parridæ falls to the ground. As to the *remiges*, I agree with Nitzsch that 20 is the right number.

The *oil-gland* of course is tufted. The dorsal *pterylosis* seems to me to have been correctly described by Nitzsch. I would add that the strong feathering of the dorsal tract ends abruptly just where

[1] 'The Geographical Distribution of the Charadriidæ' (London, 1887).

[2] Fauna of British India: Birds, vol. iv. p. 283.

[3] 'Untersuchungen zur Morphologie und Systematik der Vögel' (Amsterdam, 1889).

the single tract divides between the shoulders. This division is only just recognizable; it extends for such a very short way, that on a superficial inspection one might be disposed to deny that the tract did divide at all. The rest of the dorsal tract does not, as Nitzsch correctly states, enclose any space. It begins close up to the first part of the dorsal tract, and consists of soft feathers scattered irregularly over the back. Just in front of the oil-gland, however, there is a short row of stiff feathers, but not such strong feathers as those which form the first part of the dorsal tract. The ventral tracts are double on each side, and the outer half of each is rather wider and composed of somewhat stronger feathers than the more ventrally placed row.

Alimentary Viscera.

The *gizzard* of this bird is strong and muscular, with extensive tendinous sheets on either side. It is altogether quite a typical gizzard of a grain-eating bird. The *intestine* is 16 inches long, of which 2 inches lie between the cæcum and the cloaca. The *cæca* are $1\frac{5}{8}$ inch long. The proportions of the various sections of the gut differ from those of many Limicolæ. But it must be admitted that they are not far from those of the Jack Snipe (*Gallinago gallinula*). In that bird the intestines are one foot in length and the cæca 1 inch each. *Scolopax*, on the other hand, is very different, with an intestine of 4 feet and cæca of only half an inch in length. *Tringa canuta* agrees almost exactly in the lengths and proportions of intestine and cæca: it has an intestine of $18\frac{1}{2}$ inches and cæca of $1\frac{4}{5}$ inches.

The *liver-lobes* differ greatly in size, the right being quite twice the size of the left; they are, moreover, of a different shape, the right being broader in proportion to its length than is the left.

In these proportions of the liver-lobes *Rhynchæa* differs from both *Scolopax* and *Gallinago*, where the two lobes are subequal, but, it must be noted, different in shape. In *Tringa canuta* and *Charadrius pluvialis* the same proportions of the liver-lobes as in *Rhynchæa* obtain, also, it may be observed, in the Parridæ.

Muscular Anatomy.

Fürbringer has dealt in detail with the wing musculature of *Rhynchæa*. I have only concerned myself with the muscles of the hind limb, which show some differences in the various genera of Limicolæ. In the majority of genera, as Garrod pointed out[1], the formula is the reduced one, *i. e.* A.X.Y., the ambiens being also present in all Limicoline birds. This is the formula of *Scolopax* and *Gallinago*; and it must be noted that in these two genera, the supposed allies of *Rhynchæa*, the femoro-caudal is reported by Garrod to be "small." *Rhynchæa* agrees with the genera *Ægialitis*, *Himantopus*, *Hæmatopus*, *Recurvirostra*, and *Numenius* in having the full muscle-formula of the hind limb, viz., A.B.X.Y., and the femoro-caudal is a large and strong muscle.

[1] Collected Papers edited by W. A. Forbes (London, 1881), p. 203.

Syrinx.

The windpipe of this genus was investigated by the late Mr. Wood-Mason, who published an account [1], illustrated by a plate and two woodcuts, of the main features in the structure of that tube.

Text-fig. 56. Text-fig. 57. Text-fig. 58.

Text-fig. 56.—Portion of windpipe of *Rhynchæa capensis*, ♀.
Text-fig. 57.— " " Woodcock (*Scolopax rusticula*).
Text-fig. 58.— " " Common Snipe (*Gallinago cœlestis*).

He pointed out that in this species the windpipe of the female is slightly convoluted and that that of the male is perfectly straight.

[1] "On the Structure and Development of the Trachea in the Indian Painted Snipe (*Rhynchæa capensis*)," P. Z. S. 1878, p. 745.

I can confirm this statement. As the accompanying figure (text-fig. 56) shows, the windpipe is slightly convoluted in a female bird which I dissected, while I found it to be straight in the male. I have thought it worth while, however, to have a special figure prepared, inasmuch as those of Mr. Wood-Mason do not show with great plainness the remarkable asymmetry of the extrinsic muscles of the syrinx. It will be noted in the accompanying figure that the two muscles, instead of arising on opposite sides of the windpipe, arise close together and on the left side. This asymmetry reminds one of that of the Pigeons, a group which is by some considered to be allied to the Limicolæ. I think also that my figure is a little clearer in the details of the rings which constitute the syrinx.

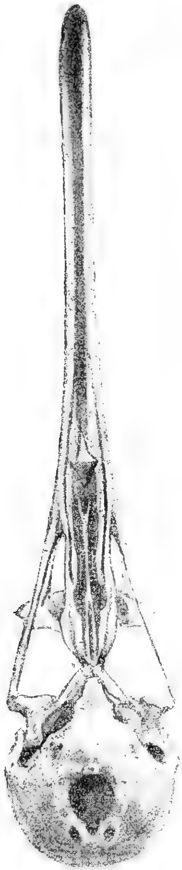
As to the intrinsic muscles, there are a slender pair which are shown in my figure. These muscles seem to be inserted, as is shown in that figure, into the interspace between two rings of the syrinx, and not into one of the rings themselves. For purpose of comparison, I have had sketches made of the windpipes of the two birds, which have been generally supposed to be near allies of the genus *Rhynchœa*, but which I do not regard as nearly akin to that Limicoline. Text-fig. 57 represents the windpipe in the neighbourhood of, and including, the syrinx in the Common Woodcock, while text-fig. 58 is a corresponding figure of the syrinx of a Common Snipe (*Gallinago cœlestis*). In both of these birds the syrinx has a more regular shape than it has in the rather exaggerated case of *Rhynchœa*. The two genera with which I compare *Rhynchœa* have syringes which are quite like those of the Ardeidæ, for example, and of many birds whose syringes are not greatly modified from the common ground-plan of that organ among birds. It is not necessary for me to go into detail in my comparisons of the organ in the three types; my object is rather to point out the several salient differences that have been indicated. I may remark, however, that in the Snipe there are but slight intrinsic muscles. In *Scolopax rusticula*, on the other hand, the syrinx has a pair of better developed intrinsic muscles, which, however, differ from those of *Rhynchœa* in the fact that their lower ends are not attached to an interspace between two syringeal rings, but to one of those rings themselves. The difference is not an important one, but, such as it is, it exists. Nor, indeed, can I, in view of the great differences in details of anatomy which distinguish the syringes of closely allied forms in some cases, lay too much weight upon the contrasting facts which I here bring together. But in any case I am justified in pointing out that, while the genera *Scolopax* and *Gallinago* (if we allow them to be distinct genera, which everyone—for example the late Mr. Seebohm—does not) possess syringes which are very much alike even in details, both of these genera differ markedly in the syringes from their supposed ally *Rhynchœa*.

The Skull.

The skull in its general aspects is quite typically Limicoline.

But it nevertheless presents certain small differences from the various genera with which I have been able to compare it. The proportions of the cranial to the facial regions of the skull are much those of *Himantopus*. Two features of some systematic importance can be noted on a dorsal inspection of the skull of

Text-fig. 59.



Text-fig. 60.

Text-fig. 59.—Skull of *Rhynchæa capensis*, ventral aspect. × 2.
Text-fig. 60.— „ „ „ dorsal aspect. × 2.

Rhynchæa. In the first place, the region of the skull lying between the orbits is narrow, the frontals being here much reduced in breadth. Nor can any impressions of the supraorbital glands be seen upon these bones. Such impressions are universal among the Limicolæ, if we omit certain forms whose exact position in the series is debatable, such as *Dromas* and *Glareola*. Even in *Tringa*, where they are perhaps least observable, a careful inspection of the bones shows the shallow furrows which indicate the existence of the structures in question. I cannot therefore agree with Dr. Shufeldt[1], who remarks that in *Aphriza virgata*, "again agreeing in this respect with most if not all true *Tringæ*, they are entirely absent." I confess, however, that in *Tringa cinclus*, a small species and thus not easy of study, these furrows are so ill-impressed that they are not plain; they are, however, definitely stated by Mr. Forbes to be present, and I can confirm the accuracy of his observations. They are plainly to be seen in *Tringa canuta*. But I cannot see these furrows in either *Scolopax* or *Gallinago*.

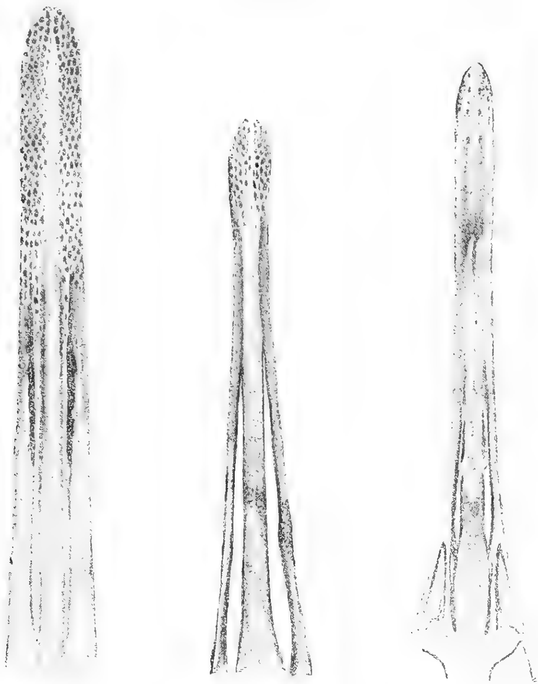
The second peculiarity of the skull of *Rhynchæa*, which is evident on the dorsal view, is the condition of the nostrils. As is well known, the Limicoline birds are schizorhinal for the most part, though the Œdicnemidæ are purely holorhinal, and in certain outlying genera, such as *Thinocorus*, the schizorhiny approaches holorhiny. *Rhynchæa* is to some extent also an intermediate type in the nature of its bony nostrils. As will be seen from the accompanying figure (text-fig. 60) the extent of the nostril is that of schizorhinal birds, *i. e.* they extend back beyond the end of the premaxillæ. But instead of their ending gradually in a gradually narrowing chink between the two halves of the nasal bone, their posterior outline is distinctly rounded. They belong, in fact, rather to that group of Limicoline birds which contains the genera *Cursorius*, *Dromas*, and *Thinocorus*, &c., than to the more typical family Charadriidæ or its immediate allies (including Snipe and Woodcock), in this particular. It is noteworthy also that in this particular, as in the absence of supraorbital impressions, the genus *Rhynchæa* is not far removed from the Parridæ, with which family Fürbringer has on other grounds suggested a resemblance. Both Garrod and Forbes refer to the Parridæ as being schizorhinal; Forbes speaks of them as "strongly schizorhinal." This expression appears to me to be too emphatic; for in *Hydrophasianus*, of which I have a skull before me, there is precisely the same "pseudoholorhiny" that is met with in *Dromas*, *Thinocorus*, &c., a little more pronounced than in *Rhynchæa*.

The Limicoline birds differ characteristically in the number and arrangement of the nerve-foramina at the end of the bony bill. In *Rhynchæa* (text-fig. 63) there are four regular rows of four or five largish foramina. In *Tringa* (and the same applies to *Aphriza*, which hardly differs generically) the end of the bill is beset with closely-set and very numerous foramina, which give a sculptured appearance to this region of the premaxillæ. This is much exaggerated in *Scolopax* and *Tringa* (text-figs. 61, 62). In *Vanellus* the foramina are as few as in *Rhynchæa*, but less regular in their

[1] "On the Affinities of *Aphriza virgata*," Journ. Morph. ii. 1888, p. 314. "Notes on the Anatomy and Systematic Position of the Jacanas (Parridæ)," P. Z. S. 1881, p. 644.

arrangement. These differences are correlated with different habits in feeding.

Text-fig. 61. Text-fig. 62. Text-fig. 63.



Text-fig. 61.—Extremity of bony bill of *Scolopax rusticula*. × 3.
Text-fig. 62.— „ „ *Tringa canutus*. × 3.
Text-fig. 63.— „ „ *Rhynchæa capensis*.

On the ventral aspect of the skull various features call for notice. The shape of the foramen magnum is as in *Tringa*, *Scolopax*, and *Gallinago*; it is, that is to say, somewhat heart-shaped, the posterior margin being bayed out between the occipital foramina at the sides. It is interesting to notice that in *Hydrophasianus* there is, just above the foramen magnum, a small perforation which seems to possibly represent in a rudimentary way this baying out of the foramen magnum itself; it cannot be, I think, a vestige of the lateral occipital foramina. The latter are well developed in *Rhynchæa* as in all typical Limicolines, with, as it appears, the occasional exception of *Machetes*[1].

[1] Shufeldt states that the occipital foramina are absent in *Hæmatopus*, while Forbes asserts their presence. In view of this conflicting testimony, I may remark that in one of two examples of *H. ostralegus* the foramina were present and conspicuous; in the other they were represented by minute perforations, which might readily be missed.

The pterygoids are slightly different in form from those of some other Limicolæ. In *Rhynchæa* (text-fig. 59, p. 591) these bones are provided, as in other genera, with facets for articulation with the basis cranii; but the facet does not stand out from the rest of the bone as it does in other genera that I have examined. The distal part of the bone, *i. e.* the end nearest to the palatine articulation, is broader than the proximal end, and the broadening commences with the facet and is carried on at its level. The quadrate shows certain recognizable differences in the different genera of Limicoline birds. In *Rhynchæa* the anterior condyle on the mandibular articular surface is not bevelled off into a trochlea; in *Hæmatopus*, *Himantopus*, *Gallinago*, *Scolopax*, and *Vanellus* there is a long trochlea, most developed perhaps in *Hæmatopus*. On the other hand, *Tringa* agrees with *Rhynchæa* and so too does *Hydrophasianus*.

I need not enter into the varying form of the maxillo-palatines in the Limicolines, as the main differences have been pointed out by Dr. Shufeldt. I may observe, however, that in the two species of *Tringa* which I have examined the maxillo-palatines do fuse with the palatines. They are undoubtedly quite separate in *Hæmatopus* and some other genera. The maxillo-palatines of *Rhynchæa* are peculiar on account of their small size; they are represented merely by a thin bar of bone on each side, which is not fused with the palatine, and is, indeed, bowed in form, the concavity lying on the palatine side. There is no extension of the maxillo-palatine upwards to form a thin shell-like, concave lamina, such as occurs, for example, in *Vanellus*. The shape and extent of the maxillo-palatines are exactly parallel in *Hydrophasianus*. In the Snipe and Woodcock the maxillo-palatines are equally small but fused with the palatines.

It is well known that the vomer of Limicoline birds varies in form, in breadth, and as to whether the end is cleft or not. In *Rhynchæa* the anterior end of this bone ends in a deeply cleft extremity. It is not cleft in *Scolopax* and barely cleft in *Gallinago*.

On the ventral aspect of the skull there is yet another ossification to be noticed the homologies of which are rather doubtful. In front of the vomer and resting upon the premaxillæ is a scutcheon-shaped piece of bone of which the two lateral wings are visible when the skull is viewed from above. I have not been able to see this bone in such other Limicoline skulls as I have had the opportunity of inspecting. But it might be, I imagine, readily detached and so lost in maceration. If the two lateral pieces of bone which are visible on the dorsal view of the skull were extended so as to join the maxillæ, the structure would recall the plate of bone which forms the "desmognathous" palate of the American Vultures, or the apparently corresponding transverse plate of bone in the Cariamidæ[1]. In *Scolopax* and *Gallinago* this region of the skull is produced downwards into a thick keel.

[1] See Beddard, "On the Anatomy of Burmeister's Cariama (*Chunga burmeisteri*)," P. Z. S. 1898, p. 596, figs. 1, 2. The bone in question lies just behind the separation of the two halves of the upper jaw.

Among the characteristic features of Limicoline birds, which distinguish them from their nearest allies, is the ring of bone formed at the anterior end of the orbit by the junction of the descending process of the lachrymal with the rather massive ectethmoid ("pars plana"). The relative proportions of these two bones and their mode of junction offer distinctive points of difference between different genera.

In *Rhynchœa* the descending process of the lachrymal is rather massive, and is attached to the also rather massive ectethmoid on the front side of that bone and some little way beyond the actual outer termination of that bone. The arrangement and proportions of these two bones are more like those which obtain in *Hydrophasianus* than in any other genus with which I have compared *Rhynchœa*.

Rhynchœa is particularly unlike *Scolopax* and *Gallinago* in this region of the skull; for in those two genera the much more completely fused lachrymal and ectethmoids form a massive plate of bone which extends downwards to join the posterior wall of the orbit at the squamosal.

This wall of bone bounding the orbit below is thicker in *Scolopax* than in *Gallinago*. This junction of the ectethmoids with the posterior wall of the orbit may perhaps be correlated with the fact that in the Snipe and Woodcock the organ of hearing, as is well known, and duly referred to by Dr. Blanford in characterizing the groups and subfamilies of the Limicolæ[1], has come to lie directly beneath the orbit. This is a further difference between the true Snipes and the wrongly called Painted "Snipe"; for in *Rhynchœa* the auditory cavity is quite normal in its position. A shortening of the quadrato-jugal arch also follows this shifting of the auditory organ; in *Rhynchœa* this bone is much longer than in its erroneously supposed allies *Scolopax* and *Gallinago*. I may finally remark that the interorbital septum is much more fenestrate in *Rhynchœa* than in *Gallinago* or *Scolopax*; in the latter genus, indeed, it is almost complete.

Vertebral Column and Ribs.

The cervical vertebræ of *Rhynchœa* are exceptionally few for a Limicoline bird. There are only fourteen, instead of the usual fifteen. But in this feature *Rhynchœa* agrees with *Scolopax* and *Gallinago*. Of these, the last two bear movable incomplete ribs, that borne by the last of the series being, as is usual, much larger than that which precedes. Then follow six free dorsal vertebræ, all of which are provided with complete ribs reaching the sternum. Of these the first five pairs are provided with uncinate processes. The first of the lumbar vertebræ possesses an incomplete pair of ribs, which, as well as the pair in front, are overlapped by the ilia There are seven free caudal vertebræ in addition to the pygostyle.

[1] Fauna of British India: Birds, vol. iv. p. 283.

Sternum and Shoulder-Girdle.

The sternum among Limicoline birds shows some variability as to the number of notches present. We find sterna of closely allied forms which have respectively two and four notches. It is not therefore of great importance to note that in *Rhynchœa*, as in *Gallinago cœlestis* and *Scolopax*, the sternum is but two-notched. It seems to be rather narrower than is often the case; but in spite of this the two coracoids do not overlap, or even come into contact at their articulation with its anterior border. The spina externa is small and, as in other limicolous birds, the spina interna is not present. Of some systematic importance is the fact that the clavicles articulate with the acrocoracoid and the acromion only, and not with the procoracoid. The typical Limicoline birds possess all three articulations; it is only some of the aberrant groups, such as the Thinocoridæ and the Parridæ, which agree with *Rhynchœa* in this fact of structure.

But neither in the sternum, pelvis, or appendicular skeleton are there such wide differences from *Scolopax* and *Gallinago* as are shown in the skull.

5. On some Anatomical Differences between the Common Snipe (*Gallinago cœlestis*) and the Jack Snipe (*Gallinago gallinula*). By Frank E. Beddard, M.A., F.R.S., Vice-Secretary and Prosector to the Society.

[Received December 3, 1901.]

(Text-figures 64–69.)

As is well known, the Jack Snipe differs from the Common Snipe of this country in the fact that it has only twelve rectrices and a double-notched sternum; whereas *G. cœlestis* has fourteen rectrices and a sternum with only a single pair of notches. The sterna have been figured by Seebohm[1], and the facts have been noted by many previous observers, such as Macgillivray, Yarrell, Newton, and others.

Prof. Garrod, who dissected examples of both species, found such characters as he examined to be identical, excepting of course the two features already mentioned.

With regard to the sternum, I may observe that one side (the left) of that bone in a skeleton of *G. cœlestis* that I examined had a small oval foramen, in addition, of course, to the lateral notch. It is, however, to the skull and the windpipe that I wish to direct attention in the present communication. Both of these portions of the body offer easily recognizable differences in the two birds under consideration.

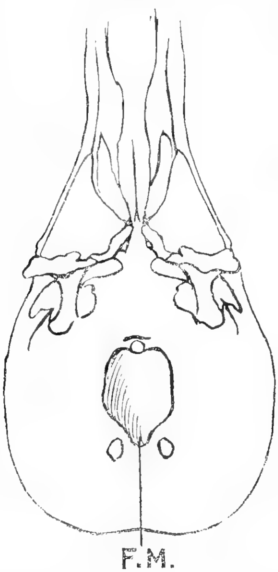
In the skull the much greater length of the beak-region in the

[1] 'The Geographical Distribution of the Family Charadriidæ' (London, 1887), pp. 481 & 485.

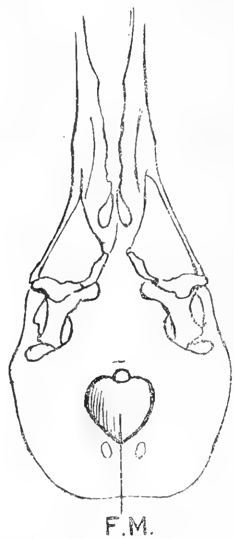
Common Snipe is a distinguishing feature, but one which is well known: also the fact that in both birds, as in many Limicoline types (e. g. *Scolopax*, *Tringa*), the extremities of the premaxillaries and dentary bones are covered with a honeycomb-like reticulation of the surface of the bone in correspondence with a pitting of the horny beak. This is rather more developed in *G. cœlestis* than in *G. gallinula*; the pitting extends farther back in the former species[1].

The chief difference between the two Snipes observable on the dorsal aspect of the skull concerns the nasal bones. Both are of course schizorhinal; but while *G. cœlestis* is typically so, the space between the two parts of that bone gradually diminishing to a mere chink, *G. gallinula* shows the same "attempt" at holorhiny which occurs in *Rhynchœa*, *Hydrophasianus*, and some other Limicoline birds[2].

Text-fig. 64.



Text-fig. 65.



Text-fig. 64.—Base of the skull of the Common Snipe (*Gallinago cœlestis*). × 3. F.M., foramen magnum.

Text-fig. 65.—Base of the skull of the Jack Snipe (*Gallinago gallinula*). × 3. F.M., foramen magnum.

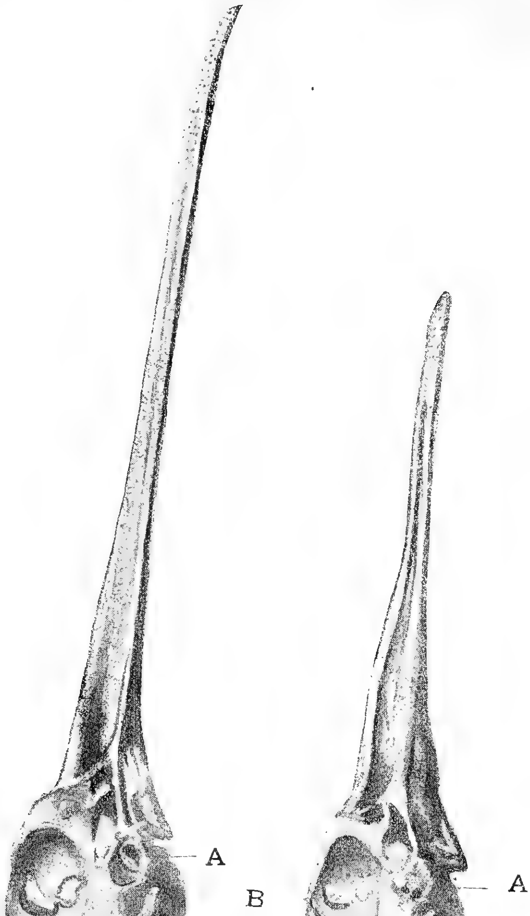
On the under surface of the skull two structural features can

[1] Beyond the symphysis in the lower jaw.

[2] This fact, of course, lessens the value of the character as a point of difference between *Rhynchœa* and its supposed allies *Gallinago* and *Scolopax*. See my paper upon the first-named bird, P. Z. S. 1901, vol. ii. p. 592, where this structural peculiarity is further referred to.

be noted which serve further to distinguish the two species. In *Gallinago cœlestis* the foramen magnum is somewhat heart-shaped, but also constricted in the middle, which gives to it an appearance

Text-fig. 66. Text-fig. 67.



Text-fig. 66.—Skull of the Common Snipe (*G. cœlestis*), lateral aspect. × 2. A, external auditory meatus.

Text-fig. 67.—Skull of the Jack Snipe (*G. gallinula*), lateral aspect. × 2. A, external auditory meatus. | B, interorbital foramina.

very different from that shown by the quite heart-shaped foramen magnum of *G. gallinula*. Moreover, the foramen in the first-named bird is slightly longer than it is broad, while the reverse is the case in *G. gallinula*. This very striking difference is shown in the drawings (see text-figures 64 & 65, p. 597). A more striking difference, perhaps, is shown in the condition of the maxillo-palatine plates in the two birds. In both species the plates in question are firmly ankylosed to the palatines without a trace of division. But while in *G. cœlestis* these projecting plates are thin and bent downwards at the free edge, they are large swollen bullæ in the Jack Snipe.

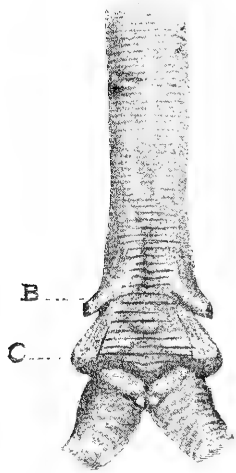
A final difference in the skull structure of these two birds appears to me to be, although but slightly marked, of some little importance. It is well-known that the Scolopacinæ differ from other Limicoline birds in the fact that the auditory meatus lies below the orbit, and even rather in front instead of rather behind it as is the more normal arrangement in birds. *Gallinago cœlestis* shows in this character the typical Scolopacine arrangement; but in the species *G. gallinula* the auditory meatus is definitely although slightly farther back, and thus approaches the more usual ornithic arrangement. This is quite obvious when the skulls are placed one below the other, or side by side as in the sketches (text-figs. 66, 67, p. 598).

It becomes a matter of interest to enquire how these various characters apply when the genus *Scolopax* (*sensu strictiore*) is taken into account. The skull of the Woodcock (*S. rusticula*) is considerably more massive than that of the Common Snipe; but apart from that it agrees very closely with the skull of *Gallinago cœlestis*. The position of the external auditory meatus is precisely as it is in that Snipe. The foramen magnum is of exactly the same form, though the occipital foramina are rather farther away from the foramen magnum than is the case with either of the two species of Snipe.

The schizorhiny of *Scolopax rusticula* is as pronounced as in *Gallinago cœlestis*, and therefore more pronounced than in *G. gallinula*. The maxillo-palatine plates in the Woodcock are so much reduced, that there is hardly the slightest projection of bone that can be identified with them. This state of affairs is in reality an exaggeration of what is to be seen in the skull of *G. cœlestis*, where the bones in question are narrow shelf-like processes. The large swollen bullæ of *G. gallinula* are almost equally different from the maxillo-palatines of both Woodcock and Common Snipe.

The syrinx of *Gallinago gallinula* is represented in the accompanying drawings (text-figs. 68, 69, p. 600), from which it will be seen that it is very different in detail from that of *G. cœlestis*. The difference is mainly caused by the laterally bowed syringeal semirings at the commencement of that organ, which cause the syrinx to project at this point very far beyond the level of the trachea. This is, of course, merely an exaggeration of the usual

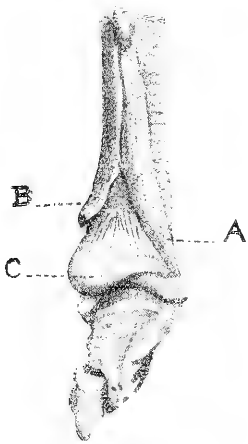
Text-fig. 68.



Syrinx of *Gallinago gallinula* ♂, front view. × 3.

B, extrinsic syringeal muscles. | C, intrinsic muscles.

Text-fig. 69.



Syrinx of *G. gallinula* ♂, lateral view. × 3.

A, C, two parts of intrinsic syringeal muscle.
B, extrinsic syringeal muscle.

structure of the avian syrinx, but it is so far a valid distinction between the two species of Snipe. The protuberance of this part of the syrinx is further increased by the considerable development of the intrinsic syringeal muscles. In *Gallinago cœlestis* these muscles are thin and narrow slips, which are attached to the membranous interval between the first two syringeal rings; these band-like muscles are so slightly marked that they are not visible in a badly preserved syrinx of that bird which I have in my possession.

G. gallinula shows the greatest contrast in these muscles. In the first place, it has distinctly two pairs of intrinsic muscles. I do not think that the existence of *two* pairs of intrinsic syringeal muscles has been recorded in any other genus of Limicoline birds. In any case it is certain that the majority of the genera have either a single pair only of intrinsic muscles, or that these muscles are entirely absent. This comparatively complex musculature of *G. gallinula* is to be seen in the accompanying drawing (text-fig. 69, p. 600), which represents a lateral view of the syrinx. It will be noticed from that drawing that the most purely lateral in position of the two muscles is the larger and that it spreads out in a fan-shaped way at its insertion. Which of the two muscles corresponds to the single one of *G. cœlestis* does not seem to be so certain; but I am inclined to regard the larger of the two muscles as the one. The other muscle lies more posteriorly.

Now of all the features that have been dwelt upon in comparing *G. cœlestis* and *G. gallinula*, the syrinx of *Scolopax rusticula* most nearly resembles that of the Common Snipe, *G. cœlestis*. I need not enter into details since the drawings illustrating a former paper[1] clearly show the closeness of the correspondence[2].

The few points with which I have dealt in the present communication obviously reopen the question of generic separation among the members of this large genus *Scolopax* or subfamily Scolopacinæ[3]. Mr. Seebohm stands at the one extreme of ornithological opinion, since he includes all the 23 species of Snipe and Woodcock in the genus *Scolopax*, though admitting possible subgeneric divisions. On the other hand, many persons separate *Gallinago* (Snipe) from *Scolopax* (Woodcock), while others retain *Limnocryptes* for the Jack Snipe and still further subdivide generically the remaining members of the group.

So little is known at the present time concerning the anatomy of the numerous species of birds which are undoubtedly Snipes or Woodcocks, that it is really premature to attempt any final settlement of the question. I have not attempted to prejudge it in the foregoing pages, and have therefore used *Gallinago* for the Snipes,

[1] Above, p. 589.

[2] Since reading this paper I find that it is only the male Jack Snipe which has the more complex syrinx; the syrinx of the female is like that of the male *G. cœlestis*, and with but a single pair of slender muscles.

[3] From which *Rhynchæa* is of course to be removed.

as I think that the prevailing opinion is in favour of retaining that genus. Now, however, I may be allowed to point out that in the three Scolopacine birds considered in the present communication the line of division is rather between the Jack Snipe and the remaining two, than between the Snipes and the Woodcock. I would rather, in fact, refer *Gallinago cœlestis* to the genus *Scolopax*, retaining *Gallinago* for *G. gallinula*.

6. On the Collection of Birds made by Dr. A. Donaldson Smith on his last Expedition to Lake Rudolf and the Nile. By R. Bowdler Sharpe, LL.D., F.Z.S., &c.

[Received November 16, 1901.]

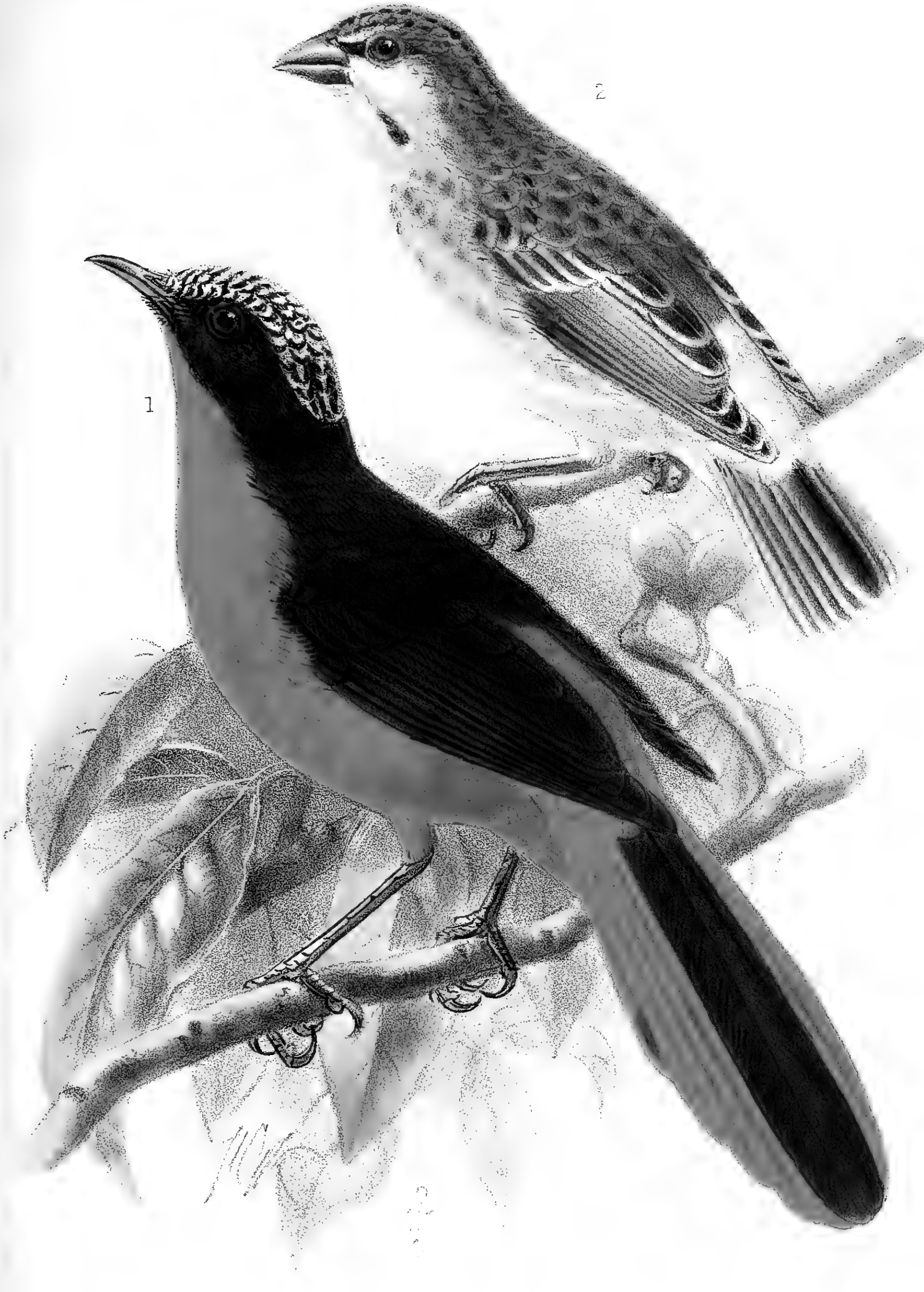
(Plate XXXVI.[1])

Dr. Donaldson Smith's adventurous journey may be traced on the excellent map which accompanies his paper in the 'Geographical Journal' for December, 1900 (vol. xvi. pp. 600–624). A remarkable point of interest for Ornithologists is that insisted upon by the traveller, namely, that on reaching the Omo River he found a great change in the aspect of the Fauna. This is confirmed by the species of birds which he obtained on the marches between the Mursu country and the Nile. A West-African element, already known to exist on the Upper Nile through the collections made by Emin Pasha at Redjaf and Lado, was here traceable farther eastward to the Omo River, as proved by such species as *Platystira albifrons*, *Cossypha verticalis*, *Lybius æquatorialis*, and *Cossypha omoensis*, a near ally of *C. giffardi* of the Niger. A species of Barbet (*Erythrobucco rolleti*) was obtained near the Nile, to which region it seems to be strictly confined, as is probably also *Crateropus tenebrosus*. A certain Abyssinian element is also present among the birds collected between the Omo and the Nile, viz., *Cryptorhina afra*, *Oriolus auratus* (vice *O. notatus*), *Laniarius erythrogaster*, *Lybius abyssinicus*. On the other hand, a number of Somali-land and East-African forms extend beyond the Omo River district, with a slight admixture of Uganda species. Perhaps the most remarkable of these is *Phyllostrophus strepitans*, an East-Coast Bulbul, of which examples were obtained by Dr. Donaldson Smith, which I have not been able to distinguish from the typical form. On the Omo River, likewise, the species of *Heterhyphantes* is *H. melanoxanthus*, which is the East-African, not the West-African form. *Ploceipasser donaldsoni*, a remarkable new species discovered by Dr. Donaldson Smith on his first expedition, appears to be confined to the hilly region near Lake Stefanie.

Francolinus granti.

Francolinus granti Hartl.; Sharpe, Hand-l. B. i. p. 23 (1899);

[1] For explanation of the Plate, see p. 622.



J.G.Keulemans del.et lith. Mintern Bros.imp

1.COSSYPHA OMOENSIS. 2.PLOCEIPASSER DONALDSONI.

id. *antea*, p. 315; Reichenow, Vög. Afrikas, Bd. i. p. 496 (1901); Grant, Ibis, 1900, p. 334, 1901, p. 299; id. & Reid, Ibis, 1901, p. 698.

a. ♂ ad. Near Okatela Villages, Feb. 26, 1900.

VINAGO WAALIA.

Vinago waalia (Gm.); Sharpe, *antea*, p. 314; Reichenow, Vög. Afrikas, i. p. 392 (1901); Grant, Ibis, 1900, p. 331, 1901, p. 298; id. & Reid, *t. c.* p. 695.

a. ♂ ad. Omo River, Dec. 23, 1899.

TURTUR SEMITORQUATUS.

Turtur semitorquatus (Rüpp.); Reichenow, Vög. Afrikas, i. p. 409 (1901); Grant, Ibis, 1900, p. 332, 1901, p. 298; id. & Reid, *t. c.* p. 696; Sharpe, *antea*, p. 315.

a. Ad. Omo River, Dec. 23, 1899.

HOPLOPTERUS SPINOSUS.

Hoplopterus spinosus (L.); Salvad. Mem. Accad. Torino, (2) xliv. p. 563 (1894; Gurat); Sharpe, P. Z. S. 1895, p. 514; Peel, Somali-land, p. 331; Reichenow, Vög. Afrikas, p. 186 (1900); Grant, Ibis, 1900, p. 328, 1901, p. 297.

a. ♂ ad. Lake Rudolf, Dec. 10, 1899.

HELODROMAS OCHROPUS.

Helodromas ochropus (L.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 437 (1896); Peel, Somali-land, p. 332; Grant, Ibis, 1900, p. 329; id. & Reid, Ibis, 1901, p. 692.

Totanus ochropus (L.); Reichenow, Vög. Ostafr. i. p. 222 (1900).

a. ♀ imm. Jira, Oct. 26, 1899.

RHINOPTILUS CINCTUS.

Rhinoptilus cinctus (Heugl.); Sharpe, Hand-l. B. i. p. 170 (1899); id. *antea*, p. 314; Reichenow, Vög. Afrikas, i. p. 160 (1900).

a. Ad. Edjo, 2100 feet, Feb. 20, 1900.

MELIERAX GABAR.

Micronisus gabar (Daud.); Sharpe, *antea*, p. 312; Reichenow, Vög. Afrikas, i. p. 565 (1901); Grant, Ibis, 1900, p. 319; id. & Reid, Ibis, 1901, p. 682.

a. ♀ ad. Magois country, Jan. 25, 1900.

LOPHOAËTUS OCCIPITALIS.

Lophoaëtus occipitalis (Daud.); Salvad. Mem. R. Accad. Sci. Tor. (2) xliv. p. 553; Peel, Somali-land, p. 326; Reichenow, Vög. Afrikas, i. p. 582; Grant, Ibis, 1900, p. 321, 1901, p. 293.

a. (Head.)

CERCHNEIS NAUMANNI.

Cerchneis naumanni (Fleisch.); Reichenow, Vög. Afrikas, i. p. 644 (1901); Grant, Ibis, 1901, p. 294.

Cerchneis cenchris, Hawker, Ibis, 1899, p. 79.

a. ♂ ad. Jira, Oct. 23, 1899.

This is a very old male of the Lesser Kestrel, in somewhat worn plumage, and doubtless on its southward journey. On comparing the series of *C. naumanni* and *C. pekinensis* in the British Museum Collection, I am still of opinion that the latter must be kept distinct, although it may not be more than a race. The African specimens mentioned by Mr. Gurney in his critique of my first volume of the 'Catalogue' (Ibis, 1881, p. 471) may after all be *C. pekinensis*, which is just as likely to occur in Africa as *Erythropus amurensis*. In fact, I now consider that the male Lesser Kestrel procured by Dr. Hinde at Machakos (*cf.* Ibis, 1898, p. 583) is *C. pekinensis*, and not *C. naumanni*, as the lesser wing-coverts are commencing to become grey. It is, however, somewhat difficult to decide, as the individual still retains some traces of immaturity.

ASIO NISUELLA.

Asio nisuella (Daud.); Sharpe, Hand-list B. i. p. 200 (1899); Reichenow, Vög. Afrikas, i. p. 659 (1901).

a. ♀ ad. Hills between Lakes Stefanie and Rudolf, Dec. 8, 1899.

BUBO ABYSSINICUS.

Bubo abyssinicus (Guér.); Sharpe, Ibis, 1898, p. 289; id. Hand-l. B. i. p. 283 (1899).

Asio abyssinicus, Reichenow, Vög. Afrikas, i. p. 661 (1901).

a. ♀ ad. Lake Rudolf, Dec. 9, 1899.

This is a very dark specimen and very rufous in tint, but seems to me to be of the same species as the birds from Jifa Uri in Somali-land obtained by Mr. Hawker. The exact status of the species remains to be determined, and it is desirable that the type should be compared. Professor Reichenow considers that it is an *Asio*; but the wing-formula given by him does not agree with that of any one of our series, the 4th primary being of about the same length as the 2nd and 3rd, while the 1st is much shorter than the 5th, and is, in fact, about equal in length to the long inner secondaries.

