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PROCEEDINGS

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OF LONDON.

1901, vol. I.

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LIST

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OF THE

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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. I. (January to April).

January 15, 1901.

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

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1900 :—

The registered additions to the Society's Menagerie during the month of December 1900 were 211 in number. Of these 91 were acquired by presentation and 16 by purchase, and 104 were received on deposit. The total number of departures during the same period, by death and removals, was 158.

Amongst the additions attention may be specially directed to the seven specimens of Verreaux's Guinea-fowl (*Guttera edouardi*) presented on December 31st by Mr. J. F. Walker of Bulawayo. Mr. Walker states that this Guinea-fowl is found only, so far as he knows, in the Wankie Hills, a district due north of Bulawayo, and about midway between that city and the Zambesi. Only one specimen of it had previously reached the Society's aviaries (see P. Z. S. 1890, p. 86).

I wish also to direct attention to the valuable series of Indian birds lately presented to the Society by Mr. E. W. Harper, F.Z.S., of Calcutta, consisting of examples of twenty species, all new to the Society's Collection, of which the following is a list.

First consignment (August 14th, 1900):—

1 Indian Roller (*Coracias indica*).
1 Bengal Weaver-bird (*Ploceus bengalensis*) ♂.
1 Manyar Weaver-bird (*Ploceus manyar*) ♂.
4 Black-throated Weaver-birds (*Ploceus atrigula*), 2 ♂, 2 ♀.

Second consignment (September 21st, 1900):—

2 Western Yellow-winged Laughing-Thrushes (*Trochalopterum nigrimentum*) ♂ ♀.
1 Rufous-chinned Laughing-Thrush (*Ianthocincla rufigularis*).
1 Slaty-headed Scimitar Babbler (*Pomatorhinus schisticeps*).
1 Black-throated Ouzel (*Turdus atrigularis*) ♂.
2 Tickell's Ouzels (*Turdus unicolor*).
1 Spotted-wing (*Psaroglossa spiloptera*).

Third consignment (November 27th, 1900):—

4 Ashy-crowned Finch-Larks (*Pyrrhulauda grisea*), 3 ♂, 1 ♀.
2 Singing Bush-Larks (*Mirafra cantillans*) ♂ ♀.
2 Slaty-headed Parrakeets (*Palæornis schisticeps*) ♂ ♀.
1 Burmese Slaty-headed Parrakeet (*Palæornis finschi*) ♂.
1 Golden-eyed Fruit-Pigeon (*Carpophaga concinna*).

Fourth consignment (January 1st, 1901).

2 Blue-winged Sivas (*Siva cyanoptera*).
1 Silver-eared Mesia (*Mesia argentauris*).
1 White-capped Redstart (*Ruticilla leucocephala*).
1 Rufous-bellied Niltava (*Niltava sundara*).
1 Burmese Roller (*Coracias affinis*).

Mr. W. E. de Winton exhibited a specimen of the large Grey Meerkat (*Cynictis selousi* de Winton), described in the 'Annals and Magazine of Natural History,' ser. 6, vol. xviii. 1896, p. 469, hitherto known from a skull only, obtained near Bulawayo.

The skin exhibited (see Plate I.), together with a skull, had been obtained by Mr. P. C. Reid on the west bank of the Linyanti River on the 5th July, 1899. The following description was given:—

Size about half as large again as the Bay Meerkat (*C. penicillata*); body-colour grizzled drab-grey; hairs of the tail broadly white-tipped; both fore and hind feet black; belly buff. The grizzling of the head and body is much coarser than in the Bay Meerkat, owing to the broader annulations on the hair, but the pattern on the hairs of the tail is similar in both species. There is an entire absence of rufous in the colouring of the Grey Meerkat, the tips of the under-fur and the broad subbasal band of the

J. Smit del. et lith.

Mintern Bros. imp.

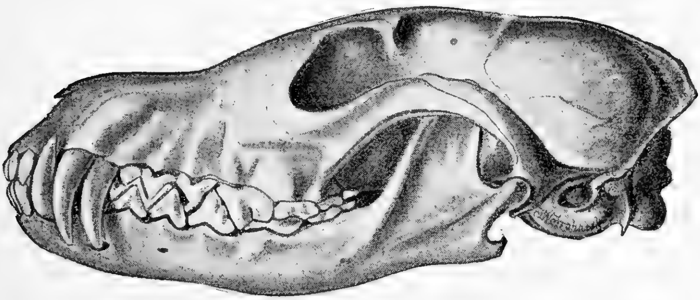
CYNICTIS SELOUSI.

coarser fur being dull buff, and the tail whitish instead of orange colour. The hands and feet of the larger species are black, while in the smaller they are golden-fawn.

Measurements taken from the dried skin:—Head and body 400 millim., tail 230, hind foot 90, ear 30; all these figures must be considered only approximate.

Mr. Lydekker exhibited the skull of an English Fox (*Canis vulpes*) with two perfect canine teeth on each side of the upper jaw (see text-fig. 1). A dog's skull with the upper canine of each side partially divided had been figured on p. 211 of Mr. Bateson's

Text-fig. 1.



Skull of Fox showing double canine teeth.

Study of Variation, and the present specimen would seem to indicate a fuller development of the same feature. An instance of the full duplication of the corresponding teeth of both sides was afforded by the skull of a Cat figured on p. 225 of the work cited.

The Fox to which the skull belonged had been killed by the South Oxfordshire Hounds. The skull itself was the property of Mr. H. G. Pease.

In describing the collection of Fishes brought home from Lakes Tanganyika and Kivu by the Tanganyika Exploring Expedition, under the leadership of Mr. J. E. S. Moore, Mr. G. A. Boulenger pointed out that the study of this important collection did not modify the conclusions embodied in his first report published in 1898. The exploration of Lake Kivu had thrown no light on the origin of the Tanganyikan fauna; the smaller lake had proved to be very thinly populated with Fishes, which all belonged to widely distributed genera, the species showing a mixture of Nile and Tanganyika elements, with two that might prove to be endemic. The list of the Fishes from the two lakes comprised 91 species, 74 of which had been named by the author. The collection now described consisted of examples of 50 species, 26 of which were new to science, two being made the types of additional genera of the family *Cichlidæ*.

This Memoir will be published in full in the Society's 'Transactions.'

The following papers were read:—

1. On the Fishes collected by Dr. W. J. Ansorge in the Niger Delta. By G. A. Boulenger, F.R.S., F.Z.S.

[Received January 4, 1901.]

(Plates II.–IV.[1])

Whilst recently staying at Sapelle Station, at the junction of the Ethiop and Jamieson Rivers, Dr. Ansorge has, at my request, made a small collection of the Fishes, which proves to be of quite an exceptional interest, from the fact that through it representatives of two families are added to the African freshwater fish-fauna, one being even entirely new, an event that has not happened since 1873, when the late Professor Peters described the genus *Pantodon*, the type of the family *Pantodontidæ*. I feel extremely grateful to Dr. Ansorge for the trouble he has taken, under difficult circumstances and without better preserving-fluid than common trade-gin.

The collection was made in August and September 1900. Some of the small Perch-like fishes (*Cichlidæ*) were caught with hook and line baited with worms. But most of the fishes, including *Calamichthys*, the Mormyrs, and the new *Phractolæmus*, were captured in creels baited with the orange-red fleshy nut of the oil-palm, set at the mouth of the Ethiop River, close to the bank, by Dr. Ansorge's native boy. All these fishes are considered good-eating by the blacks.

I am pleased to add that the examples of the new species have been generously presented to the British Museum by Dr. Ansorge.

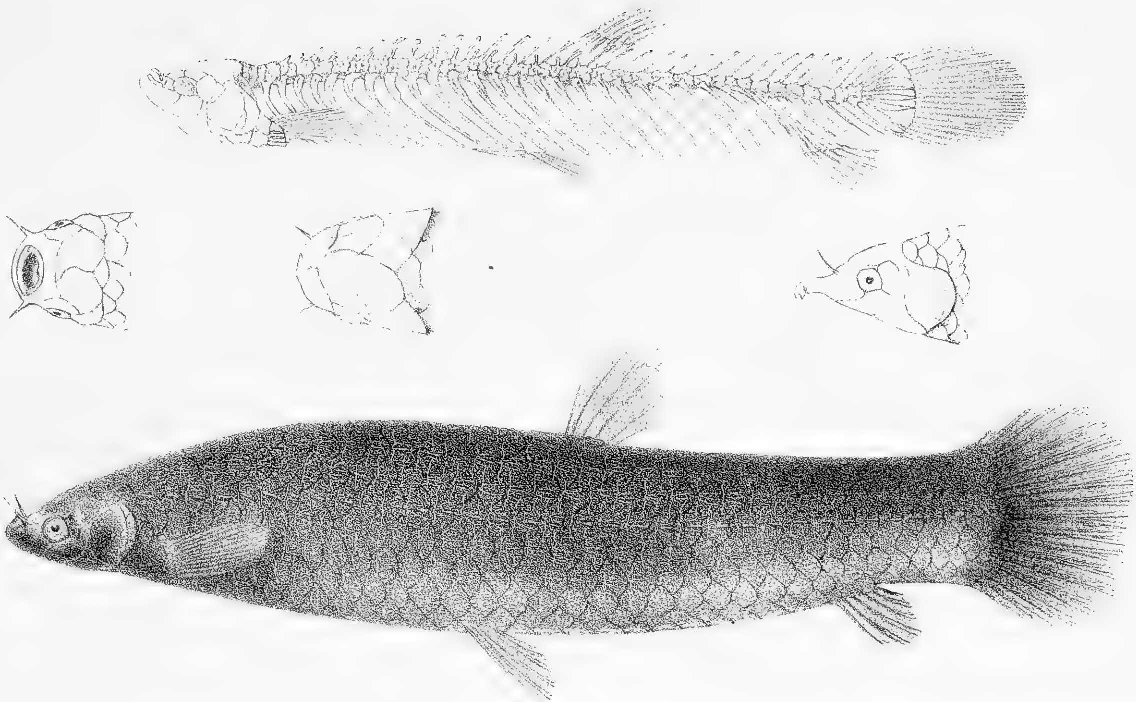
Polypteridæ.

1. Calamichthys calabaricus J. A. Smith.

The single specimen contained in the collection, a female measuring 345 millimetres, with 11 dorsal spines, is extremely remarkable for having a very small, but perfectly distinct suboperculum. The absence of this bone, verified on a considerable number of specimens, had been regarded as one of the generic characters distinguishing *Calamichthys* from *Polypterus*. The coloration of the specimen is a dark olive-brown above, gradually shading into a bright yellow beneath; a large deep-black spot on the pectoral fin.

Every possibility of the presence of a suboperculum indicating a

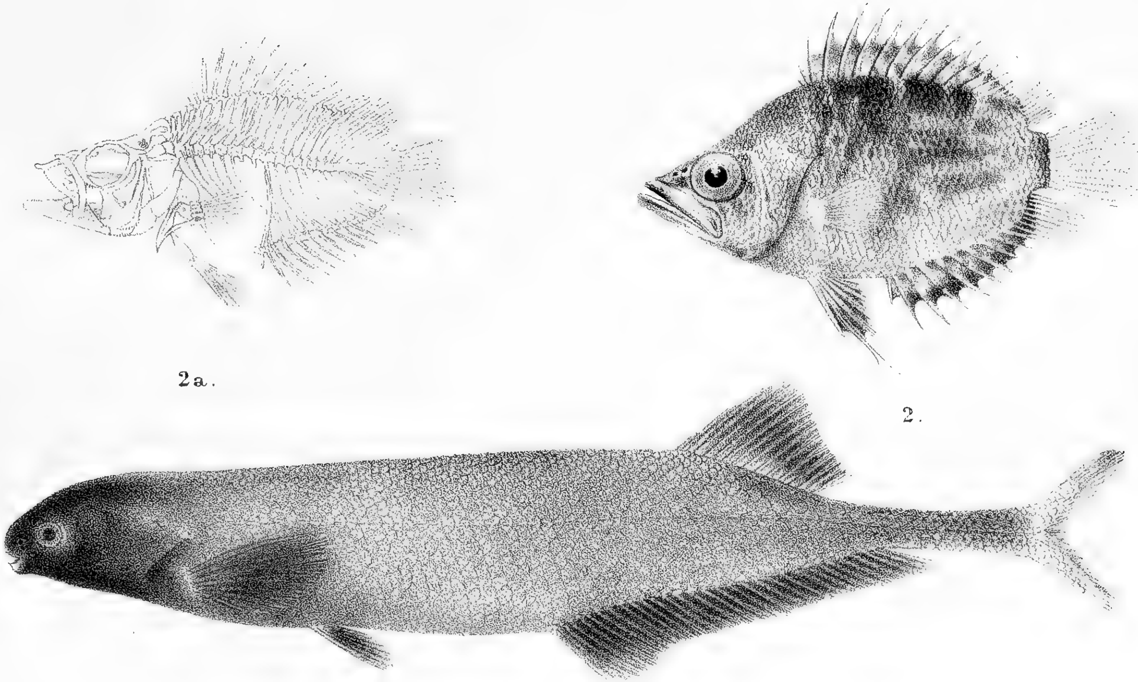
[1] For an explanation of the Plates, see p. 10.



P. J. Smit del. et lith.

PHRACTOLÆMUS ANSORGII.

Mintern Bros. imp.



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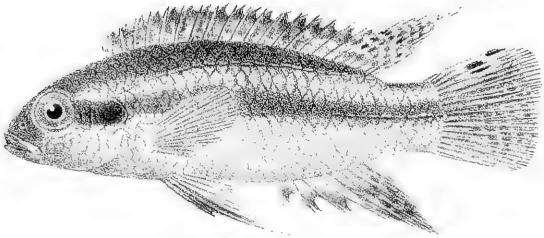
P. J. Smit del. et lith.

Mintern Bros. imp.

1. MARCUSENIUS LONGIANALIS. 2. POLYCENTROPSIS ABBREVIATA.



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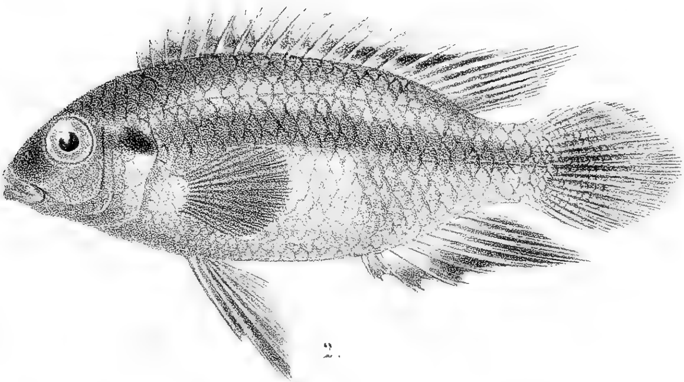

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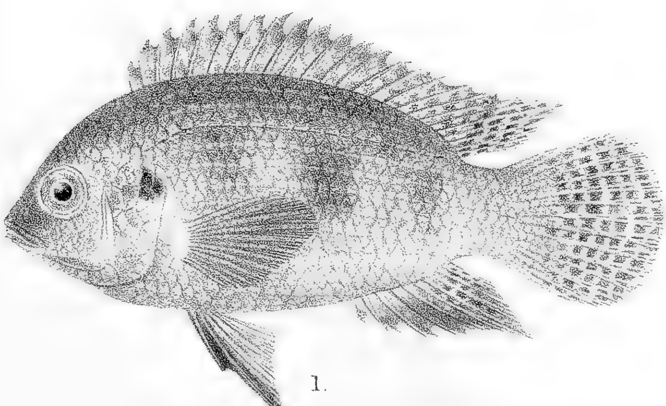

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P. J. Smit del et lith.

Mintern Bros. imp.

1. PELMATOCHROMIS ANSORGII. 2. P. PULCHER. 3. P. TÆNIATUS.

species distinct from *Calamichthys* seems to me removed by the fact that I have carefully compared this specimen with others likewise from the Niger delta, without being able to detect any other important difference. I look upon it as an atavistic individual anomaly.

MORMYRIDÆ.

2. ISICHTHYS HENRYI Gill.

The single specimen is more elongate than any on record, the depth of the body being contained 13 times in the total length, the length of the head $8\frac{1}{4}$ times. D. 53; A. 52; lat. l. 140. Total length 210 millim.

3. MARCUSENIUS LONGIANALIS, sp. n. (Plate III. fig. 1.)

Depth of body 5 to $5\frac{2}{3}$ times in total length, length of head 6 to $6\frac{1}{2}$ times. Head $1\frac{1}{4}$ as long as deep; snout convex, $\frac{1}{4}$ length of head, slightly projecting beyond the mouth; latter small, subinferior, below level of eye, its width $\frac{1}{6}$ length of head; teeth feebly notched, 5 in the upper jaw, 6 in the lower; nostrils nearly equally distant from end of snout and from eye, anterior on a level with centre of latter, posterior with its lower border; eye small, $\frac{1}{2}$ length of snout, $\frac{2}{5}$ interorbital width. Dorsal 15–16, its length $\frac{1}{4}$ its distance from the head, originating above 16th or 17th ray of anal. Anal 32–33, thrice as long as dorsal, nearer base of caudal than base of ventral. Pectoral obtusely pointed, a little shorter than head, $1\frac{2}{3}$ length of ventral, reaching base of latter. Caudal scaly at the base, with pointed lobes. Caudal peduncle $3\frac{1}{2}$ times as long as deep, nearly as long as head. 63 to 66 scales in the lateral line, $\frac{9}{10}$ in a transverse line on the body, $\frac{6-7}{6-7}$ between dorsal and anal, 12 round caudal peduncle. Purplish brown, more or less profusely speckled with blackish; fins dark brown.

Total length 145 millim.

Two specimens.

Closely allied to *M. brachyhistius* Gill. Distinguished by the more elongate form, the more slender caudal peduncle, the longer anal fin, and the higher number of scales in the lateral line.

NOTOPTERIDÆ.

4. NOTOPTERUS AFER Gthr.

PHRACTOLÆMIDÆ.

The highly remarkable fish discovered by Dr. Ansorge, which I here describe under the name of *Phractolæmus ansorgii*, cannot be incorporated into any of the families known at present. It falls into the suborder Malacopterygii as restricted and defined by me [1], and occupies a position intermediate between the *Osteoglossidæ* and the *Clupeidæ*. The family *Phractolæmidæ* may be characterized as follows:—

Mouth edentulous, projectile, bordered by the very slender

[1] Poissons du Bassin du Congo, p. 44 (1901).

premaxillaries and maxillaries. Supraoccipital in contact with the frontals, widely separating the small parietals. Operculum and suboperculum well developed; preoperculum small; interoperculum enormous, covering the gular region and overlapping its fellow; symplectic absent; only three slender branchiostegal rays; no pharyngeal teeth. Ribs stout, sessile, nearly completely encircling the body; slender epineurals; no epipleurals; caudal region very short. No postclavicle. Pectoral fins inserted low down, folding like the ventrals; latter with 6 rays.

PHRACTOLÆMUS, gen. n.