BUBO LACTEUS.

Bubo lacteus (Temm.); Shelley, Ibis, 1885, p. 392; Oust. Bibl. Hautes-Études, xxxi. Art. 10, p. 3 (1886); Salvad. Mem. Accad. Torino, (2) xliv. p. 550 (1891; Warandab); Sharpe, P. Z. S. 1895, p. 503; id. Hand-l. B. i. p. 283 (1899); Peel, Somali-land, p. 323; Reichenow, Vög. Afrikas, i. p. 650 (1901); Grant, Ibis, 1900, p. 319, 1901, p. 292; id. & Reid, *t. c.* p. 680.

a. ♂ ad. Omo River, Dec. 29, 1899.

SCOPS LEUCOTIS.

Scops leucotis (Temm.); Salvad. Mem. Accad. Torino, (2) xliv. p. 551 (1894; Duxi Katabel); Sharpe, Hand-l. B. i. p. 287 (1899).
Asio leucotis, Reichenow, Vög. Afrikas, i. p. 661 (1901).

a. ♂ ad. Akara country, Feb. 21, 1900.

GLAUCIDIUM PERLATUM.

Glaucidium perlatum (V.); Sharpe, P. Z. S. 1895, p. 504; Hawker, Ibis, 1899, p. 77; Peel, Somali-land, p. 323; Sharpe, Hand-l. B. i. p. 298 (1899); Reichenow, Vög. Afrikas, i. p. 674 (1901); Grant, Ibis, 1900, p. 319, 1901, p. 292; id. & Reid, *t. c.* p. 680.

a, b. ♂ ♀ ad. Mursu, Dec. 28, 1899.

CORACIAS GARRULUS.

Coracias garrulus L.; Salvad. Mem. Accad. Torino, (2) xliv. p. 554 (1894; Warandab); Lort Phillips, Ibis, 1896, p. 74; Peel, Somali-land, p. 323; Sharpe, Hand-l. B. ii. p. 47 (1900).

a, b. ♂ ♀ ad. Jira, Oct. 23, 1899.

The female has a much smaller bill than the male.

CORACIAS ABYSSINICUS.

Coracias abyssinicus Bodd.; Sharpe, Hand-l. B. ii. p. 46 (1900); Grant, Ibis, 1900, p. 317, 1901, p. 291; id. & Reid, *t. c.* p. 678.

a. Ad. Akara country, Feb. 12, 1900.

ISPIDINA PICTA.

Ispidina picta (Bodd.); Sharpe, P. Z. S. 1895, p. 497; Peel, Somali-land, p. 323; Sharpe, Hand-l. B. ii. p. 54 (1900).

a. Ad.; *b.* ♀ ad. Omo River, Dec. 28, 1899.

HALCYON SEMICÆRULEA.

Halcyon semicærulea, Oust. Bibl. Haut.-Études, xxxi. Art. 10, p. 4 (1886); Salvad. Mem. Accad. Torino, (2) xliv. p. 553 (1894); Sharpe, P. Z. S. 1895, p. 497; Peel, Somali-land, p. 322; Sharpe, Hand-l. B. ii. p. 57 (1900); Grant, Ibis, 1900, p. 317, 1901, p. 291; id. & Reid, *t. c.* p. 677.

a. ♂ ad. Lario, March 1, 1900.

HALCYON CHELICUTENSIS.

Halcyon chelicutensis (Stanl.); Oust. Bibl. Haut.-Études, xxxi. Art. 10, p. 3 (1886); Sharpe, P. Z. S. 1895, p. 497; Elliot, Field Columb. Mus. i. no. 2, p. 52; Hawker, Ibis, 1899, p. 76; Peel, Somali-land, p. 322; Sharpe, Hand-l. B. ii. p. 57 (1900); Grant, Ibis, 1900, p. 317, 1901, p. 291; id. & Reid, *t. c.* p. 678.

a. ♀ ad. Magois country, Jan. 21, 1900.

Halcyon cyanoleucus.

Halcyon cyanoleucus (V.); Sharpe, Hand-l. B. ii. p. 57 (1900).

a. ♂ ad. Omo River, Dec. 22, 1899.
b. ♂ ad. Mursu country, Dec. 29, 1899.

Bycanistes cristatus.

Bycanistes cristatus (Rüpp.); Sharpe, Hand-l. B. ii. p. 69 (1900); Grant, Ibis, 1900, p. 316.

a. ♀ ad. Omo River, Dec. 22, 1899.

Lophoceros nasutus.

Lophoceros nasutus (Linn.); Sharpe, Hand-l. B. ii. p. 68 (1900); Grant, Ibis, 1900, p. 315, 1901, p. 291; id. & Reid, *t. c.* p. 675.

a. ♀ ad. Magois country, Jan. 28, 1900.

Irrisor erythrorhynchus.

Irrisor erythrorhynchus (Lath.); Shelley, Ibis, 1885, p. 395; Sharpe, P.Z.S. 1895, p. 500; Lort Phillips, Ibis, 1896, p. 72; Elliot, Field Columb. Mus. i. no. 2, p. 54; Hawker, Ibis, 1899, p. 76; Sharpe, Hand-l. B. ii. p. 71 (1900); Peel, Somali-land, p. 321; Grant, Ibis, 1900, p. 314, 1901, p. 290; id. & Reid, *t. c.* p. 674.

a. ♂ ad. Mursu country, Dec. 30, 1899.
b. ♂ ad. Mursu country, Jan. 2, 1900.

Melittophagus cyanostictus.

Melittophagus cyanostictus (Cab.); Sharpe, Hand-l. B. ii. p. 237 (1900); id. *antea*, p. 311.

Melittophagus sharpei, Grant, Ibis, 1900, p. 313, 1901, p. 290; id. & Reid, *t. c.* p. 672.

a, b. Ad. Akara country, Feb. 12, 1900.

Melittophagus bullocki.

Melittophagus bullocki (V.); Sharpe, Hand-l. B. ii. p. 73 (1900); Grant, Ibis, 1900, p. 313.

a, b, c. ♂ ad.; *d.* ♀ ad. Magois country, Feb. 2–3, 1900.

Melittophagus frænatus.

Melittophagus frænatus (Hartl.); Sharpe, Hand-l. B. ii. p. 73 (1900); Grant, Ibis, 1900, p. 313.

a. ♂ ad. Magois country, Feb. 3, 1900.

Merops nubicus.

Merops nubicus Gm.; Shelley, Ibis, 1885, p. 397; Oust. *t. c.* p. 4; Salvad. Mem. Accad. Torino, (2) xliv. p. 552 (1894); Lort Phillips, Ibis, 1896, p. 73; Sharpe, Hand-l. B. ii. p. 75 (1900); Peel, Somali-land, p. 321; Grant, Ibis, 1900, p. 314, 1901, p. 290; id. & Reid, *t. c.* p. 673.

a, b. ♂ ad.; *c.* ♀ ad. Mursu country, Jan. 1, 1900.

SCOTORNIS CLIMACURUS.

Scotornis climacurus (Vieill.); Grant, Ibis, 1900, p. 312, 1901, p. 290.

a. ♀. Fort Berkeley, March 28, 1900.

MACRODYPTERYX MACRODIPTERUS.

Macrodypteryx macrodipterus (Afzel.); Hartert, Cat. B. Brit. Mus. xvi. p. 594 (1892).

a. ♀. Magois country, Feb. 4, 1900.

COLIUS LEUCOTIS.

Colius leucotis Rüpp.; Oust. *t. c.* p. 3; Salvad. Mem. R. Accad. Sci. Tor. (2) xliv. p. 552; Peel, Somali-land, p. 320; Sharpe, Hand-l. B. ii. p. 145 (1900); Grant, Ibis, 1900, p. 310, 1901, p. 289; id. & Reid, *t. c.* p. 670.

a, b. ♂ ♀ ad. Omo River, Dec. 24, 1899.
c. ♀ ad. Mursu country, Dec. 28, 1899.

COLIUS MACRURUS.

Colius macrurus (Linn.); Sharpe, Hand-l. B. ii. p. 146 (1900); id. *antea*, p. 311; Grant, Ibis, 1901, p. 289; id. & Reid, *t. c.* p. 670.

a, b. ♀ ad. Lake Rudolf, Dec. 9, 1899.

TURACUS LEUCOLOPHUS.

Turacus leucolophus (Heugl.); Sharpe, Hand-l. B. ii. p. 153 (1900).

a, b. ♂ ♀ ad. Fort Berkeley, March 10, 1900.

SCHIZORHIS ZONURA.

Schizorhis zonura Rüpp.; Sharpe, Hand-l. B. ii. p. 154 (1900); Grant, Ibis, 1900, p. 309.

a. ♀ ad. Lukoyo, 2000 ft. March 10, 1900.

CENTROPUS SUPERCILIOSUS.

Centropus superciliosus H. & E.; Sharpe, P. Z. S. 1895, p. 494; Lort Phillips, Ibis, 1896, p. 75; Peel, Somali-land, p. 320; Sharpe, Hand-l. B. ii. p. 168 (1900); Grant, Ibis, 1900, p. 310, 1901, p. 289; id. & Reid, *t. c.* p. 670.

a. ♀ ad. Lake Stefanie, Nov. 25, 1899.

INDICATOR INDICATOR.

Indicator indicator (Gm.); Sharpe, *antea*, p. 309; id. Hand-l. B. ii. p. 176 (1900); Grant & Reid, Ibis, 1901, p. 667.

a. ♀ ad. Omo River, Dec. 22, 1899.
b. ♂ ad. Magois country, Feb. 7, 1900.

ERYTHROBUCCO ROLLETI.

Erythrobucco rolleti (De Fil.); Sharpe, Hand-l. B. ii. p. 178 (1900).

a, b. Ad. Near Fort Berkeley, March 13, 1900.

LYBIUS ÆQUATORIALIS.

Lybius æquatorialis (Shelley); Sharpe, Hand-l. B. ii. p. 178 (1900).
Melanobucco æquatorialis, Grant, Ibis, 1900, p. 308.

a. ♀ ad. Omo River, Dec. 22, 1899.
b. ♂ ad. Omo River, Dec. 28, 1899.
Iris black, eyelid yellow.
c. ♂ ad.; *d, e, f, g.* ♀. Omo River, Dec. 29, 1899.

LYBIUS ABYSSINICUS.

Lybius abyssinicus (Lath.); Sharpe, Hand-l. B. ii. p. 178 (1900).
Melanobucco abyssinicus, Grant, Ibis, 1900, p. 307; id. & Reid, Ibis, 1901, p. 667.

a. ♂ ad. Lario, Feb. 28, 1900.

TRICHOLÆMA STIGMATOTHORAX.

Tricholæma stigmatothorax Cab.; Shelley, Ibis, 1885, p. 394; Sharpe, P. Z. S. 1895, p. 493; Elliot, Field Columb. Mus. i. no. 2, p. 50; Peel, Somali-land, p. 320; Sharpe, Hand-l. B. ii. p. 179 (1900).

a. ♂ ad. Lake Stefanie, Nov. 29, 1899.
b, c. ♂; *d.* ♀ ad. Mursu country, Dec. 26–31, 1899.
e, f. ♀ ad. Magois country, Feb. 2, 1900.

BARBATULA CENTRALIS.

Barbatula chrysocoma pt., Shelley, Cat. B. Brit. Mus. xix. p. 42 (1891).
Barbatula centralis, Reichen. Orn. MB. viii. p. 40 (1900); Sharpe, Hand-l. B. ii. p. 181 (1900).

a. ♀ ad. Fort Berkeley, March 12, 1900.

As Professor Reichenow (*l. c.*) has surmised, the specimen *d* of Shelley's *B. chrysocoma* (l. c.) from Kibiro is *B. centralis*, and is of the same species as that now procured by Dr. Donaldson Smith at Fort Berkeley. It is distinguished from the true *B. chrysocoma* by its sulphur-yellow under surface, in which respect it resembles *B. xanthosticta* Blundell & Lovat, but it has the outer aspect of the quills yellow, and not so golden as in *B. xanthosticta*.

TRACHYPHONUS VERSICOLOR.

Trachyphonus versicolor Hartl.; Sharpe, Hand-l. B. ii. p. 186 (1900).

a. ♂ ad. Mursu country, Jan. 2, 1900.
b. ♀ ad. Akara country, Feb. 16, 1900.

TRACHYPHONUS BOEHMI.

Trachyphonus boehmi F. & R.; Sharpe, Ibis, 1892, p. 311; id. Hand-l. B. ii. p. 186 (1900).
Trachyphonus uropygialis, Salvad. Mem. Accad. Torino, (2) xliv. p. 551 (1894); Sharpe, P. Z. S. 1895, p. 493.

a. ♀ ad. Webi Dawa, Oct. 3, 1899.

The specimen agrees with the series in the Museum from Teita, Kilimanjaro, and Paré. Count Salvadori's diagnosis of his *T. uropygialis* (Mem. Accad. Torino, (2) xlvi. p. 551) is not borne out by our series of specimens, all of which have the lateral upper tail-coverts crimson, and the two forms must be united. We have a specimen of *T. uropygialis* from the Webe Shebeli, presented by Mr. F. Gillett.

Trachyphonus arnaudi.

Trachyphonus arnaudi (Des Murs); Sharpe, Hand-l. B. ii. p. 187 (1900).

a. ♂ ad. Lake Stefanie, Nov. 29, 1899.
b. ♂ ad. Edjo, 2100 ft., Feb. 20, 1900.

Campothera nubica.

Campothera nubica (Gm.); Sharpe, Hand-l. B. ii. p. 205 (1900); id. *antea*, p. 308; Grant, Ibis, 1900, p. 304, 1901, p. 288; id. & Reid, *t. c.* p. 666.

a. ♂ ad. Mursu country, Dec. 28, 1899.
b. ♂ ad. Mursu country, Jan. 2, 1900.

Dendropicus hartlaubi.

Dendropicus zanzibari Malh.; Hargitt, Cat. B. Brit. Mus. xviii. p. 297 (1890).

Dendropicus hartlaubi Malh.; Reichen. J. f. O. 1887, p. 304; Sharpe, Hand-l. B. ii. p. 218 (1900).

a. ♀ ad. Mursu country, Dec. 31, 1899.

Thripias schoensis.

Thripias schoensis (Rüpp.); Sharpe, P. Z. S. 1895, p. 491; Peel, Somali-land, p. 319; Grant, Ibis, 1900, p. 305, 1901, p. 288; id. & Reid, *t. c.* p. 666; Sharpe, Hand-l. B. ii. p. 219 (1900).

a. ♀ ad. Mursu country, Dec. 30, 1899.

Bradyornis pumila.

Bradyornis pumilus Sharpe; id. *antea*, p. 305; id. Hand-l. B. iii. p. 209 (1901); Grant & Reid, Ibis, 1901, p. 643.

a. ♀ ad. Lake Rudolf, Dec. 9, 1899.
b. ♂ ad. Musha country, Jan. 11, 1900.

Empidornis kavirondensis.

Bradyornis kavirondensis, Neumann, J. f. O. 1890, p. 256.

Empidornis kavirondensis (Cass.); Sharpe, Hand-l. B. iii. p. 210 (1901).

Cassinia kavirondensis, Jackson, Ibis, 1901, p. 94.

a. ♀ ad. Magois country, Feb. 11, 1900.
b. ♀ ad. Lumin, Feb. 24, 1900.

Mr. Oscar Neumann separates Kavirondo birds from the true *E. semipartita* Rüpp., of the mountains of Abyssinia, on account of their much purer coloration. I have no Abyssinian specimens for comparison, but I must say that all the examples before me from Mr. Jackson's and Dr. Donaldson Smith's collections seem to me to belong to one and the same race, identical with others in the Museum from the White Nile, Lado, and the Zeraf River (*Capt. H. W. Dunn*). Strict comparison will be necessary with typical examples of *E. semipartita*; but there is also some variation to be seen in the shade of the grey on the rump and wings, as well as of the orange of the under surface; and the characters of *E. kavirondensis* do not seem to me to be very forcible ones.

MUSCICAPA GRISOLA.

Muscicapa grisola L.; Sharpe, P. Z. S. 1895, p. 490; Peel, Somali-land, p. 318; Grant, Ibis, 1900, p. 173; Sharpe, Hand-l. B. iii. p. 211 (1901).

a. ♀ ad. Lake Stefanie, Nov. 29, 1899.

BATIS ORIENTALIS.

Pachyprora orientalis (Heugl.); Lort Phillips, Ibis, 1896, p. 76, 1898, p. 444; Hawker, Ibis, 1899, p. 74; Peel, Somali-land, p. 317.

Batis orientalis (Heugl.); Oust. Bibl. Haut.-Études, xxxi. Art. 10, p. 5 (1888); Sharpe, Hand-l. B. iii. p. 244 (1901); Grant, Ibis, 1900, p. 172; id. & Reid, Ibis, 1901, p. 662.

a. ♂ ad. Akara country, Feb. 21, 1900.
b. ♂ ad. Lumin, Feb. 24, 1900.

PLATYSTIRA ALBIFRONS.

Platystira albifrons Sharpe; id. Hand-l. B. iii. p. 246 (1901) Jackson, Ibis, 1901, p. 90.

a, *b*. ♂ ♀ ad.; *c*. ♀ imm. Loker, March 12, 1900.
d. ♀ ad. Near Fort Berkeley, March 13, 1900.

TERPSIPHONE CRISTATA.

Terpsiphone cristata Sharpe; id. P. Z. S. 1895, p. 490; Lort Phillips, Ibis, 1896, p. 76; Elliot, Field Columb. Mus. i. no. 2, p. 48; Lort Phillips, Ibis, 1898, p. 414; Peel, Somali-land, p. 318; Sharpe, Hand-l. B. iii. p. 264 (1900); Grant, Ibis, 1900, p. 174, 1901, p. 288; id. & Reid, *t. c.* p. 663.

a. ♂ ad.; *b*. ♂ imm. Omo River, Dec. 23, 1899.

PHYLLOSTROPHUS STREPITANS.

Phyllostrophus strepitans Reichenow; Sharpe, Hand-l. B. iii. p. 327 (1901).

a. ♂ ad. Omo River, Dec. 23, 1899.
b. ♀ ad. Omo River, Dec. 24, 1899.
c. Ad. Mursu country, Dec. 29, 1899.
d. ♀ ad. Mursu country, Jan. 2, 1900.

These specimens are very rufous in tint, and agree with Captain Shelley's type of *P. sharpei* from Dar-es-Salaam. This species he has since identified with *P. strepitans* of Reichenow; and I think that, on a comparison of the type, *P. rufescens* of Hartlaub (Orn. Centralbl. 1882, p. 91) will likewise be found to be identical. My *P. pauper* may also turn out to be the same; but it is not so rufous in tint and rather more of a vinaceous brown; this difference, however, may be only seasonal.

PYCNONOTUS DODSONI.

Pycnonotus dodsoni, Sharpe, P. Z. S. 1895, p. 488; Elliot, Field Columb. Mus. i. no. 2, p. 47; Peel, Somali-land, p. 317; Sharpe, Hand-l. B. iii. p. 328 (1901).

a, b, c. ♂; *d.* ♀ ad. Webi River, Oct. 16, 1899.

e. ♀ ad. Lake Stefanie, Nov. 29, 1899.

ARGYA AYLMERI.

Argya aylmeri, Shelley, Ibis, 1885, p. 404, pl. xi. fig. 1; Elliot, Field Columb. Mus. i. no. 2, p. 47; Peel, Somali-land, p. 317; Hawker, Ibis, 1899, p. 73.

a. ♂ ad. Webi River, Oct. 15, 1899.

This species seems to me to have a seasonal plumage, as Dr. Donaldson Smith's specimen is so very much darker than the types and Mr. Hawker's example from Daraweina. The chin is nearly black, and the dusky bases to the feathers of the throat and fore-neck are much more pronounced and have the edges sandy buff, so that the whole appearance is much more scaly. The colour of the abdomen and the brown of the upper surface are much darker.

ARGYA RUFULA.

Argya rufula Heugl.; Sharpe, P. Z. S. 1895, p. 488.

a. ♀ ad. Magois country, Feb. 3, 1900.

b, c. ♂ ♀ ad. Magois country, Feb. 4, 1900.

d. ♀ ad. Omin, March 1, 1900.

Specimen *d* is paler above and below than the other three, which agree with the series in the Museum collected at Lado by Emin Pasha. The wing is given by me (*l. c.*) as 3·5 inches, and this I find to be the largest dimension in the Lado series, the wing ranging from 3·2 to 3·35 in the five specimens before me. In the female from Magois the wing is 3·4 inches, and in the Omin bird 3·5, these dimensions approaching those of the true *A. rubiginosa*, the wing of which is given by me (*l. c.*) as 3·8 inches.

CRATEROPUS TENEBROSUS.

Crateropus tenebrosus, Hartl. Zool. Jahrb. ii. p. 312, pl. xii. fig. 4 (1887).

a, b. ♂ ♀ ad. Fort Berkeley, March 13, 1900.

This very distinct *Crateropus* was discovered by Emin Pasha at Lado. Hartlaub's description leaves no doubt as to the identification; but the species can hardly be recognized from his figure, which represents a bird rufous-tinted below. The colour of the species is in reality a dark brown, with darker brown wings and tail. The black spotting on the throat has grey edgings, and resembles the marking of other species of *Crateropus*.

TURDUS PELIOS.

Turdus pelios Bp.; Jackson, Ibis, 1901, p. 73; Grant, Ibis, 1900, p. 163; id. & Reid, Ibis, 1901, p. 655.

a, b. ♂ ad. Magois country, Feb. 2, 1900.

MONTICOLA SAXATILIS.

Monticola saxatilis (Linn.); Sharpe, *antea*, p. 306; Grant, Ibis, 1900, p. 163, 1901, p. 288; id. & Reid, Ibis, 1901, p. 655.

a. ♀ ad. Magois country, Jan. 21, 1900.

RUTICILLA PHŒNICURA.

Ruticilla phœnicura (L.); Seebohm, Cat. B. Brit. Mus. v. p. 336 (1881); Grant, Ibis, 1900, p. 164.

a. Ad. Akara country, Feb. 12, 1900.

A male in spring plumage, commencing to lose the light edges to the feathers, heralding the assumption of the breeding-dress, in which the species arrives in Europe.

SAXICOLA ŒNANTHE.

Saxicola œnanthe (L.); Oust. Bibl. Hautes-Études, xxx. Art. 10, p. 7 (1886); Sharpe, P. Z. S. 1895, p. 486; Peel, Somali-land, p. 316; Grant, Ibis, 1900, p. 165; id. & Reid, Ibis, 1901, p. 658.

a. Ad. Lake Rudolf, Dec. 12, 1899.

SAXICOLA ISABELLINA.

Saxicola isabellina Rüpp.; Sharpe, *antea*, p. 307; Grant, Ibis, 1900, p. 166, 1901, p. 288; id. & Reid, *t. c.* p. 658.

a, b. ♂ ad. Webi Dawa, Oct. 8, 1899.
c. ♀ ad. Webi River, Oct. 20, 1899.
d, e. ♂ ♀ ad. 25 miles west of Egder, Nov. 8, 1899.
f. ♀ ad. Hills west of Lake Stefanie, Dec. 6, 1899.
g. ♂ ad. Lario, March 1, 1900.

SAXICOLA PLESHANKA.

Saxicola pleshanka (Lepech.); Sharpe, *antea*, p. 307.

a. ♀ ad. El Dere, Oct. 31, 1899.
b, c. ♀ ad. Magois country, Jan. 28, 1900.
d, e. ♀ ad.; *f.* ♂ ad. Akara country, Feb. 11–12, 1900.

Mr. Ogilvie-Grant gives his opinion that my *Saxicola somalica* (P. Z. S. 1895, p. 486) is *Saxicola vittata* Hempr. & Ehr., of which there was no specimen in the Museum when I described the species. I think this is very probable, although the three specimens from the Seebohm Collection are black and white, and very different from the type of *S. somalica*.

ERYTHROPYGIA LEUCOPTERA.

Erythropygia leucoptera (Rüpp.); Hawker, Ibis, 1899, p. 70; Sharpe, *antea*, p. 306; Grant, Ibis, 1900, p. 170; id. & Reid, Ibis, 1901, p. 660.

a. ♂ ad. Akara country, Feb. 16, 1900.

COSSYPHA OMOENSIS. (Plate XXXVI. fig. 1.)

Cossypha omoensis, Sharpe, Bull. B. O. C. xi. p. 28 (1900).

a. ♂ ad. Omo River, Dec. 22, 1899. (Type of species.)
b. ♀ ad. Mursu country, Dec. 29, 1899.
c, d. ♀ ad. Mursu country, Dec. 31, 1899.

This species has the same squamated white head as *C. giffardi* (Hartert, Bull. B. O. C. x. p. v, 1899; *C. albicapilla giffardi* Hartert, Nov. Zool. vi. p. 420), but differs in its much darker chestnut under surface and tail, the outer feathers of the latter having a black edging near the tip.

COSSYPHA VERTICALIS.

Cossypha verticalis Hartl.; Sharpe, Cat. B. Brit. Mus. vii. p. 45 (1883).

a. ♂ ad. Fort Berkeley, March 13, 1900.

Not to be separated from Niger specimens, and identical with one from Tamaja obtained by Emin Pasha.

COSSYPHA HEUGLINI.

Cossypha heuglini Hartl.; Shelley, B. Africa, i. p. 84; Jackson, Ibis, 1901, p. 72.

a. ♀ ad. Omo River, Dec. 30, 1899.

CICHLADUSA GUTTATA.

Cichladusa guttata Heugl.; Oust. Bibl. Haut.-Études, xxxi. Art. 10, p. 6 (1886); Sharpe, P. Z. S. 1896, p. 484; Peel, Somali-land, p. 318.

a. Ad. Mursu country, Dec. 30, 1899.
b. ♀ ad. Magois country, Feb. 3, 1900.
c, d. ♂ ♀ ad. Magois country, Feb. 7, 1900.

These specimens are the true *C. guttata*, and agree with one from Lado collected by Emin Pasha. Those from Lamu and the coast-region are somewhat smaller and much brighter rufous on the quills, and have been separated as *Cichladusa rufipennis* (*cf.* Sharpe, Bull. B. O. C. xii. p. 35).

HYPOLAIS PALLIDA.

Hypolais pallida (H. & E.); Seebohm, Cat. B. Brit. Mus. v. p. 82 (1881); Reichen. Vög. Deutsch-Ost-Afrikas, p. 232 (1894); Elliot, Field Columb. Mus. i. no. 2, p. 46; Lort Phillips, Ibis, 1898, p. 408; Peel, Somali-land, p. 315; Grant & Reid, Ibis, 1901, p. 647.

a. ♀ ad. Akara country, Feb. 18, 1900.

Sylviella micrura.

Sylviella micrura Rüpp.; Sharpe, *antea*, p. 306; Grant, Ibis, 1900, p. 154; id. & Reid, Ibis, 1901, p. 647.

a. Ad. Magois country, Feb. 11, 1900.

Camaroptera tincta.

Camaroptera brevicaudata Cretschm.; Lort Phillips, Ibis, 1898, p. 409; Peel, Somali-land, p. 315.

a. ♀ ad. Omo River, Dec. 23, 1899.
b, *c*. ♂ ♀ ad. Mursu country, Dec. 26, 1899.

Prinia mystacea.

Prinia mystacea (Rüpp.); Reichenow, Vög. Deutsch-Ost-Afrikas, p. 225; Jackson, Ibis, 1901, p. 63.

a. ♀ ad. Omo River, Jan. 5, 1900. Iris red.
b. ♀ ad. Magois country, Jan. 27, 1900.
c, *d*. ♀ ad. Magois country, Feb. 11, 1900.

Cisticola subruficapilla.

Cisticola subruficapilla (Smith); Grant, Ibis, 1900, p. 162; Jackson, Ibis, 1901, p. 57.

a. ♀ ad. Magois country, Jan. 27, 1900.

Calamonastes simplex.

Calamonastes simplex (Cab.); Sharpe, *antea*, p. 305; Grant & Reid, Ibis, 1901, p. 649.

a. ♀ ad. Lake Stefanie, Nov. 29, 1899.
b. ♀ ad. Between Lakes Stefanie and Rudolf, Dec. 4, 1899.

Telephonus senegalus.

Telephonus senegalus (Linn.); Jackson, Ibis, 1901, p. 45.

a, *b*. ♂ ad. Fort Berkeley, March 13, 1900.

Dryoscopus funebris.

Dryoscopus funebris Hartl.; Sharpe, *antea*, p. 304; Grant, Ibis, 1900, p. 147, 1901, p. 287; id. & Reid, *t. c.* p. 637.

a, *b*. ♂ ♀ ad. Lake Stefanie, Nov. 29, 1899.
c. ♀ ad. Akara country, Feb. 16, 1900.

Laniarius chrysogaster.

Laniarius chrysogaster (Sw.); Jackson, Ibis, 1901, p. 42.

a. ♀ ad. Mursu country, Dec. 28, 1899.

Laniarius erythrogaster.

Laniarius erythrogaster (Cretzschm.); Grant, Ibis, 1900, p. 148; Jackson, Ibis, 1901, p. 42.

a. ♀ ad. Omo River, Dec. 22, 1899.
b. ♀ ad. Mursu country, Dec. 29, 1899.

LANIUS ANTINORII.

Lanius antinorii Salvad.; Sharpe, *antea*, p. 304; Grant, Ibis, 1901, p. 287; id. & Reid, *t. c.* p. 642.

a, b. ♂ ♀ ad. Gorili, 3000 feet, 25 miles west of Egder, Nov. 8, 1899.

c. ♀ ad. Lake Stefanie, Dec. 12, 1899.

LANIUS NUBICUS.

Lanius nubicus Licht.: Grant, Ibis, 1900, p. 149, 1901, p. 288.

a. ♀ imm. Magois country, Feb. 8, 1900.

A female of the last year in very worn plumage. It is in full moult.

LANIUS EXCUBITORIUS.

Lanius excubitorius Des Murs; Grant, Ibis, 1900, p. 148, 1901, p. 287; id. & Reid, *t. c.* p. 641.

a. ♂ ad. North end of Lake Rudolf, Dec. 15, 1899.

b. ♂ ad. Magois country, Jan. 30, 1900.

c. ♂; *d, e.* ♀ ad. Magois country, Feb. 7, 1900.

f. ♀ ad. Akara country, Feb. 12, 1900.

LANIUS PARADOXUS.

Lanius pomeranus (nec Scop.), Hawker, Ibis, 1899, p. 68.

Lanius senator paradoxus (Brehm), Hartert, Nov. Zool. vi. p. 417 (1899); Grant, Ibis, 1900, p. 150.

a. ♂ ad. Magois country, Jan. 28, 1900.

b. ♂ ad. Magois country, Feb. 7, 1900.

c. ♂ imm. Akara country, Feb. 12, 1900.

d. ♀. Lario, March 1, 1900.

Mr. Hartert (*l. c.*) has written a very interesting account of the forms of the Woodchat Shrike and its allies. He recognizes four races of *Lanius senator*, as he calls the European Woodchat Shrike, all of which races are well represented in the series in the British Museum, and I am thus able to appreciate the value of Mr. Hartert's remarks. The Mediterranean form, which he calls *L. senator pectoralis*, has, as a rule, a lighter chestnut head and more buff on the under surface and on the rump. This is the Woodchat which goes to Senegambia, but I doubt very much whether, when a full series is compared, any permanent difference will be found between the buff-breasted *L. pectoralis* and the white-breasted *L. pomeranus* vel *L. senator*: the buff tint may after all be an evanescent character as the season wears on. *Lanius badius* seems to me quite recognizable as a species, though Mr. Hartert's mention of a Corsican Woodchat without a white speculum is rather puzzling.

Lanius paradoxus Brehm, which is reinstated as a distinct form by Mr. Hartert, turns out to be quite a recognizable species, with a white base to the centre tail-feathers. We have a good series of this bird in the British Museum, but the specimens have been confounded with *L. pomeranus* by myself and all recent writers, except Mr. Hartert. The range of *L. paradoxus* appears to be from Persia to Palestine and south into Equatorial Africa, as is evidenced by the series in the British Museum from the following localities:—

Persia (*Mus. Brit.*), Niriz, east of Shiraz (*W. T. Blanford*), Shiraz (*Sir O. St. John*), Mohammerah (*K. Loftus*), Bushire (*A. J. V. Palmer*), Fao (*W. D. Cumming*), Mount Carmel, Palestine, Safed, and River Kishon (*H. B. Tristram*), Egypt, Nubia, and Korusko (*G. E. Shelley*), Fashoda (*R. M. Hawker*), Bogos-land (*Esler*), Amba (*W. Jesse*), Halai, Abyssinia (*W. T. Blanford*), Gadaburka, Abyssinia (*H. Weld Blundell & Lord Lovat*), Mackanis, Somali-land (*R. M. Hawker*). The specimen from Dowlutpur in Sind, in the Hume Collection, said to have been procured there by Mr. J. A. Murray, is, like some other supposed Sind examples, doubtless from the Persian Gulf.

EUROCEPHALUS RUEPPELLI.

Eurocephalus rueppelli Bp.; Sharpe, *antea*, p. 305; Grant, Ibis, 1901, p. 288; id. & Reid, *t. c.* p. 643.

Bradyornis rueppelli, Elliot, Field Columb. Mus. i. no. 2, p. 43.

a, b. ♂ ♀ ad. Magois country, Feb. 7, 1900.

c. ♀ ad. Magois country, Feb. 11, 1900.

ZOSTEROPS FLAVILATERALIS.

Zosterops flavilateralis, Reichenow, J. f. O. 1892, p. 193.

Zosterops senegalensis pt., Shelley, B. Africa, ii. pt. 2, p. 173 (1900).

a, b. ♂; *c.* ♀ ad. River Omo, Mursu country, Dec. 28, 29, 1899.

It is scarcely surprising to find that Captain Shelley has united *Z. flavilateralis*, *Z. superciliosa*, and *Z. stuhlmanni*, all species described by Dr. Reichenow, with *Z. senegalensis*. The differences of shade of colouring are very slight, and consist of a yellower or greener tint. I can, however, see that *Z. flavilateralis*, as determined for me by Mr. Oscar Neumann, is a greener bird than *Z. senegalensis*. The same is the case with the Omo River birds, which are duller green above and more sulphur-yellow below than *Z. flavilateralis*; but I cannot bring myself to consider them distinct, though Mr. Oscar Neumann believes them to be so.

PARUS THRUPPI.

Parus thruppi Shelley; Sharpe, *antea*, p. 304; Shelley, B. Africa, ii. p. 244; Grant & Reid, Ibis, 1901, p. 637.

a. ♀ ad. Gof, Nov. 1, 1899.

Captain Shelley has united *Parus barakæ* of Jackson to *P. thruppi*; but it seems to me that the latter is much more buff below, and Dr. Donaldson Smith's specimen agrees with the Somali birds and not with *P. barakæ*.

NECTARINIA PULCHELLA.

Nectarinia pulchella (L.); Shelley, B. Africa, ii. p. 23 (1900); Grant, Ibis, 1900, p. 143; id. & Reid, Ibis, 1901, p. 634.

a. ♀ ad. Lake Stefanie, Nov. 29, 1899.

b, *c*. ♂ juv. Omo River, Mursu country, Dec. 29–30, 1899.

CINNYRIS FALKENSTEINI.

Cinnyris falkensteini Fischer & Reichen.; Shelley, B. Africa, ii. p. 66, pl. 3. fig. 3; Sharpe, Ibis, 1900, p. 496.

a. ♂ ad. Lake Stefanie, Nov. 29, 1899.

b. ♂ ad. Musha country, 5000 feet, Jan. 5, 1900.

ANTHOTHREPTES ORIENTALIS.

Anthothreptes orientalis Hartl.; Sharpe, P. Z. S. 1895, p. 475; Elliot, Field Columb. Mus. i. no. 2, p. 41; Lort Phillips, Ibis, 1898, p. 404; Hawker, Ibis, 1899, p. 67; Peel, Somali-land, p. 311; Grant & Reid, Ibis, 1901, p. 636.

a, *b*. ♂; *c*. ♀ ad. River Omo, Mursu country, Dec. 26–31, 1899.

MOTACILLA VIDUA.

Motacilla vidua Sund.; Shelley, B. Africa, ii. p. 261, pl. 12. fig. 1 (1900); Peel, Somali-land, p. 311; Grant, Ibis, 1900, p. 139; id. & Reid, Ibis, 1901, p. 630.

a. ♀ ad. Omo River, Dec. 30, 1899.

MOTACILLA FLAVA.

Motacilla flava L.; Sharpe, P. Z. S. 1895, p. 473; Hawker, Ibis, 1899, p. 66; Peel, Somali-land, p. 311; Shelley, B. Africa, ii. p. 286 (1900); Grant & Reid, Ibis, 1901, p. 631.

a. ♀ juv. Akara country, Feb. 12, 1900.

ANTHUS SORDIDUS.

Anthus sordidus Rüpp.; Lort Phillips, Ibis, 1896, p. 81; Elliot, Field Columb. Mus. i. no. 2, p. 4; Lort Phillips, Ibis, 1898, p. 402; Hawker, Ibis, 1899, p. 66; Peel, Somali-land, p. 311; Shelley, B. Africa, ii. p. 314 (1900); Grant, Ibis, 1900, p. 141; id. & Reid, Ibis, 1901, p. 632.

a. ♂ ad. Lake Rudolf, Dec. 10, 1899.

PYRRHULAUDA SIGNATA.

Pyrrhulauda signata, Oust. Bibl. Hautes-Etudes, xxxi. Art. 10, p. 9 (1886).

Pyrrhulauda harrisoni, Ogilvie Grant, Bull. B. O. C. xi. p. 30 (1900); id. Ibis, 1901, p. 286, pl. vii.

a. ♀. Lake Stefanie, Dec. 4, 1899.

PETRONIA PYRGITA.

Petronia pyrgita (Heugl.); Sharpe, *antea*, p. 302; Grant & Reid, Ibis, 1901, p. 624.

a. ♂. E. of Boran country, Oct. 18, 1899.
b. ♀. Akara country, 2330 feet, Jan. 21, 1900.

PASSER GONGONENSIS.

Passer diffusus gongonensis (Oust.); Hartert, Nov. Zool. vii. p. 43.

a. ♀. Omo River, Dec. 24, 1899.
b, c. ♂ ♀. Akara country, Feb. 16, 1900.

EMBERIZA POLIOPLEURA.

Emberiza poliopleura Salvad.; Sharpe, *antea*, p. 302; Grant & Reid, Ibis, 1901, p. 626.

a. Ad. Lake Rudolf, Dec. 9, 1899.

FRINGILLARIA SATURATIOR.

Fringillaria saturatior, Sharpe, Bull. B. O. C. xi. p. 47 (1901).

a. ♀. Lake Stefanie, Dec. 4, 1899.

This appears to be a very dark form of *F. striolata,* much darker brown above, and with the head brown, not grey, the throat and chest dull ashy brown, and the breast, abdomen, thighs, and under tail-coverts rufescent, not isabelline.

TEXTOR SCIOANUS.

Textor scioanus Salvad.; Sharpe, Cat. B. Brit. Mus. xiii. p. 508.

a, b. ♂. Magois country, Jan. 28, 1900.
c. ♀. Akara country, Feb. 21, 1900.

These specimens seem to be referable to *T. scioanus*, but have scarcely any perceptible pale lining to the primaries, and even the black-plumaged birds have no sign of any swelling at the base of the culmen.

HYPHANTORNIS TÆNIOPTERA.

Hyphantornis tænioptera Reichenb.; Sharpe, Cat. B. Brit. Mus. xiii. p. 467.

a–f. ♂ ♀ ad. Magois country, Jan. 27, 1900.

Six specimens, all more or less out of plumage, procured in the Magois country on the 27th of January, 1900. Two of these birds are apparently adult females, and two are males about to assume their full plumage; and, although it is very difficult to determine specimens in such incomplete dress, I refer them to *H. tænioptera* mainly on account of the coarse blackish striping on the back, which seems to be one of the distinguishing characters of the species.

HYPHANTORNIS ABYSSINICUS.

Hyphantornis abyssinicus (Gm.); Jackson, Ibis, 1899, p. 616; Grant, Ibis, 1900, p. 133; id. & Reid, Ibis, 1901, p. 622.

a. ♂; *b, c.* ♀. Omo River, Dec. 23–30, 1899.
d. ♀. Akara country, Feb. 21, 1900.

The birds killed in December are all more or less out of plumage.

HYPHANTORNIS ULUENSIS.

Hyphantornis vitellinus (nec Licht.); Sharpe, Ibis, 1891, p. 254; Jackson, Ibis, 1899, p. 616.
Hyphantornis vitellinus uluensis, Oscar Neumann, J. f. O. 1900, p. 282.

a. ♂ ad. Bend of Omo River, Dec. 31, 1899.
b. ♂ ad. Bend of Omo River, Jan. 2, 1900.
c. ♀ ad. Magois country, 1500 feet, Jan. 27, 1900.
d. ♀ ad. Akara country, 1700 feet, Feb. 21, 1900.

SITAGRA LUTEOLA.

Sitagra luteola (Licht.); Jackson, Ibis, 1899, p. 615.

a, b. ♂ ♀. Bend of the River Omo, Dec. 31, 1899.

Both birds out of plumage.

ANAPLECTES MELANOTIS.

Anaplectes melanotis (Lafr.); Jackson, Ibis, 1899, p. 610; Sharpe, *antea*, p. 301; Grant, Ibis, 1901, p. 285; id. & Reid, *t. c.* p. 620.

a. ♂. Omo River, Dec. 25, 1899.
b. ♂. Magois country, bend of Omo River, Dec. 30, 1899.
c. ♂. Lukoyo country, 2600 feet, 30 miles E. of Fort Berkeley, March 13, 1900.

HETERHYPHANTES EMINI.

Heterhyphantes emini (Hartl.); Sharpe, Cat. B. Brit. Mus. xiii. p. 420 (1890); id. P. Z. S. 1898, p. 468; Peel, Somali-land, p. 308.

a, b. ♀. Thirty miles east of Fort Berkeley, March 13, 1900.

HETERHYPHANTES MELANOXANTHUS.

Heterhyphantes melanoxanthus (Cab.); Sharpe, Cat. B. Brit. Mus. xiii. p. 416 (1890).

a, b. ♂; *c.* ♀. River Omo, Mursu country, Dec. 26–31, 1899.

These specimens seem to be identical with others from Lamu and the coast-region of East Africa. They are not the West-African *H. nigricollis*, which Mr. Jackson got in Kakamega, Kavirondo, a species distinguished by its olive-yellowish upper tail-coverts.

ESTRILDA PHŒNICOTIS.

Estrilda phœnicotis (Sw.); Sharpe, P. Z. S. 1898, p. 467; Peel, Somali-land, p. 308; Grant, Ibis, 1900, p. 131; id. & Reid, Ibis, 1901, p. 619.

a, b. ♂ ♀. Bend of Omo River, Dec. 30, 1899.
c. ♂. Magois country, 1500 feet, Jan. 26, 1900.
d. ♂. Okatela Mountains, 1700 feet, Feb. 24, 1900.

ÆDEMOSYNE CANTANS.

Aidemosyne cantans (Gm.); Sharpe, P. Z. S. 1895, p. 466; Elliot, Field Columb. Mus. i. no. 2, p. 34; Hawker, Ibis, 1899, p. 62; Peel, Somali-land, p. 307; Grant, Ibis, 1900, p. 131; id. & Reid, Ibis, 1901, p. 618.

a, b. ♂; *c.* ♀. Magois country, 1500 feet, Feb. 16, 1899.

ZONOGASTRIS SOUDANENSIS.

Zonogastris soudanensis, Sharpe, Cat. B. Brit. Mus. xiii. p. 298 (1890).

a. ♂. Lake Stefanie, Nov. 29, 1899.

LAGONOSTICTA BRUNNEICEPS.

Lagonosticta brunneiceps Sharpe; Grant, Ibis, 1900, p. 127, 1901, p. 285; id. & Reid, *t. c.* p. 617.

a–d. ♂. Bend of Omo River, Dec. 25–29, 1899.

QUELEA ÆTHIOPICA.

Ploceus sanguinirostris, var. *æthiopicus* (Sund.); Oust. *t. c.* p. 10 (1886).

Quelea æthiopica, Sharpe, P. Z. S. 1895, p. 465; Elliot, Field Columb. Mus. i. no. 2, p. 34 (1887); Peel, Somali-land, p. 307; Grant, Ibis, 1900, p. 126; id. & Reid, Ibis, 1901, p. 616.

a. ♂. Lake Rudolf, Dec. 10, 1899.

PLOCEIPASSER DONALDSONI. (Plate XXXVI. fig. 2.)

Ploceipasser donaldsoni, Sharpe, Bull. B. O. C. v. p. xiv (1895).

a. ♀. Hills west of Lake Stefanie, Dec. 6, 1899.

The female differs from the type specimen in having distinct brown centres to the feathers of the chest and flanks, which are consequently more spotted than in the male. Total length 6·5 inches, culmen 0·8, wing 3·5, tail 1·95, tarsus 0·95.

PLOCEIPASSER MELANORHYNCHA.

Ploceipasser melanorhyncha (Rüpp.); Grant, Ibis, 1901, p. 285; id. & Reid, *t. c.* p. 616.

a. ♂; *b, c.* ♀. Lake Stefanie, Nov. 21–29, 1899.
♀. Musha Mountains, 2330 feet.

PLOCEIPASSER SUPERCILIOSUS.

Ploceipasser superciliosus (Cretzschm.); Jackson, Ibis, 1899, p. 603; Grant, Ibis, 1900, p. 126.

a. ♂. Tarangole, March 1, 1900.

PYROMELANA TAHA.

Pyromelana taha (Smith); Jackson, Ibis, 1899, p. 602; Grant & Reid, Ibis, 1901, p. 615.

a. ♂. Lake Rudolf, Dec. 12, 1899.

The specimen is out of plumage, but seems certainly to belong to this species.

UROBRACHYA PHŒNICEA.

Urobrachya phœnicea (Heugl.); Jackson, Ibis, 1899, p. 600.

a. ♀. Tarangole, March 5, 1900.

A female bird and therefore difficult to determine, but agreeing with the hens of *U. phœnicea* in the British Museum.

BUCHANGA ASSIMILIS.

Buchanga assimilis (Bechst.); Sharpe, *antea*, p. 301; Grant, Ibis, 1900, p. 122, 1901, p. 284; id. & Reid, *t. c.* p. 613.

a. ♀ ad. Country between Lakes Stefanie and Rudolf, Dec. 30, 1899.

ORIOLUS ROLLETI.

Oriolus rolleti Salvad.; Jackson, Ibis, 1899, p. 595; Grant, Ibis, 1901, p. 284.

a. ♂. Bend of Omo River, Jan. 2, 1900.
b. ♂ ad. Mountains near Omo River, Jan. 19, 1900.
c. ♀ ad. Akara Hills, 1800 feet, Feb. 18, 1900.

ORIOLUS AURATUS.

Oriolus auratus Vieill.; Sharpe, Cat. B. iii. p. 195; Grant, Ibis, 1900, p. 122.

a. ♀. Magois country, Feb. 2, 1900.

The tail has been shot away, excepting for three middle feathers. These answer to the figure of *O. auratus* in the third volume of the 'Catalogue,' and the bird appears undoubtedly to belong to that species.

LAMPROTORNIS BREVICAUDA.

Lamprotornis brevicauda Sharpe; Jackson, Ibis, 1899, p. 591; Neum. J. f. O. 1900, p. 281.

a. ♂. Omo River, Dec. 22, 1899 [tail 5·2 inches].
b. ♀. Omo River, Dec. 24, 1899 [tail 4·7 inches].
c. ♀. Magois country, Jan. 27, 1900 [tail 4·9 inches].

The differences in the metallic shades of these Glossy Starlings are very perceptible, and the shades of green, steel-blue, and purple vary considerably. These shades of blue and green require very careful consideration in a study of these Glossy Starlings, as I believe that the differences of metallic shade are often caused by the wear and tear of the plumage.

With regard to *Lamprotornis viridipectus* of Salvadori (Mem. Accad. Torino, (2) xliv. p. 560, 1894), I may remark that his belief that spec. *l* of *L. porphyropterus* in the 'Catalogue of Birds' (p. 157), from the Adi River, would turn out to belong to *L. viridipectus*, was justifiable; but I believe the specimen in question to be a young bird of my *L. brevicauda*. It has no coppery patch on the abdomen, is steel-green on the chest, and has a dull purplish-bronzy crown.

Two specimens from Gelidi in Somali-land, presented to the Museum by Mr. F. Gillett, are very green on the chest, and agree with Dr. Donaldson Smith's specimens from the Omo River. They vary in the amount of purple and bronze on the breast, these shades not being so fully developed as in the type of *L. brevicauda*. I believe, however, that they are all of the same species, and it is doubtful whether Count Salvadori's *L. viridipectus* will turn out to be different. In case of their identity, the latter name has precedence.

PERISSORNIS CARUNCULATA.

Dilophus carunculatus (Gm.); Salvad. Mem. Accad. Sci. Torino, (2) xliv. p. 563 (1894); Sharpe, P. Z. S. 1895, p. 459; Elliot, *t. c.* p. 3; Shelley, B. Afr. i. p. 46 (1896); Peel, Somali-land, p. 305; Grant, Ibis, 1900, p. 121, 1901, p. 283.

Perissornis carunculata, Oberh. Proc. Acad. Philad. 1899, p. 216.

a. ♀ ad. Lario, March 1, 1900.

CRYPTORHINA AFRA.

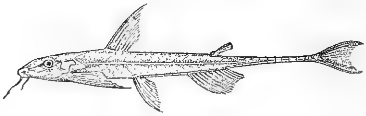
Cryptorhina afra (L.); Sharpe, Cat. B. Brit. Mus. iii. p. 75 (1877); Shelley, B. Africa, i. p. 47 (1896).

a. ♂; *b*, *c*. ♀ ad. Akara country, Feb. 21, 1900. Iris bright blue.

According to Mr. Fraser's determination of the sexes, it is the female which has the bill entirely black, and the male that has the flesh-coloured bill. This is contrary to my determination of the sexes in the 'Catalogue.' Heuglin believes that the birds with the light-coloured bills are the young, and this is, perhaps, the case with Dr. Donaldson Smith's specimen, which may be a young male.

EXPLANATION OF PLATE XXXVI.

Fig. 1. *Cossypha omoensis*, p. 613.
2. *Ploceipasser donaldsoni*, p. 620.



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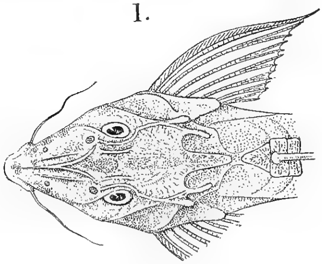

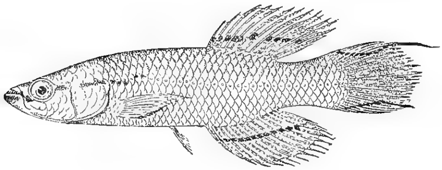

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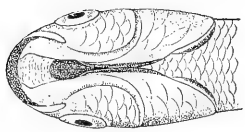
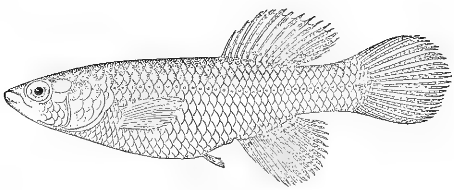




3.

J. Green, del.

NEW WEST-AFRICAN FISHES.

1. PHRACTURA ANSORGII. 2. FUNDULUS GULARIS, male.
3. FUNDULUS GULARIS, female.

7. Descriptions of two new Fishes discovered by Dr. W. J. Ansorge in Southern Nigeria. By G. A. Boulenger, F.R.S.

[Received November 15, 1901.]

(Plate XXXVII.[1])

Phractura ansorgii. (Plate XXXVII. fig. 1.)

Depth of body 10 times in total length, length of head 5 times. Head $1\frac{1}{2}$ as long as broad; skull rugose, covered with thin skin; a median ridge on the snout, bifurcating towards the interorbital region; snout a little longer than the postocular part of the head, pointed, projecting beyond the mouth; anterior nostril three times as distant from the end of the snout as the posterior from the eye; eye supero-lateral, its diameter 7 times in length of head, $1\frac{2}{3}$ in interocular width; maxillary barbel $\frac{1}{2}$ length of head, mandibulars shorter. Occipital process twice and a half as long as broad, narrowly separated from interneural shield. Dorsal I 6, first ray longest, as long as head; second dorsal very small. Anal I 10. Pectoral as long as head, nearly reaching base of ventral; latter a little shorter, nearly reaching anal. Caudal with crescentic notch. Caudal peduncle a little depressed, $\frac{1}{3}$ total length. 26 dorsal and 22 ventral scutes, the last 11 on the caudal peduncle. Pale brownish above, speckled with blackish, white beneath; two small blackish spots on the dorsal and two blackish streaks along the caudal.

Total length 46 millim.

A single specimen from Agberi, obtained in September 1901, along with other small fishes, by means of a native fishing-basket dipped in shallow creeks and flooded yam-plantations.

This is the third species of the genus *Phractura* Blgr., previously known from the Congo only. It differs from both *P. bovei* Perugia, and *P. scaphirhynchura* Vaill., in the greater number of rays to the anal (11 instead of 8), and of scutes on the body and caudal peduncle, and in the posterior nostril being much nearer the eye; from *P. bovei* in the much larger eye.

Fundulus gularis. (Plate XXXVII. figs. 2 & 3.)

Depth of body equal to, or a little less than, length of head, $3\frac{1}{2}$ to 4 times in total length. Snout as long as eye; lower jaw but feebly projecting beyond the upper; diameter of eye $3\frac{3}{4}$ to 4 times in length of head, twice in interorbital width. Dorsal 15–16, originating at nearly equal distance from the head and from the base of the caudal, longest rays about $\frac{2}{3}$ length of head in females, $\frac{2}{3}$ to $\frac{3}{4}$ in males. Anal 16–18, opposed to dorsal, the rays about as long as those of the latter. Pectoral nearly $\frac{3}{4}$ length of head, in males reaching beyond base of ventral

[1] For explanation of the Plate, see p. 624.

latter very small, with 6 rays. Caudal rounded, $\frac{3}{4}$ or $\frac{4}{5}$ length of head; one of the upper rays may be produced in the males. Caudal peduncle a little longer than deep. 30 or 31 scales in a longitudinal series, 12 or 13 in a transverse series; a series of pits represents the lateral line. Pale olive-brown above, white below; females uniform, or with a few reddish-brown dots on the dorsal and on the base of the anal. Males with a purple band on each side of the head, passing round to the other side over the lower jaw, and a median band of the same colour behind the chin, on the branchiostegal membrane; small carmine-red spots or vermiculations on the side of the head behind the eye, and often small spots of the same colour on the body; a streak or a series of spots of crimson along the dorsal and anal and usually two, converging behind, on the caudal, the latter fin being grey between the streaks and pure white outside them; lower border of pectoral sometimes crimson.

Total length 63 millim. No difference in size between the sexes.

Numerous specimens were obtained in September 1901 at Agberi in shallow creeks and flooded yam-plantations.

This species is most nearly related to *F. sjoestedti* Lönnberg, from Camaroon, which has 17 or 18 rays to the dorsal fin, 35 scales in the lateral line, and the posterior dorsal and anal rays much produced and filamentous in the males. The rudimentary pseudobranchiæ, which exist in the East-African *F. orthonotus* Peters and *F. guentheri* Pfeff., and on which Peters's genus *Nothobranchius* is founded, are not to be found in *F. gularis*.

EXPLANATION OF PLATE XXXVII.

Fig. 1. *Phractura ansorgii*, with enlarged upper view of head, p. 623.
2. *Fundulus gularis*, male, with enlarged lower view of head, p. 623.
3. Ditto, female.

December 17, 1901.

Prof. G. B. Howes, LL.D., F.R.S., Vice-President, in the Chair.

A communication was read from Mr. G. Metcalfe, M.A., drawing attention to the following entry in the 'Proceedings' for 1893 (p. 505):—"The Hon. Walter Rothschild, F.Z.S., exhibited and made remarks upon . . . . a specimen of the egg of the Duckbill (*Ornithorhynchus anatinus*) stated to have been taken out of the pouch of the mother in Queensland." A statement that the Duckbill laid its eggs in its burrow had also been placed on the label of the specimens in the Natural History Museum.

Mr. Metcalfe asserted that, after living many years in a region inhabited by these animals, making special enquiries of the authorities of the Sydney, Melbourne, Brisbane, and Hobart Museums, and publishing questions on the subject in Australian newspapers, he had been unable to obtain any evidence that eggs of *Ornithorhynchus* had ever been obtained except by dissection of the mother. He therefore did not believe that the eggs were laid at all, but that they were hatched before extrusion. It was also to be noted, in connection with Mr. Rothschild's exhibition, that *Ornithorhynchus* did not possess a pouch.

In reference to Mr. Metcalfe's communication, Mr. Oldfield Thomas drew the attention of the Meeting to the accounts given by Mr. Caldwell in his paper on the Embryology of the Monotremata [1], to the instances of the laying of eggs recorded by Prof. Spencer [2], and to the following statement [3] in Mr. J. Douglas Ogilby's work on the Mammals of Australia:—"The Platypus forms a nest in its burrow on which to deposit its eggs, and hatched them out by the warmth of its body in the same manner as birds do."

It was upon this evidence that Mr. Lydekker had based the Museum-labels referred to by Mr. Metcalfe.

But from Mr. Metcalfe's communication it was evidently still thought doubtful by some persons whether the Duckbill really laid its eggs; and Mr. Thomas expressed the hope that further enquiries might be made by naturalists in Australia as to the actual finding of such eggs in the burrows, so that this most interesting point might be finally settled.

The comparative hardness of the egg-shell, in which Mr. Caldwell had detected calcic salts, was in favour of the more usually received opinion, for, in Mr. Boulenger's words, "Viviparous reptiles have practically no shell to their eggs—it is a mere membrane."

Dr. C. I. Forsyth Major, F.Z.S., exhibited the skull of a fossil aquatic Musteline animal proposed to be called *Enhydrictis galictoides*, from the Pleistocene ossiferous breccia of Sardinia, and made the following remarks:—

When exploring, several years ago, a Pleistocene ossiferous Breccia at San Giovanni, near Iglesias, in the south-east of Sardinia, I came upon the skull of a Carnivore which, in the general shape of its upper contour, the only part at first exposed, presented absolute analogy with that of a *Lutra*. Both the facial and the cranial portions are extremely flattened, the latter besides considerably expanded laterally; the frontal region behind the

[1] Phil. Trans. vol. 178, p. 463 (1887); see especially p. 463, bottom paragraph, and page 473, second paragraph.

[2] Nature, xxxi. p. 132 (1884).

[3] P. 1 (Sydney, 1892).

postorbital processes is elongate and contracted, the rostrum short and broad, the orbits elevated, the infraorbital foramen large.

The ventral region of the skull was at first concealed by strongly adhering stalagmitic matrix; when this was disengaged, remarkable divergences from the *Lutra* became apparent. The posterior portion of the region still recalls *Lutra* by its lateral expansion, flattened *bullæ osseæ*, and broad basioccipital and basisphenoid. But the broad palatal region between the teeth, and the very elongate bony palate behind the tooth-series, are in striking contrast with all known species of *Lutra*, and approach on the other hand to some genera of the Mustelinæ, viz. *Putorius* and *Galictis*.

The dentition is undoubtedly that of a member of the Mustelidæ. There appears to be no trace of a fourth, anterior, premolar, another agreement with the two last-named genera. The most striking peculiarity of the upper dentition is in the shape of the carnassial, the one on the left side being fortunately almost completely preserved.

In the Lutrinæ the heel of the carnassial is a broad, approximately semicircular lobe, either embracing the whole of the blade, or leaving free not more than the posterior third. In the Mustelinæ the heel is generally represented by a comparatively small cusp near the anterior end of the tooth, from which it is well separated by a constriction. The fossil tooth holds an intermediate position. The heel is broad as compared with the majority of the Mustelinæ and shows throughout a raised margin encircling a cup-shaped area; starting anteriorly from the small antero-external cusp of the blade, it embraces not more than about the anterior half of the latter.

The only recent Mustelines presenting a similar carnassial are those of the *Galictis* group (*Galictis*, *Galera*, *Lyncodon*), and more than the other species, the *Galictis vittata*, in which the heel *extends* less medially than in the larger species. The only appreciable difference from the fossil is the slightly stronger antero-external cusp, which makes the heel of the *Galictis* carnassial appear to be situated more backward.

The molar of the fossil is only preserved on the right side; it is much worn and slightly damaged near the antero-internal corner. Although this tooth, placed as it is at the end of the series in the Mustelidæ, varies much in this family, even from one species to the other, it is noteworthy that the molar of the fossil again comes nearest to the smaller species of *Galictis*. It is a narrow tooth, in which the length of the external border is equal to that of the internal, and the anterior margin runs approximately parallel to the posterior.

From the description and comparisons it results that the Sardinian fossil belongs to an amphibious member of the Mustelinæ, coming nearest among recent forms to the South-American *Galictis*. It is abundantly entitled to constitute a separate genus, and I have accordingly called it

Enhydrictis galictoides, gen. et sp. nov.

At various times I have dealt with the remarkable Pleistocene Mammalia of Corsica and Sardinia, and pointed out their absolute distinctness from those of the Continental Pleistocene fauna, as well as the affinities of some of the insular forms with Tertiary European mammals. More recently, Depéret has expressed partly similar views [1].

It was therefore natural to search for related forms with *Enhydrictis* amongst the Tertiary Carnivora, with the result that the Middle Miocene *Trochictis* is the only known Tertiary genus in which the upper carnassial is almost identical with those of *Enhydrictis* and *Galictis*.

The recorded species of *Trochictis* are based on more or less perfect mandibular jaws, and the genus has been classed with the Melinæ. An imperfect skull with a mandibular ramus attached, obtained by me in the quarries of La Grive-Saint-Alban, which is now in the British Museum, shows that the upper jaw of this genus has already been described under various names, from Steinheim by O. Fraas (*Palæomephitis jaegeri* [2], *Lutra dubia*) [3], and from La Grive by Depéret and Gaillard (*Mustela filholi* Dep.) [4]. *Trochictis* has on the whole less affinities with the Melinæ than with the Mustelinæ, and amongst the latter especially with *Galictis* and *Enhydrictis*; to judge from the comparatively small infraorbital foramen and the largely developed bullæ osseæ, it was not amphibious.

Carnivora still more closely related to *Enhydrictis* may be expected from later Tertiary deposits. *Mustela majori* Weith., from the lower Pliocene of Montebamboli (Tuscany)—which, by the way, is not a *Mustela*—shows some approach to *Enhydrictis* in the shape of the upper carnassial, the heel of which is not separated by a constriction from the blade, but largely developed; it is even longer antero-posteriorly than in the latter genus. The tooth of *M. majori* is not inserted obliquely in the jaw as in *Enhydrictis*, but parallel to the palate, apparently in connection with the different insertion and direction of the zygoma. The upper molar (m. 1) of *M. majori* approaches more that of *Mustela*; its transverse diameter being less, its long axis greater than in *Enhydrictis*; the postero-internal angle is still more developed than in *Mustela*, and the transverse diameter shorter even than in the latter. The lower carnassial (m. 1) of *M. majori* is conspicuous by the small development of the heel, which conversely is very long in *Enhydrictis*; the internal cusp of the median tubercle is larger in the tooth of the latter genus.

[1] Charles Depéret, "Etude de quelques gisements nouveaux de Vertébrés pléistocènes de l'île de Corse," Ann. Soc. Linn. Lyon, xliv. p. 111 (1897).

[2] Württ. Nat. Jahresh. xviii. pp. 129, 130, pl. ii. fig. 18 (1862).

[3] Ib. xxvi. pp. 164, 165 (1870).

[4] Arch. Mus. Hist. Nat. Lyon, iv. p. 129, pl. xiii. fig. 55 (1887); v. p. 24, pl. i. figs. 8, 9 (1892).

Dimensions of the skull of Enhydrictis *in millim.*

Basilar length (henselion)		99·0
Upper length		97·6
Cranial breadth behind zygomatic arches and above meat. audit.		52·5
Greatest breadth		66·0
Breadth of occiput	ca.	60·0
Interorbital breadth		28·5
Breadth between procc. postorb.		33·0 (!)
Breadth between outer margins of alveoli of upper canines	ca.	26·0
Palate length	ca.	54·0
Length from anterior margin of alv. of upper canine to post. margin of alv. of m. 1	ca.	32·5
Length of sagittal crest	ca.	63·0
Height of mandibular ramus between p. 1 and m. 1		11·0

I conclude with a general remark on the Pleistocene Mammalia of Corsica and Sardinia. They are essentially the same in both islands and, with the exception of the Mouflon, I have not met with a single recent species amongst the fossil forms. This is as much as to say that, so far as the Mammals are concerned, I cannot endorse the following statement by Depéret, referring to the Corsican Pleistocene fauna:—"Le caractère *quaternaire* de l'ensemble de cette faune ressort déjà de la présence d'un grand nombre d'espèces actuelles, telles que le Loir, le Mulot, le Lièvre, le Mouflon de Corse, l'Aigle pygargue"[1]. On this topic I shall have something more to say at an early opportunity.

Mr. Budgett read a paper on the Structure of the Larval *Polypterus*, in which he described the urino-genital system and skeleton of a very young larva 30 mm. in length. The following is an abstract of this communication:—

The *pronephros*, consisting of the greatly coiled anterior end of the archinephric duct, was very large and lies close under the skin on either side behind the gills; the coiled portion of the pronephros communicated with a small pronephric chamber at the side of the dorsal aorta by a very fine duct, the extreme anterior end of the archinephric duct. The chamber contained at this stage a very small glomus and did not appear to communicate with the body-cavity. The pronephros of *Polypterus* closely resembled that of *Amia*.

The *mesonephros* in the hinder end of the body was simple, consisting in each segment of a glomerulus, from which there passed a short broad nephrostome-canal opening into the rudiment of the genital duct and a coiled kidney-tubule ending in the segmental duct.

[1] *Op. cit.* p. 122.

The genital ducts were regarded as being quite distinct from Müllerian ducts in the Ganoidei, Crossopterygii, and Teleostei, and to have been developed from a condition like that in the Cyclostomata, by a folding-off of a portion of the body-cavity. In those forms in which a connection occurs between the testis and the kidney, the male genital duct was regarded as having been converted into the longitudinal canal of the testicular network.

The *skeleton* was entirely cartilaginous at this stage. The chondrocranium and visceral arches were described, and shown to resemble in some respects those of Elasmobranchi, though Amphibian resemblances were also pointed out. It was shown that this larva possesses a segmented rod of cartilage attached to the hyoidean arch and forming the axis of the base of the large external gill.

The development of the vertebral column was shown to be very peculiar, there being at first three series of cartilaginous processes abutting on the notochord on either side. Later, the ventral series lose their connection with the notochord, and become the heads of the ventral ribs.

The condition of the pectoral fins at this stage was shown to support the view that these have been derived from a uniserial fin of the Elasmobranch type, rather than from a biserial archipterygium.

In general, the structure of this larva was regarded as showing that the Crossopterygii at the present day are a central group intermediate between the Elasmobranchi, the Teleostei, and the Amphibia.

This Memoir will be published entire in the 'Transactions.'

The following papers were read:—

1. On the Anatomy of Gruiform Birds; with special reference to the Correlation of Modifications. By P. Chalmers Mitchell, M.A., D.Sc. Oxon., F.Z.S., Lecturer on Biology at the London Hospital Medical College, University of London.

[Received December 17, 1901.]

(Text-figures 70–85.)

In this memoir I use the term Gruiform, descriptively, in the sense of Gadow (4) to denote the Rallidæ, Gruidæ, Dicholophidæ, Otididæ, Rhinochetidæ, Eurypygidæ, and Heliornithidæ. I have been able to dissect members of all these groups in the Prosectorium of this Society; and I am specially indebted to my friend Mr. F. E. Beddard, F.R.S., the Prosector, not only for the kindness with which he has given me his personal assistance in verifying many doubtful points, but for the complete manner in which he has placed material (some of it belonging to the Society, and some of it his own) at my disposal. I have actually dissected the following forms:—

Rallidæ	*Aramides cayennensis.*
	,, *ypecaha.*
	Fulica leucoptera.
	Gallinula chloropus.
	,, *phœnicurus.*
	Hypotænidia philippensis.
	Porzana carolina [1].
	Rallus celebensis.
	,, *longirostris.*
	,, *maculatus.*
Gruidæ	*Balearica chrysopelargus* (Gruinæ).
	Aramus scolopaceus (Araminæ).
	Psophia leucoptera (Psophiinæ).
	,, *obscura* (id.).
Dicholophidæ.	*Cariama cristata.*
Otididæ	*Otis tarda.*
Rhinochetidæ.	*Rhinochetus jubatus.*
Eurypygidæ..	*Eurypyga helias.*
Heliornithidæ.	*Heliornis fulica* (seu *Podoa surinamensis*).

I have, moreover, made full use of the published observations of Beddard (**1**), Gadow (**4**), and Fürbringer (**3**) on these and allied forms, but any detailed statements which I make in this paper I have myself observed or verified unless I cite them on the authority of their author.

The direct object of the enquiry the results of which are now to be set out, was a prosecution of investigations to which my discovery of the eutaxy in the wing of certain Pigeons (**8**) led me. I came to the conclusion that in the Columbidæ the diastataxic condition of the wing was primitive, and that the eutaxic condition was derived therefrom by a secondary closing up of the diastema in the ranks of feathers. I found that there was a general coincidence between the specialized condition of the wing and specialized conditions of other anatomical structures, and a similar general coincidence between the primitive condition of the wing and less specialized conditions of other anatomical structures. Later on I studied the structure of Kingfishers, a group in which the occurrence of both conditions of the wing was known, and I was able to show (**9**) that also in that group there existed a correlation between specialization of the wing and specialization of other anatomical structures. In a later memoir (**10**) dealing with the modifications presented by the Alimentary Canal in the whole group of birds, I had occasion to employ a precise terminology for

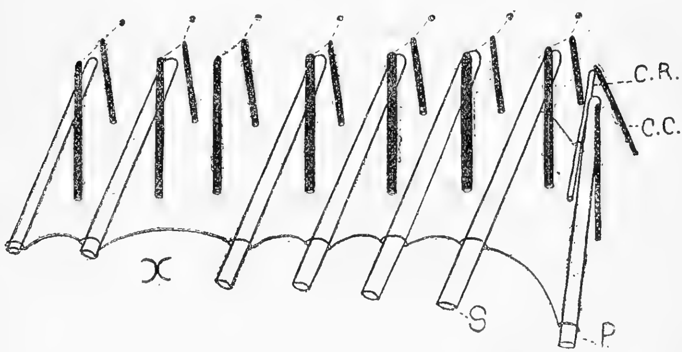
[1] Beddard (**1**) states that *P. carolina* is exceptional in having a nude oil-gland; in the specimen I examined the gland was definitely tufted, and the same was true of some chicks that I examined along with Mr. Pycraft at the British Museum.

degrees of specialization of anatomical conditions. I distinguished one condition of character found in a group as being, with regard to that group, *archecentric*, that is to say as most nearly representing the ancestral condition or common heritage of the group; while the other conditions were distinguished as *apocentric*, that is to say as having moved outwards along some radius from the archecentric condition. In this terminology, I regard the diastataxic condition of the wing as archecentric, the eutaxic condition not only as apocentric but as *multiradially apocentric*—that is to say, as being an instance of such a simple and direct change as we may imagine to have occurred independently in different cases. In Columbidæ and Alcedinidæ there is a general coincidence of this apocentricity of the wing with apocentricities of other structures. The problem of the present research was to see to what extent and in what structures there was a similar correlation of apocentricities in Gruiform birds. It is clear that the field of the problem is essentially different; there is no doubt as to the close genetic affinity of the different Doves and Pigeons, and the Kingfishers are a group at least equally coherent. In the case of the birds here associated as Gruiformes, there are many taxonomic uncertainties, among which the least uncertain point is, that even if the assemblage be natural, many of the groups assigned to it stand far apart.

Eutaxy and Diastataxy in the Gruiformes.

Rallidæ.—All the Rails that I have examined have the wings typically diastataxic. The condition in *Rallus longirostris* (text-fig. 70) may serve as a type. The primary quills have major coverts

Text-fig. 70.



Wing-structure of *Rallus longirostris*.

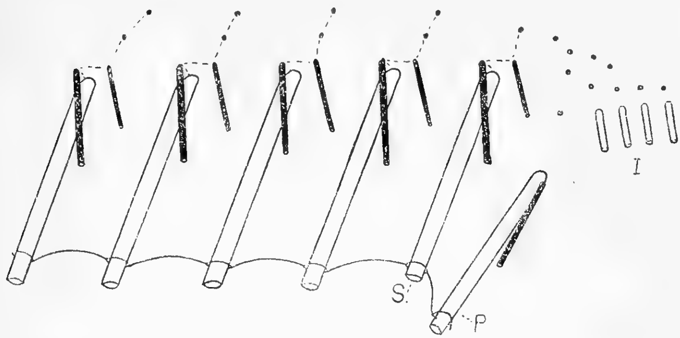
Diagram of the distal secondary quills and coverts, showing the *diastataxic* condition. The quills are in outline; the major coverts and "third-series" feathers are in black: the transverse rows are represented by dotted lines with larger black dots showing the positions of feathers.

S. First secondary. *P.* First primary. *x.* Diastataxic gap. *C.R.* Carpal remex. *C.C.* Carpal covert.

placed distally and bound closely to them. At the carpal angle of the wing, the transition to the secondaries is made and the carpal remex with the carpal covert lie in this region. Since Degen (2) drew attention to these feathers a good deal has been written about them by various authors, and when I wrote my paper on the Columbidæ (8) I was unacquainted with Degen's work. I urged the view, against later writers, that the carpal covert and remex belonged morphologically to the secondaries and not to the primaries. I am glad to find that this was Degen's view. In the Rallidæ the carpal covert crosses the carpal remex precisely as the major coverts cross the secondary quills, and the remex is frequently tied to the first large secondary by a plica of membrane similar to that which I described in the Columbidæ. I think that there can be no doubt as to the homology of these feathers, and that morphologically the diastataxic gap should be counted as coming after the fifth secondary. The carpal remex and covert are in process of reduction. In the Rallidæ this has not proceeded far, and the carpal remex, in most cases, as in the figure, lies very close to the first primary, so that it appears rather like a proximally placed, primary major covert. The four large distal quills of the secondary series are crossed by their major coverts; then comes the wide diastataxic gap (*x*) occupied by a feather in series with the major coverts, and then follow the more proximal secondaries with their coverts in even series. The transverse rows of minor coverts are not well-marked in the Rallidæ; the coverts just above the major coverts are large, and, as frequently happens in birds, owing to the large size of the quills and major coverts these third-series feathers have been pushed forwards so that they appear to lie in between the rows; their true position will be at once plain if one imagine the quills and major coverts reduced to the same size as those of this third series. In the figures, which naturally are somewhat diagrammatic, these feathers are represented rather more nearly in their morphological position than in their actual position. They are the feathers that I termed third-series feathers in my paper on the Columbidæ. The higher members of the transverse rows are fairly well marked in some Rails; in others they are reduced to small, almost downy feathers without conspicuous transverse or horizontal arrangement.

Gruidæ.—The Gruinæ and Araminæ are diastataxic, and, except that the transverse rows are rather better marked in *Aramus*, there is no point of importance to distinguish the condition of the wing in these from the condition in the Rails. As in some Rails, the carpal remex is not so close to the first primary as in *Rallus longirostris.* The Psophiinæ (text-fig. 71, *Psophia obscura*) display the eutaxic arrangement of the wing-feathering. The primary quills with their distally placed major coverts meet the secondary quills, which, as usual, are crossed by their major coverts, at the carpal angle. The secondary quills occur in even series, there being no trace of the diastataxic gap. The transverse rows are fairly well marked, the third-series feathers, as in the diastataxic forms, being displaced forwards and so lying in the interspaces of the secondary quills. There are several small feathers in the carpal angle of the

Text-fig. 71.



Wing-structure of *Psophia obscura.*

Diagram of the distal secondary quills and coverts, showing the *eutaxic* condition. General description and lettering as in text-figure 70.

I. Quills on first digit.

wing, but none of these can be identified with certainty in the adult condition as carpal remex or carpal covert. The degeneration of these feathers is an apocentric modification, and it is interesting to find it associated with the eutaxic arrangement.

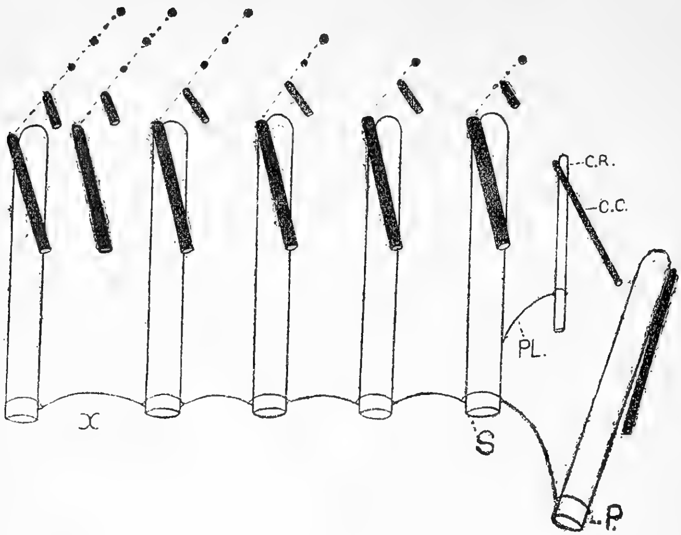
Dicholophidæ.—These are known to be eutaxic, and there is nothing in the arrangement of the feathers to distinguish it from the condition in *Psophia.* In the carpal angle there is an obvious carpal covert, recognized by its position. Under it is a very small and degenerate representative of the remex. A plica binds these two to the first large secondary quill. The degeneration of the carpal remex is here, as in *Psophia*, to be associated with eutaxy, but it has not proceeded so far.

Otididæ.—In the wings of these (text-fig. 72, *Otis tarda*) the condition is markedly diastataxic. The primary coverts are distad of their quills, there is a good carpal covert crossing the carpal remex, the latter being bound to the first large secondary by a plica, and the carpal remex with its covert being in plain sequence with the secondaries and their major coverts. The transverse rows over the secondary quills are plain. The diastema (x) is wide, and in it lies a major covert at the base of a normal transverse row.

Rhinochetidæ.—In these (text-fig. 73, p. 634, *Rhinochetus jubatus*) the wing shows the eutaxic condition. The only difference between the wing of these and that of *Psophia* is that the carpal remex is not so degenerate. It is bound to the first secondary quill by a strong plica and is crossed in normal fashion by a small covert.

Eurypygidæ.—It is curious that the references in the literature to the condition of the wing in *Eurypyga* differ. Gadow (**4**) and Beddard (**1**) state that it is diastataxic. Pycraft (**11**) places it in

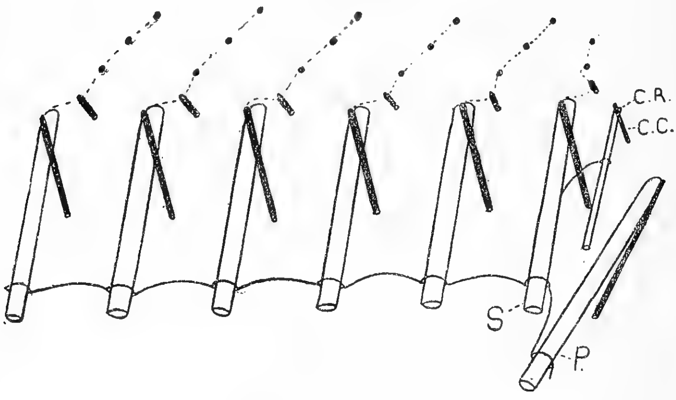
Text-fig. 72.



Wing-structure of *Otis tarda*.

Diagram of the distal secondary quills and coverts, showing the diastataxic condition. General description and lettering as in text-figure 70.
PL. Plica, or membranous fold binding the carpal remex to the distal secondary.

Text-fig. 73.



Wing-structure of *Rhinochetus jubatus*.

Diagram of the secondary quills and coverts, showing *eutaxic* condition. General description and lettering as in text-figure 70.

a list of eutaxic forms; and Seebohm (**12**) not only places it among eutaxic forms but adds a footnote stating that "having very carefully examined the wings he found no trace of surplus wing-coverts to indicate the loss of a fifth secondary." Along with Mr. Pycraft I examined carefully a well-preserved spirit-specimen in the British Museum. The wing was normally diastataxic. The feathering was of the normal type, except that while the carpal covert was large and bound down to the first large secondary quill by a plica, the carpal remex was vestigial, an exception to its usual condition among the diastataxic Gruiformes. I therefore do not hesitate to say that Seebohm was mistaken, and that the Eurypygidæ are diastataxic, as stated by Beddard and Gadow and as shown by the specimens I examined. It is of course conceivable that individual variations occur; the Columbidæ and Alcedinidæ show closely allied species with both conditions. However, the circumstance that Seebohm was mistaken about the condition in the next group, makes it more probable that he was mistaken here than that *Eurypyga* presents individual variations.

Heliornithidæ.—These are eutaxic. It is impossible to mistake the American Fin-foot, as its smaller size and feet with transverse zebra-like black bars distinguish it plainly from the African forms. I have examined a number of specimens, well preserved in spirit, both at the British Museum and in Mr. Beddard's collection. The primaries with their distally placed major coverts are as in other Gruiformes; the carpal covert crosses in normal fashion a carpal remex, and the latter, as in other eutaxic Gruiform birds except *Rhinochetus*, is vestigial. The secondary quills, crossed by their major coverts, lie in even series with no trace of a diastema. None the less Seebohm (**12**) wrote as follows:—"*Heliornis* has always been regarded as the New World representative of the Old World genus *Podica*. The theory that the resemblance is only accidental, and that *Podica* is the Old World representative of the New World Psophiæ, is supported by several facts. In spite of statements to the contrary, there can be little doubt that *Podica* is quincubital (eutaxic) and belongs to the Galliformes, whilst *Heliornis* is aquincubital (diastataxic) and belongs to the Ralliformes. Three specimens (two of them in spirit) of *Podica senegalensis*, and one of *Heliornis fulica*, have been most carefully examined for me by experts at the British Museum." *Podica senegalensis* is certainly eutaxic, as Seebohm states, but the same condition exists in *Heliornis*. I can only suggest that in the one specimen examined, the "experts," fearing to disturb the feathers too much, looked only in the space proximad of the fourth quill, and, seeing there one of the third-series feathers, mistook it for the major covert of a diastataxic form. Especially in the case of a small wing with closely-set feathers, it is necessary to examine the whole series to be certain as to the condition, as the forwardly displaced "third-series" feathers, if only a single interspace be examined, look remarkably like diastataxic additional coverts.

The Gruiform assemblage, then, like the Columbidæ and the

Alcedinidæ, has some members with the wing in the diastataxic condition and some members with the wing eutaxic, and there is no direct relation between the distribution of these conditions and the accepted classifications. On the assumption that eutaxy is an apocentric modification of the archecentric diastataxy, it is plain that it must be what I term a multiradial apocentricity, a condition that has been produced several times independently. How far is this apocentricity found associated with other apocentricities? In the wing-feathering generally there is an association between eutaxy and the degeneration of the carpal remex. *Rhinochetus* is the only eutaxic form in which the degeneration of this feather has not been carried far; *Eurypyga* is the only form of those that I have examined in which diastataxy is associated with a great degeneration of the carpal remex.

The Gut-Patterns.

I have recently (**10**) described and discussed the patterns displayed by the convolutions of the Intestinal Tract among the Gruiformes. They are all modifications of a metacentral condition closely resembling that found underlying the modifications of the Charadriiformes. It is enough to say here that *Aramus* appears to show the most primitive condition in the group, a condition in which there is little trace of the special Ralline pattern. The Ralline pattern is very definite, and the patterns found in the Gruinæ, Psophiinæ, and Heliornithidæ are practically identical with it. *Rhinochetus*, *Dicholophus*, and *Otis* show apocentric modifications of the Ralline type. *Eurypyga* stands out from the others, showing, in this respect, only an extremely generalized relationship with the group.