Body elongate, subcylindrical, covered with large striated scales; lateral line complete, formed of a series of straight tubes extending along the entire length of the exposed part of the scales. Head small, strongly ossified, covered with thin skin; mouth small, proboscidiform, capable of being thrust forward, when at rest folded over and received into a depression on the upper surface of the head; a single narial orifice, preceded by a barbel; eyes small, lateral. Gill-openings narrow, restricted to the sides; gular region protected by the interopercles, that on one side (usually the right) overlapping that on the other side. Four gills; no pseudobranchiæ. Pectoral fins small, with 18 rays; ventrals far back, with 6 rays; dorsal short, with 6 rays, opposite to the space between the ventrals and the anal; latter short, with 6 rays; caudal fan-shaped, with 18 to 20 rays; all the fin-rays articulated. Air-bladder very large, extending as far back as the anal fin. Stomach with 3 pyloric appendages; intestine extremely long and much convoluted.

5. PHRACTOLÆMUS ANSORGII, sp. n. (Plate II.)

Depth of body 5 to 6 times in total length, length of head $6\frac{1}{2}$ to $7\frac{2}{3}$ times. Head depressed, with very broad, slightly convex interorbital region; diameter of eye $4\frac{1}{2}$ to $5\frac{1}{2}$ times in length of head, 3 to $3\frac{1}{2}$ times in interorbital width; barbel nearly $\frac{1}{3}$ length of head. Dorsal with the two anterior rays simple, the other four bifid; the first ray equally distant from the head and from the root of the caudal; second ray longest, $1\frac{1}{2}$ length of head. Anal similar to dorsal, but rays shorter, the second or longest only $\frac{3}{4}$ length of head. Pectoral rounded, a little shorter than head, as long as ventral, which is pointed and equally distant from head and from anal. Caudal rounded. Caudal peduncle compressed, nearly as long as deep, as long as head. Scales large, longitudinally striated, 35 to 37 in a longitudinal series, $\frac{3\frac{1}{2}}{4\frac{1}{2}}$ in a transverse series. On the caudal region the scales of the lateral line and those of the series above it may bear a central sclerous tubercle (probably a seasonal character). Uniform olive-grey.

The vertebræ, in a male specimen of which a skeleton has been prepared, number 34, 26 precaudal and 8 caudal, the last bearing 6 hypurals to support the homocercal fin; the ribs are subequal, very thick, with a wing-like expansion behind at the base, and begin on the second vertebra, there being besides a strong occipital rib. The frontals are very large and the right extends with its curved border beyond the median line, as if overlapping its fellow; two supraorbital bones on each side; the parietals are very small, and completely separated by the broad and short supraoccipital, which does not bear a crest. The pair of large bones covering the throat, the right overlapping the left, and which at first suggest the gular plates of the *Polypteridæ*, are to be identified as interoperculum; above the interoperculum two very large suborbitals, covering the hyomandibular and quadrate, which are thrust forward for the suspension of the feeble mandibular rami, which are disconnected at the symphysis; the premaxillary and maxillary bones more slender still and connected by ligament with the mandible. The shoulder-girdle is suspended from the posttemporal close to the operculum; it includes the ordinary elements (clavicular, supraclavicular, coracoid, scapula), but a postclavicular is absent: the mesocoracoid arch is present, slender; the coracoids are much smaller than the claviculars, and do not meet on the median line; 4 pterygials support the pectoral fin-rays.

Four specimens of this extraordinary fish, measuring from 50 to 150 millim., were brought home by Dr. Ansorge, to whom it gives me great pleasure to dedicate the species.

CHARACINIDÆ.

6. SARCODACES ODOË Bl.

7. ALESTES LONGIPINNIS Gthr.

SILURIDÆ.

8. CLARIAS ANGOLENSIS Stdr.

9. SCHILBE DISPILA Gthr.

10. CHRYSICHTHYS NIGRODIGITATUS Lacép.

11. MALOPTERURUS ELECTRICUS Gm.

CYPRINODONTIDÆ.

12. HAPLOCHILUS INFRAFASCIATUS Gthr.

OPHIOCEPHALIDÆ.

13. OPHIOCEPHALUS OBSCURUS Gthr.

ANABANTIDÆ.

14. ANABAS KINGSLEYÆ Gthr.

NANDIDÆ.

The *Nandidæ* (including the *Polycentridæ*) are a small family of freshwater fishes from S.E. Asia and South America, apparently most nearly allied to the *Centrarchidæ*, but distinguished from them by the absence of the entopterygoid.

The new genus here described is its first-known African representative.

POLYCENTROPSIS, gen. n.

Body short, elevated, very strongly compressed; scales moderately large, ciliated. Lateral line incomplete, reduced to a few tubes. Mouth large, extremely protractile, the ascending processes of the premaxillaries extremely long and extending to the occipital region; villiform bands of very small teeth in the jaws, on the vomer, and on the palatines; head for the greater part covered with scales; præorbital, præopercle, and interopercle serrated; opercle ending in a spine. Gill-membranes separate; six branchiostegals; no pseudobranchiæ. Dorsal and anal fins nearly equally developed, with numerous strong spines and the soft portion much reduced. Ventrals below the pectorals, close together, with a strong spine. Vertebræ 23 (10+13) [1].

15. POLYCENTROPSIS ABBREVIATA, sp. n. (Plate III. fig. 2.)

Depth of body twice in total length, length of head twice and a half. Snout acutely pointed, chin slightly projecting; diameter of eye a little longer than snout or interorbital width; nearly one third length of head; maxillary extending to below posterior third of eye; suborbital arch very slender; 6 or 7 series of scales on the cheek. 10 gill-rakers on lower part of anterior arch, the longest nearly as long as gill-filaments. Dorsal XV–XVI 11; spines increasing in length to the fourth and decreasing from the seventh or eighth, the longest half length of head and a little longer than the soft rays. Anal similar, X 9. Pectoral obtusely pointed, half length of head. Ventral longer, produced in a filament, extending beyond origin of anal. Caudal truncate. Caudal peduncle extremely short. Sq. 32–35 $\frac{4}{17}$; lat. l. 5–6. Pinkish brown, marbled with darker; spinous dorsal and anal dark brown, with darker and lighter spots and edged with black; ventrals blackish; base of soft dorsal, anal, and caudal blackish, edged with pink.

Total length 68 millim.

Two specimens.

CICHLIDÆ.

16. HEMICHROMIS FASCIATUS Peters.

17. HEMICHROMIS BIMACULATUS Gill.

18. PELMATOCHROMIS GUENTHERI Sauv.

(*Hemichromis voltæ* Stdr.; *H. tersquamatus* Gthr.)

19. PELMATOCHROMIS ANSORGII, sp. n. (Plate IV. fig. 1.)

Teeth in 2 or 3 series in each jaw, outer largest but rather small. Depth of body $2\frac{1}{5}$ to $2\frac{1}{3}$ times in total length, length of

[1] *Nandus marmoratus* has also 23 vertebræ, but 13+10.

head $2\frac{4}{5}$ or 3 times. Snout broad, rounded, with straight or slightly convex upper profile, as long as the diameter of the eye, which is contained $3\frac{1}{2}$ to $3\frac{2}{3}$ times in length of head and $1\frac{1}{3}$ times in interorbital width; maxillary extending to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 or 11 on lower part of anterior arch. Dorsal XV–XVI 10–11; spines subequal, not quite $\frac{1}{2}$ length of head; middle soft rays somewhat produced, $\frac{3}{4}$ or $\frac{4}{5}$ length of head. Pectoral $\frac{2}{3}$ or $\frac{3}{4}$ length of head. Ventral produced into a filament, reaching origin of anal or a little beyond. Anal III 8; third spine as long as dorsals. Caudal rounded. Caudal peduncle much deeper than long. Scales smooth, with very distinct concentric striation, 28–29 $\frac{3}{10}$; lat. l. $\frac{17\text{–}19}{8}$. Dark olive-brown above, yellowish beneath; a blackish opercular spot; three or four vertically elongate large dark spots on each side of the body, below the upper lateral line; fins greyish, soft dorsal, anal, and caudal chequered with small darker and lighter spots.

Total length 90 millim.

Four specimens.

Allied to the preceding, from which it differs chiefly in the shorter snout, the smaller mouth, and the more rounded caudal.

20. Pelmatochromis pulcher, sp. n. (Plate IV. fig. 2.)

Teeth in 4 or 5 series in each jaw, outer largest. Depth of body $2\frac{2}{3}$ to 3 times in total length, length of head 3 to $3\frac{1}{2}$ times. Snout broad, rounded, with convex upper profile, as long as the eye, which is contained $3\frac{1}{3}$ times in length of head and does not quite equal interorbital width; maxillary extending to between nostril and eye; 2 or 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 to 12 on lower part of anterior arch. Dorsal XVI 9–10; spines gradually increasing in length to the last, which measures half length of head; some of the soft rays more or less produced, often longer than the head. Pectoral $\frac{2}{3}$ or $\frac{3}{4}$ length of head. Ventral more or less produced into a filament, reaching origin of anal, or beyond. Anal III 7–8; third spine as long as longest dorsal. Caudal rounded or subacuminate. Caudal peduncle as long as deep. Scales smooth, 27–29 $\frac{2\text{–}2\frac{1}{2}}{10}$; lat. l. $\frac{18\text{–}20}{8\text{–}10}$. Olive, with two darker or blackish longitudinal bands on each side, the upper from the occiput to the base of the soft dorsal, the lower from the eye, over the opercle, to the extremity of the caudal fin; sides of body below lower lateral band and between pectorals and ventrals of a beautiful rose-colour; spinous dorsal grey, black at the base, the black area gradually rising to cover nearly the whole of the soft dorsal; pectoral, outer side of ventral, and extremity of anal blackish; caudal grey, with an oblique white streak above in the males.

Total length 95 millim.

Several specimens.

Most nearly related to *P. subocellatus* Gthr., from the Gaboon, but easily distinguished by the proportions of the dorsal spines.

21. Pelmatochromis tæniatus, sp. n. (Plate IV. fig. 3.)

Teeth in 2 series in the upper jaw, in 3 in the lower, outer largest. Depth of body 3 times in total length, length of head $3\frac{1}{2}$ times. Snout broad, rounded, with convex upper profile, as long as the eye, which is contained $3\frac{1}{3}$ times in length of head and nearly equals interorbital width; maxillary extending slightly beyond vertical of anterior border of eye; 2 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 11 on lower part of anterior arch. Dorsal XVIII 7; spines gradually increasing in length to the last, which measures half length of head; longest soft rays produced into a filament, as long as head. Pectoral $\frac{4}{5}$ length of head. Ventral produced into a filament, extending beyond origin of anal. Anal III 7; third spine as long as longest dorsal. Caudal rounded. Caudal peduncle a little deeper than long. Scales smooth, $28\frac{2}{9}$; lat. l. $\frac{21}{9}$. Brownish above, yellowish beneath; two blackish longitudinal bands on each side, the upper from the occiput to the base of the soft dorsal, the lower from the eye, over the opercle, to the root of the caudal; fins greyish, ventrals white with a black outer border; oblique dark streaks on the soft dorsal; small blackish spots on the caudal and two larger ones edged with white on its upper border.

Total length 75 millim.

A single specimen.

Also nearly allied to *P. subocellatus*. Readily distinguished from it, and from *P. ansorgii*, by the dorsal formula.

22. Tilapia mariæ Blgr.

This species was described from a single specimen from Azumine Creek, Opobo River, in Miss Kingsley's collection. Three specimens are in Dr. Ansorge's collection, the largest measuring 135 millim. The caudal fin is rounded rather than truncate. D. XVI 12–13; A. III 10; Sq. 29–30 $\frac{3\frac{1}{2}}{10}$; lat. l. $\frac{20\text{–}21}{12\text{–}13}$.

23. Tilapia lata Gthr.

Gobiidæ.

24. Eleotris senegalensis Stdr.

EXPLANATION OF THE PLATES.

Plate II.

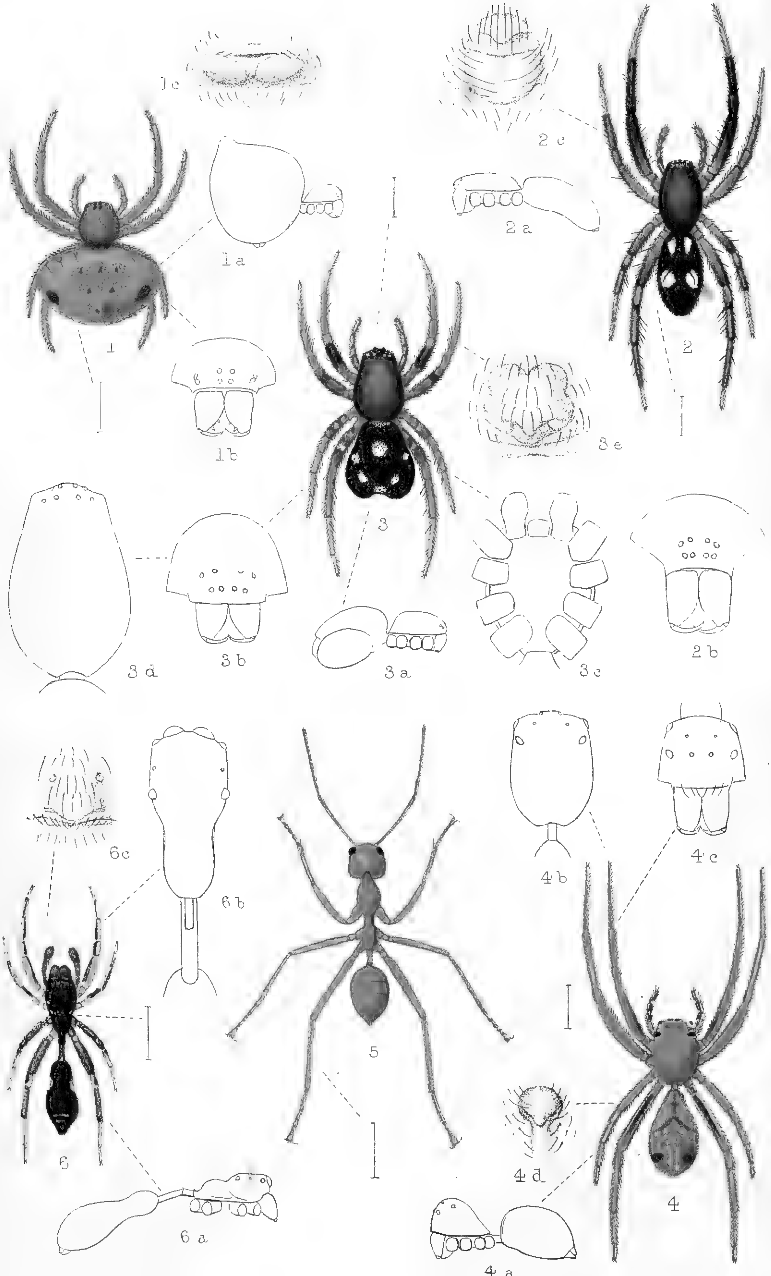
Phractolæmus ansorgii, with upper, lower, and side views of head, and skeleton, p. 6.

Plate III.

Fig. 1. *Marcusenius longianalis*, p. 5.
2. *Polycentropsis abbreviata*, and skeleton, p. 8.

Plate IV.

Fig. 1. *Pelmatochromis ansorgii*, p. 8.
2. " *pulcher*, p. 9.
3. " *tæniatus*, p. 10.



A.T. Hollick del. et lith.

West, Newman chromo.

NEW EXOTIC SPIDERS.

2. On some new and interesting Exotic Spiders collected by Messrs. G. A. K. Marshall and R. Shelford. By the Rev. Octavius Pickard-Cambridge, M.A., F.R.S., &c.

[Received December 6, 1900.]

(Plate V.[1])

Order ARANEIDEA.

Fam. Drassidæ.

Gen. Prosthesima L. Koch.

Prosthesima albomaculata, sp. n. (Plate V. figs. 2–2 *c*.)

Adult female, length $2\frac{1}{3}$ lines (4·5 mm.).

Cephalothorax flattish, oval, truncate at each end, fore end rather the narrowest, lateral marginal impressions at caput very slight, profile-line nearly level. Colour deep black-brown, softening to yellowish brown round the thoracic indentation; surface thinly covered with grey adpressed hairs.

Eyes in two transverse rows of very nearly equal length. Curve of posterior row slight and its convexity directed backwards. Anterior row almost straight, laterals of this row largest of the eight, the two centrals being placed on a slight prominence, and further from each other than from the laterals. The two centrals of the posterior row are much further from each other than from the laterals and are slightly the largest. The four centrals form a quadrangle as long as broad, the fore side being shortest.

Legs moderate in length and strength, 4, 1, 2, 3. Colour yellow to yellow-brown; the tibiæ, femora, and genuæ of the first pair black-brown, these joints of the second pair yellow-brown, and of the third and fourth pairs more or less deeply marked longitudinally and suffused with black and brown, furnished with coarse hairs and spines, the latter most numerous and strongest on the tibiæ and metatarsi of the third and fourth pairs.

Falces, *maxillæ*, and *labium* deep brown.

Sternum oval, pointed behind; colour reddish yellow-brown.

Abdomen oval, somewhat flattened, black, with four conspicuous white spots forming a quadrangle on the fore half of the upperside, the two hinder spots largest and nearly round, the anterior, near the fore margin, oval or subtriangular and forming a shorter transverse line than the hinder spots. On each side of the underside, about the middle, is a large somewhat irregular triangular-shaped white patch, whose inner angles are nearly contiguous a little way behind the middle. Spinners of the inferior pair much wider apart than the superiors. Genital aperture simple but characteristic in form.

Hab. Salisbury, Mashonaland, S. Africa, 5000 feet, Nov. 1898 to Jan. 1899 (*G. A. K. Marshall*).

[1] For an explanation of the Plate, see p. 16.

Gen. nov. Titus.

Cephalothorax elongate-oval, rounded behind, broadly and a little roundly truncate before; lateral marginal impressions at the caput gradual but distinct; upper surface strongly convex; from the fore part of the caput to the hinder slope the rise is strong, a little curved and even, with a very slight dip at the thoracic junction. The sides of the cephalothorax project over the bases of the legs, making them appear to be articulated on the same plane as the sternum. The thoracic indentation is very minute, and the other normal ones obsolete; hinder slope steep; height of the clypeus, which projects, is half that of the facial space, its fore margin overhanging the base of the falces.

Eyes moderate and not greatly unequal in size; in two transverse curved rows; the hinder row considerably longest, its eyes are very nearly equally separated, and the convexity of its curve is directed forwards, while that of the anterior row is backwards. The hind-lateral eyes are larger than the hind-centrals and are placed outside a strong tubercle; those of the anterior row on a well-marked transverse prominence or ridge. The fore-centrals are very nearly if not quite of equal size, the interval between them being about double that which separates each from the fore-lateral eye on its side. The central quadrangle is slightly broader than long, and its anterior side shortest.

Legs short, rather slender, 4, 1, 2, 3; the femora strongly clavate or tumid at their posterior end, furnished with hairs and spines; two pairs of these are beneath the metatarsi and three pairs beneath tibiæ of the first pair. Tarsi end with 2 claws.

Palpi (♀). The digital joint is double the length of the radial, rather claviform, and ending with a very minute, slightly curved single claw.

Falces moderate in length, powerful, subconical.

Maxillæ rather short, strong, straight, but inclined to the labium; rounded at their outer extremity, and a little impressed and obliquely truncate at their inner extremity.

Labium short, broader than long, narrowest at the apex, the outer corners of which are rounded, and the middle a little impressed.

Sternum longer than broad, oval, slightly hollow-truncate in front, bluntish pointed behind, and its margins strongly indented by the basal joints of the legs. From the hinder end a chitinous plate runs between the coxæ of the fourth pair of legs and spreading out behind them joins in with the upperside of the cephalothorax.

Abdomen short, broad, its upper surface covered with a strong kind of granulose coriaceous shield furnished with plumose and other hairs; sides, especially backwards, protuberant and tumid, these parts connected behind by transverse rugæ or folds, in the midst of which the spinners are placed and almost hidden in a circular cavity.

TITUS LUGENS, sp. n. (Plate V. figs. 3–3 *e*.)

Adult female, length $2\frac{1}{2}$ lines.

Cephalothorax bright red-brown, suffused with a darker hue on the sides and on the caput, the fore part of which is nearly black; the surface is thickly covered with small round shining tubercles or granulosities, and it is thinly clothed with hairs, of which some on the sides and hinder part are white and of a plumose nature.

Legs yellow tinged with brown; the femora much strongest, granulose, as also are the uppersides of coxæ. Colour of the femora of 1st pair black-brown, of the second pair not so dark, of the third and fourth pairs paler and indistinctly banded with darker. The tarsi are enlarged slightly and gradually to the ends, which are furnished with two claws and a compact claw-tuft.

Falces deep reddish black-brown, paler at the fore extremity, furnished in front with bristly hairs.

Maxillæ and *labium* yellow-brown.

Sternum yellow-red, covered thickly with small granulosities like the cephalothorax.

Abdomen coriaceous, covering of the upperside black with a central triangular patch of white plumose hairs, two patches of the same on the lateral margins, and one at the hinder extremity, sides and underside of a paler browner hue. The fore extremity on the underside is covered with a coriaceous granulose integument (the granulosities much strongest and becoming tubercular at the fore end), which forms a short sheath, covering most of the connecting pedicle as well as the spiracular openings and the genital aperture. For the peculiar form of the abdomen, see generic characters above; but whether this is only specific or whether generic, it is hard to say in the absence of allied species.

Hab. Salisbury, Mashonaland, S. Africa, 5000 feet, Nov. 1898 to Jan. 1899 (*G. A. K. Marshall*).

Fam. EPEIRIDÆ.

Genus NEPHILENGYS L. Koch.

NEPHILENGYS MALABARENSIS Walck.

An adult female of this common and widely dispersed Epeirid from Karkloof, Natal (*G. A. K. Marshall*).

Fam. GASTERACANTHIDÆ.

Subfam. EURYCOMINÆ.

Gen. CYRTARACHNE Thor.

CYRTARACHNE CONICA, sp. n. (Plate V. figs. 1–1 *c*.)

Adult female, length rather over $3\frac{1}{2}$ lines, or 8 mm.; length of abdomen $2\frac{1}{2}$ lines, width $3\frac{1}{3}$ lines.

Cephalothorax short, slightly longer than broad, broadest and rounded behind, truncate before; the profile-line forms a continuous curve; the lateral marginal impressions at the caput are very slight. Colour yellowish brown.

Eyes small, in the ordinary Epeirid position; the four centrals form as nearly as possible a square, its posterior eyes slightly largest. The lateral pairs are close to the anterior corners of the caput, minute; those of each pair are contiguous to each other and form nearly a straight line with the anterior pair of the central quadrangle.

Legs short, not very strong, 1, 2, 4, 3, devoid of spines, furnished with fine hairs only; colour brownish yellow, tinged with orange.

Falces short, strong, subconical; colour like that of the cephalothorax. Maxillæ and labium normal in form, and similar in colour to the cephalothorax, perhaps rather paler.

Sternum similar in colour to the legs.

Abdomen coriaceous, large, subtriangular, broader than long, rounded in front, the fore corners rounded, though scarcely to be described as forming distinct prominences; upper surface considerably elevated in a subconical form; colour yellowish white, that of the cone tinged with yellow-brown. Near the middle of the anterior margin, quite visible but not very distinct, are three sigilliform markings with two others behind, halfway to the summit of the conical abdomen; behind these last, and one on either side of the base of the cone, are two others similar, in a transverse line, and forming a line equal in length to that formed by the three anterior sigillæ; the upper part of the cone is encircled by some indistinct fine darker concentric lines. The underside is dark dull yellow-brown, and from the outer margins of it sundry fine dark lines issue upwards in groups of two or three, converging until they meet about one-third of the way towards the top of the cone. Genital process broad and very characteristic in form.

Hab. Singapore (*R. Shelford*).

Fam. THOMISIDÆ.

Subfam. AMYCIINÆ.

Genus AMYCIÆA Sim. (*Amycle* Cambr.).

AMYCIÆA LINEATIPES, sp. n. (Plate V. figs. 4–4 *d.*)

Adult female, length $2\frac{1}{2}$ lines.

This Spider is nearly allied to *A. forticeps* Cambr. (P. Z. S. Lond. 1873, p. 122) from Ceylon, and bears a close general resemblance to it; but it may be distinguished by the shorter legs, by the area of the four larger outer eyes, of which the anterior is of the same length as the posterior side, and the four anterior eyes forming a straight transverse line. The markings on the legs, palpi, and abdomen, and the form also of the abdomen, differ from those of *A. forticeps*, though it is possible that this last character may only be sexual.

The *palpi* have a longitudinal black streak on their inner sides.

The *legs* have a longitudinal red-brown streak on the outer side of the femora of the first pair, and a blackish one on the inner side of those of the fourth pair, a white line also runs along the side of the tibiæ and metatarsi; the tarsi of the first and second pairs are white; the general colour of the legs is dull orange-yellow.

The *abdomen* is joined to the thorax by a distinct jointed pedicle; it is of an oval form, broadest behind and pointed in front, and without any lateral transverse constriction. It is of a dull yellowish hue tinged with reddish; on either side towards the hinder extremity is a large black spot; along the middle of the upperside on the hinder half are two converging rows of small white spots, with some other white ones towards the fore extremity; on each side also of the fore half are two broadish, but not very strongly defined, oblique brownish stripes, the hinder ones meeting at an angle in the middle and continued in the median line to the fore end. The genital aperture is well marked and of a very characteristic form.

Hab. Singapore. Sent to Mr. Shelford by Mr. H. N. Ridley, Director of the Botanic Gardens, Singapore.

The type of the genus, *A. forticeps* Cambr. (Ceylon), has two similar spots on the abdomen.

This Spider was found in company with the ant *Œcophylla smaragdina*, the habits of which have been described by Mr. Ridley (Journ. Asiat. Soc., Straits Branch, 1890, No. 42, p. 345).

Fam. SALTICIDÆ.

Genus SALTICUS Latr. (sensu restricto).

SALTICUS ATTENUATUS, sp. n. (Plate V. figs. 6–6 *c*.)

Female (immature), length (including falces) $3\frac{1}{2}$ lines = 7 mm.

Cephalothorax oblong, narrowing gradually to the posterior end, which is truncate. Caput flat, rather longer than the thorax and rather longer than broad, divided from the thorax by a deep indentation or constriction. Colour deep black-brown on the thorax; caput black; in the constriction are three short lines or patches of white hairs, one on each side and one in the middle.

Eyes normal, ocular area longer than broad.

Legs rather short, furnished with short hairs, and a few fine spines in pairs beneath the tibiæ of the first and second pairs; these are of a pale yellow colour; the outer side of the tibiæ, metatarsi, and tarsi of the first pair, and of the tibiæ and metatarsi of the second, marked with a longitudinal black stripe; the coxæ, femora, tibiæ, and base of the metatarsi of the third pair black, the rest pale yellow; the fourth pair have the coxæ pale yellow, with an exterior longitudinal black line on the outer side, and the femora and tibiæ black, the metatarsi and tarsi being yellow.

Palpi yellowish; radial joint blackish; digital joint large, oval, flattish and tumid.

Falces rather shorter than the caput, strong, prominent, of a dull yellow-brown colour.

Maxillæ dull blackish, extremities pale yellowish.

Labium dull black, apex pale.

Sternum elongate, narrow; the basal joints of the legs are articulated around it on the same plane, the first two pairs with their coxæ almost contiguous on their inner sides.

Abdomen narrow, elongate-oval, strongly and broadly constricted towards the fore extremity; pedicle as long as the caput, two-jointed, the posterior joint longest and set in a circular cavity or socket at the extremity of the abdomen. Colour black, a little paler at the constricted part, just below the sides of the constriction white.

Hab. Singapore. Sent by Mr. H. N. Ridley to Mr. R. Shelford.

EXPLANATION OF PLATE V.

Fig. 1. *Cyrtarachne conica*, ♀ (p. 13). 1 *a*, profile; 1 *b*, eyes and falces from in front; 1 *c*, genital aperture.

2. *Prosthesima albomaculata*, ♀ (p. 11). 2 *a*, profile; 2 *b*, eyes and falces from in front; 2 *c*, genital aperture.

3. *Titus lugens*, ♀ (p. 13). 3 *a*, profile; 3 *b*, eyes and falces from in front; 3 *c*, maxillæ, labium, and sternum; 3 *d*, cephalothorax and eyes from above and behind; 3 *e*, genital aperture.

4. *Amyciæa lineatipes*, ♀ (p. 14). 4 *a*, profile; 4 *b*, eyes and falces from in front; 4 *c*, eyes and cephalothorax from above and behind; 4 *d*, genital aperture.

5. *Œcophylla smaragdina* (p. 15). (Ant with which *Amyciæa lineatipes* lives.)

6. *Salticus attenuatus*, ♀ (p. 15). 6 *a*, profile; 6 *b*, cephalothorax and connecting pedicle from above; 6 *c*, genital aperture. (It is doubtful whether this example is quite adult.)

3. Notes on the Anatomy of Picarian Birds.—No. IV. On the Skeletons of *Bucorvus cafer* and *B. abyssinicus*; with Notes on other Hornbills. By Frank E. Beddard, M.A., F.R.S., Prosector and Vice-Secretary of the Society.

[Received January 14, 1901.]

(Text-figures 2–5.)

The opportunity of comparing the two known species of Ground-Hornbills, *Bucorvus cafer* and *B. abyssinicus*, has been afforded me by the death of an example of each of them during the past year in the Society's Gardens. I have taken the opportunity of comparing the structure of the genus *Bucorvus* with several forms of arboreal Hornbills, of which I possess skeletons, with a view of separating from a general description of *Bucorvus* those features in which it is different from other Hornbills, and which are therefore distinctive characters of the genus, or subfamily as some would prefer to regard it.

I limit myself in the present communication to the skeleton, since I have nothing new to add to my[1] earlier account of the muscles and the viscera of *Bucorvus* and other genera of Hornbills, or to Prof. Fürbringer's[2] almost contemporaneous investigations upon the same subject. The latter work contains, naturally, a number of facts relating to the skeleton of the Hornbills in general, as well as of *Bucorvus*; but these, as might be expected, deal chiefly with the shoulder-girdle. Another source of information concerning the bones of the Bucerotidæ is Mr. Eyton's 'Osteologia Avium,' which work includes figures of the skeletons of *Bucorvus* and of a few other forms together with some quite brief notes in the text. The family is of course not neglected in the general works of Dr. Gadow[3] and myself[4] upon bird-anatomy.

There is, however, at least so far as I am aware, no account of the bones of the two species with which I deal here—no comparison of the two forms.

Vertebral Column.—Only two features in the vertebral column distinguish the two species of *Bucorvus*. In the first place, the relative lengths of the several regions differ: in *Bucorvus cafer* the cervical series (13 vertebræ in both birds) is shorter than that of *B. abyssinicus*. The total difference of length is rather more than an inch, and each individual vertebra is distinctly shorter than the corresponding one of the other species. This is not an expression of a smaller-sized bird, since the dorsal vertebræ are of exactly the same length collectively and individually in the two species. Nor is there any difference except the very minutest in the lengths of the sacral and caudal series. The last cervical vertebra of *B. cafer* has a transverse process which is slightly more rib-like than is that of *B. abyssinicus*. Though firmly welded to its vertebra, the homologue of the rib is more slender, as is the case in those birds where it is a free structure.

The second point of difference concerns the presence of an additional rib in *B. cafer* at the end of the series. The vertebra bearing that rib is not, however, free itself. The rib is long and slender.

Vertebral Column of Bucorvus *compared with other Hornbills.*—The great breadth and excavation below of the cervical vertebræ distinguish *Bucorvus* from *Buceros*. There are, moreover, thirteen of them, while in *Buceros* the thirteenth vertebra bears a small but movable rib on each side. In *Bucorvus* there are no closely approximated catapophyses; in *Buceros* the 11th vertebra has a pair of these. The remaining salient characteristic of *Bucorvus* is the slenderness of the pygostyle, which might be expected in a ground-living bird.

Sternum.—The only difference that I could detect between the sterna of the two species was that in *B. abyssinicus* the lateral incision of the xiphisternum is not nearly so deep as in *B. cafer*.

[1] "On some Points in the Structure of the Hornbills," P. Z. S. 1889, p. 587.
[2] 'Untersuchung. zur Morph. d. Vögel,' Amsterdam, 1888.
[3] Bronn's 'Ordnungen des Tierreichs,' Aves.
[4] 'The Structure and Classification of Birds,' Longmans, 1896.

There is no need to enter into comparisons between this and other parts of the shoulder-girdle in the Ground-Hornbills and the arboreal forms, since the structure and relations are as nearly as possible identical. This seems to show that use is a more important factor than disuse in the modification of organs, since the hind limbs show noteworthy differences.

Skull.—Very slight, but still perfectly recognizable and definable, differences distinguish the skulls of the two species of *Bucorvus* (*cf.* text-figs. 2, 3).

The most striking difference is, however, possibly a sexual one: in *B. cafer* the bony prominence on which sits the casque of the bird is much lower than it is in *B. abyssinicus*, and at the same time its texture is decidedly more solid; in *B. abyssinicus* this part of the skull is formed of very delicate cancellated bony tissue which immediately underlies the horny casque. My specimen of *B. cafer*,

Text-fig. 2.

Skull of *Bucorvus abyssinicus*, ♂. (× ½.)

however, is a female bird; the skeleton of *B. abyssinicus* belongs to a male.

When the two skulls are viewed from above, they can be readily distinguished by the greater breadth of that of *B. cafer*. The widest part is just behind the orbits. The measurements in the two species are as follows:

Bucorvus cafer......Length 206 mm.; breadth 63 mm.
B. abyssinicus......Length 203 mm.; breadth 59 mm.

A very small fragment of the tip of the beak in *B. abyssinicus* was, however, broken off and lost. This would therefore increase the length of the skull in that species, and thus render the proportions a little more striking than is apparent from the measurements. The greater breadth of the skull in *B. cafer* can, however, be well appreciated without any measurements at all.

A third feature in which the skulls of the two Ground-Hornbills differs is in the form of the occipital condyle. In *B. cafer* it is a little more elongated transversely than in *B. abyssinicus*. As will be seen from an inspection of the accompanying drawings (text-figs. 2, 3), the outline of the orbit is a little different in the two species.

In other respects the two skulls can hardly be distinguished.

Characteristics of the Skull of Bucorvus.—These can be arrived at from a comparison of the two species of *Bucorvus* with a skull of *Buceros rhinoceros*, which I shall take as a type of the arboreal Hornbills, indicating at the same time such divergences as are exhibited by other arboreal Hornbills. In comparing the skulls of the two, the first striking difference between the two genera is that shown by the cancellated bone which fills the casque. This, in *Buceros*, is solid behind where it projects back considerably over the roof of the skull; anteriorly it ends abruptly in a steep declivity

Text-fig. 3.

Skull of *Bucorvus cafer*, ♀. (× ½.)

which is formed of finely and beautifully cancellated bone. In *Bucorvus*, on the contrary, whether the cancellated bone shows exteriorly or not, the whole bony process slopes gradually, first upwards and then downwards in an even curve, there being no abrupt demarcation between it and the maxillæ in front. In *Buceros* a delicate shelf of bone slightly projecting marks the anterior boundary of the bony part of the casque. When the skulls of the two Hornbills are viewed laterally, notable differences are obvious. The walls of the brain-case are seen to arise in *Buceros* to a considerable distance above the orbit. The top of the skull is in fact swollen and convex. In *Bucorvus*, on the other hand, the top of the skull is almost flat and it is continued to form a projecting shelf over the orbit, which thus stands out more conspicuously from the sides of the head than in *Buceros*. The prominence of the orbit in *Bucorvus* is further emphasized by the prolongation downwards in front of the lacrymal region of a plate of bone to form a projecting ridge which joins the jugal arch behind. This renders the margins of the orbit perfectly visible when the skull is viewed directly from the front. In *Buceros* there is no such ridge, and the orbit is invisible when the skull is looked at from in front.

The narial aperture is double on each side in *Bucorvus* as it is in, for example, the Toucans. Each of the two apertures into which the originally single aperture is divided in this genus is of a rather elongated oval outline. In *Buceros* the single narial orifice is circular in outline.

A comparison of the dorsal aspect of the skull in the two genera shows several points of divergence in the two types. The greater breadth of the cranium of *Bucorvus* is apparent, this being mainly due to the projecting shelf of bone over the orbit, already referred to. Furthermore the "lacrymal" ring in front of the orbit which is absent or at least not so fully developed in *Buceros*, causes a very sharp demarcation between the cranium and the face in *Bucorvus*, a distinction which is wanting in *Buceros*, where one region gradually fades into the other. The commencement of the beak region is quite as wide as the anterior part of the orbit in *Buceros*; in *Bucorvus* it is very plainly much narrower. The contrast is so great that measurements are unnecessary to express the differences.

The basal aspect of the skull of *Bucorvus* is in some respects different from that of *Buceros*. In the first place, the foramen magnum in *Bucorvus* is much more distinctly upon the ventral surface than in *Buceros*, where this foramen looks partly backwards. It thus happens that the dorsal wall of the foramen is more apparent on a dorsal view in *Buceros* than it is in *Bucorvus*. The palatal region too shows differences which are not without a certain interest in relation to the connection between the two types of Hornbill. As has been already recorded by Fürbringer, the Bucerotidæ possess basipterygoid processes. These are, however, rudimentary, and are far from being in contact with the pterygoids. In *Buceros* not only are there present a pair of somewhat jagged rudimentary basipterygoid processes, but the pterygoids themselves are bowed inwards opposite to these processes; at the place where they should, so to speak, articulate with the basipterygoid processes they bear a roughened outgrowth which seems to suggest the remains of a pterygoid articular facet.

So exactly does the position of this facet correspond to the basipterygoid process, that if the bones could be forcibly pushed together they would meet at those points. *Bucorvus* shows a further stage of degeneration, which fits in well with the presumption that it is a later type than *Buceros*. The basipterygoid processes are distinctly more rudimentary, and, indeed, they are only just recognizable in *B. abyssinicus*. The pterygoids are straight, and are not at all bowed inwards towards the basipterygoid processes. In the place of what I have regarded as an articular facet upon the pterygoids in *Buceros*, there is in *Bucorvus* a thin, large, upwardly directed lamellar process of bone. This, however, is only to be seen in *B. cafer*. I consider this plate of bone arising from the pterygoid to be the homologue of the rudimentary articular facet of *Buceros*, but increased in a different direction. As is sometimes seen with degenerating organs, it has as it were run to seed. That it does not point toward the basipterygoid may perhaps be put down to the straightening and consequent rotation of the pterygoid.