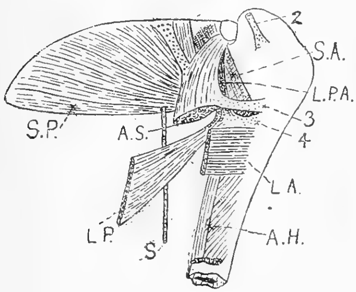
The divergence of patterns among the Gruiformes is certainly not great, but none the less is in striking contrast with the practically complete identity of pattern found among the different members of the Columbidæ or of the Alcedinidæ, the state of affairs pointing out that the Gruiform assemblage is far from coherent. *Aramus* and *Eurypyga*, two diastataxic forms, display the most archecentric patterns found in the group; the others, eutaxic or diastataxic, are all apocentric, that is to say are far modified from the Avian archecentric condition.

Muscular Anatomy.

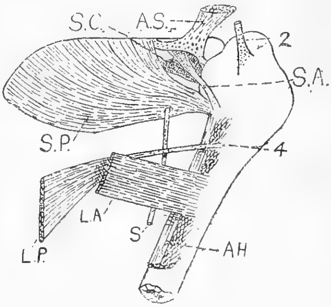
Latissimus dorsi anterior et posterior.—The conditions of these muscles present a considerable range of variation among the Gruiformes.

In the Rallidæ (when I use family names in this memoir I mean to imply only those examples mentioned as having been dissected) both divisions of the muscle are large and unusually strong, with a wide origin from the dorsal vertebral spines extending from the posterior cervicals to the ilium. The posterior margin of the anterior division is in contact with the anterior margin of the posterior division throughout the greater part of the extent of the muscle, and, save in *Gallinula phœnicurus* and *Porzana carolina*, they are actually in continuity. The posterior part, corresponding to the posterior division in most birds, is enormously strong and large, and its origin has spread distally until it has reached a considerable portion of the ilium and the musculature of the thigh. At the insertion, the fleshy and broad insertion of the anterior portion (text-fig. 74, *L.A.*) is superficial, and its proximal edge is in contact

Text-fig. 74.



Text-fig. 75.



Shoulder-muscles of *Rallus longirostris*. Shoulder-muscles of *Psophia obscura*.

Musculature of right shoulder, external view.

2. Tendon of supra-coracoideus *A.S.* Anconæus scapularis, cut short, and in text-fig. 75, reflected. *S.A.* Scapuli-humeralis anterior. *S.P.* Scapuli-humeralis posterior. *S.* Expansor secundariorum. *L.P.* Latissimus dorsi posterior. *L.P.A.* Slip of lat. dorsi post. to anconæus scapularis. *L.A.* Latissimus dorsi anterior. *A.H.* Anconæus humeralis. *S.C.* Sub-scapuli-coracoideus.

3. Humeral anchor of anconæus. *4*. Humeral insertion of lat. dorsi ant. The tendinous areas are dotted.

and partly fused with the tendinous insertion of the posterior division (text-fig. 74, *4*). The latter runs to the humerus, in close association with the humeral anchor of the anconæus scapularis (text-fig. 74, *3*). It also sends proximally a remarkable muscular slip (text-fig. 74, *L.P.A.*) which is fused with the chief origin of the anconæus scapularis. The condition of this muscle offers three points of special note. The great size and backward extension of the muscle with its iliac origin are certainly apocentric. The fusion of the two divisions along a great part of their course, from origin to insertion, is possibly archecentric, and brings to mind the single latissimus dorsi of *Apteryx*, a condition possibly archecentric for Aves, and to be compared with the single muscle in Reptiles. The muscular attachment to the anconæus of the insertion of the posterior division possibly is archecentric: in any case the only parallel to it with which I am acquainted is the similar condition described by Fürbringer in the case of *Casuarius*.

In the Gruidæ the conditions differ. In the Gruinæ the two divisions are relatively narrow and do not touch at origin or insertion; the posterior division is in tendinous degeneration, an apocentricity different from that found in the Rallidæ. In *Aramus* the condition is more Ralline, the posterior portion being extremely large and reaching to the ilium, although the two divisions are not in contact either at origin or insertion. In *Psophia* both divisions are large, the posterior division having spread backwards so as to take extensive origin from the ilium and from the thigh musculature. At their insertions (text-fig. 75) they are far apart and quite free, and along their course the edges are not in contact. In the Dicholophidæ both divisions are of fair size, the posterior division possessing a backward extension to the ilium. Throughout their course they are not in contact, and the insertions of the two divisions are very far apart. In the Otididæ the anterior division resembles that in other Gruiformes, but the posterior division has completely disappeared. In *Rhinochetus* both divisions are strong, the posterior having the Ralline backward extension to the ilium, while the insertions are well separated, that of the posterior division being in common with the insertion of the humeral anchor of the anconæus. In *Eurypyga* the condition is more archecentric than that in *Rhinochetus*; the backward extension has not reached the ilium, and the insertions are much more nearly in contact. The Heliornithidæ display the enormous backward extension and great size of the posterior division common in the group. The two divisions are free from one another and their insertions are well separated.

So far as this muscle is concerned, it is plain that the Gruiformes do not display the exact coincidence of apocentricities found in a compact group such as the Columbidæ or the Alcedinidæ. The most striking apocentricity is the enormous backward extension of the posterior division. This is best marked in the Rails, which are diastataxic, and in *Heliornis*, which is eutaxic, but it appears in all the eutaxic forms. In *Eurypyga*, which is diastataxic, it does not occur; in the Crane, which is diastataxic, another apocentric condition occurs, consisting in the reduction of the posterior division, and this is carried to the extent of complete loss in *Otis*, another diastataxic form. Among the diastataxic Rails two conditions occur for which parallels have to be sought among the Ratites.

Latissimus dorsi metapatagialis.—This muscular slip is present in all the Gruiformes. It is superficial to the posterior division of the latissimus dorsi and runs to the skin in the region of the axilla. Owing to its superficial position, it is easy to overlook it, or to remove it accidentally in process of skinning the region.

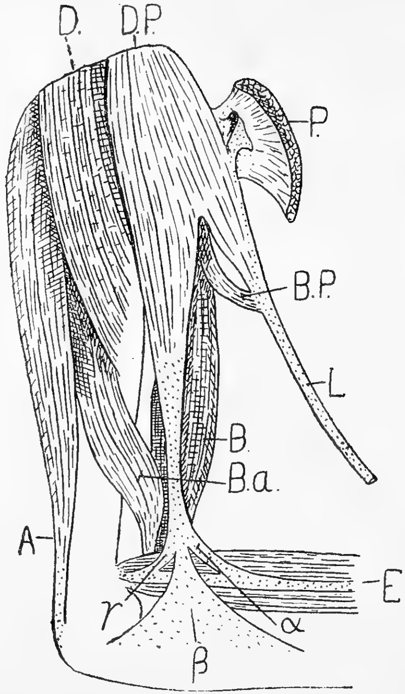
Rhomboideus superficialis et profundus.—Both muscles are present in all the Gruiformes, and the general course of the fibres is that those of the superficial muscle run nearly transversely from the scapula up towards the vertebral spines, but show a tendency to slope backwards from below upwards. The fibres of the deep muscle run upwards and forwards from the scapula to the vertebræ.

The superficial muscle shows a marked tendency to increase in its anterior region and to decrease in its posterior region. In *Otis*, a diastataxic form, it is extremely long, arising from eight or nine vertebræ, and covering the deep muscle completely. In *Eurypyga*, a diastataxic form, it is thick in front, but thins out posteriorly; in *Rhinochetus*, a eutaxic form, it is almost separated into a thick proximal and a thin distal portion. In the others, eutaxic or diastataxic, except the Gruinæ, its proximal portion extends beyond the deep muscle, and it thins out and disappears some distance in front of the posterior end of the scapula, this condition being best marked in the eutaxic *Psophia*, where it takes origin only from three to four vertebræ. As an exception to the general trend of modification within the group, the Gruinæ present the peculiar feature that it is the distal portion of the superior muscle which is best developed; this completely conceals the shorter portion of the deep muscle, while that again extends further forwards than the superficial muscle anteriorly and is left exposed.

The conditions of the deep muscle, except in Gruinæ, are less irregular. In all the others it begins at the distal extremity of the scapula and reaches forwards along the scapula to a less extent in the diastataxic forms and in *Heliornis*, and to a much greater extent in the eutaxic forms, especially in *Psophia* and *Dicholophus*, where it is extremely long, extending practically the whole length of the scapula and a portion of the clavicle. The deep muscle is certainly phylogenetically newer than the superficial muscle (Fürbringer) and is in process of growing forwards along the scapula. There is a coincidence between this apocentricity and eutaxy; the apocentricity is least in the diastataxic *Eurypyga*, greatest in the eutaxic *Psophia* and *Dicholophidæ*.

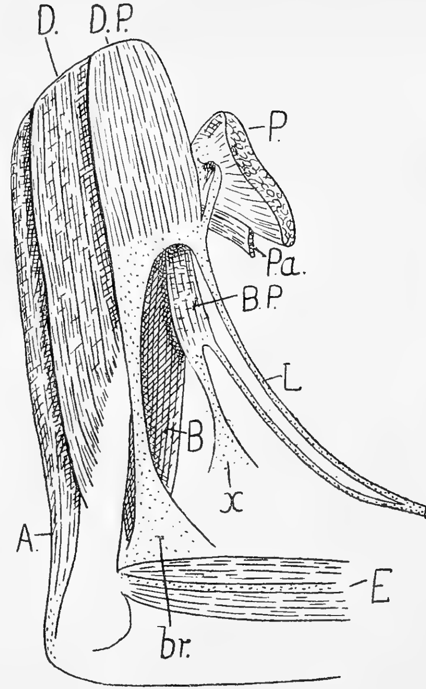
Biceps brachialis.—In the Gruiformes, with the exception of *Rhinochetus*, the biceps muscle of the arm does not present variations of importance. Its chief origin is from the acrocoracoid, but it has the usual secondary origin from the humerus, the latter being weaker. It runs undivided in most of the members of the group until close to its insertion, by tendons of nearly equal thickness, to the opposite sides of the radius and ulna. In some of the Rallidæ the radial portion shows signs of doubling. In *Rhinochetus*, as has been described by Beddard (**1**), there is a curious accessory biceps (text-fig. 76, *B.a.*); Beddard described it as arising from the humerus immediately below the insertion of the deltoid muscle; I found a much more extensive origin beginning on the scapula, close to the insertion of the subscapularis internus and thence passing down the humerus, receiving fibres from Beddard's point of origin. It is inserted to the radius close to the insertion of the radial fork of the biceps. Cases are known in which the normal biceps is divided, the radial tendon coming from the humeral or coraco-humeral portion of the muscle, *Scopus* even having a double origin and insertion to the radius and ulna; and a tendency to the doubling of the coraco-humeral portion appears in some Rallidæ. It seems most probable that this accessory biceps in *Rhinochetus* is

Text-fig. 76.



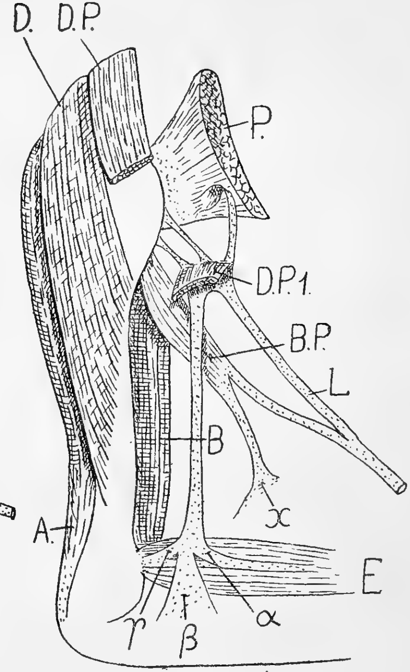
Alar muscles of *Rhinochetus jubatus.*

Text-fig. 77.



Alar muscles of *Rallus longirostris.*

Text-fig. 78.



Alar muscles of *Heliornis fulica.*

A. Anconæus scapularis. *B.* Biceps brachii. *B.a.* (in text-fig. 76) Accessory biceps. *B.P.* Biceps patagialis. *x.* Slip of biceps patagialis to the patagium. *br.* Brevis tendon. α, β, γ. The distal, median, and proximal slips of brevis tendon. *D.* Deltoides major. *D.P.* Deltoides patagialis. *D.P.* 1. Cut and deflected Delt. patag. *E.* Extensor metacarpi radialis. *L.* Longus tendon. *P.* Cut pectoralis major; the pectoralis patagialis is seen coming off the surface of this. *P.a.* Pectoralis abdominalis.

Under *D.P.* 1, in text-fig. 78, slips to the longus from the humerus are made visible by the deflection of the deltoides patagialis. The tendinous areas are dotted.

to be compared with a separated portion of a doubled coraco-humeral-radial division of the biceps, but the extension of the origin to the scapula is very peculiar. The condition is of course markedly apocentric.

Deltoides patagialis.—This muscle is relatively narrow in all the Gruiformes, being most narrow in the Gruinæ and Psophiinæ. The tendons termed *longus* and *brevis* arise from its distal extremity, directly in the Rallidæ (text-fig. 77, *L.*, *br.*) in *Otis* and in *Eurypyga*; or after a very short common tendon, as in *Aramus*, the Dicholophidæ, and *Heliornis* (text-fig. 78); or after a long common tendon, as in the Gruinæ and Psophiinæ; or the muscle itself may fork into peaks for the two tendons, as in *Rhinochetus* (text-fig. 76). The existence or length of the common tendon seems correlated with the size of the bird or of the wing, and to be of minor importance; the conditions vary in individuals and in forms so closely allied as *Chunga* and *Cariama*. With the exception of *Rhinochetus*, all the members of the group may be taken as displaying the muscle in an archecentric condition. The peaked condition suggested in some of the Rallidæ, and fully exhibited in the eutaxic *Rhinochetus*, is undoubtedly apocentric and approaches the extreme apocentricity of a completely divided muscle, a condition that I have shown to exist in the eutaxic Alcedinidæ and in other modified forms of birds.

The longus tendon is single in most of the Gruiformes (text-figs. 76, 77, 78, *L.*), but is doubled in the distal elastic portion in *Aramus*, *Cariama*, *Chunga*, and *Otis*, and in the latter two it is bound down to the brevis tendon by a forearm anchor near where the brevis is inserted to the fascia over the extensor metacarpi radialis. I have not the materials to estimate the values of these slight modifications.

The *brevis* tendon displays the most simple condition in the Gruinæ, where it is a straight, wide band running down to the tendinous portion of the extensor metacarpi radialis, without complication of any kind. In many of the Rallidæ the condition is similar (text-fig. 77, *br.*), but the tendon is rounder and more sharply separated from the fasciæ of the patagial membrane, while in other members of the family the insertion end shows signs of differentiation into the distal slip termed α by Fürbringer and the proximal slip termed γ by the same authority. In *Aramus* the tendon is broad and rather diffuse, but at its insertion it divides into a well-marked distal slip (α) and a diffuse median slip (β), which is inserted to the extensor tendon and passes in addition over that towards the ulnar edge of the forearm to form a well-marked fan-shaped extension. In the Psophiinæ the condition of the tendon is rounder and better separated from the fascia of the patagium, but the insertion end with its proximal slip and median slip with a fan-like extension is like the arrangement in *Aramus*. In *Chunga* and *Cariama* the tendon is broad and diffuse, but distally shows traces of the distal and median slips, of the fan, and of a proximal slip (γ of Fürbringer) running in towards the elbow. The conditions in *Otis* are practically identical. In *Rhinochetus* (text-fig. 76) the distal slip (a), the median slip with its fan (β), and the proximal slip (γ) are all distinct. In *Eurypyga* the condition is very like that in *Rhinochetus*, the three slips and the fan all being present, and in *Heliornis* (text-fig. 78) a similar arrangement exists.

Here again the conditions of the *brevis* tendon show that the Gruiformes are not a closely coherent group and do not show any close correlation of apocentricities. The broad, diffuse condition of the tendon, little separated from the fasciæ between the dorsal and ventral portions of the patagium, is probably the more archecentric, and occurs in the diastataxic Gruinæ and Araminæ, but also in the eutaxic Dicholophinæ. The others, eutaxic and diastataxic, show the more apocentric condition of a well rounded tendon. The extent to which the proximal, median, and distal slips of insertion (γ, β, and a) are developed has no correlation with the eutaxy and diastataxy; the extension of the median slip (β) to form a fan reaching towards the ulnar edge of the wing is almost certainly apocentric, and is absent in the diastataxic Rallidæ, present in the others, eutaxic or diastataxic.

Pectoralis propatagialis.—In *Eurypyga* alone there are separate slips running to the *longus* and *brevis* tendons from the pectoralis major. In all the others there is a reduced slip, chiefly tendinous, from the pectoralis running either to the common portion of the *longus* and *brevis* or to the *longus* tendon alone. Possibly representing the *brevis* portion, there is present in *Heliornis* (text-fig. 78, p. 640) one (or in individual cases two) tendinous slips stretching from the edge of the humerus to the common tendon of the longus and brevis. In the figure, the deltoides propatagialis muscle is represented as divided and turned backwards to show these.

Biceps propatagialis.—This muscular slip is completely absent in the Otididæ and Dicholophidæ, an obviously apocentric modification, as the slip is present in all the other members and in the most nearly allied groups. Garrod (**6**) attached great taxonomic importance to the presence or absence of this slip; but its presence appears to be an Avian archecentric character and therefore of no direct value as a guide to affinity; its loss is an occurrence that might well have occurred repeatedly and independently. Thus Fürbringer found it absent in certain members of the Steganopodes, Pelargi, Galli, Parridæ, and Megapodidæ, and in individuals of *Sula* and of *Talegalla*. Its loss is therefore to be regarded as what I term a multiradial apocentricity and is no direct indication of affinity.

Apart from the Otididæ and the Dicholophidæ, in the other members of the Gruiform assemblage the biceps slip is always present and arises as a bundle of fibres which, separating from the biceps brachii, run outwards on to the patagium in the direction of the longus tendon. The insertion displays differences. In *Eurypyga* and in *Rhinochetus*[1] (text-fig. 76, *B.P.*) it occurs in the form

[1] Mr. Beddard has failed to find this is one specimen, but mentions that Garrod had recorded its presence; there was no doubt about its presence in my specimen.

anatomically most simple; the whole muscle is fleshy and short and is inserted directly to the *longus* tendon rather high up. In *Psophia* the origin and insertion to the *longus* are also fleshy, but the whole slip is much longer, so that the insertion is more distally placed, on the elastic portion of the tendon. In the others the slip terminates in a tendon which fuses with the *longus* tendon after a short separate course in *Aramus*, and after a very long course parallel with the *longus* in the Rallidæ (text-fig. 77, p. 640) and in *Heliornis* (text-fig. 78, p. 640). The Rails, except *Porzana* and *Heliornis*, show an additional peculiarity. The tendon of the biceps propatagialis forks, the outer fork running to the *longus* as I have described, while the inner fork spreads out on the patagial membrane, as the whole biceps slip does in *Pterocles* (Fürbringer). Beddard (1) figured the arrangement in *Heliornis* differently; but after a careful comparison of his sketch with several dissections, I am satisfied that the tendon marked x in his figure is in reality the junction with the *longus* displaced in dissection, while the other tendon in the specimens I examined ended on the patagium (as Beddard stated to be the case in *Podica*), and did not end on the brevis.

I have not yet sufficient information to place these variations of the biceps slip in order of apocentricity and archecentricity. It appears to me to be probable that the biceps slip was originally a cutaneous slip, and that a condition in which it spread out on the patagium without definite connection with the longus and brevis tendons is archecentric. Were this established, the condition described by Beddard for *Podica*, a eutaxic form, would be archecentric, while *Heliornis* and the Rallidæ would stand next to it—there being thus no correlation whatever between the condition of this muscle and the condition of the feathering in the wing. I may point out, also, that on this hypothesis the curious resemblance between the arrangements in *Heliornis* and the Rallidæ, at first sight so suggestive of affinity, could not bear such an interpretation, as the common possession of an archecentric character does not afford a direct clue.

Deltoides major et minor.—In all the Gruiformes both these muscles are present and the minor presents no variations of importance. The major is a progressive muscle in most groups of birds, its insertion gradually creeping down the humerus, a relatively long extension being apocentric, a relatively short archecentric. Of the Gruiformes the Gruinæ display it in the most archecentric condition, the extension of its insertion not amounting to more than the proximal third of the humerus; in the Otididæ, also a diastataxic group, the insertion extends over the proximal half of the humerus. In *Rhinochetus*, a eutaxic form, it is also relatively short (text-fig. 76, *D.*), but its length is interfered with by the curious accessory biceps. Among the Gruiformes it reaches its maximum length in eutaxic forms such as *Psophia*, where it extends over six-sevenths of the humerus, and in the Dicholophidæ, where one portion extends to about the end of the third quarter of the humerus, but another portion, separated from the first by the nerve running to supply the forearm, reaches the distal extremity of the humerus. In the other forms, eutaxic or diastataxic, the muscle reaches to the end of the third quarter (text-figs. 77 & 78, *D.*). Thus there exists a general correlation between the apocentricity of the wing and the apocentricity of this muscle. It is least apocentric in certain diastataxic forms, most apocentric in certain eutaxic forms, intermediate in others.

Scapuli-humerales anterior et posterior.—The posterior muscle, commonly termed the teres major, is present in all the Gruiformes. It is much larger than the anterior muscle and runs from an extensive origin on the scapula to converge in a tendon which is inserted to the median process of the humerus (text-figs. 74 & 75, *S.P.*). Its size apparently is subject to individual variation; for in *Aramus* and in *Psophia* Fürbringer found it relatively small, while in my specimens of these birds I found it very large, at least as large as in any other members of the group. In *Balearica* alone I found it small. Upon its size, no doubt, depends its contact with or distance from the anterior muscle, conditions the varying nature of which have been described by Fürbringer.

The anterior muscle arises from the proximal portion of the scapula and runs across the angle between the scapula and the humerus to its insertion on the humerus near the forked origin of the anconæus humeralis. Its maximum development in the group appears in the Rallidæ (text-fig. 74, *S.A.*), where, although much narrower than the posterior muscle, it is a good strap of fleshy tissue. In the Gruinæ it is relatively as large as in the Rallidæ, and its fibres converge to a strong tendon. In the other diastataxic forms it is much reduced: thus in *Aramus* and *Eurypyga*, Fürbringer found it present but well separated from the posterior muscle, and small, while in my specimens the muscle was represented only by a few fibres. In *Otis* it is much reduced, and is attached to the humeral anchor of the anconæus scapularis. In all the eutaxic forms either it displays a very marked reduction or is absent. Thus in *Psophia obscura* (text-fig. 75, *S.A.*) I found it much reduced and chiefly tendinous; in *Psophia leucoptera* it was absent, and Fürbringer states that it is missing in the genus. In *Cariama* and *Chunga* and in *Rhinochetus* it is absent; in *Heliornis* it is present, but much reduced.

It is probable that the existence of a separate anterior and posterior scapuli-humeralis is due to the segmentation of a primitive Reptilian single muscle, and the absence of one of the portions normal in birds might therefore be ancestral or archecentric, the single muscle being the undivided representative of the Reptilian prototype. The series of conditions among the Gruiformes, however, make it plain that the presence of both muscles is the normal and archecentric condition for the assemblage, and that the loss, partial or complete, of the anterior muscle is an apocentric modification. It is to be noticed, therefore, that here is a fairly definite case of correlation of apocentricities. The anterior division is small or absent in all the eutaxic forms; it is well developed only in the diastataxic forms; but the correlation is not exact, for the apocentric reduction occurs also in two diastataxic forms—*Aramus* and *Otis*.

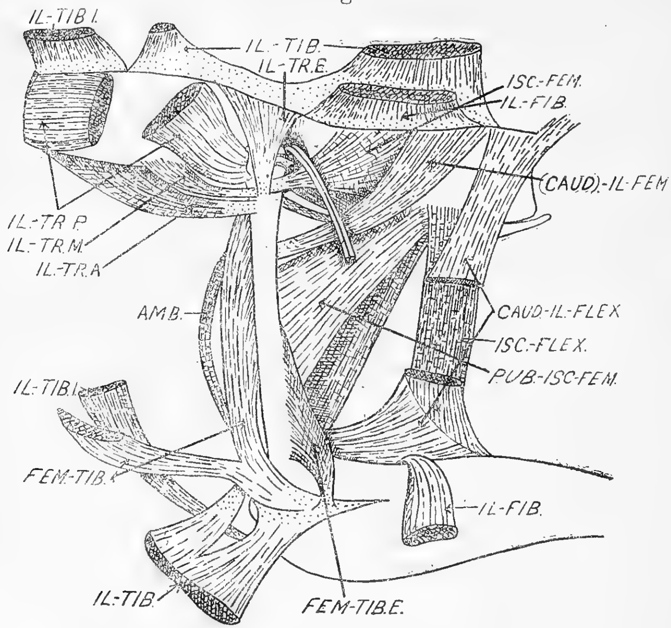
Serratus superficialis, *Serratus profundus*, *Sterno-coracoideus*, *Supra-coracoideus*, *Coraco-brachialis externus*, *Coraco-brachialis internus*, *Brachialis inferior*, *Sub-coraco-scapularis*, and *Anconæus* are present in all: in most cases they do not present variations of importance; in some cases I have not materials to justify any comment on the differences that I have noted. The portion of the anconæus described by Garrod and others as the *Expansor secundariorum* presents in all what Garrod called the Ciconine conditions; arising from a triangular ligament in the axilla, it is inserted to several of the proximal secondary quills. It is feeblest in *Rhinochetus* and in *Eurypyga*; in the latter the tendon disappears without actually reaching the secondaries, although at its origin it has the strong Ciconine character found in the whole group.

Ilio-tibialis internus seu sartorius.—In all the Gruiformes this muscle is practically identical. It arises (text-fig. 79, *IL.-TIB.I.*) from one or two vertebræ at the proximal end of the ilium, and from the ilium itself with a varying extent from the anterior vertical edge and from the fasciæ over the ilio-trochanterici; in most instances (not in the Gruinæ) it is united with the proximal border of the ilio-tibialis and it is inserted to the fasciæ over the knee-capsule.

Ilio-tibialis.—This large muscle arises by aponeuroses from the dorso-lateral edge of the ilium in front and behind the acetabulum, and is inserted along with the femoro-tibialis to the knee-capsule (text-fig. 79, *IL.-TIB.*). An anterior, a median, and a post-acetabular region may be distinguished in it. The post-acetabular portion, the most variable in birds generally, is very large and strong in all the Gruiformes. The median portion is reduced to a tendinous sheet except in *Eurypyga*, where, after the origin, it is fleshy. The anterior portion is tendinous in *Balearica*, but is fleshy after the origin in the others. The extent of its fusion with the deeper muscles of the thigh varies irregularly, but in many, as in *Psophia* (text-fig. 79, *IL.-TIB.*), it is practically separate right down to the knee. The special features of this muscle, the great development of the post-acetabular portion, the reduction of the middle portion, and the relative reduction of the anterior portion are common properties of the group.

Ilio-trochanterici posterior, anterior, et medius.—These three muscles appear in their maximum and typical development in *Psophia*. The dorsal or posterior muscle (glutæus secundus) arises from nearly all the pre-acetabular part of the ilium (text-fig. 79, *IL.TR.P.*). It is much the largest of the three and runs straight to its insertion, by a strong short tendon, on the trochanteric surface of the femur. The most ventral or anterior muscle (glutæus tertius) is next in size; it arises (text-fig. 79, *IL.-TR.A.*) from the anterior or ventral edge of the pre-acetabular ilium, and its tendon of insertion is the most distal of those on the trochanteric surface of the ilium. The median muscle (glutæus quartus) is much smaller; it lies between the others (text-fig. 79, *IL.-TR.M.*) in its origin, course, and insertion, but is partly covered by the fleshy belly of the posterior muscle. Practically the same condition exists in *Cariama* and in *Eurypyga*, although in the latter the medius is extremely small. In the Gruinæ the anterior and posterior muscles are as in *Psophia*, but the medius is absent in *Grus*, according to Gadow, while in *Balearica* I found it present although small. In *Otis* a single very broad muscle represents the anterior and medius, and there is just a trace of

Text-fig. 79.



Thigh-muscles of *Psophia leucoptera*; right thigh, external view.

IL.-TIB. Ilio-tibialis. *IL.-TIB.I.* Ilio-tibialis internus. *IL.TR., A., M., P.* Ilio-trochanterici, anterior, medius, and posterior. *IL.TR.E.* Ilio-femoralis externus seu ilio-trochantericus externus, seu glutæus anterior. *FEM.-TIB.* Femoro-tibialis, the distal portion cut and reflected. *FEM.-TIB.E.* External deep slip of femoro-tibialis. *IL.-FIB.* Ilio-fibularis seu biceps. *ISC.-FEM.* Ischio-femoralis seu obdurator externus. (*CAUD*)-*IL-FEM.* Iliac division of the caud-ilio-femoralis (accessory femoro-caudal). *CAUD.-IL.-FLEX.* Caud-ilio-flexorius. *ISC.-FLEX.* Ischio-flexorius. *PUB-ISC.-FEM.* Pub-ischio-femorales seu adductores longus et magnus.

The tendinous areas are dotted.

division in the tendon of insertion. In the Rallidæ, Araminæ, Rhinochetidæ, and Heliornithidæ the posterior and anterior muscles are as in *Psophia*, but there is no separate medius. This apparent absence may be due to disappearance of a separate medius; and the conditions in the Gruinæ, where the medius is small in one form, although quite separate, and absent in another, point towards such a cause. On the other hand, the condition in *Otis* suggests that the absence of a separate medius may be due either to a secondary fusion of the medius and anterior, or to the anterior being a primitive muscle in process of subdivision. However, whatever view may turn out to be best founded, there is certainly no correlation between the absence of the muscle, whether such absence be archecentric or apocentric, and the archecentric and apocentric conditions of the wing.

Ilio-femoralis externus seu *Glutæus anterior.*—This variable muscle is present in all the Gruiformes (text-figs. 79 & 80, *IL.-TR.E.*) and is double in *Cariama.*

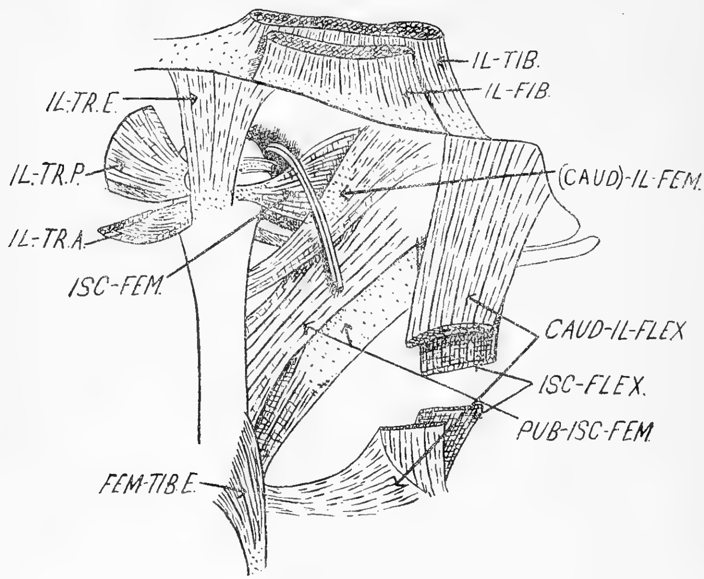
Ilio-femoralis internus seu *pectineus.*—This is present and fleshy in all the Gruiformes.

Ambiens.—This notable muscle is present in all the Gruiformes, with the customary origin from the ilium, course down the back of the thigh, passage through the knee-capsule, and insertion to the flexors of the digits. In *Cariama*, however, what may be a stage in reduction exists; the tendon is immovably fixed in the knee-capsule. This condition points in the direction of many cases where the ambiens ceases at the knee-capsule, and it is to be noted that this apocentricity occurs in a eutaxic member of the Gruiformes. Below the knee the distal extremity of the ambiens tendon forms the "ambiens head" of the perforated flexor muscles of the toes. I have already figured (7. fig. 1) the arrangement of these in *Balearica*, and in the other Gruiformes the arrangement is similar except that the ambiens head is reinforced by a strong tendinous anchor from the head of the fibula.

Femori-tibiales seu *Cruræus* and *Vastus.*—The deep muscular masses arising from the femur and passing to the tibia, or at least to the knee-capsule, are present and well developed in all the Gruiformes. The separate portion at the back of the thigh is in all strong (text-figs. 81, 82, 83, 84, *FEM.-TIB.I.*). It is what is usually termed the *vastus internus.* The mass of the muscle (text-fig. 79, *FEM.-TIB.*) which lies immediately under the ilio-tibialis, with which, as I have mentioned, it is frequently fused towards the knee, is practically identical in all; but there is specially to be noted the distinctness of a deep slip of the muscle-mass (text-fig. 79, *FEM.-TIB.E.*) with a separate origin and insertion. This slip, frequently absent in birds, is present in all the Gruiformes, but is much smallest and weakest in *Heliornis.*

Caud-ilio-femoralis (*femoro-caudal* and *accessory*).—The researches of Garrod, Beddard, Gadow, and others have made it plain that the presence of two divisions of this muscle is the archecentric condition for birds, and that deviations from this, consisting of the reduction of either or of both, are apocentric. Among the Gruiformes, the Rallidæ, Heliornithidæ, and some Cranes alone display both muscles. In *Eurypyga* Garrod (**5**) found both present, but in the specimen that I examined the iliac (accessory) was absent on both sides, and such individual variation may be taken as evidence that in *Eurypyga* the iliac division is in process of disappearing. In the genus *Balearica* it may be present or absent. In *Psophia* (text-fig. 79, (*CAUD.*)-*IL.*-*FEM.*) it is present and normal. In *Aramus* and in *Otis* it is present, but shows degeneration in the form of a large tendinous area nearly in the middle of the muscle (text-fig. 80, (*CAUD.*)-*IL.*-*FEM.*); and Beddard states

Text-fig. 80.



Thigh -muscles of *Aramus scolopaceus*; right thigh, external view.
Lettering as in text-figure 79.

that a similar condition exists in *Cariama*, a bird in which Garrod found the muscle absent and in which therefore it must be taken as disappearing. It is absent in *Rhinochetus*. The division of the muscle with caudal origin (femoro-caudal) is, as I have mentioned, present in the Rallidæ and Heliornithidæ and in some Cranes. It is absent in the genus *Balearica*, and, according to Beddard, in *Grus leucogeranos*. It is present, although small, in *Eurypyga* and *Rhinochetus*. It is absent in the Araminæ, Psophiinæ, Dicholophidæ, and Otididæ. It is plain that a tendency to apocentric modification, consisting of reduction or disappearance of one or of both divisions of this muscle, is a character of the Gruiform assemblage, and the incoherent nature of the group is shown by the chaotic incidence of the apocentricities. The archecentric condition is shown by the Rallidæ and by some Cranes, these being diastataxic forms, but also by the eutaxic Heliornithidæ; a slight degree of apocentricity is shown by the diastataxic Eurypygidæ. The apocentric loss of one division or the other is shown by the remaining groups, eutaxic or diastataxic; while diastataxic Cranes may show the final apocentricity of complete loss of both divisions, and by individuals at least of the eutaxic Dicholophidæ.

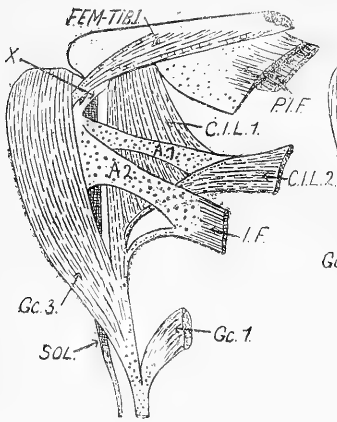
Caud-ilio-flexorius (*semitendinosus* and *accessory semitendinosus*). *Ischio-flexorius. Gastrocnemius, middle* or *posterior-femoral* head.—In all the Gruiformes the two first-mentioned constituents of this muscle-complex are present and have a similar origin and general course. The caud-ilio-flexorius (text-figs. 79 & 80, *CAUD.-IL.-FLEX.*) arises from the distal surface of the ilium, distal and superficial to the iliac portion of the caud-ilio-femoralis, and with a varying extension to the lateral fasciæ over the tail. It lies superficial to the caudal portion of the origin of the caud-ilio-femoralis when that is developed, and at its origin it may be forked to allow the passage of that muscle. The ischio-flexorius arises from the distal and lateral surface of the ischium, and runs nearly parallel with the caud-ilio-flexorius, but separated from it by the caud-ilio-femoralis when that is present. The insertions and relations with the gastrocnemius show considerable differences among the Gruiformes, but these fall readily into four types:—

(1) *Ralline* type. In *Rallus longirostris* (text-fig. 81)—and the other Rails examined are similar—the caud-ilio-flexorius has a well-marked and broad insertion to the distal end of the femur (accessory semi-tendinosus, *C.I.L. 1* in the figure), the fibres of which meet at an angle with the fibres coming from the iliac origin, forming a tendinous raphe. This tendon, and with it a good body of muscular fibres, runs distally to join the tibial head of the gastrocnemius. The junction occupies the position of the usual posterior femoral or middle head of the gastrocnemius, but this head either is absent or is indistinguishably fused with the femoral insertion of the caud-ilio-flexorius. Moreover, a well-marked flat tendon (text-fig. 81, *A. 1*) runs straight to the tibia from the proximal portion of the raphe, independent of and partly under the larger flat tendon (text-fig. 81, *A. 2*) by which the ischio-flexorius is inserted in normal fashion to the tibia. From the proximal portion of the tendon of the ischio-flexorius a stout branch is given off to the gastrocnemius, meeting that muscle near the similar branch from the caud-ilio-flexorius.

(2) *Aramus* type. This type (text-fig. 82) may be described most simply as a modification of the Ralline type, differing from that chiefly in two points: the femoral insertion of the caud-ilio-flexorius (*C.I.L. 1*) is equally broad, but is immediately superficial to a well-marked posterior femoral head of the gastrocnemius. This is shown in the figure at *Gc. 2*, a portion of the caud-ilio-flexorius being represented as cut away. The two join the tibial head of the gastrocnemius together, almost at the same point as the gastrocnemial insertion of the ischio-flexorius, but the arrangement is such that the latter muscle might be described as joining the tibial head of the gastrocnemius superficial to the

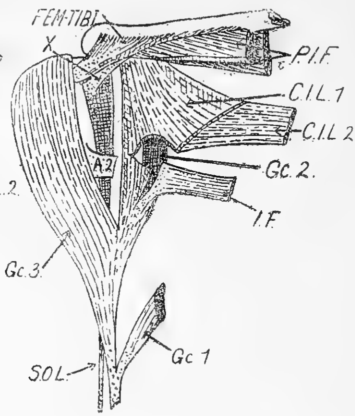
middle head. Secondly, the special tendon from the raphe of the caud-ilio-flexorius seen in the Ralline type (text-fig. 81, *A. 1*) is absent in the *Aramus* type.

Text-fig. 81.



Knee-muscles of *Rallus longirostris*.

Text-fig. 82.



Knee-muscles of *Aramus scolopaceus*.

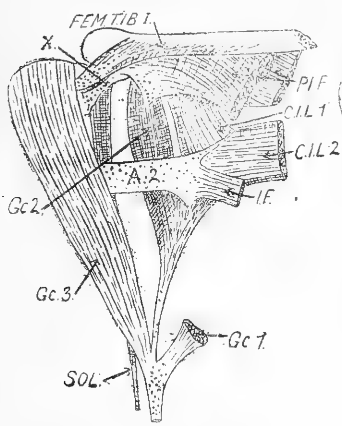
Musculature of knee; right leg, internal view.

FEM.-TIB.-I. Internal separate slip of femoro-tibialis (vastus internus).
x. Ligament from femur to tibia.
P.I.F. Pub-ischio-femorales (adductors).
C.I.L. Caud-ilio-flexorius (semi-tendinosus). *C.I.L.1.* Femoral insertion of caud-ilio-flexorius (accessory semi-tendinosus).
I.F. Ischio-flexorius (semi-membranosus).
A. 1. Anchor to tibia of *C.I.L.*
A. 2. Anchor to tibia of *I.F.*
Gc. 1. External femoral division of gastrocnemius.
Gc. 2. Internal femoral division of gastrocnemius.
Gc. 3. Tibial division of gastrocnemius.
SOL. Soleus.
In text-figure 82 the caud-ilio-flexorius has had a piece removed to exhibit the deeper lying *Gc. 2*.
The tendinous areas are dotted.

(3) *Otis* type. This (text-fig. 83) differs from the *Aramus* type first in that the femoral insertion of the caud-ilio-flexorius is much narrower than, proximal to, and parallel with, the posterior femoral head of the gastrocnemius, so that there is no longer need of cutting the former to display the latter (text-fig. 83, *C.I.L. 1* & *Gc. 2*). Its fibres meet the fibres of origin at a raphe as in the others, and the ischio-flexorius fibres join the muscle-mass at the lower half of the raphe. From this meeting-point a broad tendon (*A. 2*) runs to the tibia, obviously corresponding to the normal insertion of the ischio-flexorius, while the muscular masses along with the posterior femoral head of the gastrocnemius converge to a round tendon that joins

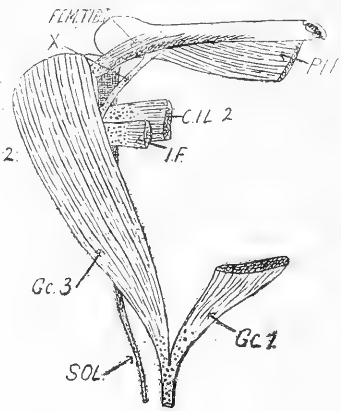
the tibial belly of the gastrocnemius after a short separate course. The *Otis* type occurs in *Otis*, in the Gruinæ, Psophiinæ (but in the latter the middle head of the gastrocnemius is double), in the Dicholophidæ, in *Rhinochetus*, and in *Eurypyga*, except that the ischio-flexorius in most cases is better separated from the underlying masses and appears to run straight to the tibia, merely receiving on its way a tendinous slip from the raphe of the two portions of the caud-ilio-flexorius.

Text-fig. 83.



Knee-muscles of *Otis tarda*.

Text-fig. 84.