The majority of these differences also hold good for other genera of arboreal Hornbills. The distinction between the cancellated bone which fills the casque, the maxilla, and between the posterior and anterior regions of the core of the casque is apparent even in the almost casque-less *Aceros*. The really casque-less *Toccus* may be left out of consideration. The principal feature in which the skulls of other Hornbills are less marked than *Buceros* are the lower elevation of the brain-case and the comparative straightness of the pterygoids.

Pelvis of Bucorvus *and* Buceros.—The pelves of the two species of *Bucorvus* agree exactly in the proportions of the pre- and of the post-acetabular regions. But when the genus is compared with *Buceros*, differences appear. In the latter genus the two regions of the pelvis which are separated by the antitrochanter are as nearly as possible equal in length; in *Bucorvus* the posterior region of the pelvis is rather the longer. This difference is coupled with another, viz., the greater depth of the ischia of *Buceros*, and the consequently more acute angle formed by the pubes with the longitudinal axis. In *Bucorvus* the pubes slope more nearly parallel to the long axis of the pelvis. One cannot but put down this difference to the difference in mode of life exhibited by the two genera.

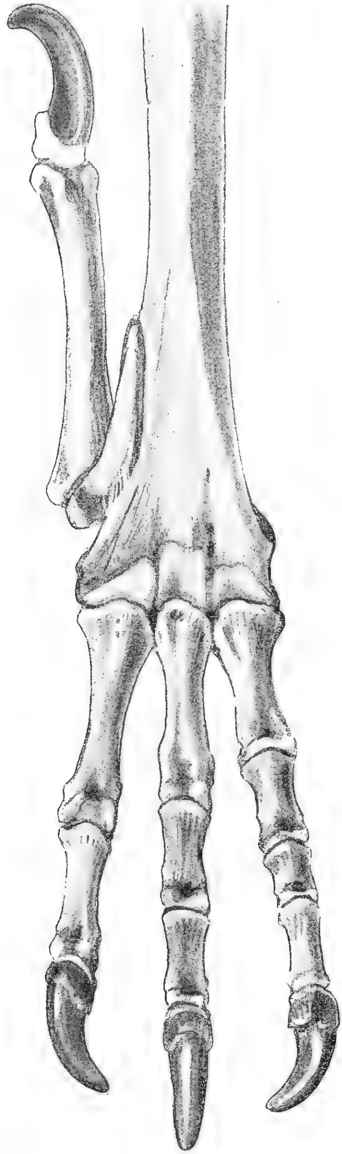
Hind Limb.—Measurements of the proportions of the several sections of the hind limb in the two species show some slight differences which are perhaps worthy of being recorded. In *Bucorvus abyssinicus* the measurements were as follows: femur 110 mm.; tibia 200 mm.; metatarsus 157 mm.; middle toe 90 mm. Of *B. cafer* the corresponding figures were 100; 185; 135; 77.

Hind limb of Bucorvus *and* Buceros.—It is of course well enough known that the Ground-Hornbills have longer legs than the arboreal genera; but nevertheless a few exact measurements may be useful. I append therefore a number of such measurements (in millim.), which have been taken in every case from the dried skeleton :—

	Femur.	Tibia.	Metatarsus.	Middle toe.
Buceros rhinoceros	90	125	62	77
Rhytidiceros plicatus	74	102	49	62
Dichoceros bicornis	108	141	71	80

It is plain from these measurements that the tibia is shorter relatively to the femur in the flying Hornbills, and that the metatarsus in the same birds is shorter relatively to the tibia than in the Ground-Hornbills. Taking the femur in all cases as 1, the

Text-fig. 4.



Left foot of *Bucorvus abyssinicus*. (Nat. size.)

proportions of the segments of the hind limb in *Bucorvus* and *Buceros* will be (quite roughly) these :—

Bucorvus	1	2	$1\frac{1}{2}$	1
Buceros	1	$1\frac{1}{2}$	$\frac{2}{3}$	1

Text-fig. 5.

Left foot of *Buceros rhinoceros*. (Nat. size.)

A final point of some little interest concerns the bones of the foot. Perching and walking on the ground are clearly two very different modes of using the feet, and we should therefore expect to find some corresponding differences in the structure of the foot. As a matter of fact, such differences do occur in the two series of Hornbills. In *Buceros* the middle metacarpal is if anything slightly longer than that of the second toe, while the fourth metacarpal is about one half of the length of the two metatarsals of the middle toes. In *Bucorvus* the second metatarsal is slightly longer, and also rather stouter, than the third metatarsal, while the fourth metatarsal is not so much reduced as in *Buceros*. It is clear then, that, apart from the differences in length which distinguish the genera, the prevailing toe in the bipedal *Bucorvus* is the second, which is really functionally the first toe, for the true first toe is of course turned backwards. It is true that the third toe is the longest; but nevertheless the increased length of the second metatarsal gives to that toe a preponderance in the foot. This state of affairs contrasts with that observable in the quadrupedal Ungulates, where it is the middle toe (or the two middle toes) that is the prevailing one. In correspondence with the greater length of the second metatarsal, the tibio-tarsus is more strongly developed on that side and projects beyond the rest of the bone, the articular surface of which is therefore oblique to the transverse axis of the leg. In *Buceros* the line of articulation is exactly transverse. This will be apparent from the drawings exhibited (text-figs. 4 & 5, pp. 22 & 23). The last-mentioned feature is not, however, distinctive of *Bucorvus*; for in *Rhytidiceros* the same obliquity at the end of the tibio-tarsus occurs. In *Toccus*, moreover, in addition to the obliquity, the second metatarsal is the longest.

From this description of certain features in the anatomy of *Bucorvus*, the osteological characters of the genus and of the two subspecies *B. cafer* and *B. abyssinicus* can be formulated :—

Genus Bucorvus.—Cervical vertebræ 13, short and broad, with concave centra and transverse processes forming a gutter beneath. No catapophysial canal or approach towards one. Pygostyle comparatively rudimentary.

Skull flat above, with marked shelf-like supraorbital plates. Foramen magnum ventral in position. Pterygoids straight. Basipterygoid processes rudimentary. Bony core of casque not sharply marked off from maxilla in front.

Second metatarsal the stoutest and longest; end of tibio-tarsus oblique. Tibia twice as long as femur; tibio-tarsus one and a half times as long.

B. cafer.—Neck comparatively short. Sternum rather deeply notched with one incision. Skull broad in proportion to length.

B. abyssinicus.—Neck comparatively long. Sternum not deeply notched. Skull narrower in proportion to length.

4. On some Butterflies from the White Nile collected by Capt. H. N. Dunn of the Egyptian Army. By Arthur G. Butler, Ph.D., F.L.S., F.Z.S., &c.

[Received November 14, 1900.]

Although the number of species recorded in the present paper is small, several of them are of considerable interest.

In the genus *Teracolus* are three interesting species—*T. phlegyas*, *T. liagore*, and *T. glycera*. The first was originally described from what I took to be the wet phase of the species, and which consequently was for some time confounded with the insect to which Miss E. M. Sharpe has given the name of *T. difficilis*; Capt. Dunn has now secured both sexes of the true wet phase, which shows that the nearest relation of *T. phlegyas* is *T. bacchus* (the form hitherto regarded as the wet phase being an intermediate phase of the species). *T. liagore* is represented in the collection by wet and intermediate phases; the intermediate phase having both a large and small form, the large form will represent *T. stygia* of Felder, and the small form *T. odysseus* of Swinhoe. *T. glycera*, which I originally described from a single male example without definite locality, has now come to hand in all its seasonal phases, and proves to be an easily distinguishable form of the *T. antigone* group: the males always characterized by an unusually straight outer margin to the primaries and hardly a trace of the dividing spot at the posterior edge of the orange apical patch; the female of the wet phase is dimorphic, either with an orange apical patch very distinctly divided by an angulated dusky line, or with the apex dusky brown enclosing four to five hastate yellowish streaks.

Another species of interest, of which both sexes were obtained, is *Belenois abyssinica* of Lucas (the wet phase approaching typical *B. gidica*), of which the Museum previously only possessed three examples; this is the insect for which, thinking it undescribed, M. Oberthür has proposed to use M. Boisduval's MS. name of "*Pieris allica*." It is apparently strictly limited to N. Africa, though the (typical) dry-season phase more nearly resembles the dry phase of the widely distributed southern and eastern *B. westwoodi* than might be expected from a comparison of the respective wet phases of the two species.

Perhaps one point of interest in this collection should be noted, namely, the resemblance of the species generally to, and their frequent identity with, those of Aden. At least fifteen of the Butterflies occurring at Aden are conspecific with those in the present collection, whilst *Precis boopis* and *Teracolus liagore* are nearly related to the Arabian forms; perhaps, however, the strangest thing is that *Limnas chrysippus* is tetramorphic both at Aden and on the White Nile, and it is probable that the same is true of *Catopsilia florella*, three of the four forms of that species being in the present collection.

Capt. Dunn made his collection on the Zeraf River (apparently the Giraffe River, sometimes spelt Seraf and sometimes Zarafe); many of the specimens are ticketed with a definite locality which looks like "Gabt-el-Meghahid or Neeghahid," but, as it is written in pencil, I am not certain of the spelling. Many of the specimens are in tolerably good condition and all are readily recognizable.

The following is a list of the species :—

NYMPHALIDÆ.

1. Tirumala petiverana, *Doubl.*
2. Limnas chrysippus, *Linn.*
3. Precis boopis, *Trimen.*
4. ,, clelia, *Cramer.*
5. ,, cebrene, *Trimen*[1].
6. Pyrameis cardui, *Linn.*
7. Hypolimnas misippus, *Linn.*
8. Atella phalantha, *Drury.*
9. Byblia ilithyia, *Drury.*
10. ,, vulgaris, *Staud.*
11. Acræa natalica, *Boisd.*
12. ,, abdera, *Hewits.*

LYCÆNIDÆ.

13. Lycænesthes amarah, *Lefeb.*
14. Polyommatus bæticus, *Linn.*

PAPILIONIDÆ.

15. Terias brigitta, *Cramer.*
16. ,, senegalensis, *Boisd.*
17. Teracolus calais, *Cramer.*
18. ,, phisadia, *Godart.*
19. ,, phlegyas, *Butler.*
20. ,, evarne, *Klug.*
21. ,, daira, *Klug.*
22. ,, glycera, *Butler.*
23. ,, eupompe, *Klug.*
24. ,, protomedia, *Klug.*
25. Catopsilia florella, *Fabr.*
26. Belenois severina, *Cramer*[2].
27. ,, boguensis, *Felder.*
28. ,, mesentina, *Cramer.*
29. ,, abyssinica, *Lucas.*
30. Pinacopteryx venatus, *Butler.*
31. Herpænia melanarge, *Butler.*
32. Papilio demodocus, *Esper.*

HESPERIIDÆ.

33. Baoris fatuellus, *Hopff.*
34. Rhopalocampta forestan, *Cram.*

5. On the Muscles and Joints of the Giant Golden Mole (*Chrysochloris trevelyani*). By F. G. Parsons, Lecturer on Comparative Anatomy at St. Thomas's Hospital.

[Received December 15, 1900.]

(Text-figure 6.)

The two specimens of *Chrysochloris* on which the following notes are made were kindly placed at my disposal by Prof. G. B. Howes and Prof. C. Stewart. The muscles of more than one species of the animal have already been recorded by Dr. Dobson in his work on the Insectivora[3]. It has been my lot to repeat many of Dobson's dissections, and I have as great a respect for his accuracy as for that of any other morphologist with whose writings I am familiar: still it is of great importance that our knowledge of any animal should rest, as far as possible, on the work of several observers; and in this case, although the chief result of my

[1] The White Nile specimens seem to be generally rather small for this species.

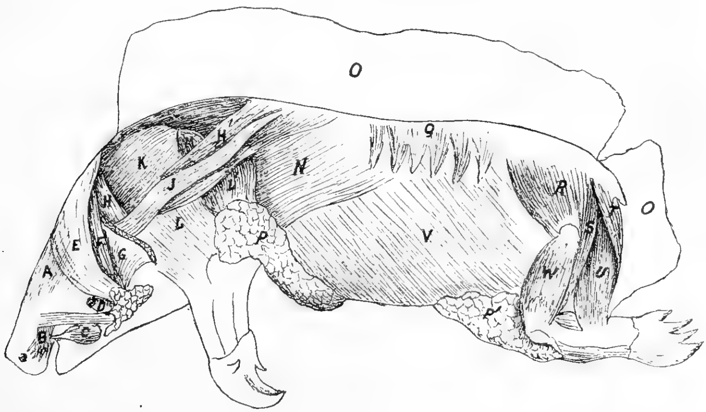
[2] All the specimens are of the extreme wet phase—*B. infida*; only one male was obtained. Of *B. boguensis* wet, intermediate, and dry phases of the female were taken.

[3] 'A Monograph of the Insectivora': London, John Van Voorst, 1882.

labour is merely to bear witness to the reliability of my predecessor's work, there are certain points in which we differ in the record of facts and others in the interpretation of facts on the accuracy of which we are both agreed.

Since completing the dissection of these two specimens, I have had the opportunity of examining a third, which has been prepared for the muscle series of the College of Surgeons Museum; so that all the following observations are founded on at least two, sometimes three animals, and one is less likely to be misled by individual variations.

Text-fig. 6.



Superficial Dissection of *Chrysochloris trevelyani*.

A. Occipito-frontalis.
B. Levator labii superioris.
C. Masseter.
D. External auditory meatus.
E. Occipito-cuticularis.
F. Cervico-cuticularis.
G. Acromio-cuticularis.
H. Anterior trapezius.
H'. Posterior trapezius.
J. Dorso-cuticularis.
K. Rhomboid.
L, L'. Triceps.
M. Serratus magnus.
N. Latissimus dorsi.
O. Superficial panniculus (reflected).
P. Anterior mammary gland.
P'. Posterior ditto.
Q. Serratus posticus.
R. Ecto-gluteus.
S. Caudo-femoralis.
T. Semitendinosus.
U. Biceps femoris.
V. External oblique.
W. Vastus externus.

The joints have been examined with the view of carrying on the work which I began for the Hunterian Lectures at the College of Surgeons in 1899[1]. I have not burdened the paper with the points in which the joints of *Chrysochloris* agree with those of a generalized mammal; but by comparing the present paper with the lectures already referred to, it will be possible to get a good idea of the details of the articulations of the animal.

[1] Journ. Anat. & Phys. vol. xxxiv.

Trunk-Muscles.

Panniculus carnosus.—This is very specialized, probably in connection with the underground habits of the animal, so that the typical mammalian dorso- and abdomino-humeralis muscles are remarkable for their absence, and their characteristic relation to the pectoral muscles is wanting. As usual, there are many layers of fibres in the panniculus, and to many of these special names have been given by Dobson. The main scheme consists of a longitudinal set of fibres running over the back region from the root of the snout to the root of the tail, forming Dobson's occipito-frontalis and dorso-cuticularis, while various oblique bands cross the general antero-posterior direction of the fibres and acquire attachments to fixed points, such as the acromion process, the elongated auditory meatus, and the ligamentum nuchæ. In this way the acromio-cuticularis, occipito-cuticularis, dorso-cuticularis, cervico-cuticularis, cervico-auricularis, and retractor naris are formed; muscles which in our specimen fully bore out Dobson's descriptions of them (text-fig. 6, p. 27).

The ventral panniculus consists of the platysma in the neck and a set of abdominal fibres which have the same direction as those of the external oblique; some of these fibres are prolonged down over the anterior (cephalic) surface of the leg as far as the dorsum of the foot. There is, so far as I could see, no indication of the sterno-facialis or sphincter colli so common among mammals; but a muscle runs almost directly outward from the manubrium sterni on a deeper plane than the ventral panniculus with which it ultimately blends, and is well-named by Dobson the sterno-cuticularis. The specimen in my possession shows that this muscle lies superficial to and probably compresses the anterior of the two mammary glands. The posterior mammary gland lies in the groin and extends as far as the front of the knee, it is merely covered by the general fibres of the ventral panniculus.

The muscles of the head, neck, and trunk closely correspond with Dobson's descriptions; perhaps the following points, however, may be worth calling attention to. There are three separate parts to the sterno-cleido-mastoid:—1. The sterno-mastoid is inserted separately by tendon. 2. The cleido-mastoid is inserted by flesh. 3. The cleido-occipital which near the clavicle lies superficial to the last, and is separated from it by the spinal accessory nerve.

The two parts of the trapezius are widely separate as in Dobson's specimens; the anterior portion only is inserted into the acromion. Both parts are supplied by the spinal accessory nerve.

The hinder (caudal) part of the rhomboids passes across the mid-dorsal line to join its fellow of the opposite side. This arrangement is described by Dobson as the transversus scapularum, and reminds one of a similar arrangement of the acromial fibres of the trapezius (acromio-cucullaris) described by Prof. Windle and myself in certain Carnivores[1].

[1] "Myology of the Terrestrial Carnivora," P. Z. S. 1897, p. 385.

The splenius capitis, biventer cervicis, and complexus agree with Dobson's descriptions. The scalenus anticus (ventralis) rises from the transverse processes of the 5th and 6th cervical vertebræ and is inserted into the first rib ventral to the subclavian artery and brachial plexus.

There is no splenius colli, and the so-called biventer cervicis, although it is quite a separate muscle from the complexus, is not at all biventral.

The trachelo-mastoid is present and distinct.

The rectus abdominis or rectus ventralis, as it would be more appropriate to call it, agrees with Dobson's description in *C. trevelyani* and *C. villosa*. After the closest scrutiny I could detect no indications of lineæ transversæ.

The external oblique rises from the 5th to the 17th ribs.

The internal oblique is well developed and distinct in the posterior (caudal) portion of the abdomen, but is hardly marked at all in the anterior part.

The transversalis in its attachments and direction of fibres agrees with Dobson's descriptions.

Both the sterno-costalis and pyramidalis are absent.

Muscles of the Fore Limb.

The muscles of the pectoral region and shoulder agree with Dobson's description, with the following exceptions:—

The teres major is a small muscle entirely unconnected with the latissimus dorsi. It has the usual attachments and it is evident that the muscle which Dobson calls teres major is really part of the triceps.

The teres minor is absent, the origin of the middle head of the triceps is so great that there is no room for it. The muscle which Dobson describes as teres minor is really teres major.

The latissimus dorsi agrees with Dobson's description, but there is a tendinous intersection in it opposite the elbow in one specimen, not in the other two. The levator scapulæ and levator claviculæ are just as Dobson described them, but they are distinct at their insertion. I am inclined to regard them as a longitudinally split levator claviculæ or trachelo-acromial muscle, because this is the only mammal I have even seen with two muscles in this position. Elsewhere[1] I have stated my reasons for regarding the trachelo-acromial muscle as a fixer of the scapula for the scapular head of the triceps to rise from, and it is probable that the extra size of that head in this animal is correlated with the double-fixing muscle.

The supra- and infra-spinati have the usual attachments, but the former is much the larger of the two.

The subscapularis is very thick, rising as it does from the deeply concave fossa. A great many of its fibres rise behind the axillary border from the front of the tendon of origin of the middle head of

[1] "Muscles of Mammals," Journal of Anatomy, vol. xxxii. p. 428.

the triceps; these fibres are slightly separate at their insertion from the rest of the muscle, and form what is sometimes called a subscapularis accessorius.

The levator anguli scapulæ and serratus magnus agree with Dobson's description but are practically one sheet.

The sterno-scapular muscle is very large, and rises from the inner half of the first rib and passes to the dorsum of the clavicle, into which some of its fibres are inserted, constituting a subclavius; the rest of the fibres pass deep to the clavicle and are inserted into the supra-spinous fascia.

The deltoid has the clavicular and acromial portions small and fused together; the spinous portion, however, is distinct and unusually large.

The triceps has an enormous long or middle head, which rises from the whole length of the axillary border of the scapula; the external and internal heads are of ordinary size, and in addition there is a fourth head from the angle of the scapula which reminds us of the arrangement found in the Mustelidæ among the Carnivora[1], and in most of the Edentata except the Sloths[2]. It is worthy of remark that all the animals mentioned are accomplished diggers, as is *Chrysochloris*.

The brachialis anticus rises, as is usual in mammals, from the back of the surgical neck of the humerus; it winds round the outer side of that bone and is inserted into the ulna. It is supplied by a branch from the musculo-cutaneous nerve, but after a careful search on both fore limbs of two specimens I could find no supply from the musculo-spiral.

The epitrochleo-anconeus muscle is especially massive.

The anconeus is present, but is only about a quarter as large as the last. There is neither supinator longus nor extensor carpi radialis longior, but the brevior passes from the external condyle to the metacarpal bone of the medius.

The extensor communis digitorum divides into two tendons for the terminal phalanges of the medius and annularis.

There is a separate muscle which is inserted into the metacarpal bone of the annularis, and which probably corresponds to the extensor minimi digiti, since in the second specimen it was inserted into the terminal phalanx of the minimus.

The extensor carpi ulnaris rises only from the external condyle and is inserted into the base of the 5th metacarpal.

The flexor carpi radialis was not enclosed in the osseous tunnel described by Dobson in either specimen.

The flexor carpi ulnaris comes from the great olecranon, and not from the internal condyle; it runs to the pisiform.

The flexor sublimis digitorum is absent.

The flexor profundus digitorum comes from the internal condyle and olecranon and bones of the forearm; the bony tendon mentioned by Dobson extends from the middle of the forearm to the

[1] P. Z. S. 1897, p. 394. [2] P. Z. S. 1899, p. 330.

wrist; below that three fibrous tendons pass to the medius, annularis, and minimus in one specimen, in the other the slip to the minimus is absent.

The pronator quadratus, lumbricales, and palm-muscles are absent.

The palmaris longus is absent in one specimen, present in another.

Muscles of the Hind Limb.

The following points which were either unnoticed by Dobson or differ from his descriptions may be called attention to:—

The gracilis is a single muscle.

The adductor longus is only separable from the adductor mass just above the internal condyle of the femur. The rest of the mass cannot be satisfactorily divided.

The pectineus is supplied entirely by the anterior crural nerve.

The caudo-femoralis (agitator caudæ) lies as usual caudal to the ectogluteus; it rises from the caudal vertebræ by a narrow tendon deep to the origin of the semitendinosus, and is inserted into the femur lower down than the insertion of the ectogluteus, with which it is closely connected. (In the R. C. S. specimen it is indistinguishable.)

The meso- and ento-glutei cannot be satisfactorily separated one from another.

There is no gluteus ventralis (scansorius).

The sartorius and tensor fasciæ femoris are absent.

The biceps femoris runs from the tuber ischii to the fascia on the outer side of the leg. There is no bicipiti accessorius (tenuissimus).

The presemimembranosus is quite distinct from the semimembranosus and adductor mass, the femoral artery passes between it and the latter.

The peroneus longus rises from the head of the fibula.

The peroneus brevis rises from the upper third of the shaft of the fibula.

The peroneus quinti digiti is inseparable from the peroneus brevis in the leg; this is probably owing to the fibula being a distinct bone only in the upper part of the leg. On the dorsum of the foot the tendon separates from that of the peroneus brevis and runs down to the distal phalanx of the minimus, of which it is the only extenser.

The extensor longus digitorum goes only to the annularis in all three.

The extensor brevis digitorum is not so large as in Dobson's specimens; it runs to the index and medius in one animal, but in the other two it goes to the annularis as well. There is thus in one specimen a great economy of extensor tendons, no toe having more than one—the hallux has the extensor hallucis, the index and medius the extensor brevis digitorum, the annularis the extensor longus digitorum, and the minimus the peroneus quinti digiti.

The gastrocnemius is as Dobson describes it; there are no fabellæ in its heads of origin.

The plantaris tendon passes under the tuber calcis and is continuous with the flexor brevis digitorum and plantar fascia in the sole.

The popliteus lies, as in most mammals, behind the anterior tibial artery.

The flexor fibularis resembles the flexor profundus digitorum in the fore limb in having its tendon ossified; in both my specimens there were two sesamoid bones, one at the ankle and another in the sole.

The flexor tibialis is only imperfectly separated from the last muscle in the calf, and the two tendons fuse in the lower part of the leg.

The abductor ossis metatarsi minimi digiti is feeble; while the tibialis posticus, accessorius, and flexores breves agree with Dobson's description.

There is only one lumbrical, the outermost, in one specimen; in the other the two outer ones are present.

Articulations.

The joints of *Chrysochloris* are in many respects those of a generalized mammal in spite of its extremely specialized fossorial habits. As I have in another place [1] given a description of the joints of mammals, I shall not take up space by drawing attention to the details which this animal shares with other mammals, but shall only mention the points of special importance.

The temporo-maxillary articulation is a perfect hinge, and the condyle is elongated transversely to fit into a socket bounded by a definite pre- and post-glenoid process. The meniscus is very thin and concave downward. The whole articulation is of the carnivorous type.

The sterno-clavicular articulation consists of a short fibro-cartilaginous band which connects the sternal end of the clavicle to the dorsal side of the anterior (cephalic) margin of the presternum. No ossific nodule was present in this band, nor could I make out any synovial cavity between it and the sternum.

The presence or absence of a synovial cavity at the sternum seems to depend very much on the histological structure and consequent rigidity of the connection between the bony clavicle and the sternum. In the Hedgehog, for example, there is a synovial cavity, but then the rod of connective tissue is much more densely chondrified than it is in *Chrysochloris*; indeed, in the latter animal the connecting band between the two bones is so flexible that a synovial joint would be quite superfluous.

The coraco-clavicular ligaments are absent; the acromion is so long and projects so far forward that the clavicle is carried far

[1] Journ. Anat. vol. xxxiv.

away from the rudimentary coracoid, and all ligamentous connections between the two are obliterated.

To the comparative anatomist the contrast between the arrangement met with in this animal and the Three-toed Sloth (*Bradypus*) is very striking. In the latter animal the coraco-clavicular ligament forms the only union between the clavicle and the scapula, while in the Golden Mole it is absent altogether. The Armadillo, as will be seen on referring to my paper[1], forms a transition between the two.

The acromio-clavicular articulation is very interesting. A small bone is interposed between the acromial end of the clavicle and the acromion, and there is a synovial cavity on each side of it; this is the only instance I have hitherto noticed of the presence of such a bone, and the possibility of its being homologous with the interarticular meniscus of the same joint in man at once occurs to the mind. Personally, I should be more inclined to regard the two structures as analogous than homologous, because intraarticular menisci are so often found where rotation is combined with hinge or gliding movements; and in *Chrysochloris*, partly owing to the absence of the coraco-clavicular ligaments, the rotation or pendulum movement of the scapula is very free in addition to gliding movement. Probably this little bone is an ossified meniscus developed to meet the requirements of the joint. Of course this is merely a surmise, but it seems borne out by the facts at my disposal.

The great differences in the detail of the bones and joints connecting the shoulder-girdle with the trunk in the Mole (*Talpa*) and the Golden Mole are very obvious.

The shoulder-joint differs little from that of a generalized mammal, it is chiefly remarkable for the lateral compression of the head of the humerus. The oblique middle gleno-humeral ligament is well marked, but does not project at all into the cavity of the joint; it has the typical mammalian attachments. It becomes tight in extension and external rotation.

The elbow is chiefly remarkable for the enormous development of the olecranon, but there is no upward extension of the back of the head of the radius as in the Mole. During flexion of the joint considerable lateral movement is allowed, as well as rotation of the radius and ulna together, through an axis passing between the two bones and parallel to their long axes; this movement is possible to the extent of about $\frac{1}{4}$ of a circle, and is quite distinct from pronation of the radius, which is only possible for about $\frac{1}{8}$ of a circle. As there is so little true pronation one would not expect an orbicular ligament, nor can anything of the kind be found. The external lateral ligament runs to the outer side of the head of the radius, while the internal is fan-shaped and passes down to the inner margin of the sigmoid cavity of the ulna.

The wrist-joint resembles that of most mammals in which there is little pronation and supination of the forearm. There is no

[1] *Op. cit.* p. 50.

triangular fibro-cartilage, the ulna is received into a facet formed by the cuneiform and pisiform, and this part of the wrist is shut off from the rest by an antero-posterior septum. In addition to this there is a partial septum which projects into the joint from the anterior ligament opposite the articulation between the scaphoid and semilunar bones.

The hip-joint on disarticulation in both shows exactly the same arrangement that I have already described and figured in the Armadillo[1]. The ligamentum teres is present but is continuous along its lower border with the capsule, and the head of the femur shows a vertical notch for its reception instead of a pit.

The knee-joint has all the characteristics of a generalized mammalian knee; the only characteristic thing about it is that the joint is bipartite owing to the great size of the ligamentum mucosum. As in the case of the Brocket Deer, the external condylo-tibial joint is shut out of the main cavity of the knee by the ligament which is attached behind to the crucial ligaments and in front to the origin of the extensor longus digitorum.

The external lateral ligament is very strong, and passes from the condyle to the head of the fibula just behind the prominent anterior projection. The crucial ligaments and the semilunar cartilages are those of a generalized mammal.

There are no tibio-fibular joints. As in most of the Insectivora, the two leg-bones are synostosed above and below.

The ankle-joint is nearly a perfect hinge; it consists of tibio-astragalar and fibulo-calcaneal portions. There is absolutely no posterior ligament, as the articular surfaces of the tibia and astragalus are continuous posteriorly with the cartilage-covered surfaces lining the broad groove in which the flexor fibularis tendon plays; this groove is continued on beneath the sustentaculum tali.

There is no articular facet on the anterior border of the lower end of the tibia for articulation with the neck of the astragalus during dorsal flexion of the ankle.

The external lateral ligament has, as usual in mammals, only two fasciculi; they correspond to the middle and posterior of human anatomy. The internal lateral ligament has the typical mammalian X-form, the more superficial fasciculus of the X running downward and forward to the navicular, the deeper running downward and backward to the astragalus.

[1] Journal of Anat. vol. xxxiv. p. 305.

February 5, 1901.

Howard Saunders, Esq., Vice-President, in the Chair.

Before proceeding with the ordinary business of the Meeting the Chairman made the following remarks:—

This being the first meeting of the Zoological Society of London since the sad event which has placed the British Empire and the whole civilized world in mourning, it seems befitting that, even at a Scientific Meeting, allusion should be made to the great loss which this Society has sustained by the death of our beloved Queen, who was not merely our Patroness, but also a generous benefactor of the Society.

Inasmuch, however, as an Address of Condolence to His Majesty the King on this sad event will be prepared by the Council tomorrow, it seems unnecessary to say more upon the present occasion.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1901:—

The total number of registered additions to the Society's Menagerie during the month of January was 92, of which 31 were by presentation, 8 by purchase, 50 were received on deposit, and 3 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 165.

Amongst these special attention may be called to the three examples of the Open-bill (*Anastomus oscitans*) purchased on January 4th, being the first examples of this anomalous Stork received by the Society.

Mr. Sclater called attention to the fine specimen of Prejevalsky's Horse (*Equus prejevalskii*) now mounted and exhibited in the large Gallery of the Muséum d'Histoire Naturelle of Paris.

A recent letter from Mons. Oustalet had assured Mr. Sclater (in answer to enquiries) that there were, without doubt, callosities ("chestnuts") on the hind as well as on the fore legs of this animal, so that it would have to be placed in the typical section of the genus *Equus*, and was, in Mr. Sclater's opinion, in all probability a descendant of the original stock whence the Horse of domesticity (*Equus caballus*) had been derived. M. Oustalet would prepare a figure and description of this specimen very shortly.

The following papers were read:—

1. On the Mammals of the Balearic Islands. By Oldfield Thomas, F.Z.S.

[Received December 18, 1900.]

In the spring of last year Mr. R. I. Pocock and I made a trip to the Balearic Islands in order to procure zoological specimens of all sorts for the Museum collection. Up to that date there had been no Balearic mammals at all in the collection, and, as I gather from my colleagues, very few members of any other groups.

We were able to spend about 10 days in each of the two larger islands, Majorca and Minorca, and obtained fairly representative collections in each.

In Majorca our collections were made at Inca, a small town in the centre of the islands, on the low ground, but not far distant from the main mountain chain which runs the whole length of the north-western edge of the island.

In this place we had the advantage of the kind assistance of Don Miguel Riutort, himself an enthusiastic naturalist and collector, and were able to examine in his little Museum specimens of some species which we failed to capture ourselves.

From Inca we made collecting excursions to the "Albufera" or reclaimed swamp of Alcudia, to neighbouring lignite-mines in search of fossils, and to the local cave of Santa Magdalena, and the more distant and better-known one of Manacor in search of Bats. Of fossils from the lignite, although we found none ourselves, we were able to purchase some remarkably fine molars of *Anthracotherium*, which have been placed in the hands of Dr. Forsyth Major for determination.

In Minorca, acting on the good advice of Don Bartolomé Escudero, the British-Vice Consul at Mahon, we stayed at San Cristobal[1], and found it in every way a most excellent locality for collecting. The natives took the greatest interest in our work, and constantly brought us in specimens which we should not otherwise have been able to get. Thanks to the suitability of both place and natives, we obtained examples of every land mammal known to inhabit Minorca, with the exception of the Weasel, and even this has since been obtained by the kind assistance of Mr. Escudero.

The mammals of the islands prove to be very similar to those of the neighbouring mainland of France and Spain, and I can find no evidence of insular specialization. The occurrence in them of the Algerian instead of the European Hedgehog is of remarkable interest, although this animal had been already recorded from Spain (see below).

Three species—the Wild Cat, Genet, and Hare—range eastwards from Spain to Majorca, but do not reach Minorca, where, when introduced, the last-named has failed to maintain itself and has again died out. All the other mammals are found in both islands.

The only previous list of any importance of the Mammals of the Balearics is the very excellent one by Prof. F. Barcelo[2], published in 1875. To this list we have been able to add one terrestrial species (*Mus spicilegus*) and several Bats, to disprove the presence of the Water-Vole, and to make some corrections in the determinations.

[1] San Cristōbal.

[2] An. Soc. Españ. iv. p. 53 (1875).

1. Rhinolophus ferrum-equinum Schreb.

San Cristobal, Minorca.

The Greater Horseshoe Bat is evidently one of the commonest species in Minorca, as we ourselves found examples in two of the caves we visited, and the natives kept bringing in further specimens as they explored the different caves on our behalf. But in no case were large numbers found together, one or two being all that were to be obtained in any one cave.

2. Rhinolophus hipposideros Bechst.

Inca, Majorca.
San Cristobal, Minorca.

All the specimens obtained of the Lesser Horseshoe Bat were found in caves.

3. Plecotus auritus L.

Recorded by Barcelo from Majorca and Iviza, and described to us as found in a cave at San Cristobal, Minorca. So windy a country is probably not very favourable to the Long-eared Bat. We ourselves did not see any specimens.

4. Vespertilio serotinus Schreb.

Recorded by Barcelo from Majorca and Iviza.

5. Pterygistes noctula Schreb.

Majorca (Barcelo).

6. Pipistrellus pipistrellus Schreb.

Recorded as common by Barcelo. Not seen by ourselves, the Bats flying round the houses in Minorca proving to be the next species.

7. Pipistrellus kuhli Natt.

a–c. San Cristobal, Minorca.

Shot in the close neighbourhood of the village. The flight of this species struck us as very similar to that of its near ally our British Pipistrelle.

8. Myotis myotis Bechst.

Minorca (Ramis *fide* Barcelo). There was also a specimen, presumably from Majorca, in Don Miguel Riutort's collection at Inca.

9. Myotis capaccinii Bonap.

♂. Inca, March 26.

Found in a crevice in the "Cueva de Santa Magdalena," a limestone cave in a hill a couple of miles from Inca. In another crevice close by we found a pair of *Miniopterus schreibersi*, the occurrence together of the two species being just as described in the Marquis Doria's paper on Ligurian Bats [1]. And again, from Sardinia the Museum has since received examples of these two bats, taken together in the Grotto de Sardali. With regard to the identification of Bonaparte's species, I may express my entire accord with the conclusion arrived at by Dobson, Trouessart, and Doria.

As might be expected, the present forms an addition to the list of Balearic Mammals, the species not having been mentioned by Prof. Barcelo. Its nearest recorded locality is Marseilles; the Museum possesses examples from Cagliari, Sardinia; it occurs in Italy and Germany, and is said, though I venture to doubt the statement, to range eastwards to Japan and the Philippines.

10. Miniopterus schreibersi Natt.

Inca, Majorca.
San Cristobal, Minorca.
New to the Balearic list.

Although not recorded by Barcelo, this species is evidently common. At Inca we found two specimens of it in the Cueva de Sta. Magdalena, in company with *Myotis capaccinii*, and at San Cristobal quite a large number of specimens were brought us from the caves in the neighbourhood. We failed to persuade captive specimens to eat anything, nor did we have the opportunity of seeing this species on the wing.

11. Erinaceus algirus vagans, subsp. n.

a. Inca, Majorca.
b–f. San Cristobal, Minorca.

The "Erisso" is very common in both islands, and is eaten by the natives; we ourselves tried a hash of Hedgehog, and found it excellent.

It is of remarkable interest to find that the Hedgehog of the Balearic Islands is not the European species at all, as Prof. Barcelo not unnaturally supposed, but is the North-African *E. algirus*, from which, however, it is subspecifically distinguishable by size and colour. The same species has been recorded by Mr. de Winton as occurring in Andalucia [2], but with some doubt owing to the exact locality of the specimen not being known. Now, however, that *E. algirus* has turned up in the Balearics, the Andalucian record may be accepted as certainly correct, for it is through that region that the species must have reached the islands.

As a subspecies *E. a. vagans* may be distinguished from *E. a. typicus* by the smaller size of its skull and by the nearly uniform whiteness of its hairy parts. In some specimens the face, feet, and inguinal regions are faintly browner than the rest of the body, but are still far lighter than is the case in the African representatives of the species. The general colour of the upper surface of

[1] Ann. Mus. Genov. (2) iv. p. 459 (1887).
[2] P. Z. S. 1897, p. 856.

the body is very white, and quite different to what we are accustomed to see in our British Hedgehog. In the length and detailed coloration of the spines, and in the various cranial characteristics which Dobson and de Winton have described as distinguishing *E. algirus* from *E. europæus*, our Balearic specimens agree entirely with the former.