Knee-muscles of *Heliornis fulica*.

Description and lettering as in text-figures 81 & 82.

(4) *Heliornis* type. This type is peculiar to the group. I describe it from *Heliornis* (text-fig. 84), but I gather from Beddard's description that the condition in *Podica* is similar. The caud-ilio-flexorius is devoid of the normal femoral insertion, and the gastrocnemius has no posterior femoral head. The caud-ilio-flexorius and the ischio-flexorius end in flat tendons to the tibia inserted very closely together.

In most respects the final interpretation of these four types in terms of archecentricity and apocentricity must await further knowledge. It is clear, however, that the condition in *Heliornis*, a eutaxic form, is the most apocentric. Comparative anatomy shows plainly that the existence of a femoral insertion of the caud-ilio-flexorius (accessory semi-tendinosus) is archecentric in birds, and its loss must be regarded as an apocentric modification. The great width of this femoral insertion in *Rallus* and *Aramus*, two diastataxic forms, would appear to be archecentric. The placing of the *Otis* type and its modifications depends partly on the interpretation of the morphological nature of the posterior femoral head of the gastrocnemius. On my present knowledge I am inclined to think that that head is a separated portion of the femoral insertion of the caud-ilio-flexorius; and that therefore the Ralline type is more archecentric in this respect than the type of *Otis*. But however further knowledge may lead us to interpret this, it is again plain that the specialization of the different members of the Gruiform assemblage has proceeded on lines of considerable independence.

Ilio-fibularis.—In most of the Gruiformes this muscle (text-fig. 79, *IL.-FIB.*) in its origin, passage through a sling at the knee, and insertion to the fibula is similar to the condition found in the majority of Avian groups. Beddard (**1**) has described a peculiarity of insertion in the Heliornithidæ; in *Podica* there are, in addition to the normal insertion, a second insertion to the leg and an insertion to the fascia covering the gastrocnemius. The latter insertion he found also in *Heliornis*, but in my specimens of that bird it was represented only by a very slight band of fascia devoid of muscular fibres. Such additional insertions plainly are apocentric modifications. I have found the gastrocnemial insertion in the Ostrich and in some Anatidæ, and it has been described in the case of the Alcidæ. It is a multiradial apocentricity, and there is to be noted about it only that among the Gruiformes it occurs in eutaxic forms.

Ischio-femoralis (*obdurator externus*), *Obdurator* (*obdurator internus*), *Accessorii obduratoris* (*gemelli*).—In all these are present, but I have no peculiarities to note.

Pub-ischio-femoralis (*adductors*).—In most of the Gruiformes both adductors are present, and in these cases the superficial adductor is entirely fleshy and is much narrower than the deep adductor. The latter is wide and strong in all but the Rallidæ and Heliornithidæ; in *Otis* (text-fig. 83, *P.I.F*) and in *Eurypyga* it shows an attachment to the middle head of the gastrocnemius. In the Rallidæ it shows tendinous degeneration, in many forms being reduced to a thin although wide sheet of fascia. In the Heliornithidæ (at least in *Heliornis*, text-fig. 84) only one of the two muscles is present, and this muscle is entirely fleshy and very narrow. It appears to be the superficial muscle, the representative of the deep muscle, which in the Rails is tendinous, having been lost. It is to be noted that this apocentricity occurs in a eutaxic form.

Tibialis anticus, *Popliteus*, *Extensor digitorum communis*, *Peroneus superficialis* (with slip to the perforated flexor of digit iii.).—These are all present and practically identical in the Gruiformes, the tibialis anticus passing through only a fibrous bridge.

Peroneus profundus.—This muscle is present and strong in all the Gruiformes except the Aramidæ, Dicholophidæ, and Otididæ. I am able to corroborate Gadow's statement that it is absent in *Otis*. I found no trace of it in *Aramus* and in *Cariama*, but Beddard (**1**) affirms its presence in the Dicholophidæ. The absence must be regarded as an apocentric modification, and the incidence of this is not correlated with eutaxy and diastataxy.

Gastrocnemius.—Apart from the middle or posterior femoral head, which I have discussed above in connection with the femoral insertion of the caud-ilio-flexorius, the archecentric condition of the gastrocnemius in birds appears to be the existence of a strong anterior femoral head, with which the short arm of the biceps-sling is connected, and a very strong tibial (inner) head, the tendons from the two heads uniting and running down to the ankle-capsule. The anterior femoral head is double in *Cariama*, there being, in addition to the normal head to which the biceps-sling is attached and which lies under the separate deep slip of the femori-tibialis, a head passing external to that muscle. In *Otis* both these heads are present, and there is a third head to which the biceps is superficial. In *Eurypyga* there are three heads with similar relations. In *Heliornis* the anterior femoral head is enormous, but I found no trace into the two or three divisions found respectively in *Cariama* and *Otis*.

The middle and outer heads of the gastrocnemius show marked variations amongst the Gruiformes, but these do not present any definite correlation with the apocentric and archecentric conditions of the wing.

Soleus.—This muscle is present in all, and has the origin (text-figs. 81, 82, 83, 84, *SOL.*) normal in birds; its tendon passes down to the ankle-capsule without fusing with that of the gastrocnemius.

Flexores perforantes et *perforati.*—The superficial flexors of digits ii. and iii. are present in all the Gruiformes and have the relations normal in birds. In *Balearica* the tendon for the second digit fuses with the tendon of the perforated flexor of the same digit for some distance along the tarsus, but the two separate before insertion. Except in *Psophia obscura* and *Heliornis*, the tendon of digit iii. is connected with that of the perforated flexor of the same digit by a strong slip near the insertion. Such a connection is common in birds, and may be an archecentric remnant of the original unspecialized condition of these tendons.

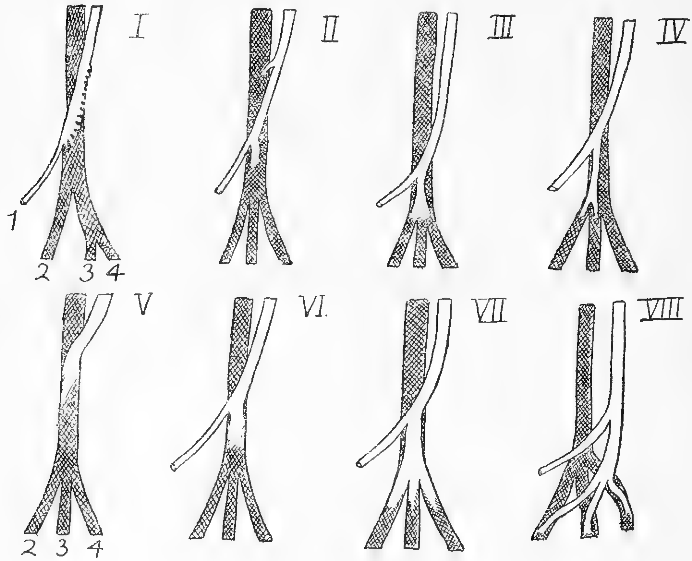
Flexores perforati.—The perforated flexor muscles of digits ii., iii., and iv. are closely similar in all these birds to the condition that I have already figured (7. fig. 1) in *Balearica*. The only points to mention are that the ambiens head in most cases is tied to the head of the fibula by a strong ligament absent in *Balearica*, and that in *Otis* the external head is very weak.

Flexor profundus seu *perforans* and *Flexor longus hallucis.*—These are present and are of the normal origin and general course in all the Gruiformes including *Otis*, in which the hallux is absent. The modes of junction of the tendons, however, are not all alike.

The condition found in *Eurypyga* (text-fig. 85, VII) appears to me to be the most archecentric. The longus hallucis, as it does in all the Gruiformes in which a hallux is present, sends a slip to the hallux, and distal of this blends completely with the profundus tendon in such a fashion that both tendons supply each of the three digits.

The condition in *Heliornis* (text-fig. 85, VIII) is an apocentric modification in one direction of the *Eurypyga* type. Its peculiarity is that the divisions of the hallucis tendon for the digits unite with the similar divisions of the profundus tendon only very close to the insertions. The conditions in the other members of the Gruiformes, as will be apparent without description from the drawings in text-fig. 85, can easily be explained as apocentric modifications in a different direction, consisting in further specialization

Text-fig. 85.



Deep plantar tendons of Gruiformes.

I. *Rallus* and *Psophia*. II. *Balearica*. III. *Aramus*. IV. *Cariama*. V. *Otis*. VI. *Rhinochetus*. VII. *Eurypyga*. VIII. *Heliornis*.

The hallux in all is to the left; the arabic numerals represent the digits; the flexor longus hallucis is in white; the flexor perforans seu profundus is deeply shaded.

of the hallucis tendon and withdrawal from supply to the digits other than the hallux. The vinculum seen in the case of *Rallus* and *Psophia* (text-fig. 85, I), and which is found in a large number of birds, appears to be a late stage in the withdrawal of the hallucis tendon from the other digits, and not, as it often has been regarded, as a simple condition. It is plain, however, that these junctions show in the same fashion as many of the other structures I have passed in review, that while there is a general similarity among the members of the Gruiform assemblage, there is little close coherence in the group.

Conclusions.

The most salient generalization that may be drawn from the series of facts described in this paper is that, if one of the Gruiformes shows the eutaxic or apocentric arrangement of the wing, it is more likely also to show apocentric conditions of the other structures examined. Of the apocentric modifications discussed (and I discussed each that came within the range of my investigations), there is none found in a diastataxic bird that does not occur also in eutaxic forms. The archecentric or primitive conditions similarly are more abundant in the birds which show the archecentric or diastataxic condition of the wings. Apart from this general correlation of apocentricities, however, there is not the same close and definite incidence of modifications among the Gruiformes that there is to be found in the Alcedinidæ and Columbidæ. I hope in later communications to extend these observations to a number of forms allied with the Gruiformes, and for the present I wish to reserve more detailed conclusions and especially the interpretation of the series of facts in terms of taxonomy.

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(7) Chalmers Mitchell, P.—"On the Perforated Flexor Muscles in some Birds." P. Z. S. 1894, p. 495.

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2. On the Muscles of the Ungulata.

By BERTRAM C. A. WINDLE, D.Sc., M.D., M.A., F.R.S., Professor of Anatomy in the University of Birmingham, and F. G. PARSONS, F.R.C.S., F.Z.S., F.L.S., Lecturer on Human and Comparative Anatomy at St. Thomas's Hospital, and Hunterian Professor in the Royal College of Surgeons, England.

PART I.—MUSCLES OF THE HEAD, NECK, AND FORE-LIMB.

[Received November 6, 1901.]

(Text-figures 86–91.)

This paper has been carried out on the same lines as those on the Rodentia, Carnivora, and Edentata which have preceded it[1]. We have as far as possible carefully compared and incorporated the existing literature, and have checked and supplemented it by a series of dissections of our own. In deference to the suggestion of several critics whose opinion we value, we have paid special attention to the nerve-supply of the muscles, though here the literature helped us very little, and we would like to point out that, while there is sufficient material to make us pretty sure of eliminating the effects of variation on the attachments of muscles in the Orders reviewed, any accurate records of dissections of nerve-supplies, however incomplete, would be of great value to future reviewers.

As in former papers, small numerals refer to the list of animals at the commencement of the paper, and Roman figures to the bibliography at its end. Those animals in the list against which no author's name is placed have been dissected by ourselves. All general observations on the Order we shall reserve until the trunk and hind-limb have been described. In conclusion, we beg to thank those gentlemen, especially Prof. Howes and Mr. Beddard, who have so kindly helped us with material, and Prof. Macalister, Prof. Paterson, Dr. Dun, and Dr. Thompson, who have placed hitherto unpublished notes at our disposal.

List of Animals.

Division A. *UNGULATA VERA.*

Suborder ARTIODACTYLA.

Family HIPPOPOTAMIDÆ.

1. *Hippopotamus amphibius.* Gratiolet et Alix (III.).
2. „ „ Humphry (IV.).
3. „ „ Cuvier et Laurillard (I.).

[1] See P. Z. S. 1894, p. 251; 1896, p. 159; 1897, p. 370; 1898, p. 152; 1899, pp. 314, 990.

Family SUIDÆ.

4. *Sus scrofa* (Domestic Pig). Lesbres (V.).
5. ,, ,, ,, Chauveau (II.).
6. ,, ,, ,, Bronn (VI.).
7. ,, ,, ,, Cuvier et Laurillard (I.).
8. ,, ,, ,, Macalister (unpublished).
9. ,, ,, ,, Meckel (VII.).
10. ,, ,, (Wild Boar). Cuvier et Laurillard (I.).
11. ,, *porcus* (Red-River Hog).
12. *Babirusa*. Vrolik (VIII.).
13. *Dicotyles* (Peccary). Cuvier et Laurillard (I.).
14. ,, ,,

Family CAMELIDÆ.

15. *Camelus dromedarius*. Chauveau (II.).
16. ,, ,, Lesbres (V.).
17. ,, ,, Walton (IX.).
18. ,, ,, Meckel (VII.).
19. ,, ,, P. Thompson.

Family TRAGULIDÆ.

20. *Tragulus javanicus* (Chevrotain). Kinberg (X.).
21. ,, *kanchil*.
22. ,, *stanleyanus*. Macalister (unpublished).
23. *Dorcatherium* (Water-Chevrotain). Chatin (XI.).

Family CERVIDÆ.

24. *Cervus axis*. Macalister (unpublished).
25. ,, *manchuricus*.
26. *Cervulus muntjac*. Macalister (unpublished).
27. *Cariacus rufus* (Brocket).
28. ,, *mexicanus* (Brocket).

Family GIRAFFIDÆ.

29. *Camelopardus giraffa*. Joly et Lavocat (XII.).
30. ,, ,, Murie (XXXII.).
31. ,, ,, Owen (XIII.).

Family BOVIDÆ.

32. *Bos taurus*. Chauveau (II.).
33. ,, ,, Lesbres (V.).
34. ,, ,, Meckel (VII.).
35. ,, ,, Bronn (VI.).
36. ,, ,, R.C.S. Museum.
37. *Ovibos moschatus* (Musk-Ox). Bell (XIV.).

38. *Ovis aries.* Lesbres (V.).
39. " " Chauveau (II.).
40. " " Bronn (VI.).
41. " " Meckel (VII.).
42. " " R.C.S. Museum.
43. " " *steatopyga* (Fat-tailed Sheep).
44. " " (Syrian Sheep).
45. " *musimon* (Mouflon).
46. *Capra hircus.* Lesbres (V.).
47. " " Chauveau (II.).
48. " " Haughton (XV.).
49. *Cephalophus grimmi* (Duiker-bok).

Suborder PERISSODACTYLA.

Family Tapiridæ.

50. *Tapirus americanus.* Turner (XVI.).
51. " " De Longchamps (XVIII.).
52. " " Cuvier et Laurillard (I.).
52*a*. " " Vrolik (VIII.).
53. " " Lesbres (V.).
54. " "
55. " *indicus.* Murie (XVII.).

Family Equidæ.

56. *Equus caballus.* Chauveau (II.).
57. " " Bronn (VI.).
58. " " Lesbres (V.).
59. " " Cuvier et Laurillard (I.).
60. " " Meckel (VII.).
61. " *asinus.* Cuvier et Laurillard (I.).
62. " " Steel (XIX.).

Family Rhinocerotidæ.

63. *Rhinoceros sumatrensis.* Beddard & Treves (XX.).
64. " ? sp. Haughton (XXI.).
65. " " Owen (XXII.).
66. " " Macalister (XXIII.).

Division B. *SUBUNGULATA.*

Family Procaviidæ.

67. *Procavia dorsalis* (Hyrax). Mivart & Murie (XXIV.).
68. " *capensis.*
69. " ? sp. Brandt (XXV.).
70. " " George (XXVI.).
71. " " Meckel (VII.).

Family ELEPHANTIDÆ.

72.	*Elephas indicus.*	Anderson (XXVII.).
73.	,, ,,	Mayer (XXVIII.).
74.	,, ,,	Miall & Greenwood (XXIX.).
75.	,, ,,	Watson (XXX.).
76.	,, ,,	Young (XXXI.).
77.	,, ,,	Cuvier & Laurillard (I.).
78.	,, *africanus.*	R.C.S. Museum.
79.	,, *indicus.*	Paterson & Dun (unpublished).

Panniculus carnosus.—The dorso-humeral part of the panniculus is well developed in all Ungulates except the Tapir, but is not so clearly separated from the abdomino-humeralis as is the case in many other orders of Mammals; indeed, the latter muscle is often only indifferently represented.

The posterior attachments of the dorso-humeralis are from the fascia over the buttocks and outer side of the thigh as well as from the mid-line of the lumbar and thoracic regions of the back, and the fibres run downward and forward to be partly inserted into the spine of the scapula and the fascia near it, and partly with the latissimus dorsi tendon into the humerus, helping to form a fleshy floor to the axilla.

The abdomino-humeralis, as we have said, tends to blend with the last muscle posteriorly, though it may, as in the case of the Elephant (77), be attached down the front of the thigh as far as the knee; its anterior attachment is to the mid-ventral line partly superficial and partly deep to the pectoral mass. From the records of Cuvier and Laurillard (I.), Miall and Greenwood (XXIX.), and Anderson (XXVII.), we believe that the abdomino-humeralis must be better developed in the Elephantidæ than it is in other families, although it was very well marked in our specimen of Hyrax.

It is important to state here that we have no knowledge of the condition of the panniculus in the Rhinoceros or Hippopotamus, or it would have been interesting to have noticed whether the thick skin of their backs is coincident with small size of the dorso-humeralis, as in the case of the Tapir.

The Equidæ are remarkable for a vertical bundle of pannicular fibres situated over the shoulder, which is doubtless of value, by its twitching, in driving off flies from this region. It is present both in the Horse (59) and Ass (61).

In male animals, especially of the Bovidæ, Tragulidæ, and Cervidæ families, some portions of the ventral panniculus are modified for moving the prepuce.

In the neck-region of Ungulates the platysma is always present, but it seems to reach its maximum in the Suidæ. In our specimen of the Peccary (14) there were three distinct sheets—one from the deep fascia covering the mid-line of the dorsum of the neck as far back as the first thoracic spine and curving round the base of the ear, another thin sheet from the fascia over the scapula, and a third, thicker one from the shoulder-region lower down.

The sterno-facialis is well-marked in the Suidæ—Pig (5, 7), Wild Boar (10), Red-River Hog (11), Babirusa (12), and Peccary (13, 14); but a curious point about it is that it lies superficial to the platysma instead of deep to it, as in most mammals.

In the Tragulidæ (20, 21) the muscle is generally absent.

In the Cervidæ we only have records of it in two dissections of Brocket Deer; in one (*Cariacus rufus*, 27) the muscle was absent, but in the other (*C. mexicanus*, 28) it was present.

In the Giraffe we can find no specific mention of the muscle, but we feel sure that if it had been present, either Owen (XIII.), Murie (XXXII.), or Joly & Lavocat (XII.) would have taken some notice of it, as the attention of all these writers had been specially directed to the neck-muscles.

Among the Bovidæ, Chauveau (II.) says the sterno-facialis is present in the Ox; but there seems little doubt that it is absent in the Sheep (39, 43, 45), as it was also in our Duiker-bok (49) among the Antelopes. Chauveau (II.) notices the feebleness of the cervical panniculus in the Sheep.

In the Perissodactyla the sterno-facialis was absent in our Tapir (54), and Murie makes no mention of it in his (55), while in the Horse, and especially the Ass, it is present, but not distinct from the platysma.

Of the Rhinoceros we have no records.

Among the Subungulata the muscle is certainly absent in the Hyrax (68), and no mention is made of it by any writer on the Elephant, nor do Cuvier and Laurillard figure it in that animal (77).

Summing up, we feel justified in saying that the Ungulates as an order do not show a high development of the panniculus carnosus, that the platysma and sterno-facialis are much more highly developed in the Suidæ than in the other families, and that the latter muscle is sometimes present, but more often absent throughout the order.

Facial Muscles.

Orbicularis palpebrarum closely resembles the same muscle in Man; as a rule the part below the eye is better developed than that above, this is especially the case in the Elephant (74, 75, 77). Watson (XXX.) describes elaborate details which possibly are not constant as they were unnoticed by Miall and Greenwood and Cuvier.

Orbicularis oris has no bony attachments, but is continuous with the various muscles acting on the mouth. In those animals, such as the Elephant and the Tapir, which possess a trunk, the muscle is prolonged into the lateral longitudinal bundle of that organ.

Zygomaticus.—A well-marked and very constant muscle, which rises from the malar bone below the orbit and runs to the angle of the mouth. The only Ungulate in which we failed to find this muscle was the Hyrax.

Superficialis faciei.—We have ventured to suggest this name for a thin sheet of muscle which we found in the Pig and Mouflon, and which is figured by Cuvier and Laurillard in the Wild Boar (I.). We are unable to homologize it with any of the facial muscles of human anatomy, but we have little doubt that it is present in more than the two animals in which we have recorded it, and that its thinness and superficial situation have caused it to escape our notice as well as that of other writers. The fibres cover the whole of the side of the snout and run downward and slightly forward to the upper lip.

Levator labii superioris.—The nomenclature of the lip and nose-muscles of Ungulates is extremely difficult, owing to the fact that the veterinary writers have names of their own, while human anatomists have tried to trace homologies with the muscles of Man's face; the matter is still further complicated when one realizes that there is almost as much difference between the nose- and lip-muscles of the Horse and the Pig as there is between either of these animals and Man. In the Horse and Ass the muscle, which is usually called levator labii superioris, rises from just in front and below the orbit, and runs down to the upper lip, its tendon passing with that of the other side between the two nostrils. Physiologically the muscle well deserves its name, but it is clearly not the same muscle as the levator labii superioris of Man.

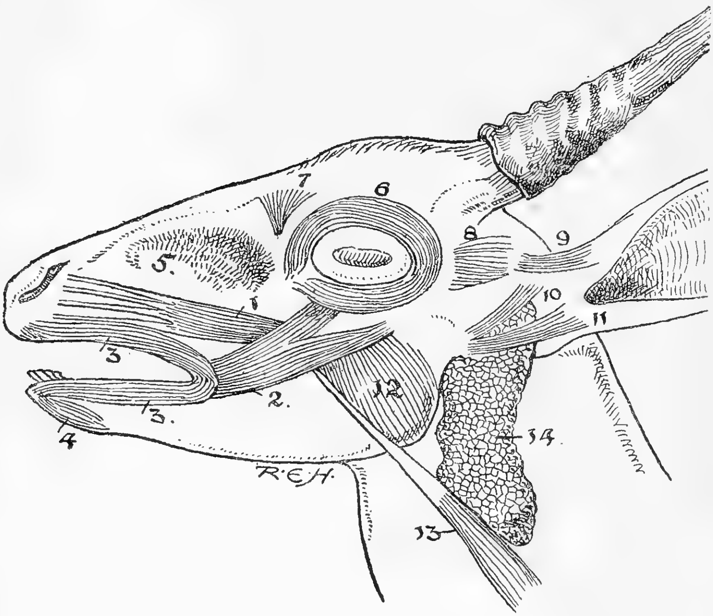
In the Ox (32) the same muscle is seen, but its origin is much lower down on the maxilla. In other members of the Bovidæ, such as the Mouflon Sheep (45) and the Duiker-bok (49) (see text-figs. 86 and 87), this muscle ends in the nose just above the nostril instead of being continued on to the upper lip, and now the name of levator labii superioris becomes objectionable because it is misleading. We should like to suggest that this and the other muscles which run from the maxilla to the nose should be called naso-maxillary muscles, and be identified as superior, middle, and inferior, but experience in this direction has shown us the risk of adding to the existing confusion by giving fresh names (see text-fig. 86).

Levator labii superioris alæque nasi.—This muscle is well named in the Horse, and rises from above and in front of the orbit; below it divides for the side of the nostril and angle of the mouth,

In the Tapir (55) the muscle is extremely well developed, and in the Ox (32) it is also well-marked. In the Deer and Antelopes it is suppressed, owing to the great development of the suborbital glands; and in the Sheep (39) and Mouflon (45), where rudiments of this gland persist, the muscle is also absent. In the Suidæ, too (5, 7, 10, 11, 13, 14), the muscle is absent, unless its rudiments are present as the superficialis faciei already described.

Dilator naris (retractor naris).—There are usually two fleshy bellies rising close together from the canine fossa of the maxilla below the infraorbital foramen, and ending by a number of fine tendons in the skin of the side of the nostril and of the upper lip (see text-fig. 87). As we have already pointed out, in the Bovidæ, Cervidæ, and Suidæ the so-called levator labii superioris proprius rises with and just above these, and its tendon ends also in the nostril. These muscles are very constant, as might be expected when one remembers how regularly they are found throughout the Mammalia [1].

Text-fig. 86.



Facial muscles of the Duiker-bok.

1. Levator labii superioris and Dilatores naris (Naso-maxillaris).
2. Zygomaticus.
3. Orbicularis oris.
4. Depressor labii inferioris.
5. Depression for suborbital gland.
6. Orbicularis palpebrarum.
7. Triangularis frontis.
8. Attrahens aurem anterior.
9. ,, ,, superior.
10. ,, ,, inferior.
11. Parotido-auricularis.
12. Masseter.
13. Sterno-massetericus.
14. Parotid gland.

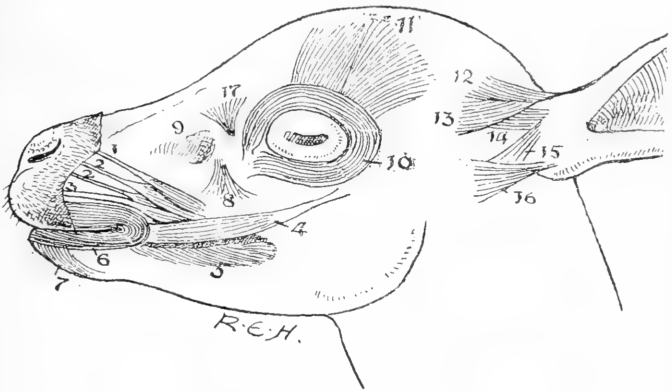
Lachrymalis.—A small fan-shaped muscle rising from the anterior or internal margin of the orbicularis palpebrarum, of which it is probably a detached portion; the fibres run down and spread out over the face. It is best seen in the Bovidæ (Ox, Sheep, Mouflon), and is small or absent in the Equidæ, Tapiridæ, and Suidæ (see text-figs. 86 and 87).

Triangularis frontis.—A small fan-shaped muscle which we have

[1] A description of the musculature of the trunk will be found in Watson's paper on the Elephant (XXX.) and in Murie's on the Tapir (XVII.).

met with among the Bovidæ and Cervidæ, and which rises by its apex from the same point as the last muscle, but the diverging fibres run up instead of down. We hesitate to homologize this with Man's corrugator supercilii because it is very superficial and is not covered by the orbicularis palpebrarum (see text-figs. 86 and 87).

Text-fig. 87.



Facial muscles of the Mouflon.

1. Levator labii superioris.
2. } Retractores naris.
3. }
4. Zygomaticus.
5. Buccinator.
6. Orbicularis oris.
7. Depressor labii inferioris.
8. Lachrymalis.
9. Rudimentary suborbital gland.
10. Orbicularis palpebrarum.
11. Frontalis.
12. } Attrahens aurem superior.
13. }
14. ,, ,, medius.
15. ,, ,, inferior.
16. Parotido-auricularis.
17. Triangularis frontis.

Occipito-frontalis.—The frontalis portion of this muscle is always feeble, and in horned animals is often suppressed; the occipitalis, on the other hand, rises from the occipital crest and, if looked for, can usually be satisfactorily displayed.

Depressor labii inferioris forms a single sheet, rising from the mandible and being inserted into the lower lip.

Muscles of the Ear.

The most satisfactory method of describing these muscles seems to be to follow Watson's example, and to divide them, as he did in the Indian Elephant (XXX.), into an anterior group of attrahentes, a superior of attollentes, and a posterior of retrahentes. A detailed description of them in all the Ungulates which have come under our notice would need a special paper, but we have satisfied ourselves that they not only vary a good deal in different animals, but in different specimens of the same animal.

In the Suidæ, Cuvier and Laurillard (7) figure three distinct attrahentes and three retrahentes, and there can be little doubt that it would be most convenient to name these superior, middle, and inferior from their position. In addition to these three attrahentes there is another, which, from its anterior position, is best named attrahens anterior, and which rises from the upper and back part of the orbicularis palpebrarum. Cuvier and Laurillard also show the attollens divided into an anterior and posterior bundle. There is another bundle which rises from the fascia over the parotid gland and is inserted into the lower part of the auricle, and which evidently corresponds to the hippotomists' parotido-auricular, a name which seems perfectly satisfactory. Our own specimens of Suidæ (11, 14) agreed fairly well with Cuvier and Laurillard's plates, but the different divisions of the muscles were not so distinct as in the drawings. The attollens nearly reached its fellow in the mid-line, and we failed to make out any division into anterior and posterior parts, while the attrahens anterior rose from the temporal fascia close to the posterior margin of the orbit.

In the family of Tragulidæ, a very detailed description of the ear-muscles of the Javan Chevrotain is given by Kinberg (X.), though, owing to the absence of illustrations, it is difficult to follow his terminology; it is interesting to notice that he describes the following intrinsic muscles in addition to the extrinsic—antitragicus, helicus major et minor, and transversus.

In the Mouflon (45) the attrahens anterior was absent in our specimen, but the superior was subdivided into two bundles, one above the other (see text-fig. 87). In this animal and the Duikerbok (49) the parotido-auricularis was short but perfectly distinct. In the Horse (56) the parotido-auricularis reaches its maximum of development. For the details of the muscles of the Elephant's ear, we must refer the reader to Watson's careful paper (XXX.), with the nomenclature of which we have tried to make our foregoing remarks agree.

Muscles of Mastication.

Buccinator.—This muscle rises from the alveolar margins of both jaws and from the pterygo-mandibular ligament. As Chauveau (II.) and Lesbres (V.) have noticed, it is divisible into two planes, of which the superficial is the more bipenniform. It is this plane apparently which Kinberg (X.) describes in the Chevrotain as a separate muscle and calls m. molaris.

Temporal.—This muscle is always small, though it is comparatively larger in the Equidæ than in the other families. The fibres are much more nearly horizontal than vertical, and probably act much more as opponents of the pterygoids in retracting one side of the jaw during rumination than as closers of the mouth. This seems the more likely as the fibres are more nearly horizontal in the Bovidæ, Cervidæ, and Tragulidæ than in the Equidæ, Suidæ, Hippopotamidæ, Tapiridæ, and Elephantidæ. Bronn (VI.), probably on the authority of Bendz, says that two layers may always be made out in Ungulates, and Chauveau notices the same in the Horse. Our own experience is that these two planes require some little care to display satisfactorily; and authors such as Miall and Greenwood in the Elephant (XXIX.), and Kinberg in the Chevrotain (X.), make no mention of any bilamination, although they have evidently dissected the muscle with care. The temporal never seems to be large enough to meet its fellow in the sagittal line of the skull, although in the Camel (17) the two approach very closely.

Masseter.—This muscle is always very well developed, and has the usual origin from the zygomatic arch and insertion into the outer surface of the ramus of the mandible.

The chief interest of various writers seems to centre in the number of layers into which the muscle may be divided, and we have no hesitation in saying that these are by no means constant, and probably mean very little.

In the Horse, for example, Bendz and Liesering say there are two laminæ, v. Teuteleben three, while Chauveau says that there are several laminæ of which two are very distinct.

In the Ruminants, again, v. Teuteleben says there are three laminæ, but Allen says six.

In the following animals there are two layers which correspond with the arrangement found in man:—Hippopotamus (3), Pig (6), Red-River Hog (11), Peccary (14), Red Brocket (27), Mexican Brocket (28), Sheep (43), Mouflon (45), Elephant (74, 77). In the Duiker-bok (49), Chevrotain (21), Hyrax (68), and Tapir (54, 55) no lamination was present; while in the fat-tailed Sheep (43) and Kinberg's Chevrotain three layers were made out, the deepest one being the most posterior. We are therefore inclined to agree with Lesbres, on whose opinions we place a good deal of reliance, that two layers are usually found in the masseter of Ungulates but that occasionally the muscle may be trilaminar or unilaminar.

Pterygoids.—Throughout the Order the internal is a much larger muscle than the external, and arises from the posterior part of the alisphenoid and anterior part of the pterygoid bone as well as slightly from the palate. On their way to be inserted the fibres diverge somewhat, and the muscle, becoming fan-shaped, is attached to the mandible between the angle and the inferior dental canal, but more strongly near the lower border. There can be no doubt that in animals which chew the cud the internal pterygoid acts as a powerful lateraliser of the jaw, and it is noticeable that in these the fibres of the muscle are directed outwards more than they are in the Perissodactyla. Lesbres says that in the Horse, and to a less degree in the Pig, the muscle is bilaminar, but that this is not the case in the Bovidæ. Our own experience does not support this generalization, for neither in the Red-River Hog (11) nor the Peccary (14) which we dissected did we find any bilamination; while in the specimen of the Sheep's masticatory muscles in the Museum of the College of Surgeons (42) there is a feeble though distinct bilamination exactly corresponding with that of the masseter. The external pterygoid rises from the alisphenoid above and in front of the origin of the internal, it has only one head and is always the smaller of the two muscles. The fibres run horizontally backward and outward, and are inserted into the inner side of the neck of the condyle. The internal maxillary artery runs below the muscle in the groove between it and the internal pterygoid, indeed in our specimen of Duiker-bok (49) the artery lay between the two muscles.

The nerve-supply of all the preceding muscles has been carefully looked for and in most cases found in all the animals which we have dissected. In every case it was as in Man.

Depressor mandibuli (Digastric).—As a rule this muscle rises from the paroccipital process on its anterior border, in some cases it also comes from the paramastoid process, though in the literature of the subject these two processes are often confounded with one another. The central tendon and anterior attachments vary, as will be seen from the following details.

In the Hippopotamidæ, Humphry (2) says that the anterior belly is connected with the hyomental muscle, while in Cuvier and Laurillard's plate (3) there is apparently only an anterior belly, the muscle rising by tendon from the paroccipital process and being inserted into the middle of the body of the jaw.

In the Suidæ, Lesbres (4) says that there is only one belly which rises from the paroccipital, and this agrees with Vrolik's description of the Babirusa (VIII.).

In our Red-River Hog (11) we found that the posterior belly was absent and that no nerve was supplied to it by the facial. In Cuvier and Laurillard's Pig (7), however, two distinct bellies are figured.

In the Peccary (13, 14) two bellies and a distinct central tendon are found, and the nerves from the facial and mylo-hyoid are both present (14).

In the Camel (19) we are indebted to the kindness of Dr. Peter Thompson, who has placed some unpublished notes and drawings at our disposal. In his specimen two bellies with the usual nerve-supply were found, the posterior rising from the paroccipital, the anterior, much larger, being inserted by a thin flattened tendon near the insertion of the internal pterygoid and extending some distance.

In the Tragulidæ we found (21) the usual attachments from the paroccipital to the mandible and a very slight central tendon, while in Kinberg's specimen (20) the central tendon was evidently longer and the anterior belly attached to the third quarter of the lower border of the mandible, *i. e.* just behind the middle.

In the Cervidæ (25, 27, 28) the central tendon is very distinct, but, as in all the preceding animals, there is no attachment to the hyoid bone. In *Cariacus rufus* (27) the two anterior bellies are connected by a muscular layer supplied by the mylo-hyoid nerve.

In the Bovidæ (32, 35, 36, 39, 40, 42, 43, 45, 47, 49) the central tendon is present but unattached to the hyoid. Bronn (VI.) says that the anterior bellies are always connected with one another in Ruminants; and Chauveau (II.) describes a small square muscle in the Ox which passes transversely across, uniting the two digastrics by passing beneath the base of the tongue. Our own experience, based on the Ox (36), Sheep (42, 43, 45), and Duiker-bok (49), shows us that this union across the middle line is not a characteristic mark of the Bovidæ as a family,

In the Tapiridæ (52, 52 *a*, 54) the muscle is very strong and is inserted into the posterior half of the lower border of the mandible, but there is no central tendon at all,

In the Equidæ (56, 57, 58, 61) the muscle divides immediately after its origin from the paroccipital: one part goes to the border of the ramus of the mandible just above the angle, while the other forms the normal posterior belly of a typical digastric and is separated from the anterior belly by a definite central tendon. The insertion of the anterior belly is a good deal nearer the symphysis than it is in most other Ungulates. Among the Subungulata the Hyrax (67, 68) has the origin of the digastric chiefly from the paramastoid; as it goes forward the muscle spreads out like a fan to be inserted into the greater part of the lower margin of the body of the mandible from the angle forward. About two thirds of the way from the origin is a narrow zigzag tendinous streak, the only representative of a central tendon.

In the Indian Elephant (73, 74, 75, 76, 77) the muscle runs from the paroccipital to the jaw in front of the angle, but there is some difference of opinion about the central tendon. Mayer (XXVIII.), Watson (XXX.), and Young (XXXI.) found one, but Miall and Greenwood (XXIX.) and Cuvier and Laurillard (I.) did not see it. Miall and Greenwood's description seems somewhat complicated, but we have little doubt that they have included the stylo-hyoid and masto-styloideus with the digastric.

From the foregoing description it will be seen that the digastric, as in other orders, is of some classificatory importance: thus in the Hippopotamus and Suidæ the posterior belly is often suppressed. In the Tapiridæ the central tendon is absent. In the Hyracoidea it is a mere zigzag streak. In the Elephantidæ it may be present or absent. In the Equidæ a part of the posterior belly is inserted into the ramus of the jaw, while in the Cervidæ the tendon is better developed than in any other family.

Muscles attached to the Hyoid Bone.

Mylo-hyoid.—This muscle has the usual attachments, though it does not in all cases run forward as far as the symphysis; this is especially seen in the Suidæ (11, 12, 14). In the Elephant, Miall and Greenwood (74) say that the muscle is attached to the great cornu of the hyoid and to a tendinous arch which crosses the thyrohyoid membrane. Chauveau (II.) and Lesbres (V.) notice that in Ruminants two planes are found, and our own dissections bear this out; we have noticed, too, that the fibres of the more superficial layer run forward and outward, while those of the deeper layer run backward and outward.

In the Ass (62), Steel points out that the muscle is often divided anteriorly into two laminæ.

In the Horse (56), Chauveau says that a delicate slip lies superficial to the mylo-hyoid, but from the antero-posterior direction of its fibres it probably represents a mento-hyal muscle. We have some little doubt as to whether the superficial layer in the Ruminants may not represent a mento-hyal muscle the fibres of which have become deflected, but this is a mere speculation; and the occasional presence of these two layers is probably a repetition of the splitting tendency of the mylo-hyoid, which formerly gave rise to the anterior belly of the digastric.

The nerve-supply is from the mylo-hyoid branch of the fifth.

Genio-hyoid and *Genio-hyoglossus.*—These two muscles have the usual mammalian attachments throughout the Order, except that in the Equidæ, where the glosso-hyal process of the hyoid bone is very large, they are attached to it. In the Red-River Hog (11), owing to the imperfect development of the mylo-hyoid already alluded to, the genio-hyoid is seen before removing that muscle.

In the Ass (62), Steel points out that the genio-hyoid sometimes sends a distinct band to the genio-hyoglossus opposite the middle of the intermaxillary space.

In the Giraffe (31), Owen points out that both these muscles rise by tendon.

The nerve-supply was the hypoglossal in all the animals which we dissected.

Hyoglossus.—This is the hyoglossus brevis of many veterinary surgeons, it rises from the basi- and thyro-hyals, and in the Equidæ from the glosso-hyal process as well; the fibres run much more forward than upward, and in some cases—*e. g.* the Mouflon (45) and Elephant (74, 75, 77)—the fibres coming from the basi-hyal are quite distinct and have a somewhat more vertical direction than those coming from the thyro-hyal. We would prefer to speak of the fibres coming from the basi-hyal as the basi-glossus, but Watson (XXX.) calls them hyoglossus anterior, and Miall and Greenwood (XXIX.) hyoglossus minor, while Steel (XIX.) introduces a novelty by speaking of them as hyoglossus brevis. In Cuvier and Laurillard's plate (I.) the Elephant's basi-glossus is larger than the rest of the hyoglossus, and in the Giraffe Joly and Lavocat (XII.) say that the basi-glossus is the only part present. In the Ass, Steel describes the basi-glossus as sometimes getting an origin from the stylo-hyoid element, though this is not the normal arrangement; and Kinberg in the Chevrotain describes the "baseo-glossus" as coming from the anterior part of the body and styloid cornu (cerato-hyal).

The nerve-supply seems always to be the hypoglossal.

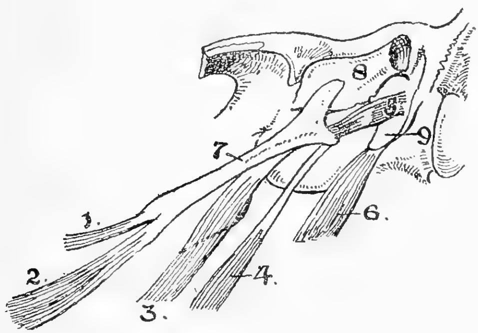
Masto-styloideus.—This muscle is apparently present in all

Ungulates except Hyrax (see text-fig. 88)[1]; it rises from the paramastoid and outer side of the base of the paroccipital processes, and is inserted into the posterior projection at the upper end of the stylo-hyal bone. In the Horse (56, 57) the muscle covers the outer side of the eustachian air-pouch.

In the Camel (19), Thompson says that its fibres seem to be continued into the stylo-pharyngeus muscle, but this we did not notice in any other animal.

The nerve-supply is the facial.

Text-fig. 88.



Hyoid muscles of the Duiker-bok.

1., 2. Double Stylo-glossus.
3. Stylo-pharyngeus.
4. Stylo-hyoid.
5. Masto-styloideus.
6. Digastric (Depressor mandibuli).
7. Stylo-hyal bone.
8. Tympanic bone.
9. Paroccipital process.

Stylo-hyoid.—This muscle usually rises by tendon from the posterior tuberosity at the upper end of the stylo-hyal, and runs downward and forward to be inserted into the base of the cerato-hyal. In the Hippopotamus, Gratiolet and Alix (III.) say that it rises from the paramastoid process, and in Cuvier and Laurillard's plate of this animal (I.) it apparently has the same origin. In the Hyrax also we (68) agree with Mivart and Murie (67) that it arises from the paramastoid process. It is always supplied by the facial nerve, and we believe that the masto-styloideus is the proximal part of this muscle, which is cut off by the projection of the stylo-hyal bone so characteristic of most Ungulates (see text-fig. 88). This belief is strengthened by the fact that in the Hyracoidea, where the stylo-hyoid rises from the paramastoid process, the masto-styloideus is absent, and we await future investigations of the muscles of this region of the Hippopotamus with interest. Thompson's assertion that some of the fibres of the masto-styloideus are continued into the stylo-pharyngeus in

[1] We have no definite account of it in the Hippopotamus.

the Camel must be borne in mind; but he lays stress on the fact that the two muscles have different nerve-supplies, the stylo-pharyngeus being as usual supplied by the glosso-pharyngeal nerve.

In the following animals the stylo-hyoid splits to enclose the digastric:—Peccary (13), Red-River Hog (11), only on one side, Chevrotain (20), Brocket (28), Mouflon (45). In the other animals which we dissected, or of which details are available, the muscle passes deep to the digastric, with the exception of the Giraffe (31) and Hippopotamus (3), where it is superficial. In the Elephant we have already remarked that Miall and Greenwood apparently described the stylo-hyoid as part of the digastric; but Young (XXXI.) failed to find any separate stylo-hyoid.

Styloglossus.—This muscle usually rises from the lower end of the stylo-hyal bone, and runs along the outer surface of the hyo-glossus to the tongue. In the Ox (32), Duiker-bok (49), and Brocket (28) the muscle was double, and we are inclined to think that this was the condition in Kinberg's Chevrotain, although he uses a different terminology (see text-fig. 88).

The nerve-supply is the hypoglossal.

Stylo-pharyngeus rises from the stylo-hyoid bone beneath the backwardly-projecting tuberosity, and is inserted into the posterior margin of the thyroid cartilage very much as in Man (see text-fig. 88). The only points about it to which we wish to draw attention are that Mivart and Murie were doubtful about its presence in Hyrax (67), but it was undoubtedly present in our specimen (68); and that Steel (XIX.) says that in the Ass the hyo-pharyngeus, which we presume is synonymous with the stylo-pharyngeus, has often an extra head from the inferior third of the stylo-hyoid, in addition to the normal head from the superior third.

The nerve-supply is the glosso-pharyngeal.

Hyoideus latus.—This muscle, which is sometimes called the hyoideus parvus or cerato-hyoideus parvus, is usually present in Ungulates; at least it is present in the following fairly representative series:—Hippopotamus, Pig, Chevrotain, Brocket, Ox, Sheep, Mouflon, Duiker-bok, Horse, and Ass (see text-fig. 89); it passes from the thyro-hyal to the cerato- and epihyals, thus connecting and approximating the second and third arches. Bronn (VI.) says that it is supplied by the facial nerve; but up to the present we regret that we have failed to find the nerve to it.

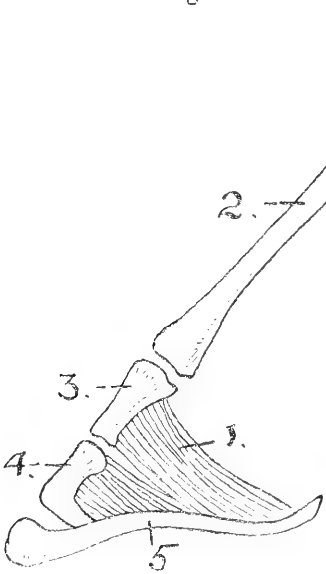
In the Ass, Steel (XIX.) says that the muscle is sometimes absent.

Hyoideus transversus.—This muscle connects the cerato- and epihyal of one side to those of the other across the mid-line. It is found in the Hippopotamidæ, Tragulidæ, Cervidæ, Bovidæ, and Equidæ as far as our present knowledge goes, but not the Suidæ. Of the other families we have no satisfactory records. According to Bronn (VI.) it is supplied by the facial nerve.

Hyo-epiglottideus runs from the basihyal, and slightly from the ceratohyal, to the front of the epiglottis. It is present in the Tragulidæ and Bovidæ and possibly in other families.

Sterno-hyoid.—In the Hippopotamus the sterno-hyoid rises as usual from the deep surface of the manubrium sterni in its anterior part, and runs forwards to be closely connected with the cephalo-humeralis, so that Cuvier (XXXIII.) describes it as part of the "deltoido trapeze"; it can, however, be traced forward, and it is then found to divide into two layers, of which the more superficial continues forward to near the symphysis of the mandible, and is sometimes called mento-hyal, while the deeper layer is inserted into the basihyal.

Text-fig. 89.



Hyoid apparatus of the Duiker-bok.

1. Hyoideus latus.
2. Stylo-hyal bone.
3. Epi-hyal bone.
4. Cerato-hyal bone.
5. Thyro-hyal bone.

In the Suidæ (4, 6, 7, 11, 12, 13, 14) the muscle is very well developed; and in our specimens it was supplied by the ansa cervicis as in Man.

In the Tragulidæ (21) the two muscles of opposite sides are closely connected, and they are also fused with the sterno-thyroids in the posterior part of the neck (20).

Among the Cervidæ the muscle is very slight in the Deer (25) and Brocket (28).

In the Giraffidæ the muscles of opposite sides are fused near the sternum and for 15 inches from it (31). Owen (XIII.) describes two distinct tendons and three fleshy bellies in the interval between the sternum and hyoid, while Joly and Lavocat (XII.) say that there are many tendinous intersections.

In the Bovidæ the arrangement is inconstant in the Ox and Sheep. Chauveau (II.) says there is no tendinous intersection; but in the Duiker-bok (49) we found the sterno-hyoid and sterno-thyroid united into a single muscle with a short central tendon. Near the thyroid cartilage a small slip was delaminated from the main mass for the hyoid bone. In the Mouflon (45) and Fat-tailed Sheep (43) we failed to find any trace of the sterno-hyoid.

In the Tapiridæ (52, 54) the muscle was separate and human in its attachments.

In the Equidæ (56, 61) the sterno-hyoids of opposite sides are fused with the two sterno-thyroids, and have the same arrangement that we have already described in the Duiker-bok, only the central tendon is much longer. In the Ass (61) the fused mass is proportionally much slighter than in the Horse.

In the Procaviidæ (68) the muscles are quite distinct from one another and from the sterno-thyroids and rise from the dorsal surface of the triangular cartilaginous forward projection of the sternum. The insertion is normal (67, 68).

In the Elephantidæ (74, 76) the sterno-hyoid is absent.

From the foregoing it will be seen that in the Hyrax and Tapir, which are regarded as archaic types, this muscle has the generalized mammalian arrangement; but in the more specialized Ungulates the sterno-hyoid tends to fuse with its fellow and with the sterno-thyroid, and in some instances, such as the Elephant and Sheep, to be altogether absent as a separate muscle. In animals with long necks, such as the Giraffe, Horse, and Antelope, one or more tendons are developed in the course of the muscle

Sterno-thyroid.—It has already been pointed out how often the sterno-hyoid and thyroid are fused, and in these cases the sterno-thyroid seems to form by far the greater part of the combined muscle. In the Pig (4, 6) the sterno-thyroid is sometimes a double muscle, at other times it splits to be inserted into the thyroid cartilage in two bundles. It is supplied by the ansa cervicis.

Thyro-hyoid.—This muscle always seems to have the usual mammalian attachments from the thyroid cartilage to the thyro-hyal. Its nerve-supply is the hypoglossal.

Omo-hyoid.—In the Hippopotamus (1, 2) the omo-hyoid runs from the hyoid bone to blend with the cephalo-humeral muscle in the neck. In the Pig (4, 5, 11) among the Suidæ the hinder attachment of the muscle is, as in so many Ungulates, from the fascia attaching it to the transverse processes of the middle cervical vertebræ. In the Babirusa (12) and Peccary (14), however, a more generalized arrangement is found, and the muscle is continued on to the venter of the scapula. In the Tragulidæ (20, 21), Cervidæ (25, 7, 28), Giraffidæ (29, 31), and Bovidæ (32, 33, 35, 39, 40, 46, 47,

49) the posterior part of the muscle is suppressed, and the anterior belly spreads out into fascia over the carotid artery and deep to the cephalo-humeral, so that it depends a good deal on the fancy of the observer whether he describes the attachment to the middle cervical transverse processes through fascia, or to the deep surface of the cephalo-humeral. It is apparently not an unusual thing for this partial suppression of the omo-hyoid to become complete, as we failed to find it in the Mouflon (45) and the Fat-tailed Sheep (43), and Macalister records its absence in a Chevrotain (22). It is interesting to notice that in these two sheep the sterno-hyoid was also absent.

In the Tapiridæ (52, 52*a*) the whole muscle is present and is attached to the scapula.

In the Equidæ (56, 57, 59, 61) the origin is from some part of the scapula, though authorities differ as to the exact attachment for instance, Chauveau (II.) says it comes from the surface of the scapularis; Owen, from the coracoid process; and Bendz, from the first rib. In any case the omo-hyoid is a very well-developed muscle in the Equidæ.

Lesbres (V.) points out that in both the Ruminants and Solipeds the two muscles of opposite sides tend to fuse close to the hyoid bone and to cover the insertion of the sterno-hyoid. We cannot, however, agree that this is always the case.

In all the foregoing animals it will be noticed that the origin, as in so many other muscles elsewhere, is the variable part, while the insertion is constant; it seems to us that this is one of those examples of the dependence of structure on function, for the function of a muscle is to move a certain point in a given direction, and it does not matter where it does this from so long as the origin is in the right direction and fairly fixed.

In the Procaviidæ (67, 68, 71) the omo-hyoid is absent.

In the Elephantidæ it is also absent.

Muscles of Ventral Surface of Neck unconnected with Hyoid Bone.

Sterno-mastoid and *Cleido-mastoid.*—These muscles vary very much in different Ungulates. It will be seen that there is a constantly recurring tendency to become partially inserted into the lower jaw in the region of the masseter, and on this account part of the muscle is often described as the sterno-maxillaris; but this practice leads to much confusion, since the name of sterno-maxillaris is also given to the forward extension of the sterno-hyoid muscle to the symphysis of the jaw—an arrangement which is frequently found in the Edentata, and has also been already described in the Hippopotamus, *cf.* Sterno-hyoid. We think, therefore, that it will be advisable, if possible, to limit the name of sterno-maxillaris to the ventro-median muscle, which is the continuation of the sterno-hyoid; and if a name is required for the facial insertion of the sterno-mastoid, we would suggest that of sterno-massetericus (see text-fig. 86, p. 662). In the Hippopotamus the sterno-mastoid runs from the sternum to the paramastoid process (1, 3), and in (1) sends a fibrous expansion to the posterior border of the ramus of the mandible. The cleido-mastoid is blended with the cephalo-humeral posteriorly, but anteriorly it is inserted into the paramastoid and paroccipital processes (3), or into the occipital curved line (1). Beyond the fibrous expansion already noticed there is no attachment to the masseter.

In the Suidæ (4, 7, 8, 11, 12, 13, 14) the muscles are of the generalized mammalian type, and there is no masseteric attachment. The sterno-mastoid runs from the sternum to the paramastoid process, while the cleido-mastoid rises from the tendinous intersection in the cephalo-humeral muscle marking the site of the clavicle, and runs up to be inserted into the same place as the sterno-mastoid, but deep to it. Between these two muscles runs the spinal accessory nerve, by which they are supplied.

In the Camel (18) the two sterno-mastoids are fused in the posterior third of the neck, anteriorly there is an insertion into the angle of the lower jaw as well as into the paramastoid process (16, 18).

In the Tragulidæ (20, 21) the sterno-mastoids are connected with one another in the lower third of the neck, and there is a distinct masseteric insertion into the fascia over the masseter by means of which the muscle acts upon the zygomatic arch. The cleido-mastoid, as usual, is more or less fused with the cephalo-humeral.

In the Cervidæ (24, 25, 27, 28) the sterno-masseteric portion of the sterno-mastoid ends in a thin tendon, which fuses with the anterior border of the masseter and so reaches the zygomatic arch. Macalister says that the sterno-mandibularis (sterno-massetericus) takes the place of the sterno-mastoid; this we do not think is the case, as we have always been able to find a paramastoid insertion in addition to the masseteric, although it is a good deal hidden by the latter. The cleido-mastoid is, as usual, blended with the cephalo-humeral in the posterior part of the neck.

In the Giraffidæ (29, 31) the sterno-maxillaris is present. Owen says (31) that it is fleshy all the way to the angle of the jaw, while Joly and Lavocat say (29) that it is inserted into the angle of the jaw and the surface of the masseter.

Among the Bovidæ the sterno-mastoid is inserted into the paramastoid process and into the basioccipital with the rectus capitis ventralis (anticus) major in the Ox (32, 33, 35), Sheep (38, 39, 40, 41, 43), and Goat (46), though in the Duiker-bok (49) we failed to find the basioccipital insertion. The sterno-masseteric insertion is present in the Ox (32, 33), Goat (46), and Duiker-bok (49) (see text-fig. 86), and combines with the anterior part of the masseter just as it does in the Cervidæ; but in the Sheep (38, 41, 43, 45) (see text-fig. 87) the masseteric insertion is absent, and this seems to be one of the few myological points of distinction between the Sheep and the Goat.

Among the Perissodactyla the Tapir (52, 53, 54, 55) has a masseteric insertion into the angle of the mandible, and Lesbres (V.) also found a basioccipital insertion, though in our specimen we failed to find this (54).

In the Equidæ (56, 58, 59, 61) the masseteric attachment is also into the posterior border of the ramus just above the angle, but there is no basioccipital nor paramastoid (59) insertion. The two sterno-mastoids of opposite sides blend in the mid-line of the posterior part of the neck. In all the above-mentioned families where it is not specially mentioned, the cleido-mastoid rises from the clavicular tendinous intersection in the cephalo-humeral, and is inserted into the paramastoid process deep to the insertion of the sterno-mastoid.

In the Procaviidæ (67, 68) the sterno-mastoid, sterno-masseteric, and cleido-mastoid elements are present, but the cleido-mastoid is attached to the occipital crest instead of the paramastoid process, and the masseteric portion is a huge muscular mass rising from the manubrium and its fellow of the opposite side in the mid-ventral line of the caudal half of the neck, and being inserted into the angle of the mandible and the fascia over the masseter. The sterno-mastoid element to the paramastoid process is very small.

The Elephantidæ are remarkable for having two masseteric insertions (74, 76, 77), one into the posterior part of the zygoma, and the other into the body of the mandible just in front of the insertion of the digastric. The latter part is a separate muscle in its whole extent, and according to Anderson (XXVII.) rises by three heads, two from the first rib and one from the sternum. The cleido-mastoid has the usual ungulate attachments; but in Cuvier and Laurillard's plate (I.) seems to send a slip to the basi-occipital.

From the above it will be seen that the masseteric portion of the sterno-mastoid is a very characteristic ungulate arrangement, which is wanting in the Suidæ and in the Sheep, and, if present, is only feebly developed in the Hippopotamus. It varies in its exact attachment in different families; but its presence in Hyrax is of interest as pointing to the ungulate affinities of that animal.

The nerve-supply of the sterno-mastoid, sterno-masseteric, and cleido-mastoid portions of the muscle is the spinal accessory and cervical nerves in the Sheep, Pig, Chevrotain, and Antelope.

Omo-trachelian Muscle.—This muscle seems fairly constant throughout the Order, and runs from the transverse process of the atlas to the acromial end of the spine of the scapula, as well as to the fascia over the infraspinatus and scapular part of the deltoid. It becomes superficial by passing between the occipital and cervical portions of the trapezius, which as a rule are very distinct. Many authors describe the omo-trachelian as fusing posteriorly with the cephalo-humeral, and in two or three of our own dissections we have thought that it ended in this way; but more careful dissection enabled us to trace the muscle to the region where the acromial process ought to be, so that although we shall divide the material at our disposal into two groups according to the insertion of the muscle, the reader must bear in mind that many of the cases in which the insertion is said to be into the cephalo-humeral are possibly the result of imperfect dissections, and this applies to some of our own dissections as well as to those of other observers, for at first we failed to realize the amount of careful cleaning which is necessary to satisfactorily display the posterior attachment of the omo-trachelian. On the other hand, we do not feel justified in asserting that the muscle never ends by completely fusing with the cephalo-humeral.

In the following animals the omo-trachelian was traced to the fascia over the scapula and the scapular spine—Hippopotamus (1, 3), Pig (4, 5, 7, 11), Peccary (14), Ox (33), Sheep (38), Mouflon (45), Goat (46), Duiker-bok (49), Tapir (52), Hyrax (68).

In the following the muscle is said to blend with the cephalo-humeral:—Pig (6), Chevrotain (21), Brocket (27, 28), Ox (35), Sheep (40, 43), Tapir (54, 55), Rhinoceros (64). In the whole of the above two groups of animals the origin was from the transverse process of the atlas, except in the Duiker-bok (49), in which a small slip came from the basioccipital in addition.

In the Muntjac (26) among the Cervidæ, Macalister says that the muscle was absent, and in our own specimen of Cervus (25) we failed to find it; possibly in these animals the incorporation of the omo-trachelian with the cephalo-humeral has become complete and the origin from the atlas suppressed.

In the Giraffe (29), Joly and Lavocat point out that the length of the neck has caused the origin of the muscle to shift back to the transverse processes of the sixth and seventh cervical vertebræ; and there is every reason to believe that Murie (XXXII.) verified this, since he carefully studied the above authors' paper, and only drew attention to points in which his animals differed from theirs or to facts which they had omitted.

In the Equidæ (56, 57, 58, 59) the origin is from the anterior four cervical transverse processes, and the muscle in this case certainly does fuse posteriorly with the cephalo-humeral in a very complete manner.

In the Elephant, Miall and Greenwood (XXIX.) apparently failed to notice the muscle, but we believe it is there because Anderson (XXVII.) describes a part of the masto-humeral (cephalo-humeral) which he says may be regarded as a separate muscle, and which rises from the basioccipital to be inserted into the anterior border of the scapular spine as well as into the fascia covering the deltoid. This insertion is clearly that of the omo-trachelian, and the origin from the basioccipital we have already shown exists in the Duiker-bok (49), but further details of the muscle are badly wanting in the Elephant.

In the Pig, Peccary, Brocket, Sheep, Duiker-bok, and Hyrax we found the nerve-supply coming from the spinal accessory.

Scalenus ventralis.—The arrangement of parts in the Ungulates makes it necessary to define what is meant by the scalenus anticus, or ventralis as we prefer to call it. If it is a scalene which passes ventral to the subclavian artery, as in Man, there is no such muscle among the Ungulates as far as we know. If, on the other hand, it is a scalene which passes ventral to the brachial plexus, the Ungulates have it often enough. It rises from the lower three or four cervical transverse processes and is inserted into the first rib. It is present in the following animals:—Hippopotamus (1), Pig (9, 11), Peccary (13, 14), Tragulus (20, 21), Camel (18), Brocket (27), Giraffe (29, 30, 31), Ox (33), Sheep (38, 41, 43, 45), Goat (46), Antelope (49), Tapir (52, 54), Horse (56, 58, 60), Hyrax (67, 68).

In the Elephant we are unable to find any definite statement as to whether the scalenus ventralis was present or absent, but the foregoing list is a very representative one and, in the absence of any definite statement that the muscle was absent in any animal, justifies us in generalizing and saying that the Ungulates, as an Order, are characterized by having a scalene muscle which is inserted into the first rib dorsal to the subclavian artery and ventral to the brachial plexus; but whether this applies to the Elephant or not must be left for future observation.

Scalenus longus et brevis.—These two muscles are both dorsal to the brachial plexus, and they are so closely connected at their anterior attachment that it is very difficult to say to how many cervical transverse processes each is attached; nor does there seem any object in trying to do so, for in different specimens of the same animal the attachments vary markedly, and this is the case even when they are recorded by the same observer. The lower attachment of the scalenus brevis is into the first rib, while the longus usually lies ventral and near to it; it is inserted into a variable number of anterior ribs on their outer surface.

The upper attachment of the conjoined muscles is into a variable number of lower cervical vertebræ, occasionally even reaching the atlas; the strongest and most constant fasciculi are fastened to the 4th and 5th as a rule.

The following are some records of the number of ribs into which the scalenus longus is inserted:—Hippopotamus (1), ribs 1, 2, and 3; Pig (4, 7, 11), ribs 1, 2, and 3; Pig (9), ribs 3 and 4; Peccary (13), ribs 1, 2, and 3; Peccary (14), ribs 1, 2, 3, 4; Camel (18), only to 1st rib; Chevrotain (20), ribs 1, 2, and 3; Cervus (25), only to 1st rib; Brocket (27), only to 1st rib; Giraffe (29, 30), ribs 1 and 2; Ox (33), ribs 1, 2, 3, and 4; Sheep (38, 41, 43, 45), only to 1st rib; Goat (46), ribs 1, 2, 3, and 4; Antelope (49), ribs 1, 2, and 3 (quite a small muscle); Tapir (52, 54), ribs 1?, 2, and 3; Horse (56, 58, 60), only to 1st rib; Ass (62), usually as in Horse, but occasionally reaches to the 2nd and 3rd ribs; Hyrax (67), ribs 1, 2, and 3; Hyrax (68), ribs 3 and 4; Hyrax (71), ribs 3, 4, 5, and 6; Elephant (74), ribs 2, 3, and 4.

In the foregoing descriptions we fear that the posterior attachments of the scalenus longus and brevis are more or less confused, and that the attachment of the longus to the first rib might, in many cases, be more fitly described as brevis; but the difficulty of satisfactorily separating the two muscles is such, that those who have dissected most will be least inclined to criticize our inability to be definite. One way out of the difficulty would be to only call those fibres which pass to ribs behind the first as scalenus longus; but this would only be meeting one difficulty with another, since, in some cases, there are distinctly two insertions into the first rib dorsal to the brachial plexus.

Summing up, we may say that the Camelidæ (we have no records of the Llama), the Cervidæ, the Sheep, and the Equidæ have no prolongation of the scalenes beyond the first rib; while in the other families (? Rhinocerotidæ) the scalenus longus usually reaches the third rib, and in the Procaviidæ may be prolonged back as far as the sixth. The arrangement in the Sheep, of which we have many records, is especially interesting, since it forms another sharp myological contrast with the Goat. Steel's observation (XIX.) that the Ass has occasionally a prolongation of the scalenus longus to the third rib, points to the fact that that animal is less highly specialized than the Horse. We are more than ever convinced of the futility of attempting to homologize the scalenus longus and brevis individually with the scalenus medius and posticus of Man, since the brevis in its dorsal position corresponds to the Man's posticus, but the longus is the muscle which goes beyond the first rib, as does the scalenus posticus of Man. The nerve-supply of the scalenes is from the upper trunks of the brachial plexus.

Rectus capitis ventralis (*anticus*) *major* rises from the transverse processes of the third and two or three succeeding cervical vertebræ and is inserted into the basioccipital. There is nothing special to remark about it.

Rectus capitis ventralis (*anticus*) *minor.*—Chauveau (II.) in the Horse and Kinberg (X.) in the Chevrotain point out that this muscle lies external to the last, and we found the same muscle rising from the atlas and axis in the Pig (11) and the Brocket Deer (27). Unfortunately we failed to look carefully for this in the other animals we dissected, but the records we have show that it is at least of frequent occurrence in the Ungulates. We have some little doubt as to whether this muscle can be homologized with the r. c. v. minor of other mammals, or whether it would not be advisable to speak of it as r. c. v. externus.

In Hyrax (67), Mivart and Murie failed to find the minor in its usual place, but we found a few fibres running from the ventral arch of the atlas to the basioccipital (68).

Longus colli.—Lesbres (V.) and Kinberg (X.) point out that the vertical fibres of this muscle are absent and only the two oblique parts present. The lower oblique portion usually comes from the anterior six thoracic vertebræ, though in the Camel (18) and Moufion (45) it only reached the fourth. Steel (XIX.) points out that in the Ass it sometimes only reaches the fifth. Meckel (VII.) says that in the Sheep the muscle is bilaminar, but this was not so in our Mouflon (45).

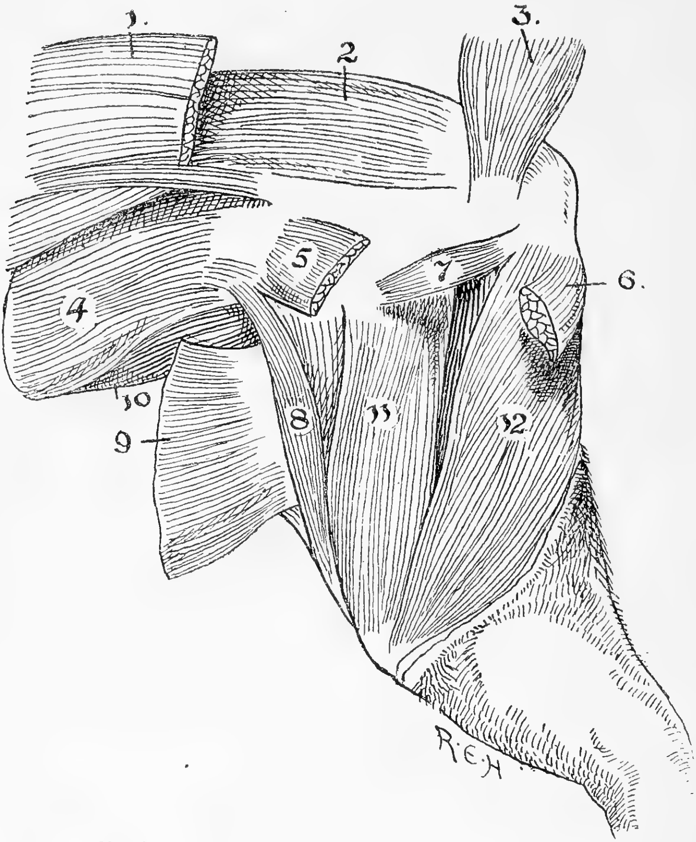
Muscles connecting the Fore-limb with the Trunk.

Cephalo-humeralis.—This is a combination of the anterior part of the trapezius, the cleido-mastoid, and the clavicular part of the deltoid, and it has already been pointed out that the omo-hyoid and omo-trachelian occasionally become blended with these. No Ungulate possesses a clavicle, but in most cases there is a fibrous intersection marking its site and indicating the place where the trapezius ends and the deltoid begins.

The part of the trapezius which forms the cephalo-humeral rises from the occipital crest in the Hippopotamidæ (3), Suidæ (7, 11, 13, 14), Tragulidæ (20, 21), Cervidæ (25, 26, 27, 28), Bovidæ (32, 33, 38, 39, 46, 49), Tapiridæ (52, 54, 55), Equidæ (56, 58), Procaviidæ (67, 68), and Elephantidæ (72). In the Camelidæ and Giraffidæ apparently it rises from further back in the neck. Meckel (VII.) says that in the Camel it comes from the posterior third of the ligamentum nuchæ, while Murie in the Alpaca (XXXII.) found it rising from the transverse processes of the fifth and sixth cervical vertebræ. In the Giraffe (29, 30) it had the same origin. We have stated that the anterior part of the trapezius and cleido-mastoid are continued into the fore-limb by the clavicular part of the deltoid, and this is usually inserted into the lower part of the humerus, at least this is the case in the following animals:—Suidæ (7, 11, 12, 14), Tragulidæ (20, 21), Brocket Deer (27, 28), Giraffe (29, 30), Duiker-bok (49), Tapir (52, 52 *a*, 55). In the Hippopotamus (1) and Elephant (74, 77, 79) the cephalo-humeral is inserted into the upper part of the humerus, while in the Horse (56) and Ass (61) it is attached just below the remainder of the deltoid. In the Sheep (43, 45), Goat (48), and Hyrax (68) the insertion blended with that of the biceps and was carried down into the forearm, and in one specimen of Tapir (54) there was an insertion into the forearm as well as one into the lower part of the humerus. The nerve-supply of the muscle corresponds with its compound nature; the trapezius part is supplied by the spinal accessory and upper cervical nerves, the deltoid part by the circumflex.

Trapezius.—The posterior portion of the trapezius is in some animals, especially the Suidæ, separated by a marked interval from the cephalo-humeral; in others, such as the Brocket Deer, the two muscles are only separable in their lower parts. It has already been pointed out that the omo-trachelian usually appears on the surface between the cephalo-humeral and the trapezius to reach the fascia over the scapula. In other orders of Mammals the second and third parts of the trapezius are often quite distinct, but in Ungulates this is seldom the case, and in many cases it is quite difficult to separate the part of the muscle which is inserted into the spine from that which ends in the root of the spine. When a separation is either naturally or artificially made, it is found that the second part (counting the cephalo-humeral as the first) rises from the posterior half or two-thirds of the ligamentum nuchæ and from two or three anterior thoracic spines, while the

Text-fig. 90.



Shoulder-muscles of the Hyrax. (Dorsal view.)

1. Trapezius.
2. Supraspinatus.
3. Omo-trachelian.
4. Infraspinatus.
5 & 6. Deltoid.
7. Teres minor.
8. Dorso-epitrochlearis.
9. Latissimus dorsi.
10. Teres major.
11 & 12. Triceps.

third or posterior part comes from a very variable number of thoracic spines behind the third, usually reaching for about the anterior two-thirds of the thoracic region of the vertebral column.

In the Pig (8) it reaches to the 9th, in the Tapir (55) to the 8th, in the Horse (57) to the 10 or 11th, and in the Elephant (74) to the 14th thoracic spine. It is noticeable that in many animals the posterior fibres are not only inserted into the root of the scapular spine, but also for some distance along the posterior (caudal) margin.

Latissimus dorsi.—This muscle rises from a variable number of posterior thoracic spines, from the lumbar aponeurosis, and usually from some of the posterior ribs. Its insertion is into the shaft of the humerus below the neck with the teres major, and very often some of its fibres pass across the axilla in front of the vessels and join the insertion of the pectorals (see text-fig. 91). Lesbres (V.) points out that in the Ruminants and Solipeds the insertion is lower down on the humerus than in most Mammals, but that in the Pigs this is not the case. In most Ungulates the latissimus dorsi is a feeble muscle, but in the Tapiridæ it is very well developed. The exact number of thoracic vertebræ from which the muscle rises varies sometimes in different records of the same animal and is often extremely difficult to determine; still, we tabulate the origins for what they are worth :—

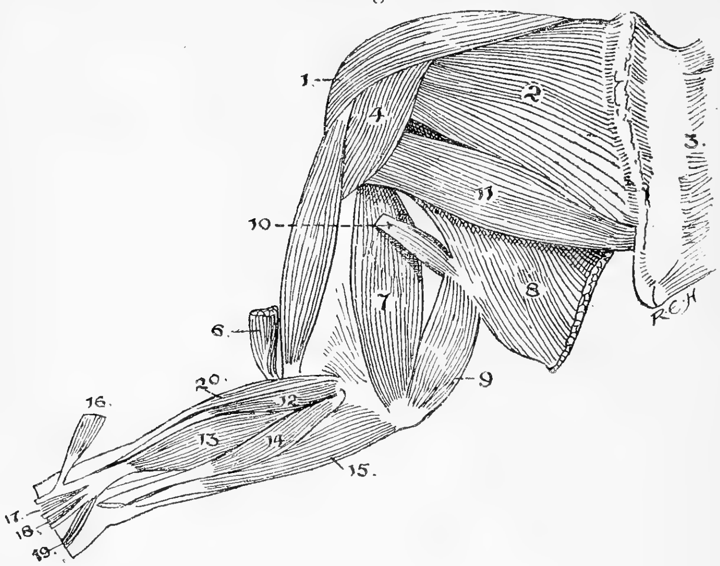
	Thoracic vertebræ.	Ribs.
Hippopotamus (1).	? number.	Posterior ones.
Pig (8)	? ,,	Posterior 4.
Pig (11)	5th to last.	None.
Peccary (13)	?	Posterior 4.
Peccary (14)	5th to last.	?
Chevrotain (20) ..	Last 5 (9–13)	None.
Chevrotain (21) ..	Last 7 (7–13).	Posterior ribs.
Brocket (28)	?	Last 4 ribs.
Giraffe (30)	?	Last 4 ribs.
Ox (35)	Last 4.	?
Sheep (40)	Last 4.	?
Sheep (43)	Last 8.	Last 3.
Sheep (45)	Last 4 (10–13).	Feeble costal origins.
Antelope (49)....	Last 6 (9–14).	Feeble costal origins.
Tapir (54)	?	Last 10.
Horse (57)	Last 4.	?
Horse (56)	Last 14 or 15.	12th and 13th.
Hyrax (67)......	?	No ribs.
Hyrax (68)	Last 11 (10–20).	No ribs.
Hyrax (71)	?	No ribs.
Elephant (74) ..	?	Last 6 (9–14).

With regard to the insertion, slips were found crossing the axilla in front of the great vessels in the following animals :—Brocket (27), Sheep (41, 45), Antelope (49), Hyrax (68) (see text-fig. 91), and apparently Elephant (74, 79).

The nerve-supply in the Pig, Deer, Sheep, Antelope, Elephant, and Horse is from the long subscapular nerve.

Dorso-epitrochlearis (*Latissimo-olecranalis*).—This muscle tends to vary from the typical mammalian arrangement in shifting its origin from the latissimus dorsi to the axillary border of the scapula or the surface of the infraspinatus; its insertion, however, is into the inner side of the olecranon as usual.

Text-fig. 91.



Arm- and shoulder-muscles of the Hyrax. (Ventral view.)

1. Supraspinatus.
2. Subscapularis.
3. Serratus magnus.
4. Coraco-brachialis.
5. Biceps.
6. Cephalo-humeral.
7. Triceps.
8. Latissimus dorsi.
9. Dorso-epitrochlearis.
10. Slip passing over vessels.
11. Teres major.
12. Flexor carpi radialis.
13. Flexor sublimis digitorum.
14. Palmaris longus.
15. Flexor carpi ulnaris.
16. Index-slip of Flexor brevis digitorum.
17. } Lumbricales.
18. }
19. Double tendon of profundus to minimus.
20. Flexor carpi radialis.

In the Suidæ, Lesbres (V.) says the muscle is very well developed, but in our specimen of the Red-River Hog (11) it was small. Its origin is from the axillary border of the scapula close to the origin of the triceps and from the fascia over the infraspinatus (11, 13), but in Macalister's specimen (8) it was also connected with the latissimus dorsi. In the Babirusa (12) it is small and attached to the latissimus dorsi.

In the Chevrotain (20) it rose from the infraspinatus, but in the Water-Chevrotain (23) from the latissimus dorsi. In the Deer (25) the origin was from the latissimus dorsi, but in the Brocket (28) the place of the muscle was taken by a slip of what appeared to us as dorsi-humeral panniculus coming off from the main panniculus over the teres major and being inserted into the inner side of the olecranon. We also found some connection with the panniculus in the Pig (11); and on this account have asked ourselves whether, in spite of the nerve-supply always coming from the musculo-spiral or circumflex, the dorso-epitrochlearis might not originally be a specialized portion of the panniculus, but we do not feel justified in doing more than making the suggestion at present.

In the Bovidæ, Bronn (VI.) says that the muscle rises from the axillary border of the scapula, but Lesbres (V.) found it connected with the latissimus.

In the Ox (36) at the R.C.S. Museum it rose from the latissimus and teres major, and so it did in our specimens of Sheep (43, 45), but it was very feeble and blended with the triceps below.

In the Antelope (49) it was altogether absent.

In the Tapiridæ (52, 53, 55) it is very well developed and rises fleshy from the latissimus.

In the Horse (57) and Ass (61) from the axillary border.

In the Hyrax (67) from the infraspinatus and in (68) from there and slightly from the latissimus dorsi (see text-fig. 90).

In the Indian Elephant (74) from the latissimus and the axillary border of the scapula near the angle; in (79) from the latter origin only; while in the African species (78) it was large and rose entirely from the latissimus dorsi.

The generalization which we would make from the preceding is that the Ungulates have as a group an ill-developed latissimus dorsi, and that as an effect or coincidence the dorso-epitrochlearis is feeble and tends to shift its upper attachment, but that in the Tapirs, where the latissimus is very well developed, the dorso-epitrochlearis is also large and has the usual mammalian attachments.

Rhomboids.—In the Hippopotamidæ (1, 3), Suidæ (4, 6, 8, 11, 13, 14), and Procaviidæ (67, 68, 71) the capitis is well developed. In the Tragulidæ (20, 21), Camelidæ (18), Cervidæ (25, 27, 28), Giraffidæ (29, 30, 31), Bovidæ (32, 33, 35, 38, 39, 40, 41, 43, 44, 45, 46, 49)[1], Tapiridæ (54, 55), Equidæ (56, 57, 58, 60), and Elephantidæ (74) there is no capitis.

The rhomboideus colli et thoracis are usually blended into one sheet, which stretches from the middle of the ligamentum nuchæ, from the fourth to the seventh thoracic spines, though in Hyrax (67, 68) it reaches the tenth. The insertion is into the ventral surface of the suprascapular cartilage where that exists. In the Horse, Lesbres (V.) points out that the rhomboid sheet is strengthened on its deep surface by an elastic lamina, but this is not found in other Ungulates.

[1] Vrolik (VIII.) found a rhomboideus capitis in the Gnu.

In the Camel (18) and Giraffe (30, 31) the rhomboids are very small and only reach the second or third thoracic spine; indeed, in the latter animal Joly and Lavocat (XII.) deny its existence. The nerve-supply of the thoracic portion of the muscle is from the 6th cervical in the Horse (57) and Hyrax (68); in the latter animal the rhomboideus capitis et colli was supplied by the 4th and possibly 5th cervical.

Subclavius and *Sterno-scapularis.*—As the clavicle is always wanting, the subclavius, if it is present at all, is always continued from the junction of the first or more ribs with the sternum to the fascia over the supraspinatus. It is present in the Hippopotamidæ (1, 3), Suidæ (4, 6, 7, 8, 11, 12, 13, 14), Tragulidæ (21) (not mentioned by Kinberg (20)), Cervidæ (24, 27), Tapiridæ (50, 52, 54, 55), Equidæ (57, 58), Rhinoceros (64), Procaviidæ (67, 68), and Elephantidæ (72, 76).

In the Tragulidæ and Cervidæ the muscle is small and possibly often absent, as no mention is made of it in many of these animals.

In the Tapiridæ, Equidæ, and Procaviidæ the origin is from the sternum and first three costal cartilages.

In the Bovidæ the muscle may be present or absent, but if it is present it is always very small. Chauveau (II.) found it in the Ox (32), but not in the Sheep (39) or Goat (47). Lesbres (V.) says it is present in Ruminants as a small bundle which joins the cephalo-humeral at the clavicular intersection, while Bourgelat (quoted by Lesbres) describes it as absent, and Rigot (also quoted by Lesbres) as fused with the pectoralis quartus. In our own dissections it was fully developed though small in the Antelope (49), rudimentary in the Fat-tailed Sheep (43), and altogether absent in the Mouflon (45).

We have unfortunately no records of it in the Camelidæ and Giraffidæ, but if it had been at all well marked its presence would probably have been noticed. In consulting the literature of this muscle the reader should bear in mind that it has many synonyms and that only recently has it been recognized as a distinct muscle; it is most often found with the description of the pectoral group.

The nerve-supply comes from the 5th and 6th cervical in the Pig (9) and Peccary (14), from the second root of the phrenic in the Pig (8), from the phrenic and 7th cervical in the Duikerbok (49).

Levator anguli scapulæ and *Serratus magnus* (*Serratus ventralis colli et thoracis*).—The following origins of these muscles are recorded by ourselves and other observers:—

	Cervical transverse process.	Ribs.
Hippopotamus (1).	1–7.	1–8.
Hippopotamus (3).	. .	1–11.
Pig (4)	1–7.	
Pig (8)	. .	1–7.
Pig (9)	1–7.	1–6.

	Cervical transverse process.	Ribs.
Pig (11)	1–7.	1–8.
Peccary (13)	3–7.	1–8*.
Peccary (14)	3–7.	1–8.
Chevrotain (21)	2–7.	1–10.
Deer (25)	3–7.	1–8.
Brocket (28)	3–7.	1–8.
Giraffe (30)	5–7.	1–11.
Ox (33)	2–7.	1–10.
Sheep (40)	3–7.	
Sheep (41)	3–7.	1–8.
Sheep (43)	3–7.	1–9.
Sheep (44)	4–7.	1–8.
Sheep (45)	3–7.	1–9.
Antelope (49)	3–7.	1–8.
Tapir (55)	3–7.	
Tapir (52)	3–7.	1–7.
Tapir (54)	..	1–7.
Horse (56)	3–7.	1–8.
Horse (57)	5–7.	1–9.
Horse (60)	3–7.	1–9.
Ass (62)	3–7 (sometimes 2–7).	
Hyrax (67)	5–7.	1–15.
Hyrax (68)	5–7.	1–11.
Hyrax (71)	3–7.	1–14.
Elephant (74)	3–7.	1–10*.
Elephant (77)	3–5.	1–12.

In the two animals (Peccary and Elephant) against which an asterisk is placed there was a perfectly distinct slip from the transverse process of the atlas, and in a great many others it will be seen that the serratus ventralis colli or levator anguli scapulæ extends up to the atlas. We have little doubt that this is the same muscle which we have already described in the Mustelidæ (XXXIV.) under the name of rhomboideus profundus, though in the Ungulates it is much more closely blended with the serratus than with the rhomboid sheet. It is quite possible that we were wrong in associating it by name so closely with the rhomboid lamina, and that it should be looked upon more as a connecting-link between the rhomboid and serratus sheets. The nerve-supply of the costal portion of the serratus ventralis sheet (serratus magnus of human anatomy) is, as usual, the posterior thoracic. The part from the transverse processes of the cervical vertebræ is supplied from some of the cervical nerves—in the Pig, Peccary, and Duiker-bok from the 4th and 5th, in the Brocket Deer from the 5th and 6th.

The insertion is into the ventral surface of the suprascapular cartilage, closely blended with the insertion of the rhomboids, and also slightly to the adjoining part of the bony subscapular fossa.

Pectorals.—All authors seem to agree in describing two main sheets, a superficial and a deep, but the subdivisions of these vary immensely, and it would be impossible to quote all the combinations which are described, nor do we think it desirable to do so as the arrangements are not even constant for the same animal.