Dimensions of the type, an old male, the largest of the series, measured in the flesh:—

Head and body 250 mm., tail 40, hind foot 37, ear 33.

Skull—greatest length from condyle to gnathion 53·8 mm.; basal length 51; zygomatic breadth 33; nasals, greatest (diagonal) length 16·5; interorbital breadth 17; intertemporal breadth 14; palate, length 32, breadth outside $m.^1$ 22, inside $m.^1$ 10·5.

The corresponding greatest length of a rather younger skull of *E. algirus typicus* is 59 mm.

Type. Male, B.M. No. 0.7.1.36; original number 287; killed 10th April, 1900, at San Cristobal, Minorca.

The specimen selected as the type was brought to us with half a dozen others, and was considered by the natives as decidedly larger than usual. No doubt the persecution these animals undergo, owing to their edibility, tends to kill them off before they have the chance of attaining a good old age. On the other hand, no very young ones were met with, our smallest skull (♀) measuring 48·5 mm. in greatest length.

The range of *Erinaceus algirus* is now shown to extend over North Africa from Tripoli westwards to Marocco, and in Europe from Andalucia to the eastern island of the Balearic archipelago. In Spain its exact distribution still remains to be worked out, and, especially, its geographical relationship to *E. europæus*, which, in the subspecies *E. a. hispanicus* B. Ham., occurs as far south as Seville.

12. Crocidura russula Herm.

a–c. San Cristobal, Minorca.

The Garden Shrew is said by Barcelo to be very rare in Majorca, and this assertion is borne out by our catching none in that island and only three in Minorca; for when present it is easily trapped, and at Cintra in Portugal I captured as many as I wished of the same species.

By such natives as were observant enough to know it at all, it was called "Rata aranera," while the Castilian name for it is "Musaraña."

We failed either to catch or hear of the Southern Pigmy Shrew, *Pachyura etrusca*. It may also be safely asserted that neither the Water-Shrew (*Neomys fodiens*) nor the Common Shrew (*Sorex araneus*) occur in the islands.

The Mole is also entirely absent.

13. Felis catus L.

Majorca and Iviza (Barcelo). Does not occur in Minorca.

I can offer no opinion as to whether this animal is a real Wild-Cat or not. A specimen in Don Riutort's collection looked as if of rather doubtful ancestry, but was not examined very closely.

14. Genetta genetta L.

Majorca and Iviza (Barcelo; also in Don Riutort's collection). Does not occur in Minorca.

The Genet is common in Majorca, but unfortunately, owing to the bad weather, we were unable to procure any specimens of it.

15. Mustela martes L.

a. ♀. San Cristobal, Minorca.

The Marten is said to be by no means rare either in Majorca or Minorca. At San Cristobal a hunting-party of three men and eight dogs was organized in our interests, and succeeded in getting the specimen mentioned above. It does not appear to differ in any way from ordinary Southern specimens of *M. martes*.

Barcelo records *M. foina* from Majorca, but I should hesitate to believe that both species occur in so small a country. Three Martens in Don Miguel Riutort's collection were, like ours, referable to *M. martes*.

Barcelo also states that Ramis records the Polecat (*Putorius putorius*) from Minorca. In the wild condition, however, it is not known to the natives, although ferrets are used for rabbit-catching, and it may have been these that were referred to by Ramis.

16. Putorius nivalis boccamela Bechst.

a–b. Inca, Majorca.

The "Mostel" is common both in Majorca and Minorca, although in the latter island we failed to secure specimens.

It is highly interesting to find that the Balearic Weasel is quite distinct from that of Spain or at least Seville (*P. n. ibericus* B.-Ham.), which has a sharp Ermine-like division of the brown and white colours, and that it belongs instead to the group with this line vague and wavy[1]. To this group belong the Weasels of Sardinia, Italy, Malta, and Egypt, while those of Sicily and Spain are of the other type.

In the present group, which comprises *P. n. boccamela*, *italicus*, and *africanus*, the differences are rather baffling, and it seems to me that the Balearic Weasel might be almost as well referred to one as the other. But *boccamela* is the earliest name within the group, and its locality, Sardinia, is the nearest to the Balearics, and I therefore use that name.

The occurrence of a Weasel of this type within the Spanish dominions is a fact which should be borne in mind in connection

[1] Although much smaller than *P. africanus*, a Weasel from Oporto, received since the above was written, also proves to be of the same group; so that both wavy-lined and straight-lined Weasels occur in the Iberian Peninsula.

with the question as to which is the original home of the Weasel of the Island of St. Thomas, Gulf of Guinea, where, on zoogeographical grounds, it is difficult to believe a Weasel is really indigenous. The British Museum has recently received a fine example of the St. Thomas Weasel, and this is remarkably like the large forms from Malta and Egypt. It is therefore possible that there is a substratum of truth both in my own suggestion that *P. africanus* Desm. might be the large Maltese Weasel [1], and Prof. Bocage's [2] that the type specimen of that name might have come to Lisbon from St. Thomas.

17. ELIOMYS QUERCINUS L.

a–e. San Cristobal, Minorca.

The "Rata Sarda" is a well-known animal both in Majorca and Minorca, but is said by Barcelo not to occur in Iviza.

We were unable to obtain any specimens in Majorca, although we saw one in Don Miguel Riutort's collection, but succeeded in trapping several at San Cristobal, Minorca. There, among the Ilex-trees near the town, Schuyler traps baited with cheese took several specimens of this beautiful animal.

The Minorcan examples appear to be precisely similar to the true *E. quercinus* of France and Germany, and show no approximation towards the fine South-Spanish species *E. amori* Graells [3]. The geographical relationship of this animal is therefore markedly different from that of the Hedgehog, where the Balearic species is the South-Spanish and Algerian, not the European one.

Younger examples are paler in colour than the old ones, and indeed the resemblance between our younger specimens and the *E. pallidus* of Sicily raises a suspicion as to whether old specimens of that form will not be as dark as normal *E. quercinus*.

[1] P. Z. S. 1895, p. 128.

[2] J. Sci. Lisb. (2) xiii. pp. 24 & 48 (1895).

[3] MIOXUS NITELA var. AMORI Graells, Mem. Ac. Madrid, xvii. p. 481 (1897).

This form appears to me worthy of recognition as a species distinct from *E. quercinus*. The following are the characters shown by six specimens of it from Seville, which were obtained for, and presented to the Museum by, the late Lord Lilford:—

Size considerably larger than in *E. quercinus*, as shown by the skull-dimensions. General colour of the same character as in that animal, but very deep and strong, markedly different from that of the pale Sicilian *E. pallidus*. Facial and other markings as usual, but the black of the tail usually runs right round that organ, interrupting the white below for about the middle third.

Skull similar in general characters to that of the typical species, but very much larger throughout.

Dimensions, measured in skin:—

Head and body (c.) 139 mm.; tail 120; hind foot (wet) 31; ear (wet) 21.

Skull—greatest length 41; basilar length 32·2; greatest breadth 23·2; nasals 15·8×4; interorbital breadth 4·7; palatal length from henselion 14; diastema 9; palatal foramina 5·4×3·9; length of upper tooth-row 6·1.

I owe to the kindness of Don Angel Cabrera, of Madrid, several additional particulars about Dr. Graells's type, beyond those that appear in the original description.

18. Mus norvegicus Erxl.
(*Mus decumanus* Pall., auctorum.)[1]

Common in all the towns. It has also taken to an aquatic life in many places, and is the "Water-rat" of the workers in the Albufera of Majorca.

19. Mus rattus alexandrinus Geoffr.

a–b. San Cristobal, Minorca.

"Common in all the islands" (Barcelo).

This Rat was living a wild natural life, away from houses, among the trees on the hill-sides, and is probably perfectly indigenous in the islands. Unlike *M. spicilegus*, however, it also occurs in the houses, wherever it has not been ousted by the more powerful *M. decumanus*. In colour it is a fulvous grey above and white below, as unlike the typical Black Rat as could well be conceived.

20. Mus sylvaticus L.

a–m. Inca, Majorca.
n–o. San Cristobal, Minorca.

As is the case everywhere else in Europe, the Long-tailed Field-Mice are the commonest and most easily trapped of the Balearic mammals. They are of rather large size, running about 99 to 105 mm. in length of head and body, and are on the whole rather dark in colour, very few of them being rufous. In this respect the Majorca specimens are remarkably uniform, all being of a dark greyish colour, but the Minorca ones are more variable.

21. Mus musculus L.

Common, as usual, everywhere.

22. Mus spicilegus Pet.

a–f. Inca, Majorca.
g–m. San Cristobal, Minorca.

This is the Mouse which, under the name of a "wild-living form of the *Mus musculus* group," I recorded some years ago[2] as occurring at Cintra in Portugal. Further observation shows that it is quite a distinct animal from the house-haunting *Mus musculus*, and in searching for a name applicable to it I find that the Hungarian *Mus spicilegus* Petenyi is so closely allied to it that for the present it would be inadvisable to separate the two. The Algerian *Mus spretus* Lataste also belongs to the same group.

The Balearic specimens are quite like those which I first caught at Cintra, and show no sign of insular specialization.

We also found this species at Cerbère, at the eastern end of the Pyrenees, on the Franco-Spanish frontier, that being as yet the most northern locality in the west of Europe where this form

[1] See Rehn, P. Biol. Soc. Wash. 1900, p. 167.
[2] Zoologist (3) xx. p. 137 (1896).

has been taken. It does not occur in the collections made by M. Alphonse Robert in S.W. France to the north of the Pyrenees, nor do I know of its capture in other parts of France. On the other hand, so little careful trapping has as yet been done in Europe, that it may prove to be much commoner and more widely distributed than at present appears.

The differences in colour and proportion between this Mouse and the true *Mus musculus* we found to be exactly the same in the Balearics as in Portugal, and it is evident that it can always be distinguished from its parasitical ally by its smaller size, much shorter tail, and paler colour.

Like other previous writers, Barcelo did not distinguish this species from *Mus musculus*, and it therefore forms an addition to his list, the only addition that we have been able to make among the non-volant Mammalia.

[" ARVICOLA AMPHIBIUS."

The Water-Vole is recorded by Barcelo as occurring in all three islands, but I am convinced that the animal known to the natives as the " Rata d'aygo " (*i. e.* Rata de agua) is *Mus norvegicus*, which in the Balearic Islands, as elsewhere, commonly takes to an aquatic life.

In the water-courses of the Albufera of Majorca, Rats are exceedingly numerous and the banks are much damaged by them. They are therefore hunted down on every opportunity; and one of the Albufera Company's employées spent a happy afternoon chasing them for us with an excited cur, but we failed to secure a specimen. However, I had a fair view of one, and from that, from the character of the ditches and burrows, and from the accounts the natives gave me, I was quite convinced that the Albufera animal was not a Vole but a Rat. No other locality that we saw or heard of was at all suitable for Voles. I think, therefore, that the name of this animal may be safely deleted from the Balearic list.]

23. LEPUS[1] MERIDIONALIS Graells.

Majorca and Iviza. Does not occur in Minorca.

Owing to its being close time, when shooting was prohibited,

[1] Remembering the extreme interest that the late Lord Lilford took in the Fauna of Spain, and the material assistance he gave towards its elucidation, it is with great regret that I find that the Spanish Hare cannot retain the appropriate name *Lepus lilfordi* given to it by Mr. de Winton in 1898 (Ann. Mag. N. H. (7) i. p. 153). Mr. de Winton gave a long list of synonyms, all of which he supposed to be *nomina nuda*, and so far as the older works were concerned he was no doubt perfectly correct; but unfortunately Prof. Graells's work on the Mammals of Spain (Mem. Ac. Madrid, xvii.), dated 1897, but received in London only on Feb. 8, 1898, a week after de Winton's paper was published, gives a description of the animal under the title of *Lepus meridionalis* Gené, and this name will have to stand, though of course on Graells's and not Gené's authority. Like the other references quoted by de Winton, that in Rosenhauer's 'Thiere Andalusiens' (p. 3, 1856) will not stand as valid, for the description given is that of an animal reported to be different to the one "bei Granada beobachtet, und von Schimper *Lepus granatensis* genannt."

we were not able to get any specimen of the Majorcan Hare. Barcelo relates that it was introduced into Minorca by the English, but that it died out there after a short time. It certainly does not occur there now.

24. Oryctolagus cuniculus L.

The Rabbit (*Cuni* in Balearic, *Conejo* in Spanish) occurs in all the three islands of the group, but is nowhere very common.

2. On the Structure of the Horny Excrescence, known as the "Bonnet," of the Southern Right Whale (*Balæna australis*). By W. G. Ridewood, D.Sc., F.L.S., Lecturer on Biology at the Medical School of St. Mary's Hospital.

[Received December 18, 1900.]

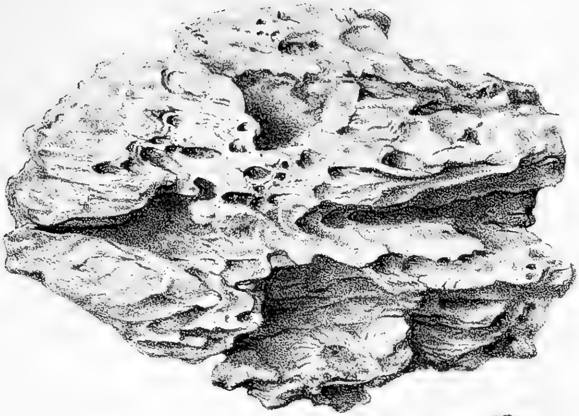
(Plate VI.[1])

The two specimens upon which the following observations were made are those described by Gray in 1864 in the 'Proceedings' of this Society (p. 170), and in 1866 in the British Museum Catalogue of Seals and Whales (p. 95). They are respectively catalogued at the Natural History Museum, where they are exhibited, as "epidermic excrescence from the median line of the fore part of the head; called by whalers the *bonnet*," and "smaller specimen of the same"; and they bear the register numbers 64.6.1.15 and 64.6.1.6 [2]. Both were presented to the Museum by Mr. E. W. Holdsworth in 1864. The larger specimen measures 11 inches by 8, and the smaller 6 inches by $2\frac{1}{2}$. A rough woodcut of the former was given by Gray in the 'Proceedings' of this Society, and in the British Museum Catalogue of Seals and Whales.

This wart or "bonnet" on the snout has been the object of many ingenious speculations. Gray mentioned it as the opinion of a foreign zoologist, whose name is not disclosed, that the "bonnet" is an excrescence formed by the adhesion of the barnacles called *Coronula*. A second opinion of the same authority is that it is caused by the irritation of the whale-louse. Mr. Holdsworth suggested that it was a natural development, and was possibly characteristic of the species; while Owen considered it as due to disease of the outer layers of integument. Beddard, in his recent 'Book of Whales' (1900, p. 136), states that "it gives one the impression that it is a pathological structure, a kind of corn, perhaps produced by the animal rubbing itself against rocks, as this species has been observed to do in order to get rid of the barnacles which are apt to infest it."

[1] For an explanation of the Plate see p. 47.
[2] List of Cetacea in the British Museum, London, 1885, p. 3.

1.



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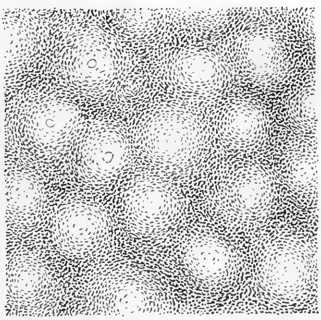

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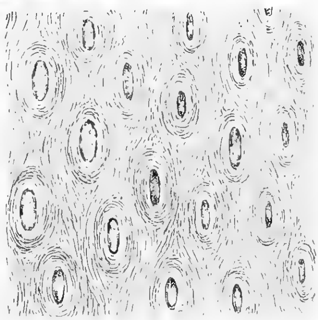

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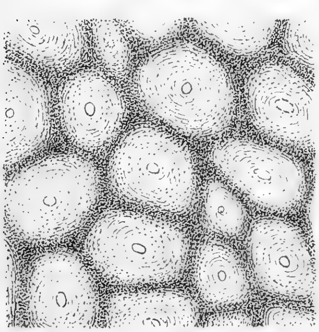

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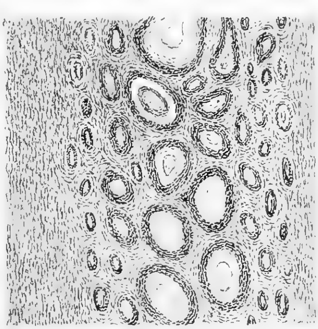


J.Green del. et lith.

Mintern Bros.imp.

HORNY EXCRESCENCE OF WHALE'S SNOUT.

It is an interesting fact that the "bonnet" appears to be confined to the Southern Right Whale. Gray has expressed his inability to find mention of the structure in any account of the Greenland Whale; and the experienced whaling captain Mr. Robert Kinnes of Dundee writes, in a letter dated Oct. 4, 1900, that "the Greenland Whale has no excrescence on its nose." What is still further of interest is the fact that in the Whale figured by Gray in Dieffenbach's 'Travels in New Zealand,' vol. ii., as *Balæna antipodarum*, there is a prominence on the front of the lower jaw as well as on the front of the upper one.

The specimens are black in colour, and very irregular in shape. Two views of the larger specimen are now exhibited (see figs. 1 and 2, Plate VI.). The under surface is comparatively smooth, and the formative area is rather narrower than the total width of the structure.

To the naked eye the mass appears to be made up of a number of thin layers of horny matter, for in the dried condition the edges seem disposed to fray out in laminæ. But by a study of microscopic preparations the structure is seen to be one of closely packed fibres or rods, disposed at right-angles to the broader surface of the mass. Each constituent is rod-like for the greater part of its length, but is slightly hollow towards the cutaneous surface; and in the cavity there doubtless resided a soft and vascular papilla, covered with prismatic epithelial cells, to the proliferating activity of which the increase in the bulk of the "bonnet" is due.

Sections taken at right angles to the fibres (Plate VI. fig. 3) fail to show any sharply defined outlines between these constituents, the main indications of their structure being the dark air-spaces arranged in concentric series. Very little can be made out by the use of sections taken at right angles to the cutaneous surface, for, probably owing to contraction in drying, the rods are bent and twisted in all directions, and it is not possible to trace any individual one for more than a fractional part of its total length.

Beddard[1] has called attention to the resemblance which this form of structure bears to that of the nasal horn of the Rhinoceros, which has always been regarded as consisting of agglutinated coarse horny fibres, differing from true hairs in the fact that their papillæ are not lodged in depressions, but exist as eminences on the surface of the skin. The constituent rods or fibres of the Rhinoceros horn, however, are sharply defined by intermediate agglutinating material of darker appearance (Plate VI. fig. 4: see also Daubenton, Hist. Nat. de Buffon, ed. 8vo, xxiv. p. 269, pl. 318. figs. 3–7), and of a less resistant nature than the fibres themselves, for the latter tend to fray out on the basal parts of the horn.