The superficial sheet rises from the pre- and mesosternum, and usually consists of a main quadrilateral part which is inserted into the pectoral ridge and greater part of the shaft of the humerus; in addition to this there is usually an insertion into the fascia of the forearm near the elbow which rises from the mesosternum behind the last but in many cases overlaps or is overlapped by it.

The oblique superficial band running from the presternum to the lower part of the insertion of the muscle, which is so frequently found in the Rodents, seems only to be present in the Procaviidæ, where it comes from the cartilaginous omosternum and goes to the lower half of the humerus. The deep layer consists of the pectoralis quartus which rises from the posterior part of the mesosternum and from the linea alba and which runs forward, narrowing as it goes, to the region of the great tuberosity of the humerus and blending with the panniculus. Cephalad of this is often another slip, which is the pectoralis minor of most authors, coming from the mesosternum and being inserted with the last-named into the fascia over the front of the shoulder-capsule. These two deep slips are in the same plane as the sterno-scapular muscle which is often included in their description.

Roughly speaking, the pectoral mass of the Ungulates bears out the usual mammalian tendency, which is for the most superficial fibres to be drawn towards the lower part of the arm, while the deeper ones concentrate their action on the upper part. The nerve-supply of the pectoralis minor, quartus, and ventral panniculus is from the great internal anterior thoracic nerve; the more superficial layer is partly supplied by the external anterior thoracic, partly by the internal. There is therefore a sharp demarcation in the nerve-supply between the pectoralis minor and the sterno-scapularis.

Muscles of the Fore-limb.

Deltoid.—The clavicular portion of this muscle has been already described with the cephalo-humeralis. The acromial part is usually absent owing to the suppression of the acromion process, but in the Elephant (77, 78, 79), in which the acromion is found, this part of the muscle is well developed and rises from the fork between the two processes. In the Hippopotamus (3) and Tragulus (20, 21) the acromial part is well developed, but in the Tapir (54, 55), although present, it is feebly developed. In the Hyrax (67), Mivart and Murie describe the acromial part as rising from the great tuberosity of the humerus, but in our specimen (68) it was entirely absent.

The spinous portion is a very thin sheet which rises not only from the spine of the scapula but also from the fascia over the infraspinatus. Lesbres (V.) says that in the Horse and Pig a slip comes from the dorsal angle of the scapula. We have never found a separate slip of the deltoid from the angle, but the origin from the infraspinatus fascia is so extensive that it reaches the dorsal (posterior) angle, and in Lesbres's specimens was probably thickened there. The nerve-supply is in all cases the circumflex.

Subscapularis.—This is a comparatively small muscle seldom covering more than two-thirds of the ventral surface of the scapula, it usually rises by a series of fleshy digitations with fibrous septa between them; in the Hyrax (68) there are four or five of these, in the Hippopotamus (1) three. The insertion as usual is into the lesser tuberosity.

Bronn (VI.) describes a muscle in the Horse and Pig which he calls "subscapularis accessorius," and he says that it is inserted into the posterior aspect of the head of the humerus and capsule and is supplied by the circumflex nerve (n. axillaris). The nerve-supply and insertion show that this is not the axillary bundle of the subscapularis, which in some animals is very distinct.

Paterson and Dun noticed a muscle in the Indian Elephant (79) which rose from the axillary part of the subscapular fossa anterior to the triceps and passed below the capsule of the shoulder to be inserted into the posterior surface of the humerus just below the head; it was supplied by the circumflex nerve, and it is evidently the same as the muscle quoted above from Bronn.

These authors call it the subglenoid muscle, and we think that this name had better be retained, since it corresponds with nothing we have hitherto met with in mammalian myology. It is apparently a muscle which occurs occasionally in Ungulates and is not confined to any one family.

The subscapularis is usually supplied by two nerves from the upper part of the brachial plexus.

Supraspinatus.—This is a larger muscle than the infraspinatus, and rises not only from the supraspinous fossa but from a fibrous septum between it and the cephalic edge of the subscapularis. At its insertion it usually divides to embrace the long tendon of the biceps. In the Brocket Deer (27), Antelope (49), and Horse (56) the insertion was entirely fleshy, but in the Pigs (11, 14) it was tendinous. In the Horse, Ox, Sheep, Antelope, and Pig it is supplied by the suprascapular nerve.

Infraspinatus.—This is smaller than the last and is chiefly remarkable for having a small bundle of fibres near the axillary border separated from the rest. This bundle is said by Chauveau and Lesbres to be peculiar to the Solipeds, but Murie (XVII.) describes what is evidently the same thing in the Tapir (55) as an extra teres minor, and Haughton (XV.) says it is present in the Goat.

In the Horse this muscle has received many names, the chief being scapulo-humeralis posticus, flexor brachii minimus, abductor trochiterien, and infraspinatus secundus. We should prefer to use the last of these, but we are not sure of the nerve-supply;

if it is from the suprascapular, infraspinatus secundus will be a good name, but if it is supplied by the circumflex some other may be desirable.

Steel points out that in the Ass (62) this muscle is sometimes almost obsolete.

Teres minor presents little of special interest; it rises usually from the middle third of the axillary border of the scapula, and is inserted just below the infraspinatus into the great tuberosity. We have already pointed out that Murie has described this muscle as double in the Tapir, and Mayer does the same in the Elephant (73), though whether this is another example of an infraspinatus secundus or not depends on its nerve-supply. In any case no other author seems to have noticed it in the Elephant. The nerve-supply is always the circumflex, but there is apparently no gangliform enlargement on the nerve, at least we looked for it in the Hog (11), Peccary (14), Brocket (27), Duiker-bok (49), and Hyrax (68) without success.

Teres major rises from the dorsal third of the axillary border of the scapula, but only very slightly from the suprascapular cartilage; it is inserted into the neck of the humerus, and is always very closely connected here with the latissimus dorsi. In the Elephant, judging from Cuvier and Laurillard's plate (I.) and the specimen in the R. College of Surgeons Museum, the teres major at its insertion lies dorsal to the latissimus dorsi, but in all the other Ungulates of which we have records (3, 7, 36, 45, 49, 52, 55, 61, 53) the teres major is ventral. The nerve-supply is from the lowest subscapular.

Biceps (Flexor longus cubiti).—Only one head of the biceps is present, and this we believe is always the long head, in spite of the fact that it often rises from the coracoid process and is sometimes altogether outside the shoulder-capsule. Our reasons for believing this are that in other Mammals it is always the short head which disappears, and that the tendon in the Ungulates always occupies the bicipital groove. The insertion is chiefly into the upper part of one or both forearm-bones; but as these are so closely connected, very careful cleaning is required to be sure of its exact attachment. Often when we thought the insertion was into the radius, careful dissection has shown us that this was only apparent and that the tendon really went on to the ulna, and this probably accounts for some of the discrepancies found in the literature of the subject. In many cases a fibrous expansion is given off before the main insertion which goes into the fascia on the extensor surface of the forearm; this may or may not be homologous with the semilunar fascia of human anatomy, but it is very different in direction and does not pass inward superficial to the brachial artery as in Man. Welker (XXXV.) has pointed out that in the Tapir and Horse the tendon lies altogether outside the shoulder-capsule, and it would be interesting to know whether this is also the case in the Rhinoceros, as it would then be a characteristic of the Perissodactyla. We believe that in the

Artiodactyla the tendon always lies in the shoulder-capsule (it certainly does in the Ox, Sheep, Antelope, and Elephant); but unfortunately we read Welker's paper too late to pay special attention to this point, and we must reserve the question for future investigation.

The following table gives the recorded attachments of the biceps in Ungulates; but in using it it should be remembered that the stunted coracoid and the top of the glenoid cavity are close together and very likely to be confused, and that some of the insertions recorded as radial possibly went on to the ulna. In this way many of the apparent discrepancies may be harmonized.

	Origin.	Insertion.
Hippopotamus (1)	Coracoid.	Radius and fascia of forearm.
Hippopotamus (3)	Coracoid.	
Pig (4)	......	Radius and ulna.
Pig (6)	......	Radius and ulna.
Pig (7)	......	Radius and ulna.
Pig (9)	......	Radius and ulna.
Pig (11)	Glenoid.	Ulna.
Babirussa (12)	Glenoid.	Radius.
Peccary (14)	Glenoid.	Ulna.
Camel (15)	......	Radius and fascia.
Camel (18)	Glenoid.	
Chevrotain (20)	Coracoid.	Radius and ulna.
Chevrotain (21)	Glenoid.	Radius.
Water-Chevrotain (23) .	......	Radius and fascia.
Deer (25)	Glenoid.	Radius.
Brocket (27)	Glenoid.	Ulna and fascia.
Brocket (28)	Coracoid and glenoid.	Ulna.
Giraffe (29)	......	Radius.
Giraffe (30)	......	Ulna and fascia.
Ox (33)	Glenoid.	Radius.
Ox (35)	Glenoid.	Radius.
Ox (36)	......	Apparently to radius, really to ulna.
Sheep (38)	Glenoid.	Radius.
Sheep (40)	Glenoid.	Radius.
Sheep (44)	Glenoid.	Radius.
Sheep (43)	Glenoid.	Ulna.
Sheep (45)	Glenoid.	Ulna and fascia.
Goat (48)	......	Radius.
Antelope (49)	Glenoid.	Ulna and fascia.
Tapir (55)	Coracoid.	Radius.
Tapir (52)	Coracoid.	
Tapir (Welker)	Coracoid.	
Horse (56)	Glenoid.	Radius.
Horse (57)	Glenoid.	Radius.

	Origin.	Insertion.
Horse (58)	Glenoid.	Radius.
Rhinoceros (63)	......	Radius and fascia.
Rhinoceros (66)	Coracoid.	Radius.
Hyrax (67)	Glenoid.	Ulna.
Hyrax (68)	Glenoid.	Ulna.
Hyrax (71)	......	Ulna.
Elephant (74)	Glenoid.	Ulna.
Elephant (77)	Glenoid.	Ulna.
Elephant (78)	Glenoid.	
Elephant (79)	Glenoid and small coracoid.	Radius and ulna.

In the Camel (18) and the Brocket Deer (28) the tendon of origin was thick at the margins and very thin in the centre, giving the appearance of a fusion of two tendons. It has been suggested that this points to the conclusion that the long and short heads have fused together instead of the short one disappearing. Until some intermediate stages are found we think that this should remain a mere suggestion. In the Water-Chevrotain (23) Chatin notices some tendinous intersections in the muscle, but we have not seen them in any other animal.

The nerve-supply is from a branch of the external head of the median, which corresponds to the musculo-cutaneous of human anatomy.

Coraco-brachialis.—Various authors state that the first, second, or third parts of this muscle are present, but it is very difficult to be sure what they mean by it. Our own experience makes us insist very strongly that the position of the musculo-cutaneous nerve does not necessarily mark out the division between any two parts of the muscle. The first part is the coraco-brachialis brevis or rotator humeri, and is always inserted into the neck of the humerus above the tendon of the latissimus dorsi. The second part is inserted into the middle of the shaft, and passes ventral to the latissimus dorsi. It is true that in most Mammals the nerve passes above this part, that is, between it and the brevis; but, as we shall see, it is not at all uncommon for the nerve to sink into the coraco-brachialis medius in the same way that the whole or part of the great sciatic nerve occasionally perforates the pyriformis. Between the second and third parts (medius and longus) there is no definite demarcation; whenever the muscle reaches the lower extremity of the humerus, it is usual to say that a coraco-brachialis longus is present.

It is greatly to be desired that anatomists in the future should record in connection with this muscle not only the amount of the humerus to which it is attached, but also its relation to the latissimus dorsi tendon and to the musculo-cutaneous nerve.

In the Hippopotamus, Alix and Gratiolet (III.) say that the longus alone is present; but in Cuvier and Laurillard's plate (I.) there are no signs of any part of the muscle.

In the Suidæ (4, 7, 11, 12, 14) the medius alone is present. In our specimen of the Pig (11) the nerve passed entirely above the muscle; but in the Peccary a small part of the muscle was above the nerve.

Bronn says, apparently on the authority of Bendz, that the brevis and medius are present; but from our experience we are entirely unable to agree with this. In the Camel (18) Meckel says that the muscle is inserted into the upper half of the humerus, but whether the brevis is present or not we have no knowledge.

In our Chevrotain (21) only the middle part was present; but Kinberg describes internal, middle, and external portions in his (20); as these all seem to be inserted below the upper third of the humerus, and none of them reach the lower extremity of the bone, we presume that they are component parts of the medius, and it is possible that one of the separations was formed by the nerve.

In the Cervidæ (25, 27, 28) and Bovidæ (33, 36, 38, 44, 43, 45, 49) we believe that the medius or medius and longus are the only parts present, and that the medius is always pierced by the nerve to the biceps. Bronn says that in the Ox and Sheep the longus and brevis are present; but apparently this generalization is taken from other authors, and no details of the exact attachments or the relations to the latissimus dorsi or nerve are given.

In the Giraffe, Murie (XXXII.) and Joly and Lavocat (XII.) describe a brevis and longus, but exact details are wanting.

In the Tapir (50, 52, 54, 55) our specimen agrees with the descriptions of three other observers, that the insertion is into the lower three quarters of the humerus, that is to say that the medius and longus are present.

In the Horse, Bronn (VI.), Chauveau (II.), Lesbres (V.), and Meckel (VII.) describe a brevis and medius between which the musculo-cutaneous nerve passes, and in Cuvier and Laurillard's plate these two parts are clearly shown in the Ass (I.).

In the Rhinoceros (64), Haughton (XXI.) describes a medius inserted into the middle of the shaft of the humerus for three inches; but in Beddard and Treves's animal (63) the longus was alone present and was inserted just above the internal condyle.

In the Hyrax (67, 68) the medius alone was found (see text-fig. 91), but in (71) there seems to have been a longus as well.

In the Elephant (72, 74, 76, 77, 78, 79) the insertion extends from the level of the attachment of the latissimus dorsi to the internal condyle, so that, although the position of the nerve is not given, it is pretty evident that in this animal the medius and longus are the two parts normally found.

Brachialis anticus (*flexor brevis cubiti*).—In Ungulates only the outer head of this muscle is present: it rises from the back of the surgical neck of the humerus, winds spirally round that bone, and is inserted into one or both bones of the forearm a little below the insertion of the biceps. In all the animals in which we carefully examined the insertion—Pig (11), Peccary (14), Brocket (27), Ox (36), Mouflon (45), Duiker-bok (49), and Hyrax (68)—we found that it was into the ulna; but the exact attachment of this muscle, like that of the biceps, can only be clearly seen after careful dissection. There are many records of its insertion into the radius which we dare not contradict; but we can affirm that in most of the animals in which we carefully dissected the muscle it seemed at first to be fixed to the radius, and careful cleaning was necessary to show that the real attachment was entirely into the ulna. The only animal in which we found a distinct short head from the front of the lower half of the humerus was the Hyrax (68), but it was not present in Mivart and Murie's specimen (67). In Paterson's and Dun's Elephant (79) a slip of the muscle rose separately from the front of the upper tubercle of the external condyle and continued separate to its insertion; it was supplied by the musculo-spiral nerve.

The nerve-supply in the Pig (11), Peccary (14), Brocket (27), Mouflon (45), and Duiker-bok (49) was entirely from the median, not from the musculo-spiral or musculo-cutaneous.

Triceps (*Extensor longus cubiti*).—The usual three parts of this muscle are always present, but they are liable to more or less subdivision. The long or scapular head rises from half to nearly the whole of the axillary border of the scapula, and is the largest of all the heads; sometimes it can easily be separated into a ventral and dorsal plane, the latter being the broader of the two; this occurred in the Syrian Sheep (44), Mouflon (45), Duiker-bok (49), and Elephant (77). The external head is small, and rises from the posterior part of the neck of the humerus just under cover of the origin of the brachialis anticus. Meckel (VII.) says that this head is divided into two in Ruminants. The inner head rises from the greater part of the posterior surface of the humerus. Murie, in the Tapir (55) and Hyrax (57), found this head double, and in the Giraffe (29) the same thing occurred. In Cuvier and Laurillard's plates of the Pig (7) and Peccary (13), a separate slip from near the angle of the scapula is figured; but we failed to observe this in our specimens of these animals, nor have we found any other records of it.

The nerve-supply of the triceps is entirely by the musculo-spiral.

Anconeus.—In spite of Lesbres's opinion that the anconeus is always present in Ungulates, we believe that it is very rarely seen as a distinct muscle. The only two animals in which it is at all well marked are the Hippopotamus (1, 3) and the Elephant (74, 78, 79). We presume that the nerve-supply is the musculo-spiral.

Epitrochleo-anconeus.—This muscle is also wanting in the Ungulates. The only record of it we can find is that Testut says it is present in the Elephant; but this specimen was probably an individual variation, since Miall and Greenwood and the other writers on the Elephant make no mention of it.

Pronator radii teres.—This muscle is often absent, but when it is present it is usually merely a fibrous band stretching from the internal condyle to the middle of the shaft of the radius on its anterior surface.

In the Hippopotamus (1, 3) it is absent.

In the Suidæ it may be present as a small fleshy muscle (5, 6, 7, 14) or absent (11, 12).

In the Camelidæ (18) it is rudimentary.

In the Tragulidæ (20, 21) it is small but fleshy.

In the Cervidæ (25, 26, 27, 28) absent.

In the Bovidæ it is absent according to Chauveau (II.) and Bronn (VI.), feeble according to Lesbres (V.). We found it as a fibrous band in the Ox (36), Sheep (45), and Antelope (49); and Meckel (VII.) says it is rudimentary in the Goat.

In the Tapiridæ a feeble muscle was present in 50, 52 *a*, and 55, but not in 52 or 54.

In the Equidæ, Chauveau (II.) and Bronn (VI.) say that it is absent; but Lesbres (V.) describes an occasional fibrous rudimentary band.

In the Rhinoceros (63) it is absent.

In the Hyrax (67, 68) it is present but rudimentary (see text-fig. 91).

In the Elephant (72, 74, 77, 78, 79) there is always a strong fibrous band running from the internal condyle to the middle of the radius, but this is usually reinforced by some fleshy fibres. Cuvier says that this fleshy part is only found close to the flexor carpi radialis; but Anderson (XXVII.) and Paterson and Dun (79) describe it as lying deep to the fibrous band, and having an attachment to the radius about 5 in. long. The specimen of the African Elephant in the Roy. Coll. Surg. Museum (78) agrees with Anderson's description. From the foregoing it will be seen that the muscle is best marked in the Suidæ and Tragulidæ, and least well-marked in the Cervidæ and Perissodactyla. In the Pig it is supplied by the median nerve.

Flexor carpi radialis.—This is the radialis internus of many of the veterinary authors; it rises from the internal condyle, and, after a short, fusiform, fleshy belly, ends in a long tendon which runs in a fibrous canal in the lower half of the radius. The insertion is into the palmar surface of the base of the metacarpal bone of the index or medius, or both, according to their development. In the Elephant the fleshy belly of the muscle is very remarkable; between the fleshy bundles are a number of longitudinal planes of yellow elastic tissue, which in a transverse section have a coarse network appearance. There is a good specimen of this in the Roy. Coll. Surg. Museum. The nerve-supply in the Pig (11), Peccary (14), Brocket (27), Sheep (45), Antelope (49), and Elephant (79) is the median.

Palmaris longus.—Although this muscle is often described in the scattered literature of the subject, we believe that it is only present in the Subungulata, *i. e.* in the Procaviidæ and Elephantidæ. The confusion as a rule is due to mistaking the extensor carpi ulnaris for the flexor and in calling the flexor carpi ulnaris the palmaris longus. Space does not allow us to discuss in detail the so-called palmares longi of different authors; but in each case we have gone carefully into the question, and, with the exceptions above given, have always found that what is described as a palmaris longus is in reality some other, or part of some other muscle.

In Hyrax (67), Mivart and Murie say that the muscle ends in a broad flat tendon which divides into four slips for the digits, and in the palmar portion of which a flat cartilaginous disk is present. Our own specimen (68) agrees with this, but we found no palmar cartilage (see text-fig. 91). In Meckel's specimen (71) the whole muscle seems to have been replaced by a broad tendon.

In the Elephant (73, 74, 77, 78, 79) the muscle is well developed and passes into the palmar fascia, after which its distribution seems to depend a good deal on the taste of the dissector, as is so often the case with fibrous planes.

The nerve-supply in our specimen of Hyrax (68) was the ulnar.

Flexor sublimis digitorum.—This muscle rises from the internal condyle and sometimes from the surface of the flexor profundus. The muscular belly may or may not divide into two distinct slips, and when this is the case the two slips are sometimes connected lower down. The muscle may end in tendons for one, two, three, or four toes, but those for the medius and annularis are of course the most constant. The insertion is into the second phalanx, and the tendon is perforated by that of the profundus in the usual mammalian manner; but the fibrous loops which we have noticed in other orders of the Mammalia passing round the profundus before the perforation of the sublimis are, if present at all, very feebly developed. In many cases the sublimis in encircling the profundus forms a complete tunnel for it, so that if a section is made the profundus looks like a solid circular fibrous rod which accurately fits into the ring-like sublimis.

In the Hippopotamus (1) tendons pass to the 2nd, 3rd, 4th, and 5th toes.

In the Suidæ (4, 6, 14) the usual insertion is only into the medius and annularis; but in our specimen of the Red-River Hog (11) there were tendons to all four toes. Lesbres (V.) points out that in the Pigs the two muscular bellies separate early and end in tendons for their respective digits, without any further connection with one another.

In the Camelidæ, Tragulidæ, Cervidæ, Giraffidæ, and Bovidæ there are only tendons for the medius and annularis; in the latter family, as Lesbres (V.) points out, the two fleshy bellies reunite before giving off the two tendons; but this is not the case in the Cervidæ or Tragulidæ.

In the Tapir (52, 54, 55) and Rhinoceros (63) there are three tendons, for the index, medius, and annularis respectively. In the Horse, of course, there is only one for the medius. In the Hyrax

(67, 68) there are tendons for the index, medius, and annularis, but they sometimes join the flexor brevis digitorum manûs, as will be pointed out under that muscle. In the Elephant we believe that the flexor sublimis is absent. The muscle which Miall and Greenwood (XXIX.) describe as sublimis is evidently profundus, for it goes to the terminal phalanges and has the lumbricals rising from it. In the other two Elephants of which we have clear records (77, 78) there is no flexor sublimis. The nerve-supply is the median in the Deer, Sheep, and Hyrax.

Flexor brevis digitorum manûs.—This muscle was first noticed by Mivart and Murie in Hyrax, but since then it has been described by us in many mammals. It is possibly a slip of the flexor sublimis which has acquired a new origin from the annular ligament and palmar fascia, and its tendons of insertion either join the flexor sublimis or form perforated tendons replacing that muscle. In the Ungulates it is found in the two archaic types Hyrax and Tapir and in the Elephant. In the Tapir (55) Murie found it passing to all four digits; but we failed to find it in our specimen (54), nor do Cuvier and Laurillard figure it in theirs (52). In Hyrax (67), Mivart and Murie found it going to the 2nd, 4th, and 5th digits, but it only formed a flexor perforatus in the 4th; the tendon to the index joined the flexor perforans, while that to the minimus joined the flexor sublimis and with it formed a flexor perforatus. In our specimen of Hyrax (68) tendons passed to the index, medius, and annularis; the index-slip joined the tendon of the flexor sublimis (see text-fig. 91), but those for the medius and annularis formed independent flexores perforati.

In Miall and Greenwood's Elephant (74) there were slips to the sheath of the annularis and minimus, and in Cuvier and Laurillard's specimen (77) the insertion was apparently the same. In the College of Surgeons preparation (78) there is only one tendon for the medius. The nerve-supply is the median.

Flexor carpi ulnaris.—This is also called the oblique flexor of the metacarpus, the anterior ulnaris, and the ulnaris internus. In many Ungulates it has the usual origin from the internal condyle and olecranon, and is inserted into the pisiform; but the olecranal head is seldom as well developed as in more generalized mammals, and in many cases is absent altogether.

In the Hippopotamus (1, 3) the two heads are separable as far as the pisiform.

In the Suidæ (4, 7, 11, 14) the olecranal head is absent. In the Camel (17) both heads are present.

In the Tragulidæ the olecranal head was present though feeble in our specimen (21), but it is not mentioned by Kinberg (X.).

In the Cervidæ the Brockets (27, 28) have both heads. In the Giraffe, Joly and Lavocat (XII.) neither figure nor mention the olecranal head.

In the Bovidæ, Lesbres points out that the olecranal head is feeble; it is present in the Ox (42), Sheep (45), and Goat (48), but not in the Duiker-bok (49). In the Tapiridæ, Lesbres says that it is almost fibrous; but in other specimens (52, 54, 55) both heads seem present though small.

In the Horse neither Bronn (VI.) nor Chauveau (II.) mention the olecranal head, while Lesbres says that it is very slight. In the Rhinoceros (63, 64) both heads are present.

Among the Subungulata also both heads are present and well developed in Hyrax (67, 68) (see text-fig. 91) and Elephas (74, 78, 79).

Flexor profundus digitorum.—As we have pointed out elsewhere, the flexor profundus of a generalized mammal consists of three heads from the internal condyle—condylo-radial, condylo-central, and condylo-ulnar—and one each from the radius and ulna. In Man the condylar heads are usually suppressed; but in Ungulates the ulnar and especially the radial heads are feebly developed. In the Hippopotamus (3) the three condylar heads are distinct, and there is a small ulnar origin from the olecranon. In (1) Gratiolet and Alix only mention one condylar origin and one from the ulna; but in addition it is very interesting to note that they found a continuation from the triceps to the muscle, winding round the internal condyle in the same way that we have already recorded among the Edentata in *Myrmecophaga*, *Tamandua*, *Cyclothurus*, and *Orycteropus* (P. Z. S. 1899, p. 330). The muscle divides into four tendons for the index, medius, annularis, and minimus.

In the Suidæ (11, 14), as one would be inclined to expect, all the five origins of the generalized muscle are present, and the insertion is into all four digits.

In the Tragulidæ our specimen (21) showed only one large condylar head, an ulnar from the olecranon, and a very small radial, but Kinberg made out two condylar origins in his specimen (20). The insertion is into the medius and annularis. In the Water-Chevrotain (*Dorcatherium*) Chatin found one condylar, one ulnar, and one radial origin, and tendons passed to all four digits.

Among the Cervidæ, the Deer (26) had a condylar, olecranal, and radial head, while in the Brocket (27) there were: (1) condylo-ulnaris, which was the largest; (2) condylo-radialis, next in size; (3) ulnaris, from olecranon only; and (4) radialis, smallest of all. Tendons only passed to the medius and annularis digits.

In the Giraffe (29) the origin seems to correspond with that of the Brocket.

In the Bovidæ (35, 36, 37, 40, 44) there are either one or two condylar origins as well as a radial and ulnar. The Duiker-bok (49), however, is remarkable for having all three condylar origins and no radial. The insertion in this family is into the medius and annularis only, except in the Musk-Ox (37), where there are two very small tendons for the lateral digits. In the Tapir Murie (XVII.) notices the presence of the condylo-ulnar slip, and the insertion is into all four digits (52, 55). In our specimen (54) there were (1) condylo-ulnar, (2) condylo-central, (3) ulnar (olecranal), and (4) radial origins. In the Horse (56, 58) there are condylar, radial, and olecranal heads, and the insertion of course is only into the medius.

The Rhinoceros (63) apparently has two condylar heads, one of which Beddard and Treves call palmaris longus. The insertion is into all three digits.

In the Hyrax (68) we found one condylar head rising in common with the flexor sublimis and probably corresponding to the condylo-radialis, there were also radial and ulnar heads. The insertion (67, 68) is into all four digits.

In the Elephant (77, 78) there are radio-condylar, radial, and ulnar heads and the insertion is into all five digits (74). Anderson (XXVII.) describes a radio-carpeus rising from the anterior surface of the radius, external to the attachment of the pronator radii teres, and corresponding to the origin of the flexor longus pollicis in Man; it is inserted into the anterior annular ligament and is apparently also present as the muscle marked ξ in Cuvier and Laurillard's plate (I.).

We are able to give the following details of the nerve-supply. In the Pig (11) and Peccary (14) the condylo-radialis, condylo-centralis, and radialis slips are supplied entirely by the median, the ulnaris entirely by the ulnar, while the condylo-ulnaris gets a twig from both the median and ulnar.

In the Brocket (27) the condylo-radialis and radialis are supplied by the median, the ulnaris by the ulnar, and the condylo-ulnaris by the median and ulnar.

In the Duiker-bok (49) the condylo-radial and condylo-central heads were supplied by the median, the ulnaris by the ulnar, while the condylo-ulnar was entirely supplied by the ulnar.

Lumbricales.—In the Hippopotamus (1) there was only one lumbrical rising from the annularis tendon. In the Suidæ (4, 6, 11) one from the index tendon of the flexor profundus. In the Tragulidæ, Kinberg's Chevrotain (20) had one evidently belonging to the annularis, but in Chatin's Water-Chevrotain (XI.) the index one was apparently alone present. In the Cervidæ (25, 26, 27, 28) and the Bovidæ (33, 35, 36, 37, 38, 40, 43, 49) no lumbricals are present. In the Tapiridæ (54, 55) there are three, for the index, medius, and annularis. In the Equidæ (56, 57, 58) two, one from each side of the single profundus tendon, corresponding therefore to medius and annularis.

In the Rhinoceros there are none according to Beddard and Treves (XX.).

In the Hyrax (67, 68) the medius and annularis are present, but Meckel failed to find any in his specimen (71) (see text-fig. 91).

In the Elephant (74) there were four, but in (73) and (78) the ulnar one was wanting.

Pronator quadratus.—The only ungulate in which we have been able to find any notice of this muscle is the Tapir (55), in which Murie says that it occupies the lower quarter of the forearm.

In our Tapir (54) and in all the other Ungulates we examined the muscle is absent.

Supinator longus.—This muscle was found in the Hippopotamus (1) but not in (3), in the Tapir (52, 53, 54, 55), in the Rhinoceros (63, 64), and in the Elephant (73, 74, 78, 79); in the latter animal it is prolonged beyond the styloid process of the radius to one of the carpal bones, apparently the lunare; in Cuvier and Laurillard's specimen (77), however, it is absent. In our Hyrax (68) it was entirely wanting, but in Mivart and Murie's (67) it is described as very diminutive and inserted into the radius near its neck [1].

In other Ungulates the muscle is absent. When it is present it is doubtless supplied by the musculo-spiral; our reason for thinking this is that we know that the extensor carpi radialis longior is so supplied.

Extensor carpi radiales longior & brevior.—It is only occasionally that these two muscles are found distinct in the Ungulates, more frequently they are either fused or the extensor longus is suppressed. In the Hippopotamus there is only one muscle which is inserted into the metacarpal bone of the medius (1, 3), but in (3) a slip is given off which joins the extensor communis tendon to the index. In the Suidæ (4, 5, 7, 10, 11, 13, 14) the brevis only is present and is inserted into the metacarpal bone of the medius. In the Camelidæ (17, 18), Tragulidæ (20, 21), with the exception of *Dorcatherium*, Cervidæ (25, 26, 27, 28), Giraffidæ (29), Bovidæ (33, 35, 36, 37, 38, 40, 43, 49), Equidæ (56, 58), and Rhinocerotidæ (63, 64) there is only one muscle, which at least is chiefly composed of the brevior; it is very large and forms a broad strap-like tendon, which plays over the lower end of the extensor surface of the ulna and is inserted into the dorsal surface of the base of the large canon-bone, which is composed of the third or third and fourth metacarpals; it is *the* important extensor of the carpus, and reminds one of the ligamentum patellæ in the knee except that no sesamoid bone (patella) is developed in it. In the Water-Chevrotain (*Dorcatherium* 23), which, possibly as an adaptation to its swimming-habits, retains a more generalized arrangement of its forearm musculature, the extensor longior is also present. In the Tapiridæ there may be a single insertion into the third metacarpal (54), or a small slip may be given off for the second as well (55). In the Procaviidæ (67, 68, 71) the longior and brevior are distinct and separate muscles. In the Elephantidæ (73, 74, 77, 78, 79) there is one muscle but it ends in two tendons for the second and third metacarpals.

With regard to the nerve-supply, the musculo-spiral supplies it in the Pig (11), Peccary (14), Brocket (27), and Elephant (79), the posterior interosseous in the Duiker-bok (49).

Extensor communis digitorum.—This has the usual origin from the external condyle and is usually inserted into the middle and

[1] Possibly this is supinator brevis.

distal phalanges of a variable number of digits. In the Hippopotamus (1, 3) tendons pass to all four digits. Gratiolet (III. pl. v.) draws and describes two distinct fleshy bellies which unite below the dorsal annular ligament and again divide for the four digits. In the Suidæ the number of digits supplied varies a good deal: for instance in the Domestic Pig (4, 5, 6, 7) there are three fleshy bellies which are distributed with varying detail to all four digits; in the Red-River Hog (11) no tendon goes to the minimus; in one Peccary (13) there are four fleshy bellies which altogether divide into eight tendons for the four toes in such a way that the medius has one tendon for each phalanx, the annularis also three tendons, while the index and minimus have one each; in another Peccary all the tendons are distributed to the medius and annularis.

In the Camelidæ (15, 17, 18) there are slips for the medius and annularis, the former having two.

In the Tragulidæ (20, 21, 23) all four toes are supplied, though here again the medius has two tendons.

In the Cervidæ (25, 26, 27, 28) and Giraffidæ (29) only the medius and annularis are provided with tendons. In (25) and (28) we found an extra small origin from the ulna.

In the Bovidæ (32, 33, 36, 38, 39, 43, 44, 48, 49) there are two tendons for the medius and one for the annularis; the muscle is double almost from its origin, the more ulnar of the two dividing for the medius and annularis, while the radial one passes to the medius only and in many cases at all events ends in the middle phalanx of that digit. The Musk-Ox (37) differs from the rest of the Bovidæ in having a tendon to the index from the radial of the two fleshy bellies.

The Tapir (53, 54, 55) has tendons for the index, medius, and annularis, and our specimen (54) had in addition a slender slip for the minimus. Murie (XVII.) noticed a small origin from the ulna in his animal (55).

In the Equidæ (56, 58, 60) there is a small origin from the radius as well as the usual one from the external condyle; the muscle divides into the usual two fleshy bellies, one of which passes to the terminal phalanx of the medius, while the other joins the so-called extensor minimi digiti.

In the Rhinoceros (63) there are tendons for all three digits.

In the Procaviidæ (67, 68, 71) all four digits have tendons, and the same observation applies to the Elephant (74, 77, 78).

Two points strike one in reviewing this muscle in the Ungulata. The first is that an extra origin from one of the forearm-bones is often found; the other that the muscle divides high up and forms many tendons for few toes, so that two or more phalanges of one toe may each be acted upon by its own tendon. This is the more curious when one thinks of the one function which the fore-foot of an ungulate is called upon to play; but the possible explanation is that the muscle acts chiefly from the foot, and that when this is planted on the ground the different slips act one after another in pulling the forearm and arm forwards over the foot, as the varying position of the phalanges gives each one a temporary advantage.

Extensor minimi digiti (*Extensor digitorum lateralis*).—This muscle rises from the external condyle and deep fascia and occasionally gains some fibres from the upper end of the radius. Its usual insertion is either into the annularis or minimus or both digits. We have often noticed that the tendon to the annularis is inserted into the middle phalanx, leaving the extensor communis to supply the terminal phalanx, but whether this is the normal arrangement or not our material does not allow us to say.

In the Hippopotamus tendons may pass to the 4th and 5th digits (1) or to the 5th only (3). In the Suidæ it is usually the 4th and 5th (annularis and minimus) (5, 6, 7, 13, 14), but sometimes the minimus only (4, 11). In the Camel (15, 17) annularis only. In the Chevrotain (20) and Water-Chevrotain (23) annularis and minimus. In the Cervidæ usually to the annularis only (Bell XIV. 27, 28), but Lesbres found it going to annularis and minimus. In the Giraffe (29) and all the Bovidæ (32, 33, 34, 35, 36, 37, 38, 39, 40, 40, 41, 49) to the annularis only. In this last family Chauveau describes an extra origin from the upper end of the radius. In the Tapir (52, 54, 55) there are slips to the annularis and minimus. Murie found in his animal (55) three muscles coming from the external condyle in addition to the extensor communis, two of these went to the annularis and minimus and one to the minimus only; he homologizes these muscles with the peroneals.

In the Equidæ (56, 58, 60) the muscle is very small and has lost its condylar attachment and slipped down to the external lateral ligament and upper part of radius and ulna. Its insertion is into the proximal phalanx of the medius. In the Rhinoceros (63, 64) the insertion is into the medius and annularis. In the Hyrax (67, 68) there were tendons for the annularis and minimus, the annularis going to the proximal phalanx in (67), and to the head of the metacarpal according to Mivart and Murie (XXIV.) in (68). In Meckel's specimen (71) there was only one tendon, which went to the proximal phalanx of the minimus.

In the Elephant the muscle rises from the condyle and ulna (74, 78), it is inserted into the annularis and minimus (74, 77) or into the minimus alone (78). The nerve-supply is from the posterior interosseous.

Extensor carpi ulnaris; also called *posterior ulnaris, ulnaris externus,* and *flexor metacarpi externus.*—This muscle in the Ungulates is in most instances a powerful flexor of the carpus, and passes from the external condyle to the pisiform bone, just before which it often joins the tendon of the flexor carpi ulnaris; it also usually gives off a slip to be inserted into the fourth or fifth metacarpal, if it is present. The muscle is well developed in the Hippopotamus (1, 3), but in the Suidæ (4, 5, 7, 11, 13, 14) it is small and in some cases almost entirely tendinous. In the

Tragulidæ (20, 21, 23), Cervidæ (25, 26, 27, 28), and Bovidæ (32, 33, 34, 35, 36, 38, 39, 40, 41, 43, 48, 49) it is very well marked and forms the chief flexor of the carpus. In the Tapir (54) it is chiefly inserted into the metacarpal bone of the minimus. In the Equidæ (56, 58, 59, 61) one part goes as usual to the pisiform with the flexor carpi ulnaris, the other is inserted into the rudimentary fourth metacarpal. In the Rhinoceros (63) it is figured but not described, it seems to be largely inserted into the metacarpal bone of the annularis. In the Hyrax (67) and Elephant (74, 77, 78, 79) the muscle, though still an important flexor, is chiefly inserted into the metacarpal of the minimus. The conversion of this muscle from an extensor to a flexor is correlated with two compensatory changes: firstly, the extensor carpi radialis is much enlarged and does all the extension of the carpus; secondly, the flexor carpi ulnaris is reduced in importance and its olecranal head is often absent.

The nerve-supply is the posterior interosseous in the Pig, Duiker-bok, Sheep, Hyrax, and Elephant.

Supinator brevis.—This muscle is described by Bronn as entirely absent in the Ungulata, and with two exceptions we can confirm his statement. In the Pig (V.) Lesbres found it once, and Chauveau (II.) says that in this animal it is extremely thin. In our specimens of Suidæ (11, 14) no trace of it could be found. In the Hyrax (68) we found it as a mere tendon, which is continued into the superficial plane of the extensor ossis metacarpi pollicis; but in Mivart and Murie's animal (67) there is no mention of it, though possibly the muscle which these authors describe as supinator longus may, in reality, be supinator brevis. The muscle was so aborted that we could trace no nerve to it.

Extensor ossis metacarpi pollicis.—In the Hippopotamus (3) this rises from the shaft of the ulna, and is inserted (1) into the radial side of the carpus.

In the Suidæ (4, 5, 7, 9, 11, 13, 14) it is small, and rises from below the middle of both forearm bones to be inserted into the proximal end of the metacarpal bone of the index.

In the Tragulidæ (20, 21, 22, 23) it rises from the ulna, and has the same insertion as in the Suidæ; in our specimen (21) it was almost entirely tendinous, but in Kinberg's (20) seems to be well developed, since it rises from the lower half of the ulna. In the Camelidæ (15, 16), Cervidæ (26, 27, 28), Giraffidæ (29), and Bovidæ (32, 33, 36, 38, 39, 43, 48, 49) it is inserted into the canon-bone (3rd and 4th fused metacarpals), but sometimes (26, 27, 28, 49) a sesamoid bone is found in its tendon which, from careful examination of the Duiker-bok (49), we believe is the vestige of the index metacarpal. In the Tapir (54, 55) it is well developed, rises from almost the whole length of the radius and ulna, and is inserted into the index metacarpal. In the Horse, Bronn (VI.) says it is absent, but Chauveau (II.) and Lesbres (V.) agree that it is present, though feeble, and inserted into the rudimentary index metacarpal. In the Rhinoceros (63,

64) it has the same attachments, but in 63 an extra head was found coming from the external condyle; there is just a possibility that this is really supinator brevis.

In the Hyrax (67, 68, 71) the extensor pollicis is large and is inserted into the rudimentary metacarpal bone of the pollex; in our specimen, as we have mentioned before, the supinator brevis is continued into it, and this we think may account for the condylar head in Beddard and Treves's Rhinoceros. In the Elephant (74, 77, 78) the muscle runs from the radius and ulna to the metacarpal bone of the pollex, and in 78 to that of the index also. In Paterson and Dun's Elephant (79) the muscle was inserted into the trapezium and 1st metacarpal. The nerve-supply is the posterior interosseous.

Extensores primi et secundi internodii pollicis.—The only record of these muscles which we have been able to find is in the Elephant (74), where Miall and Greenwood found a slip from the extensor profundus digitorum going to the pollex, but this was not seen in 77 or 78.

Extensor profundus digitorum. — This muscle includes the extensor indicis. In the Pig (5, 6) it was found passing from the forearm below the origin of the ext. oss. metacarpi to the index and medius digits, but we did not find it in our Pig (11) or Peccary (14). In the Elephant (74, 77, 78) there is one tendon to the index. In no other ungulate was any trace of it found.

Thenar Muscles.—In only three Ungulates are there any traces of these muscles. In the Pig (7) Cuvier and Laurillard figure an abductor indicis which, from its position, may be an abductor pollicis which has shifted its insertion. In the Hyrax (67) Mivart and Murie found two muscles, possibly abductor and flexor brevis; in our specimen (68) there was only one rudimentary one, while Meckel (71) did not find any at all. In the Elephant (74) Miall and Greenwood found a muscle running from the os magnum to the sesamoid bone on the pollex, perhaps a flexor brevis pollicis; while Paterson and Dun (79) found two distinct muscles—an abductor rising from the trapezium, and a flexor brevis rising by two heads, from the trapezoid and the shaft of the 1st metacarpal respectively, and being inserted into the sesamoid bones at the head of the metacarpal. Both were supplied by the median nerve. These muscles are not recorded in other Elephants, nor are they present in the College of Surgeons specimen (78).

Hypothenar Muscles.—An abductor minimi digiti rising from pisiform is present in the following animals:—Hippopotamus (1), Pig (4, 6, 7, 11), Peccary (14), Chevrotain (20), Water-Chevrotain (23) (apparently), Tapir (55), Rhinoceros (63), Hyrax (67, 68), Elephant (74, 77, 78, 79). In the last animal (79) there is also a flexor brevis minimi digiti.

Oblique Adductor Muscles.—This layer of muscles is found only in the Pig (4, 6, 11, 14), the Chevrotain (20), and the Elephant (74, 79); in most of these there are adductores indicis et minimi, but in (74) only an adductor minimi. In (79) there was also an adductor quarti digiti.

Interossei or Flexores breves.—In the Pig (4, 6), Chevrotain (20), Water-Chevrotain (23), Tapir (55), and Hyrax (67, 68) there are four double-headed muscles corresponding to those of more generalized mammals. In the Horse (56, 57, 58) there are three, but Chauveau points out that the one belonging to the medius has been transformed into the "suspensory ligament" of the fetlock.

In the Rhinoceros (63) Beddard and Treves (XX.) describe four, but there are only three toes, and in their figure (fig. 5, p. 15) one muscle labelled interosseous clearly rises from the pisiform, and is probably an abductor minimi which has shifted its attachment to the annularis. In the Elephant (74) Miall and Greenwood describe three palmar and three dorsal interossei.

In the Bovidæ (32, 33, 35, 38, 39, 40, 49) there are two flexores breves, but they are entirely ligamentous.

Unfortunately, we know very little definitely about the nerve-supply of the hand-muscles of the Ungulates, but the researches of Paterson and Dun make us suspect that, in the Elephant at least, the median nerve plays a much larger part than it does in Man and, so far as we know, most other mammals. We hope that at some future date these authors will publish the result of their dissections.

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3. On the Spermatophores of the Earthworms of the Genus *Benhamia*. By FRANK E. BEDDARD, M.A., F.R.S.

[Received November 19, 1901.]

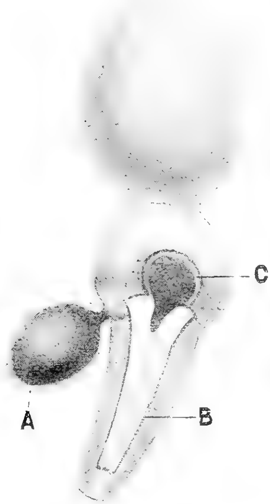
(Text-figures 92–94.)

At the present moment little is known of the spermatophores in this genus, except the fact that they occur in several species. So far as I am aware the following is the extent of our knowledge on this matter. Dr. Michaelsen has reported upon the structure of the spermatophore of *Benhamia monticola*[1] in the following words:—"Fast jede der untersuchten Samentaschen enthielt eine grosse Spermatophore, die den grössten Theil des Raumes der Tasche in Anspruch nahm. Eine solche Spermatophore hat die Gestalt einer langhalsigen Karaffe. Der Bauch derselben liegt in dem Hauptraum der Samentasche, der röhrenförmige Hals in dem Ausführungsgang. Das aussere Ende des Halses schien bei den herausprepärirten Spermatophore offen zu sein; doch ist es möglich das ein Verschluss abgefallen ist." A briefer note in the same memoir concerns the spermatophore of *Benhamia itiolensis*.

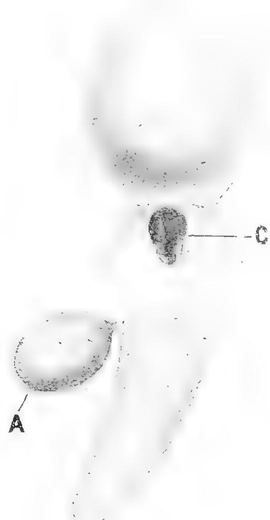
[1] "Die Regenwürmer Ost-Afrikas," in Deutsch-Ost-Afrika, pp. 27 & 28, pl. i. figs. 1 & 4.

In the spermathecal pouch of that species is found—"ein festerer, mit hornartiger Wandung versehener Körper, den ich für eine Spermatophore halte." Of both these structures are figures given. Finally I have myself called attention to the spermatophore of a species of *Benhamia*, which I have called *B. moorei* [1]. This spermatophore is of large size and lies chiefly in the long and thick muscular duct of the spermatheca. I have recently studied the spermatophores in a new species of the genus *Benhamia* kindly collected for me in tropical Eastern Africa by Mr. Austen, and which I have proposed to call *Benhamia austeni* [2]. The spermatophores were studied *in situ* by means of glycerine preparations of

Text-fig. 92.



Text-fig. 93.



Text-fig. 92.—Spermatheca of *Benhamia austeni*.
A, diverticulum; C, B, parts of spermatophore.

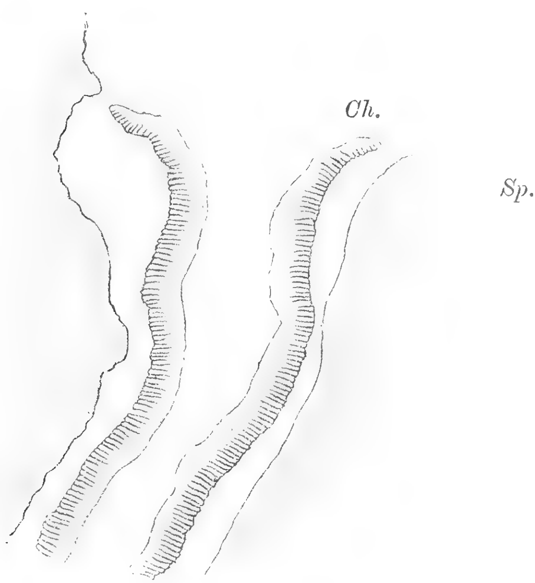
Text-fig. 93.—Spermatheca of *Benhamia austeni* with an incompletely formed spermatophore (C).
A, diverticulum of spermatheca.

the spermathecæ mounted entire or teased, and by longitudinal sections of the entire spermatheca. The spermathecæ of this species (see text-fig. 92), like those of some others, consist of a large thin-walled sac, which is divided by a constriction into a larger distal and a smaller proximal portion. The latter is followed by a thick-walled duct leading to the exterior. At the junction of the duct with the smaller of the thin-walled pouches opens a single

[1] P.Z.S. 1901, ii. p. 197.
[2] *Loc. cit.* p. 206.

oval-contoured diverticulum by means of a short and slender duct. The latter, as is the rule with the diverticula of the Megascolicidæ, is filled with a felted mass of spermatozoa. In no one instance out of the many spermathecæ which I have examined did I find an entire absence of spermatophores; but they were fully developed in but few. The spermatophore of this worm has a remarkable form and mode of origin. The muscular duct of the spermatheca was sometimes quite empty of any traces of a spermatophore. In other specimens it was occupied (see text-fig. 92) by a body of apparently chitinous structure and of a trumpet-shape, as is shown in the figure referred to. This body contains a lumen which appears to be open at both ends. The upper end is like the mouth of a trumpet, and is wider than the section which follows. It is closely applied to the walls of the spermatheca, and its shape is indeed an expression of this close contact. The trumpet-shaped extremity corresponds to the widening of the duct to form the thin-walled pouch of the spermatheca; the edges of the spermatophore are here curved outwards, and again slightly downwards. At the opposite end there is no diminution of calibre until the very end. At this extremity the spermatophore ends before the end of the spermathecal duct in which it lies, and apparently by an open mouth, as is figured by Michaelsen in the spermatophore of *Benhamia monticola*. A closer examination of this trumpet-shaped or quiver-shaped tube, by compression in glycerine, and by sections (text-fig. 94, p. 707), enables the structure to be seen. It is hardly at all stained by the carmine which was used; a fact which shows its likeness to chitin, of which I cannot doubt that it is formed. It has, however, a definite and characteristic minute structure. The walls are very thick in the shaft region, and thin out considerably as the case widens out to form the trumpet-shaped mouth with its slightly-recurved edges. The thick part of the walls consists of two layers. The inner layer which borders upon the lumen appears to be quite structureless, and it resembles exactly the thick chitinous lining of the gizzard of earthworms. Outside of this the spermatophoral walls are composed of a parallel series of oblong pieces closely adpressed, but tending to come apart in sections. These correspond, I take it, to the individual cells of the lining membrane of the spermathecal duct. The separation of the individual contributions of these cells may be a mark of fatigue, so to speak, on the part of the cells after throwing out the abundant matter required to form the inner half of the spermatophoral case. They are an indication that the secretion of chitinous matter is getting less active. When the spermatophore is viewed from the outside, these brick-like constituents form a kind of mosaic upon its surface. I have found no variation in the form of this half of the spermatophore; indeed the identical form of the spermatheca leaves no room for variation. It must be noted that there can be no doubt that this chitinous case is formed where it is found; it is altogether too large to have been produced by the thin ducts of the spermiducal glands and then to have been transferred to where it is found. This structure, however, is not all of the spermatophore. The fully-developed spermatophore is built up of two pieces, of which the second has apparently the following origin, and has certainly the following characters. Very constantly I have found in one or other (not in both) division of the spermathecal pouch, in the thin-walled portion into which the duct expands (or rather opens, for the minute structure of the two divisions is different), a small chitinous case. This appears to have been seen and figured by Michaelsen in *Benhamia itiolensis*. The structure in question has an outline like a tear-drop (see text-fig. 93, p. 705) or the pendant

Text-fig. 94.



Longitudinal section through duct of spermatheca of *Benhamia austeni*, to show portion of spermatophore in position.

Sp., wall of spermathecal duct.
Ch., chitinous wall of spermatophore.

of a cut-glass chandelier. It is usually, in fact, broader at one end and narrower at the other, which is widely open. This small chitinous case is gorged with sperm, and it has been somewhat of a problem to me to understand how it is that the sperm remains inside. For in many instances these small cases were so widely open at the bottom—at the end, that is to say, which is turned towards the spermathecal duct. Why the sperm is not shed through sheer force of gravity, if for no other reason, is impossible for me to explain. The fact that these small cases are found in both the upper, larger, and the lower, smaller, half of the spermathecal pouch seems to me to show that they are formed in the first-named division of the spermatheca, and gradually make their way downwards. The cells which line the spermathecal pouch are tall and columnar, and may easily be responsible for the formation of the chitinous case, though I have no positive facts at my disposal which allow me to assert this mode of origin for the cases. The case itself does not show the complication of structure that is exhibited by the quiver-like case within the duct of the spermatheca. It is not thick, and shows no structure except some stratification. Now so far I have mentioned no connection between the small pear-shaped chitinous cases found in the spermathecal pouch and the large long case found in the spermathecal duct. There is, however, a connection which is in my opinion quite extraordinary. In specimens with what I consider to be fully-formed spermatophores, the top of the lower case, its trumpet-shaped funnel, is plugged by these small pear-shaped cases, by one of them at least, which, as it is pear-shaped and as the mouth of the trumpet-like case gradually diminishes in calibre, completely closes its orifice, and possibly fits in and remains in position by the simple process of being jambed tight within the tube. In any case I have (as is shown in text-fig. 92, p. 705) found the two in this juxtaposition. It seems to me that the small sperm-holding case gradually falls down, and therefore must end by falling into the widely open mouth of the chitinous tube below, as that tube completely blocks the orifice of the spermatheca. It exactly suggests a cup and ball.

I can see no other interpretation of the facts at my disposal than that which has been suggested. But in any case we have here, as apparently in other species of *Benhamia*, a spermatophore undoubtedly formed in the spermatheca, and not possibly to be accounted for by the activity of the glandular epithelium of the spermiducal glands; that is to say, the moulding at least must be accomplished within the spermatheca, though it is conceivable that the material may be derived from the spermiducal glands. But even this amount of share appears to me to be doubtful by reason of the apparent correspondence of the outer layer of the spermatophoral case with the epithelium of the spermathecal duct. What is the ultimate fate of these spermatophores must for the present be left undetermined. They have never been observed adherent to the body externally as in the case of the Lumbricidæ and the Geoscolecid genus *Alma*. If they are transferred to the cocoon along with the ripe ova, the formation of such an elaborate case appears to be a work of unnecessary activity. The unprotected sperm could, one would be disposed to consider, be conveyed thither without any difficulty or risk of loss. We are, however, totally unacquainted with the mode of copulation and fertilization of these Annelids. The occurrence of spermatophores in those

J. Green del. et lith. Mintern Bros. imp.

1. TRICHOBATRACHUS ROBUSTUS. 2, 3. GAMPSOSTEONYX BATESI.

earthworms which do not possess spermathecæ is intelligible enough, as some place is required for the storage of sperm, and the male ducts are not furnished with glandular or atrial appendices of sufficient roominess to enclose the liberated sperm. The question, however, raises the larger question of the meaning and homologies of the spermathecæ, which is one that is hardly ripe for discussion at present.

4. Further Notes on the African Batrachians *Trichobatrachus* and *Gampsosteonyx*. By G. A. Boulenger, F.R.S.

[Received November 19, 1901.]

(Plate XXXVIII.)

Since the publication, in the Society's Proceedings [1], of the account of the Batrachians and Reptiles obtained in the Gaboon district by Mr. G. L. Bates, further collections have been received at the Natural History Museum, made by that energetic collector in the same district and also in the Bulu Country, Camaroons. Among the Batrachians sent from the latter country, I was happy to find further examples of the two Frogs which have been described as *Trichobatrachus robustus* and *Gampsosteonyx batesi*, the former upon two specimens, the latter upon a single one, and this fresh material adds much to our knowledge of these extraordinary Batrachians.

Trichobatrachus is now represented by seven further specimens. With reference to the villose dermal papillæ, from which the name is derived, I observed in the original description that I suspected it to be a mere seasonal peculiarity, which, far from being a nuptial attribute of the males, as one might have been inclined to suppose from analogy with various fishes, is more strongly developed in the female than in the male. Dr. Gadow, who, with the assistance of Mr. F. F. Laidlaw, has since made an examination of the histological structure of these hair-like appendages, remarks [2] that they consist of finger-shaped prolongations of the skin with an axis of fibrous connective tissue which is a little denser than the neighbouring skin; small, very insignificant blood-vessels and lymph-spaces are present, but no nerves or nerve-terminations could be detected; they are therefore not sensory organs. We possess no clue whatever to their physiological signification. Now, of the five adult new specimens, two are males and three are females, evidently obtained during the breeding-season, as evidenced by the nuptial asperities on the inner finger of the males and by the state of the oviducts of one of the females, filled with very large ova 4 millim. in diameter; and these males have the hair-like

[1] P. Z. S. 1900, p. 433.
[2] Anat. Anz. xviii. 1900, p. 588.

papillæ much more developed than in the original specimens, whilst the females show no trace of them. The larger male, which is figured here (Pl. XXXVIII. fig. 1), measures 107 millim. from snout to vent, and the villosities measure up to 7 millim. on the sides of the body, 5 on the sides of the thighs; the second male measures 100 millim. from snout to vent, and the villosities of the body and thighs 15 and 12 millim. respectively. I have also ascertained that the claw-shaped phalanx of the toes is present as in *Gampsosteonyx*, but does not always project through the skin.

Four specimens of *Gampsosteonyx* were obtained in the Bulu Country. These further substantiate the comparison which I established between the exposed extremity of the claw-like phalanx of the toes and the end of the ribs in *Pleurodeles*, since here likewise the character is not an attribute of all individuals; in two out of the five specimens examined, the curious conformation could not be detected externally. One of these specimens I have had prepared as a skeleton, and, to my great surprise, it was found that distally and dorsally to the "claw" there is a small detached ossification, which is also well shown in a sciagraph of another specimen, kindly taken for me by Mr. Gardiner, to whom I am indebted for similar favours in the past. This unique feature is a great puzzle. Is it to be looked upon simply as an additional ossicle, or are we to assume that the intercalary ossification which occurs between the penultimate and distal phalanges of many Ranid genera has here attained an exceptional hypertrophy, whilst the distal has undergone atrophy? Another very peculiar feature of the limb-skeleton of *Gampsosteonyx* is the presence of large sesamoid bones under the articulations of the metacarpals with the basal phalanges of all four fingers and of the first and second phalanges of the two outer fingers. Smaller sesamoid bones are present in the pes. The number of phalanges in the manus is the same as in *Rana*, viz. 2, 2, 3, 3. The whole skeleton is typically Ranid, but the so-called sternum is only strongly calcified, not bearing a true bony style, as stated in the original description; the omosternum, on the other hand, is supported by a bony style, which is forked at the base.

As in *Trichobatrachus*, the ova are of great size. A female measuring 80 millim. from snout to vent contains about 15 ripe ova on the right side and 30 on the left, each measuring 4 millim. in diameter. A breeding male, measuring 52 millim. from snout to vent, is provided with an internal gular vocal sac, and the inner surface of the inner metacarpal joint is covered with a black layer formed of crowded minute horny asperities.

EXPLANATION OF PLATE XXXVIII.

Fig. 1. *Trichobatrachus robustus*, breeding male.
2. *Gampsosteonyx batesi*, lower aspect of skeleton of right manus, $\times 1\frac{1}{2}$.
3. Side view of skeleton of left foot of same, $\times 1\frac{1}{2}$.

5. On some Butterflies from St. Lucia, W. Indies, collected by Major A. H. Cowie, R.E., F.Z.S. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Received November 20, 1901.]

The collection of which the following is an account was forwarded to me by our Secretary on September 4th of the present year, with a request that I would send him a list of the species for publication.

The series of insects forwarded consists of 149 Butterflies, 2 Moths, a Locust, 2 Dragonflies, and an Ant-lion. The Moths are identified by Sir George Hampson as *Mulelocha* sp. and *Thermesia gemmatalis*. Respecting the Orthoptera and Neuroptera, Mr. W. F. Kirby reports that "they are all widely distributed species in Tropical America, except *Myrmeleon leachii*, which appears to be confined to the West Indies."

Orthoptera (Fam. Phasgonuridæ).

Conocephalus macropterus Redtenbacher, Verh. z.-b. G. Wien, xli. p. 402 (1891).

Neuroptera (Fam. Libellulidæ).

Trithemis umbrata (*Libellula u.*) Linn. S. N. x. 1, p. 545 (1758).

(Fam. Myrmeleonidæ).

Myrmeleon leachii (*Formicaleo l.*) Guilding, T. Linn. S. Lond. xvi. p. 49. Originally described from St. Vincent. It also occurs in Bermuda and Jamaica, and doubtless in other islands."

The Butterflies now sent by Major A. H. Cowie, R.E., F.Z.S., consist of examples of twenty-one species, of which one—*Cystineura cowiana*—is new. There seems to be a considerable resemblance between the Butterfly-fauna of this island and that of Dominica.

The following is a list of the Butterflies:—

Nymphalidæ.

1. Anosia archippus, var. megalippe Hübn.

The specimens show considerable variation in the black bordering to the veins.

2. Precis genoveva Cram.

Both sexes agreeing perfectly with those from other West Indian islands.

3. Anartia iatrophæ Linn., and var. saturata Stgr.

Judging from analogy the variety named by Staudinger should be the wet phase of the species; those received in the present collection are rather intermediate in character, the orange suffusion on the outer areas of the wings being very slightly indicated, though the markings below are well-defined and the ocelli large and distinct. I am inclined to conclude therefore that such differences as occur in St. Lucia may be purely varietal and not subject to seasonal influence.

4. Marpesia peleus Sulzer.

5. Cystineura cowiana (new species).

6. Dione vanillæ Linn.

This appears to be very common in the island.

7. Dione julia Fabr.

Lycænidæ.

8. Syntarucus cassius Cram.

The New World forms of *Syntarucus* differ from those of the Old World in the absence of a tail to the secondaries, but in all other structural characters they agree: the general pattern is very similar; and, if all the forms referred to *S. cassius* are really modifications of one species, the variability of that butterfly must be quite equal to that of *S. telicanus*. I have not, however, seen any Continental examples so boldly marked or with so few bands on the under surface of the primaries as in the examples occurring in St. Lucia and Dominica.

9. Chilades hanno Stoll.

I have been unable to find any structural difference between the Old and New World forms of this genus.

10. Callicista salona ♀ Hewits.

The genus *Callicista* was founded by Grote for a little group of hairy-eyed *Theclinæ* of dull colouring, the males of which show a conspicuous black sexual brand at the end of the discoidal cell of primaries; the first two subcostal branches of these wings are emitted well before the end of the cell, the third branch and the upper radial being emitted almost from one point at the superior angle of the cell.

Papilionidæ.

11. Terias venusta Boisd.

A common species both in St. Lucia and Dominica.

12. Callidryas sennæ var. Fabr.

The West Indian form appears constantly to differ at all seasons from typical *C. sennæ* ♀ in the smaller marginal spots and absence of the biangulated discal series of the primaries on the upper surface; that sex also seems to be invariably either sulphur-yellow or whitish, occasionally with a weak buffish tinge, but never golden yellow as in some females of *C. sennæ*. I doubt, however, whether the dry phase of the West Indian form can be separated from *C. drya*, the dry phase of *C. sennæ*.

This is the only species of the group in the present consignment, but one previously sent included three other species belonging to as many genera. A list of all the additional species then received will be added at the end of the present paper.

13. Pieris phileta Fabr., vars. *eubotea* Godart & *evonima* Boisd.

14. Glutophrissa poeyi Butl.

A male of the dry phase in poor condition.

15. Papilio xenodamas Hübn.

Hesperiidæ.

16. Eudamus proteus Linn.

17. Eudamus santiago Lucas.

18. Pyrgus syrichtus Fabr.

19. Hylephila phyleus Drury.

20. Catia ravola Godm.

21. Calpodes ethlius Cram.

New Species.

Cystineura cowiana, sp. n.

Nearest to *C. cana*, from which it differs constantly in the fact that the broad white belt across the disk of the primaries [1] is represented by a trifid oblique bar beyond the cell; an ill-defined conical belt crossed and interrupted by the median branches; and a discal series of small spots varying in number, sometimes reduced to three on the upper surface of the female: on the upper surface of the secondaries the broad central belt is ochraceous excepting above the subcostal vein, and the white belt which follows it is much divided up by the nervures or suffused with fuscous; on the under surface the reduction to spots of the white belt of the primaries represents the chief difference between the two species. Expanse of wings 44–52 mm.

St. Lucia and Trinidad. B.M.

Had we only possessed one or two examples of this species, I should have thought it possible that it might be a variety of *C. cana*; but Major Cowie sends seven examples (one shattered), and we previously possessed four from Trinidad; it thus becomes clear that we have to do here with a constant West Indian type related to but distinct from *C. cana*.

Specimens of the following additional species, mostly in poor condition, had been previously received through our Secretary from St. Lucia.

[1] The white markings on the upper surface are sometimes obliterated in the female, but on the under surface they are always distinct.

NYMPHALIDÆ.

22. PYRAMEIS CARDUI Linn.
23. HYPOLIMNAS MISIPPUS Linn.
24. CYMATOGRAMMA DOMINICANA Godm. (A mere fragment.)
25. AGANISTHOS ODIUS Fabr.
26. DIONE JUNO Cram.

PAPILIONIDÆ.

27. RHABDODRYAS TRITE Linn.
28. PHŒBIS AGARITHE Boisd.
29. APHRISSA STATIRA var. Cram.
30. PAPILIO PIRANTHUS Cram.

6. On the Spawn and Young of a Polychæte Worm of the Genus *Marphysa*. By L. A. BORRADAILE, M.A. F.Z.S., Lecturer in Natural Sciences at Selwyn College, Cambridge.

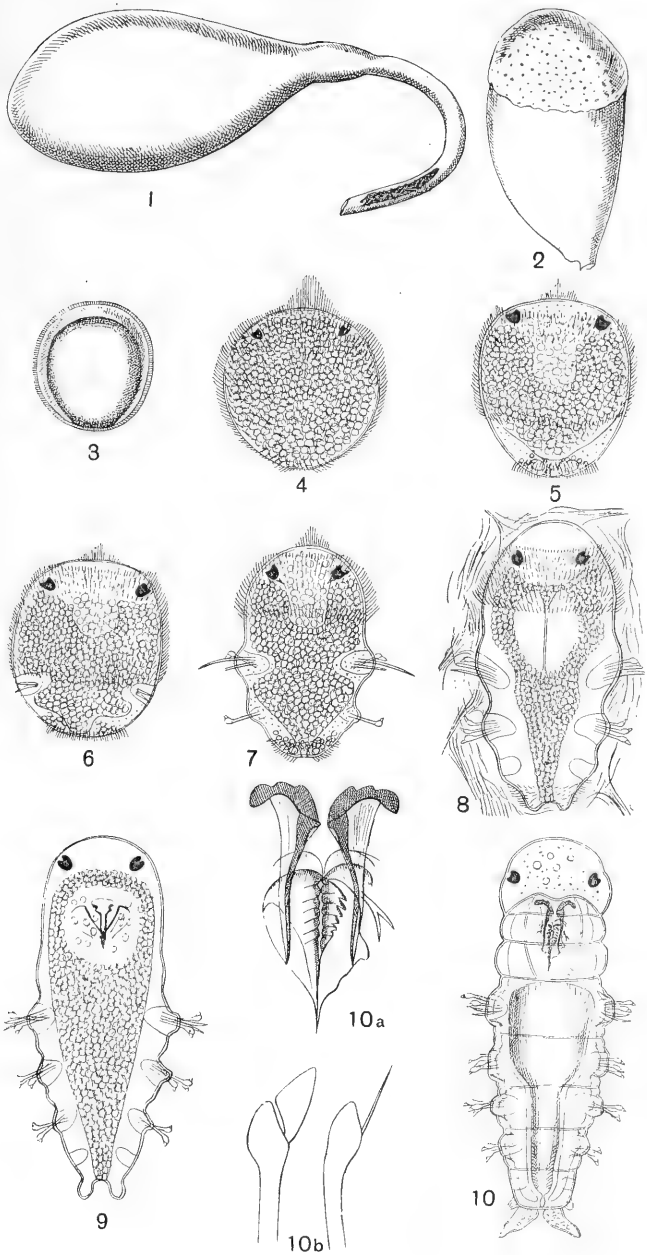
[Received July 27, 1901.]

(Plate XXXIX.[1])

The Jafna district in the extreme north of Ceylon presents a striking contrast to the rest of the island. Instead of the rainy hills of the south central districts, the jungle of the centre, or the swampy plains of the south and west, all equally covered with luxuriant vegetation, there are here flat, dry, sandy plains of coral-limestone, endowed with the lowest rainfall in the island and bearing a scanty growth of palmyra-palms, *Ricinus*-bushes, aloes, and cactus. These plains are intersected by a system of shallow salt-water lagoons, communicating with the sea at three points only—on the west at Jafna, on the east at Chundikulam, and on the north near the little native village of Tondimanar.

From the Tondimanar entrance a lagoon runs southward for some half-dozen miles inland and then breaks into two arms, extending south-east and south-west at an obtuse angle. The western arm finally ends by joining the large expanse of water south-east of Jafna, which, opening to the sea both on the east and on the west, makes the Jafna district an island. The seaward opening at Tondimanar is narrow and is almost closed by a sand-bank at low tide. At high water there is free communication, and the level of the lagoon of course rises and falls with that of the sea, the water running out with a strong current at the ebb. The bottom is of white sandy mud covering darker greyish mud, with patches of weed in parts. The depth at low water is nowhere more than three feet.

[1] For explanation of the Plate, see p. 720.



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YOUNG OF A WORM OF THE GENUS MARPHYSA

In the month of May, 1899, I spent a fortnight at Kankesanturai, a small native town situated on the north coast five or six miles west of Tondimanar. From here it was easy to reach the lagoon at its southward entrance, and I naturally made excursions thither, exploring the shallow waters on a native raft or catamaran. Punting along in one of these, with the midday sun blazing overhead and the water swirling up, hot and salt and stinging to the ankles, between the logs of the raft, my attention was caught by large numbers of little pear-shaped masses of jelly, attached to the bottom by their narrow ends and swinging to and fro with the movements of the water. The native fishermen told me that these were "the eggs of prawns," indicating a species of *Penæus* which is common in the sea near the mouth of the lagoon, and enters the latter at high tide, and of course no subsequent demonstration was of the least avail to shake this belief, which is entirely erroneous. Digging in the sandy bottom reveals the fact that the objects in question are spawn-masses of a polychæte worm of the genus *Marphysa* [1], which lies in its burrow [2] in the sand head downwards and sets free its eggs. These, with the jelly in which they are imbedded, pass upwards and form the pear-shaped mass.

The fully-formed spawn-mass (Pl. XXXIX. fig. 1) is about four inches in length, of which more than one inch is due to the stalk. It consists of a colourless translucent mucus, in which are imbedded small yellowish eggs, the whole being covered with a delicate transparent pellicle. How this pellicle is formed I did not discover, but would suggest that it is due to some change undergone by the surface-layer of the mucus. When it is torn the enclosed substance has a tendency to bulge out, as though it were under a slight tension within (Pl. XXXIX. fig. 2). The end of the stalk, which is inserted into, and fills, the opening of the burrow, contains a blackish or greenish mass of oval pellets, which seem to be the dung of the worm. The mucus, which is not divided into areas corresponding to the eggs, appears structureless under the microscope and contains numerous Infusorians. The enclosed eggs and young are in various stages, the older ones being generally on the outside and at the free end of the mass.

[1] Owing to an unfortunate accident to a portion of my material on the way from Ceylon to England, only one damaged specimen of this worm is in my possession. Dr. A. Willey has kindly identified this for me as a species of *Marphysa* allied to, or identical with, *M. teretiuscula*, Schmarda. Similar spawn-masses are also found in the lagoon at Minikoi on the sand-flat at the south end, in a spot where the conditions are not unlike those at Tondimanar in some respects—namely, in that there is a shallow sheet of water, fully exposed to the sun's rays, with a sandy bottom and with but a narrow opening to the sea. A few spawn-masses were found on a stretch of sand just outside the bar of the Tondimanar lagoon, but I did not meet with them either at Kankesanturai or on the south coast of Ceylon.

[2] This burrow, which extends to some distance in the sand, is perfectly definite, but has not very strong walls. In it there are often to be found, besides the *Marphysa*, specimens of a small Nereid closely allied to *Nereis brevicirris* Grube, 1867.

Several of these spawn-masses were brought in a vessel of water to the rest-house at Kankesanturaï, where, when they had been placed in shallow glass dishes, a number of larvæ hatched out of them and passed through the successive stages of their development until, as I was on the point of leaving for the south of the island, the observations were unfortunately broken off. The progress of the larvæ was, however, so rapid that, starting as spherical ciliated objects, they had, in the few days during which they were under observation, assumed a completely worm-like appearance. Their history, which I propose to describe in as great detail as my information will allow[1], shows an interesting feature in the secretion by the larvæ, after they have for some time been free-swimming, of a second mucous matrix, in which they live gregariously, much as some caterpillars do in the web which they spin.

1. The youngest embryo observed (Pl. XXXIX. fig. 3) was very nearly spherical in shape, about ·2 mm. in diameter, without eye-spots or cilia, and almost filled with a mass—presumably endodermal—of protoplasm containing yolky granules and droplets. Viewed with reflected light, this mass was yellow while the outer layer was white. The whole was enclosed in a thick radially-striated membrane.

2. To these succeeds a stage (Pl. XXXIX. fig. 4) in which the young, while still enclosed in the spawn-mass, develop two eye-spots in the anterior half of the sphere and a complete covering of cilia, by means of which they rotate in the mucus. The cuticle is thinner and its striation is less obvious. This "atrochal" or "holotrochal" stage resembles the pelagic larva described by Krohn and Schneider (**5**) as probably belonging to a Eunicid. The body of the latter larva, however, was more elongate, and the apical tuft longer.

3. At the hatching-stage the young larva (Pl. XXXIX. fig. 5) is oval, with a broad anterior end and a somewhat narrower hinder end. Round its middle is a broad ciliated band, separated by a narrow gap from a tuft of longer cilia at the apical pole and by a wider gap from a patch of medium length at the hinder end. These are the characters of Haecker's "Prototrochophora," which thus follows an atrochal stage in the present instance. In front, just within the anterior boundary of the ciliated band, is on each side a conical black eye-spot, with the apex of the cone directed backwards and inwards and its base hollowed for the reception of the—as yet indistinct—refractive body. The greater part of the interior of the body is filled by a yolky mass—the rudiment of the future mid-gut,—but at each end is a clearer granular area. The mid-gut rudiment projects backwards in the axial line towards the anal region, with which it seems to be already in connection by a narrow non-yolky passage, although, as no outward opening

[1] The same accident which deprived me of specimens of the adult worm having also destroyed my preserved material of the developmental stages, I am unable to deal with any but the outward features of the young and those which may be seen, when they are mounted whole, as transparent objects.

can be seen, this passage is probably only the space between the masses of mesoblast. A clearer area of squarish shape marks the position of the fore-gut.

The mouth cannot yet be seen in a surface view, and its relation to the ciliated band is therefore uncertain, but the fore-gut rudiment stands in the middle of the band.

On each side of the backward projection of the mid-gut rudiment is a space in which the first seta-sac will shortly arise. Behind this, on each side of the anal site, is a small mass of mesoblast, in the middle of which lies a rounded object, perhaps a pole-cell. The larvæ now work their way out of the mass of mucus, and swim about in a lively manner in the surrounding water by means of their cilia.

4. Very shortly after hatching (Pl. XXXIX. fig. 6) the first pair of seta-sacs appear towards the hinder end of the body. The setæ are at first only two in number and of simple form, one pointed at the end and the other somewhat blunter.

5. To these two setæ there is added, in the course of an hour or two, a third of a different form. This is a compound seta, having at its free end an oval swelling, flattened at one side, and bearing on the flattened surface a triangular end-joint, articulated to the seta by one angle of its base. When placed under a coverslip the larvæ now show movements of the body of an "euglenoid" nature, and protrude the setæ on a parapodium-like prominence, which, however, is very contractile and can be completely withdrawn. The form of the body is already more elongate than at hatching, owing to the gradual lengthening of the region between the main band of cilia and the perianal patch. It is in this region that the successive bundles of setæ will arise, the latest always at the hind end. As this process continues, the ciliated band becomes narrower and narrower, both absolutely and relatively to the whole length of the body, and is thus less and less efficient as an organ of locomotion.

6. About eighteen hours after hatching[1] (Pl. XXXIX. fig. 7) a second pair of seta-sacs appears behind the first, with a single seta in each. This seta is of the same compound form as the third one of the anterior sac. The body is steadily elongating, and the hind end is now no longer rounded but truncated. The larvæ begin to show a preference for the sides and bottom of the vessel, and have a power of adherence to objects due, as it seems, to the secretion of a sticky mucus by the epidermis, which contains numerous unicellular glands for this purpose. They show a strong tendency to swarm together, and such swarms are beginning to secrete webs of mucus[2], in which they lie nearly motionless.

7. About forty hours after hatching (Pl. XXXIX. fig. 8) the

[1] The times given throughout this paper for the appearance of various organs are only approximate and refer to specimens in captivity. Of course, it by no means follows that they hold good under natural conditions.

[2] That this is a normal and not a pathological phenomenon I am convinced by the fact that it occurred in every batch of larvæ under observation, and by the perfectly regular progress of the subsequent development.

first traces of a third seta-sac with a partly-formed compound seta were observed. The second seta-sac has now three compound setæ. The body is much elongated, and the unciliated region preponderates greatly over the ciliated band, which lies wholly in front of the mouth. The apical tuft is lost. Rudimentary parapodia bear the two anterior pairs of seta-bundles. At the hind end a small blunt knob appears on each side of the anus. The pharynx is elongating, and a faint double line runs down its long axis, diverging into two at the anterior end and thus forming a **Y**. This is the rudiment of the lower jaws (*Unterkiefer*, inferior maxillary plates).

8. Sixty hours after hatching (Pl. XXXIX. fig. 9) the embryo has elongated until its form may be said to be definitely wormlike. There are now three seta-bundles raised on low parapodial eminences. The first has two compound and two simple setæ, the second three compound, the third two compound. Behind these may be seen rudiments of a fourth pair of seta-sacs. The anal processes are larger but still rounded. All the cilia have disappeared. The mid-gut has the form of an elongated isosceles triangle, with the apex, which is truncated, situate at the anus, and the base rounded and placed just behind the eyes; it is still very yolky. In the fore gut (pharynx) the lower jaws are better formed, and their diverging limbs bear each three blunt teeth. Rudiments of the large toothed plates of the upper jaws have appeared. But the most important feature of this stage is the beginning of the segmentation of the region in front of the first pair of parapodia. In this region, which has hitherto formed a large unsegmented "head," there now appears a low bulging of the body-wall on each side just before the first parapodium. Thus the segment bearing the latter becomes the second after the head, and eventually, as we shall see, the third. The new segment is unprovided with setæ. It is interesting to notice that the two segments which thus arise so differently from the rest are, in the adult *Marphysa*, as in various other Polychætes, distinguished by not having parapodia. The exact meaning of the process is doubtful; but it must be of cænogenetic origin, for Salensky (**7**) has shown that this portion of the body belongs to the trunk, not to the head.

9. Twenty-four hours later (*i.e.*, eighty-four hours after hatching) a second segment without setæ has appeared in front of the first, so that the body now shows a rounded head followed by two segments without setæ, three with setæ, and a hinder portion from which the fourth seta-bearing segment has not yet differentiated itself. All the segments are better marked off from one another than on the preceding day, and the parapodia stand out more sharply from the body. The anal processes are longer, taper slightly towards the tip, and curve outwards.

10. In the course of the next twenty-four hours the body elongates somewhat, the fourth pair of parapodia appear with two compound setæ, and the food-yolk grows considerably less.

11. The oldest larvæ examined by me (Pl. XXXIX. fig. 10)

had been hatched about 150 hours. They measured about ·75 mm. in length, and were ·16 mm. in breadth at the broadest part—the first pair of parapodia. There were four seta-bearing segments, each with a pair of parapodia, the latter growing progressively smaller from before backwards. The first parapodium bears two simple and two compound setæ, the rest have only compound. Of these there are two kinds—those with a triangular end-piece like the first-formed ones, and others with a narrower sabre-like appendage. With the two setaless segments in front and the terminal segment (bearing traces of the fifth seta-sac) there is a total of seven, exclusive of the head. Each is separated from its neighbours by a well-marked annular depression, and the parapodia, which are still uniramous, stand up sharply above the general surface of the body. At the hind end the anal processes or cirri are longer than the terminal segment, taper to a point, and are directed outwards. In front of them a pair of small knobs arise from the hinder angles of the terminal segment, apparently the rudiment of a second pair of cirri.

In the interior of the body there is now a distinct body-cavity surrounding the gut, into which project the seta-sacs provided with well-developed muscles. The gut consists of a pharynx, a dilated stomach, a narrower intestine, and a ciliated rectum. The jaws are well developed and amount to seven pieces at least. Of the several parts of this apparatus in an adult Eunicid the forceps alone appear to be wanting.

It is interesting to compare the larval history just described with those of the other Eunicids in which the same processes have been followed. These fall into three groups [1] :—

i. The free-swimming larvæ, all of unknown species, described by Müller (**6**), Krohn and Schneider (**5**), Claparède and Metschnikoff (**1**), and Haecker (**3**).

ii. The larvæ of *Lumbriconereis* sp. and *Diopatra magna*, described by Fewkes (**2**) and Wilson (**9**, **10**) respectively. These pass through the whole of their earlier stages in the spawn-jelly, and leave as young worms with several pairs of parapodia. There is no free-swimming stage.

iii. The embryos of *Marphysa sanguinea* described by Koch (**4**)[2], which pass through their earlier stages in the body-cavity of the mother and are born as young worms.

The larvæ of the present species of *Marphysa* are clearly allied with the first of these groups rather than with either of the others. This is shown by the form of the body, the arrangement of the ciliation and its successive phases, the presence of two eye-spots and only two, and the early hatching-stage. Also the course of development differs in no important feature in the two cases, so far as they are known. But it would appear that the same cause,

[1] *Ophryotrocha* would form a fourth group, independent of the others, polytrochal and free-swimming.

[2] For the later stages, see Webster (**8**).

whatever it be, which makes it undesirable for so many other Eunicid larvæ to pass through a pelagic stage, is at work here also; only that, instead of the early development being accomplished in the spawn-jelly, as in group ii., or in the body-cavity of the mother, as in *Marphysa sanguinea*, the larvæ make use of the power, which they share with those of various other Polychætes, of secreting mucus in quantities from their epidermal glands, to attain the same end of providing a fixed resting-place during the formation of the more important organs of the body.

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EXPLANATION OF PLATE XXXIX.

Spawn and young of a Polychæte Worm of the genus *Marphysa*.

Fig. 1. Spawn-mass, unbroken, somewhat reduced, p. 715.
2. Spawn-mass, broken, showing embryos and pellicle, somewhat reduced, p. 715.
3. Embryo in striated coat, greatly enlarged. The outline of the ectoderm underlying the coat is not shown, p. 716.
4. Young, stage 2, greatly enlarged, p. 716.
5. „ „ 3, „ „ p. 716.
6. „ „ 4, „ „ p. 717.
7. „ „ 6, „ „ p. 717.
8. „ „ 7, „ „ p. 717.
9. „ „ 8, „ „ p. 718.
10. „ „ 11, „ „ p. 718.
10 *a*. Jaws of stage 11, more highly magnified, p. 719.
10 *b*. Setæ „ „ „ p. 719.

The figures, which are copies of working drawings of the living objects, are not drawn to scale; but nos. 4–10 are very roughly so.

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THE END.

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December 3, 1901 (*continued*).

December 17, 1901.

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PART II.

NOTICE.

The 'Proceedings' for the year are issued in *four* parts, forming two volumes, as follows:—

VOL. I.

Part I. containing papers read in January and February, on June 1st.
II. ,, ,, ,, March and April, on August 1st.

VOL. II.

Part I. containing papers read in May and June, on October 1st.
II. ,, ,, ,, November and December, on April 1st.