The formation of horny growths of considerable thickness by the activity of closely-set papillæ, giving rise to coarse horny fibres or hairs connate from the first, is, however, by no means uncommon among Mammals. It occurs in the hoof of the Horse (fig. 5: see

[1] 'Book of Whales,' 1900, p. 136.

also Nathusius, Arch. f. Anat. u. Phys., Leipzig, 1869, pp. 76–80), and in baleen or "whalebone," in which a strongly marked, superficial, stratified layer is present in addition, especially in the basal parts (fig. 6: see also Milne-Edwards, Leçons sur la Physiol. vi., Paris, 1860, p. 120). The stiff hairs on the tail of the Elephant are described by Naunyn[1] as intermediate in character between simple hairs and Rhinoceros horn. Even the horns of Oxen and Goats show, in their deeper, most recently formed layers, a closely analogous structure. This becomes lost in the outer layers in consequence of the compression which the fibres undergo—they first become elliptical or crescentic in section, and finally so flattened that the outer layers exhibit a marked stratification.

The skin of Whales is peculiar in structure[2]. Not only is it practically hairless in the adult condition, but it is devoid of glands, and cutaneous nerves are scarce. The *stratum corneum* is very thin, but the *rete malpighii* is strongly developed, and is traversed by numerous very long, vascular papillæ. The *corium*, as a layer, is in most cases almost completely wanting.

Elongated, finger-like papillæ of this kind are, be it observed, not confined to Whales. They occur in most cases where the skin attains an unusual thickness, and they serve the purpose, as Leydig[3] pointed out, of supplying nourishment to a thickened epidermis, since the epidermis, being but slightly pervious, cannot absorb the nourishing plasma through more than a limited thickness of its substance. Long papillæ were remarked by Steller in the skin of *Rhytina*; they occur in the skin of the Hippopotamus, particularly in the region of the upper lip[4], in the hairless skin on the muzzle of the Ox[5], in the snout of the Pig, and on the point of the proboscis of the Elephant[6].

I have not had an opportunity of examining sections of the skin of the Whale, but the published descriptions go to show that the structure of the "bonnet" under consideration does not differ in essential features from that of the *stratum corneum* of the normal skin; for this exhibits just the same disposition of the cornified cells. Heusinger, for instance, in describing the skin of *Balæna mysticetus*, writes:—"Die Lederhaut ist äusserst dünn oder fehlt ganz; dagegen findet sich eine mehr als zolldicke Schicht, die aus parallelen, dicht mit einander verklebten und verwachsenen Fasern besteht; zu unterst, wo sie auf dem Fette standen, sind diese Fasern am dicksten, nach oben werden sie dünn und sind schwer

[1] Arch f. Anat. u. Phys. 1861, p. 670.

[2] Leydig, F., "Ueber die äusseren Bedeckungen der Säugethiere," Arch. f. Anat. u. Phys. 1859.

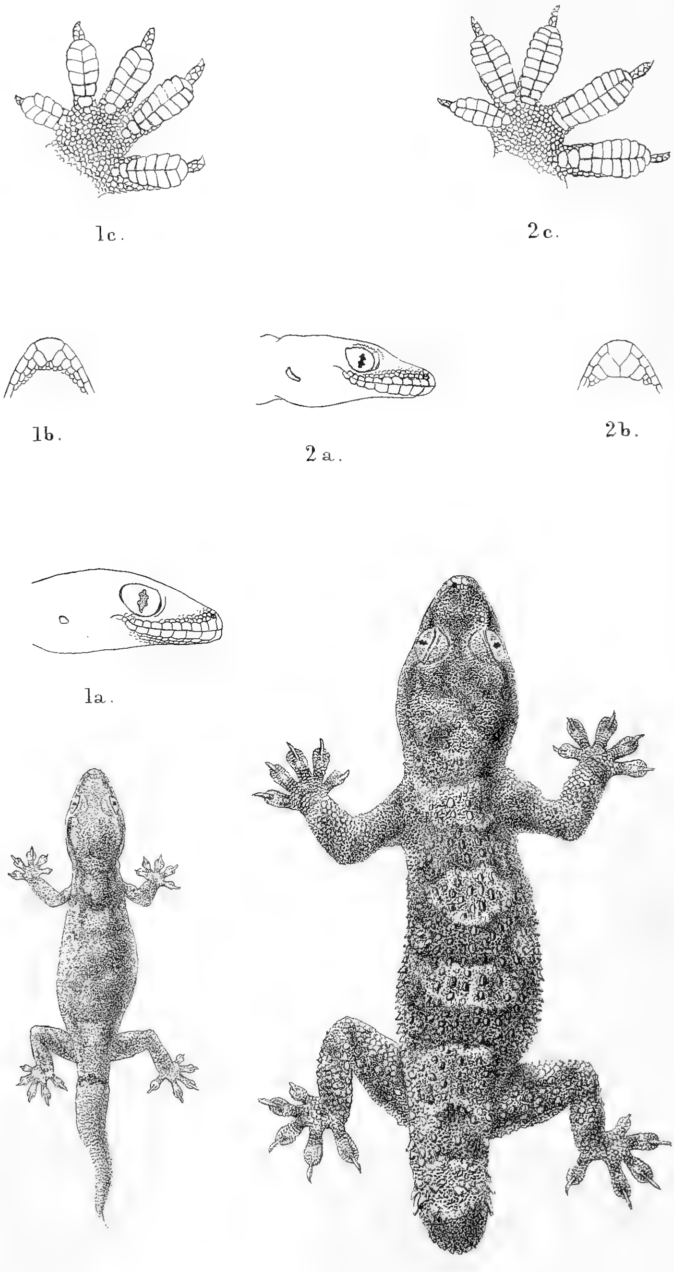
Kükenthal, W., "Die Haut der Cetaceen," Denkschr. d. med.-nat. Gesell., iii., Jena, 1889.

[3] *L. c.* p. 701.

[4] Leydig, *l. c.*; and Weber, M., 'Studien über Säugethiere,' Jena, 1886.

[5] Nathusius, W., "Ueber die Marksubstanz verschiedener Horngebilde," Arch. f. Anat. u. Phys., Leipzig, 1869, pl. iii. fig. 11.

[6] Smith, F., "Histology of the Skin of the Elephant," Journ. Anat. & Phys. xxiv. 1890.



Smit del. et lith.

Mintern Bros. imp.

1. HEMIDACTYLUS LÆVIS. 2. H. BARODANUS.

von einander zu trennen, bis sie endlich in eine mehr blätterigte als faserigte, feste und hornartige homogene, ein paar Linien dicke Schicht verschmelzen, die dann noch mit einer dünnen, aber ihr ähnlichen Oberhautschicht bedeckt ist." And Leydig[1], from whose paper the above extract is quoted, himself observes :—" Betrachtet man endlich die freie Fläche der Hornschicht vom Wallfisch, so unterscheidet das unbewaffnete Auge kleine scharf abgegrenzte Flecken, die mikroskopisch angesehen sich als besonders geartete Epidermispartien kund geben, indem sie von den gewöhnlichen Epidermiszellen genau umschriebene Haufen eigenthümlicher rundlicher, mit concentrischen Ringen versehener Zellen darstellen. So viel ich gesehen habe, entsprechen diese Flecken den Stellen, wo die Spitzen der Lederhautpapillen liegen."

The "bonnet" of the Southern Right Whale would thus appear to be but a circumscribed tract of skin, where, for some reason not yet apparent, the cornified layers fail to rub off at their normal rate, but remain and accumulate to produce a hard mass, projecting above the general surface of the epidermis as a kind of corn.

EXPLANATION OF PLATE VI.

Fig. 1. Upper surface of the horny excrescence or "bonnet" of the Southern Right Whale (*Balæna australis*). Two-sevenths natural size.

Fig. 2. Side view of the same structure.

Fig. 3. Section of the same structure, taken parallel to the cutaneous surface and at right angles to the cuticular fibres. (×30.)

Fig. 4. Section of the nasal horn of *Rhinoceros indicus*, taken at right angles to the axis and about halfway up the horn. (×16.)

Fig. 5. Section of the front part of the hoof of the Horse, taken halfway up and at right angles to the cuticular striations. (×30.)

Fig. 6. Section of one of the baleen-plates of the Southern Right Whale (*Balæna australis*), taken at right angles to the axis and about one-fourth of the total length from the point. (×16.)

3. A List of the Batrachians and Reptiles obtained by Dr. Donaldson Smith in Somaliland in 1899. By G. A. Boulenger, F.R.S.

[Received December 23, 1900.]

(Plate VII[2].)

The following list refers to a small collection made by Dr. Donaldson Smith on behalf of H.H. the Gaikwar of Baroda, to whose generosity the British Museum is indebted for a selected series of specimens, including the types of the new species here described. The specimens were obtained in January and February at three localities south and south-west of Berbera :—Biji, Ania, and Gan Lebar (altitude 5900 feet).

[1] *L. c.* p. 681.

[2] For an explanation of the Plate see p. 4

BATRACHIA.

Ecaudata.

1. Rana delalandii D. & B.—Gan Lebar.

REPTILIA.

Lacertilia.

1. Tropiocolotes tripolitanus Peters.—Biji.

New to Somaliland. First discovered in Tripoli, this little Gecko has since been found in Tunisia and in Egypt.

2. Pristurus phillipsii Blgr.—Gan Lebar.

3. Hemidactylus isolepis Blgr.—Gan Lebar.

4. Hemidactylus lævis, sp. n. (Plate VII. fig. 1.)

Head short, oviform; snout as long as the distance between the eye and the ear-opening, which is small and round; forehead concave. Body and limbs rather short. Digits moderately dilated, free, with rather short distal joints; 4 lamellæ under the inner digit, 6 under the median finger, 7 under the median toe. Upper parts covered with uniform small granules, largest on the snout. Rostral quadrangular, twice as broad as deep, with median cleft above; nostril pierced between the rostral, the first labial, and three nasals; 9 upper and 7 lower labials; symphysial large, trapezoid, entirely separating the chin-shields, of which there are two pairs. Ventral scales moderately large, cycloid, imbricate, smooth. Brownish above marbled with darker, white beneath; a dark brown streak on each side of the head, passing through the eye; a dark brown, light-edged cross-bar at the base of the tail.

	millim.
Total length..........	62
Head	12
Width of head........	8
Body................	27
Fore limb............	13
Hind limb	16
Tail (reproduced)......	23

A single female specimen from Gan Lebar.

5. Hemidactylus barodanus, sp. n. (Plate VII. fig. 2.)

Head oviform; snout a little longer than the distance between the eye and the ear-opening, which is rather large, oval, and oblique; forehead concave. Body and limbs robust. Digits strongly dilated, free, with long distal joints; lamellæ nearly straight, transverse, 7 or 8 under the inner digit, 9 under the median finger, 10 or 11 under the median toe. Upper parts covered with fine granules intermixed with large, strongly keeled, trihedral tubercles, forming about 16 very irregular longitudinal series; these tubercles oval or elliptical on the back, subcircular on the sides. Rostral quadrangular, little broader than deep, with median cleft above; nostril pierced between the rostral, the first labial, and three nasals; 9 or 10 upper and 8 lower labials; symphysial large, pentagonal; two pairs of chin-shields, the inner large and forming a suture behind the point of the symphysial. Ventral scales moderately large, cycloid, imbricate, smooth. Male with an angular series of præanal pores. The tail of the type specimen is lost; the base only remains, and shows the organ to have been strongly depressed, covered with small striated scales and transverse series of subconical, striated and keeled tubercles. Brownish grey above; head spotted with brown; three brown dark-edged bands across the body, bifurcating on the sides; lower parts white.

	millim.
Head	22
Width of head	15
Body	56
Fore limb	25
Hind limb	32

A single male specimen from Gan Lebar.

6. Tarentola ephippiata O'Shaughn.—Biji.

7. Agama vaillanti Blgr.—Ania.

8. Agama hartmanni Peters (*doriæ*, Blgr.).—Ania, Gan Lebar.

9. Agama phillipsii Blgr.—Gan Lebar.

10. Eremias brenneri Peters.—Biji.

11. Mabuia varia Peters.—Gan Lebar.

12. Chalcides ocellatus Forsk.—Biji.

Ophidia.

13. Eryx thebaicus Reuss.—Biji.

14. Zamenis rhodorhachis Jan.—Biji.

15. Psammophis biseriatus Peters.—Gan Lebar.

16. Echis carinatus Schneid.—Gan Lebar.

EXPLANATION OF PLATE VII.

Fig. 1. *Hemidactylus lævis*, p. 48.
2. „ *barodanus*, p. 48.

a. Side view of head; *b.* Chin-shields; *c.* Lower view of foot.

4. On an apparently new Species of Zebra from the Semliki Forest. By P. L. Sclater, M.A., Ph.D., F.R.S., Secretary to the Society.

[Received February 4, 1901.]

(Text-figure 7.)

I have now had time to examine more carefully the two waist-belts, made of skin, forwarded to me by Sir Harry Johnston, K.C.B., F.Z.S., and already exhibited at the meeting on December 18th last (see P. Z. S. 1900, p. 950). I have come to the conclusion that, whether the native account of the animal from which they were taken is precisely correct or not, the specimens themselves cannot be referred to any of the known species of Zebra and must belong to an undescribed animal, which I propose, provisionally at least, to name after its discoverer, with the following characters, until better specimens are obtained:—

Equus (?) johnstoni, sp. nov.

Supra saturate nigro-cinereus aut fulvus; cruribus intus albicantibus, cruribus extus et lateribus fasciis nigris, utrinque castaneo distincte limbatis, ornatis; capite longo extenso.

Hab. in sylvis fluvio Semliki adjacentibus.

The chief peculiarity in the two pieces of skin, which are all the certain evidence we as yet possess of the existence of this Zebra, is that the black bands, which are separated from each other by pale buffy-white bands, as shown in the figures (text-fig. 7), are distinctly edged on both sides with pale rufous.

The two bandoliers, which I again exhibit, have been apparently taken from the external portion of the front or hind legs. The hairs are very short, thin, and closely adpressed. Their lay is downwards from the more regularly banded portion of the skins (which I take to be the highest on the sides) to that less banded (which I suppose to be low down on the legs).

The bandoliers measure—specimen *a* about 36 inches, and specimen *b* about 30 inches in length including the fringes.

In order to make the subject complete I read again the portion of Sir Harry Johnston's letter (dated Fort Portal, Toru, Aug. 21, 1900) that refers to it:—

"Reading Stanley's 'Darkest Africa' I noticed that he mentions his Dwarf having a word for horse or ass, and stating that such animals were found in their forests. As the ordinary Zebra type of equine steadily avoids dense woodland, this statement seemed to me a curious one. While I entertained for months the pigmy band who had been captured by a filibustering German (and the restoration of whom to their homes was one of my motives for going into the Congo Free State), I questioned them on this subject and they were very explicit: they told me they called the animal 'O',Api' (', stands for a gasping sound like an aspirate or Arabic H). They described it as being dun-coloured or dark grey over all the

Text-fig. 7.

Bandoliers made from the skin of Johnston's Zebra.

upper parts of the body, with stripes on the belly and legs. As soon as I reached the Belgian post of Mbéni I began questioning my host, who at once acknowledged the existence of this animal and promised to send me where I could shoot one. They stated that it frequented the deepest parts of the Forest, went usually in pairs, was dark iron-grey on the upper part of the body, and had brownish stripes on the belly and legs. I found the Bambuba natives dwelling alongside the dwarfs called it 'Okapi.' The Belgians state that the head is very long 'et très effilée.' One man said that the muzzle was particularly 'effilé'—or drawn out. At first they excited me by declaring that there was a skin lying about which I could have; eventually it was found that the skin had been cut up by the native soldiers to be made into waist-belts and bandoliers. Two of these fragments were found and given to me, and I shall send them home to you by first opportunity. Whatever the animal may be to which these pieces belong, it is not any one of the known Zebras or wild Asses; the pieces of skin unfortunately exhibit chiefly the stripes of the belly and legs. These are very irregular with a chestnut border, and they look as though from above they emerged from a uniform dun or dark grey."

5. On a Second Collection of Mammals made by Mr. Th. H. Lyle in Siam. By J. L. Bonhote, B.A.

[Received January 10, 1901.]

This second consignment of Mammals from Mr. Th. H. Lyle has proved to be of exceptional interest, almost every specimen having added to our knowledge of the species to which it belongs. One new race of *Sciurus macclellandi* is now described, which, apart from being distinct in colour, differs in undergoing a seasonal change of pelage, a feature unknown among the other forms of that species. From a study of *Funambulus berdmorei* suggested by Mr. Lyle's specimens, that species also appears to have a seasonal change; and it should be observed that the *seasonal* change observed in these two species must be carefully distinguished from the *breeding-pelage* of two other species, viz., *Sc. caniceps* and *Sc. atrodorsalis*. In these latter a distinctive and brighter pelage is assumed in mid-winter during the rutting-season by both sexes; whereas in *F. berdmorei* the brightest pelage, which is merely a more intense form of the duller dress, is assumed, as one would expect, during the summer months.

A Bat, *Eonycteris spelæa*, is recorded for the first time from this region; and the specimens of *Megaderma spasma* are the first received in the Museum from Siam.

Another specimen of *Petaurista lylei* showing the immature pelage, and a Mongoose (*Herpestes exilis*) identical with Capt. Flower's specimen recorded in his paper, also form part of the consignment.

The collection is made in Mr. Lyle's usual careful style, each specimen having full date, particulars, and measurements, and it is by these, and these alone, that local races and seasonal changes can be made out.

1. Eonycteris spelæa (Dobs.).

Macroglossa spelæa, Dobson, J. A. S. B. xl. 1871, pt. 2, p. 261, pl. x. figs. 3, 4.

Eonycteris spelæa (Dobs.), Flower, P. Z. S. 1900, p. 341.

a. ♀. Nan, Siam. 10th May, 1900.

b. ♀. Nan, Siam. 3rd June, 1900.

As predicted by Mr. S. S. Flower last year, this species is now recorded for the first time from Siam.

2. Megaderma spasma (L.).

Vespertilio spasma, Linn. Syst. Nat. i. p. 47 (1766).

Megaderma spasma (L.), Flower, P. Z. S. 1900, p. 344.

a, *b*. Sokotai, Siam. 20th February, 1900.

3. Herpestes exilis Gerv.

Herpestes exilis, Gerv. Voy. Bonité, 1841, pl. iii.

Herpestes javanicus (Desm.), Flower, P. Z. S. 1900, p. 332.

a. ♂. Nan, Siam; alt. 200 m. 16th May, 1900.

Agrees in all respects with the specimen mentioned in Mr. Flower's paper quoted above.

4. Petaurista lylei Bonh.

Petaurista lylei, Bonhote, P. Z. S. 1900, p. 192.

a. ♂ imm. R. Mee Nan, Utaradit; alt. 61 m. 20th March, 1900.

This specimen is only about half-grown and differs from the adults in several respects. The tail is grizzled nearly to its tip, which is black, the grey hairs being very woolly. The edge of the parachute, which in the adults is rufous succeeded by a narrow black line, is in this specimen light grey; the fore half of the ear is grizzled rufous, not bright red; the underparts are lighter, and the long stiff black hairs at the edge of the shoulder are softer and grizzled with rufous.

5. Sciurus finlaysoni (Horsf.).

Sciurus finlaysoni, Horsf. Zool. Research. Java, 1824; Anders. Zool. Res. Yunnan, p. 243 (1879); Thos. P. Z. S. 1898, p. 245; Bonhote, P. Z. S. 1900, p. 193; Flower, P. Z. S. 1900, p. 335.

Type A. *Sc. finlaysoni.*

f. ♂ ad. sk. R. Mee Nan; alt. 75 m. 4th April, 1900.

Type B. *Sc. splendens* Gray.

d. ♂ ad. sk. Below Utaradit, R. Mee Nan; alt. 58 m. 11th March, 1900.

e. ♀ ad. sk. Above Utaradit, R. Mee Nan; alt. 64 m. 3rd April, 1900. Pregnant with two young.

Type C. *Sc. leucocephalus* Gray.
a. ♂ ad. sk. Cheimat, R. Menam ; alt. 20 m. 21st January, 1900.

Type D. *Sc. harmandi* M.-Edw.
b, c. ♂ ♀ ad. sk. Kampeng, R. Mu Ping; alt. 110 m. 3rd February, 1900. ♀ pregnant with two young.

I have again been most carefully through the series of this Squirrel in the Museum, and there seems but little doubt that we have here a true instance of a polymorphic species. Without going into the outlying forms, four distinct types may be found in Siam, and are, in fact, all represented among the specimens in this collection. They have all received names at various times, but I am unable to recognize their title to specific or subspecific rank.

Type A. The true *Sc. finlaysoni* is pure white all over, with the soles of feet and eyes black.

Type B (*Sc. splendens*) is of a uniform bright chestnut throughout, and, according to Mr. Lyle, is found in regions where the earth is similarly coloured.

Type C (*Sc. leucocephalus*) is of a grizzled brown above and white below.

Type D (*Sc. harmandi*) is similar above and chestnut below ; but amongst these last two varieties every possible mixture and combination is found.

Apparently, although it must be understood that there is no such thing as an invariable rule in dealing with this species, the pure white (type A) and type C are found on the lower levels, and as one ascends the river the tendency to red underparts increases.

In the measurements of a series of skulls, they fall into two groups, separable by their size alone; the measurements of types A and B average larger than the rest, but a few skulls intermediate in size are also found to be those of individuals intermediate in colour. Furthermore, the skull of the type of *Sc. finlaysoni*, although quite adult, is the smallest of any in the series. There is therefore at present no alternative but to consider the various races as polymorphic forms of one species.

It may perhaps be of use to future workers if I add the average measurements of part of the series of skulls and skins ; those imperfect in any of the measurements have been left out of the calculation, although measured and taken into account in my general remarks.

Skins in flesh :—

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.
Types A & B [5 skins] ..	219·5	221	49	22
Types C & D [16 skins] ..	201	209	44	19·5

Skulls :—	Greatest length.	Length of palate from henselion.	Width behind post-orbital process.	Length of nasals.
	mm.	mm.	mm.	mm.
Types A & B [12 specs.]	52 (53–30)	23·6 (25–23)	19+ (19, one 20)	16·5 (16–17)
Types C & D [17 specs.]	47 (49–46)	20·5 (19–22)	17+ (17–18)	14 (13–15)
Type of *S. finlaysoni* ..	44	19	17	13

6. SCIURUS CANICEPS Gray.

Sciurus caniceps, Gray (nec Temm.), Ann. & Mag. N. H. x. 1842, p. 263; Bonhote, P. Z. S. 1900, p. 194; Flower, P. Z. S. 1900, p. 356.

a, b. ♂ ♀. River Mu Ping, Paknampo, Siam. 28th January, 1900.

Both these specimens are in the full breeding-pelage with a bright yellow back.

7. SCIURUS ATRODORSALIS Gray.

Sciurus atrodorsalis, Gray, Ann. & Mag. Nat. Hist. x. 1842, p. 263; Bonhote, P. Z. S. 1900, p. 194; Flower, P. Z. S. 1900, p. 357.

a. ♀. R. Mee Ping, above Paknampo; alt. 34 m. 26th January, 1900.

As in *Sc. caniceps* the brighter pelage is assumed during the winter months.

8. SCIURUS MACCLELLANDI KONGENSIS, subsp. n.

Sciurus m. barbei Blyth, Bonhote, P. Z. S. 1900, p. 194.

This collection contains three more specimens of this Squirrel, which, on a close comparison with specimens from other localities, is seen to form a distinct Siamese race of *Sc. macclellandi*. The form it most nearly approaches is *Sc. m. barbei*, from which it may be distinguished by the general coloration being much greyer and the outer light stripes of a much paler yellow; these characteristics will hold good at all seasons of the year, for from the material at hand it appears that this race has a seasonal change, which is not known among the Burmese specimens.

Description of type. (Winter pelage.)

General colour greyish, each hair being dark at its base with a very pale tip. The outer light stripes very broad and well-marked and of a very pale cream. The inner light stripes slightly darker in colour, but narrow and short. All the three dark stripes dull, owing to each hair having a rufous tip. Hairs of the ears long and conspicuously white, those near the tip having no black bases. Underparts pale ferruginous.

Dimensions:—

Head and body 122 mm.; tail 133; hind foot 29; ear 14.

Hab. Rahong, Siam; alt. 120 m. Several specimens also from Nan.

Type. B.M. 0.10.7.18. ♀. 7th February, 1900. Collected and presented by Mr. T. H. Lyle.

In summer the pelage is similar, only clearer and brighter; the central median dark stripe is black, and the ear-tufts much shorter and thinner. The general greyish coloration and the paleness of the outer light stripes are sufficient to distinguish this race from all the others.

Mr. Lyle procured two other specimens besides the type:—

a. ♀. Rahong, Siam; alt. 120 m. 7th February, 1900.

b. ♀. Nan, Siam; alt. 200 m. 31st May, 1900.

9. FUNAMBULUS BERDMOREI (Blyth).

Sciurus berdmorei, Blyth, J. A. S. B. xvii. 1849, p. 603; id. loc. cit. xliv. 1875, extra no. p. 37; Thos. P. Z. S. 1886, p. 71.

Sciurus mouhoti, Gray, P. Z. S. 1861, p. 137.

Funambulus berdmorei (Blyth), Bonhote, P. Z. S. 1900, p. 194; Flower, P. Z. S. 1900, p. 359.

a. ♀. Rahong, Siam; alt. 120 m. 7th February, 1900.

On comparing this specimen with those mentioned in my former paper on Mr. Lyle's collection, one is able to note two distinct varieties among the series—some specimens (e. g., *b*, *c*, *d* of my former paper) differing from the other individuals in the greater intensity of their colouring. In these individuals the uppermost pale stripe is clear and distinct and is succeeded by a black stripe; the lower light stripe is very clear and broad, while there are traces of another black stripe below that. The colouring of the whole animal, moreover, is very light and the underparts are pure white. In other individuals, collected by Mr. W. Davison in Tenasserim during January, the whole animal is duller and the dark patch below the uppermost pale stripe is precisely of the same colour as the rest of the back; the second light stripe and the succeeding darker stripe are by no means so clearly defined, while the white of the underparts is tinged with yellowish.

The type of *Sc. mouhoti* Gray is intermediate between these two forms, as is also another specimen from Siam collected by Mr. S. S. Flower in March. Mr. Davison's specimens having been procured in January and the brighter individuals in June, these latter in all probability represent the summer pelage of the species; and *Sc. mouhoti* must be regarded as an individual of *Sc. berdmorei* assuming the brighter pelage.

10. MUS RATTUS L.

Mus rattus, Linn. Syst. Nat. i. p. 83 (1766); Bonhote, P. Z. S. 1900, p. 194; Flower, P. Z. S. 1900, p. 361.

a. ♀. Nan, Siam. 8th July, 1900.

Differs in no way from specimens in the former collection.

11. LEPUS sp. inc.

a. Skull. ♀. Makonsawan. 23rd January, 1900.

6. On the Birds collected during the "Skeat Expedition" to the Malay Peninsula, 1899–1900. By J. L. Bonhote, B.A.

[Received December 31, 1900.]

In writing an account of the Birds collected by the "Skeat Expedition" in 1899, it is unnecessary to dwell on the geographical positions of the places mentioned, as they have already been fully dealt with in my former paper on the Mammals. Although among the 139 species of which examples were collected none are new to science, yet there are several of considerable rarity; it is worthy of notice that the eastern side produced nothing very striking or even scarce, and most of the interesting forms were procured by Mr. Laidlaw on Mt. Gunong Inas, in Perak, a locality which had previously been visited on various occasions, viz., in 1886, 1887, and 1888 by Mr. Wray, in 1889 by Mr. Hartert, and again quite recently by Mr. A. L. Butler.

Mr. Laidlaw was, however, successful in procuring examples of several species which, so far as I am aware, are known only from the specimens originally procured by Mr. Wray. Chief among these is a fine male example of *Chrysophlegma wrayi*, which has hitherto been known only by a single specimen, a female; among the rest may be mentioned *Pericrocotus croceus* (a doubtful species, possibly only a variety of *P. wrayi*), *Corythocichla leucosticta*, *Pteruthius æralatus*, *Heliopais personata*, &c. Although the number of species is considerable, the number of individuals of the various species is somewhat restricted, so that this paper is more of the form of a mere list than I would wish it to be.

+ 1. Spilornis cheela (Lath.).

Falco cheela, Lath. Ind. Ornith. i. p. 14 (1790).

Spilornis cheela (Lath.), Sharpe, Cat. Bds. Brit. Mus. i. p. 287 (1874); Oates, Bds. Brit. Burm. ii. p. 193 (1883).

a. Ad. sk. Patelung. 28th April, 1899.
b. ♂. Bukit Besar, Jalor. 6th May, 1899.
c–e. ♂. Biserat, Jalor. 13th May, 1899.
f. ♂. Kota Bharu, Kelantan. 9th July, 1899.

+ 2. Spizaetus caligatus (Hume).

Limnaetus caligatus, Hume, Str. Feathers, 1879, p. 44.

Spizaetus caligatus (Hume), Sharpe, P. Z. S. 1887, p. 433.

a. ♂. Sungei, Kelantan. Sept. 1899.

+ 3. Haliaetus leucogaster (Gm.).

Falco leucogaster, Gm. S. N. i. p. 257 (1788, *ex* Lath.).

Haliaetus leucogaster (Gm.), Sharpe, Cat. Bds. Brit. Mus. i. p. 307 (1874); Kelham, Ibis, 1881, p. 368; Oates, op. cit. ii. p. 199.

a. ♂. Tringganu. 31st Oct., 1899.
b. Kedah. 3rd May, 1900.

4. Haliastur indus (Bodd.).

Falco indus, Bodd. Tab. Pl. Enl. 25 (1783).

Haliastur indus (Bodd.), Sharpe, Cat. Bds. Brit. Mus. i. p. 313 (1874); Kelham, loc. cit. p. 368; Oates, op. cit. ii. p. 201; Hartert, Journ. für Ornith. 1889, p. 379.

a, b. ♂ ♀. Bankok, Patelung. 6th April, 1899.
c. ♂. Biserat, Jalor. 12th May, 1899.
d. ♂. Sungei, Kelantan. Sept. 1899.
e. Arrah Bukit, Kedah. 5th May, 1900.
f, g. Pull. Tale Nawry, Patelung. April 1899.
h. No particulars.

5. Microhierax fringillarius (Drap.).

Falco fringillarius, Drap. Dict. Class. d'Hist. Nat. vi. p. 412, pl. v. (1824).

Microhierax fringillarius (Drap.), Sharpe, Cat. Bds. Brit. Mus. i. p. 367 (1874); Kelham, loc. cit. p. 364; Oates, op. cit. ii. p. 212.

a, b. ♂ ♀. Aring, Kelantan. 2nd Sept., 1899.

6. Polioaetus ichthyaetus (Horsf.).

Falco ichthyaetus, Horsf. Tr. Linn. Soc. xiii. p. 136 (1822).

Polioaetus ichthyaetus (Horsf.), Sharpe, Cat. Bds. Brit. Mus. i. p. 452 (1874); Kelham, loc. cit. p. 367.

a. Tringganu. 15th July, 1899.
b. No particulars.

7. Syrnium sinense (Lath.).

Strix sinensis, Lath. Gen. Syn. Suppl. pl. ii. Add. p. 368.

Syrnium sinense, Sharpe, Cat. Bds. Brit. Mus. ii. p. 261 (1875); Oates, op. cit. ii. p. 164.

a. ♀. Bukit Besar, Jalor. 6th May, 1899.

8. Ketupa javensis Less.

Ketupa javensis, Less. Traité, p. 14; Sharpe, Cat. Bds. Brit. Mus. ii. p. 8 (1875); Kelham, loc. cit. p. 369; Oates, op. cit. ii. p. 149.

a. ♀. Bukit Besar, Jalor. 8th May, 1899.
b. ♀. Biserat, Jalor. 14th May, 1899.

9. Corone enca (Horsf.).

Fregilus enca, Horsf. Tr. Linn. Soc. xiii. p. 164 (1822).

Corone enca (Horsf.), Sharpe, Cat. Bds. Brit. Mus. iii. p. 43 (1877); Kelham, loc. cit. p. 518.

a. ♀. Bukit Besa, Jalor. 8th May, 1899.
b. ♂. Pulau, Bidang. 6th Dec., 1899.
c. No particulars.

+10. Platysmurus leucopterus (Temm.).

Glaucopis leucopterus, Temm. Pl. Col. 265.

Platysmurus leucopterus (Temm.), Sharpe, Cat. Bds. Brit. Mus. iii. p. 90 (1877); Kelham, loc. cit. p. 519; Oates, op. cit. i. p. 409; Hartert, Journ. für Ornith. 1889, p. 391.

a. ♀. Aring, Kelantan. 12th Sept., 1899.

+11. Oriolus consanguineus (Wardl.-Rams.).

Analcipus consanguineus, Wardl.-Rams. Ibis, 1881, p. 32, pl. i.

Oriolus consanguineus (W.-Rams.), Sharpe, P. Z. S. 1887, p. 434; Hartert, loc. cit. p. 389.

a. ♂. Gunong Inas, 3500 ft., Perak. 6th Dec., 1899.
b. ♂. Gunong Inas, 4000 ft., Perak. 12th Dec., 1899.

Feet, bill, and iris slaty black.

+12. Dicrurus annectens (Hodgs.).

Buchanga annectens, Hodgs. Ind. Rev. i. p. 326.

Dicrurus annectens (Hodgs.), Sharpe, Cat. Bds. Brit. Mus. iii. p. 231 (1877); Oates, op. cit. p. 217.

a. ♂. Pulau Bidang. 7th Dec., 1899.
b. Kedah. May 1900.

+13. Bhringa remifer (Temm.).

Edolius remifer, Temm. Pl. Col. iii. p. 178.

Bhringa remifer (Temm.), Sharpe, Cat. Bds. Brit. Mus. iii. p. 257 (1877); Oates, op. cit. i. p. 224; Sharpe, P. Z. S. 1887, p. 434.

a, b. ♂ ♀. Gunong Inas, 4000 ft., Perak. Dec. 1899.
c. No particulars.

Feet black; iris dark brown.

+14. Dissemurus paradiseus (Bp.).

Edolius paradiseus, Bp. Consp. i. p. 351.

Dissemurus paradiseus (Bp.), Sharpe, Cat. Bds. Brit. Mus. iii. p. 259 (1877); Oates, op. cit. i. p. 225; Hartert, loc. cit. p. 389.

Dissemurus platurus (Vieill.), Kelham, loc. cit. p. 507.

a. ♀. Nawry Chik, Patelung. 28th April, 1899.
b, c. ♀. Blembing, Legeh. July 1899.
d–f. ♂ ♂ ♀. Aring, Kelantan. August 1899.

+15. Artamides sumatrensis (S. Müll.).

Ceblepyris sumatrensis, S. Müll. Verh. Nat. Ges. Land- en Volkenk. p. 190 (nec Gm.).

Artamides sumatrensis (S. Müll.), Sharpe, Cat. Bds. Brit. Mus. iv. p. 12 (1879).

Graucalus sumatrensis (S. Müll.), Kelham, loc. cit. p. 501.

a. ♂. Gunong Inas, Perak. 7th Dec., 1899.

Feet dark; iris brown.

16. Pericrocotus croceus Sharpe.

Pericrocotus croceus, Sharpe, P. Z. S. 1888, p. 269.

a. ♂. Gunong Inas, 4000 ft., Perak. 14th Dec., 1899.

Bill and feet black; eyes hazel.

This specimen is, I believe, the only one collected since the species was described from an isolated specimen procured by Mr. Wray near this same locality. It differs slightly from the type in having the cheeks dark grey, *i. e.* lighter than the crown, and in the throat being golden buff fading to white at the base of the bill, instead of dark slate-grey. As the type of *croceus*, however, shows signs both of the yellow on the throat and also of the grey on the cheeks, these differences are probably due to age.

Dr. Sharpe, in describing the species, suggests that it may be merely a yellow variety of *P. wrayi*, but more material is necessary before the matter can be definitely settled. I have carefully examined the series of *P. wrayi* at the British Museum; and those males that are still in their immature yellow dress or in process of assuming the red plumage are easily to be distinguished by the following characters:—

(i.) In *P. wrayi* ♂ there is always a slight trace of red visible somewhere, which is not the case in *P. croceus*.

(ii.) In *P. croceus* the colour of the back is as deep and glossy as in specimens of *P. wrayi* in full red plumage; *P. wrayi* in yellow plumage is always duller on the back.

(iii.) In *P. wrayi* in yellow plumage the yellow does not extend over the throat to the base of the bill, but it has those parts of a dirty white which are afterwards to be black; in *P. croceus* the intensity of the yellow is not diminished.

17. Rhipidura javanica (Sparrm.).

Muscicapa javanica, Sparrm. Mus. Carls. iii. pl. 75.

Rhipidura javanica (Sparrm.), Sharpe, Cat. Bds. Brit. Mus. iv. p. 332 (1879); Oates, op. cit. i. p. 267; Hartert, loc. cit. p. 389.

a. Tringganu. 29th Oct., 1899.

Iris brown; bill and feet black.

[Local name "murai gila" (= mad murai), so called from its alleged eccentricity of flight.—*R. E.*]

18. Terpsiphone affinis (Blyth).

Tchitrea affinis, Blyth, J. A. S. B. xv. p. 292 (*ex* A. Hay MS.).

Terpsiphone affinis (Blyth), Sharpe, Cat. Bds. Brit. Mus. iv. p. 349 (1879); Oates, op. cit. i. p. 261; Sharpe, P. Z. S. 1888, p. 270.

a. ♀. Aring, Kelantan. 1st Sept., 1899.

Bill and feet blue-black.

19. Siphia rubeculoides (Vigors).

Phœnicura rubeculoides, Vigors, P. Z. S. 1831, p. 35.

Siphia rubeculoides, Sharpe, Cat. Bds. Brit. Mus. iv. p. 445 (1879); Oates, op. cit. i. p. 287.

a. ♂. Aring, Kelantan. 28th August, 1899.

+20. ÆGITHINA TIPHIA (L.).

Motacilla tiphia, Linn. S. N. i. p. 331 (*ex* Edwards).

Ægithina tiphia (L.), Sharpe, Cat. Bds. Brit. Mus. vi. p. 7 (1881); Oates, op. cit. i. p. 202.

a–c. ♂. Biserat, Jalor. 15th May, 1899.
d, e. ♀. Biserat, Jalor. 15th May, 1899.
f. Pull. Biserat, Jalor. 13th May, 1899.

+21. HEMIXUS CINEREUS (Blyth).

Iole cinerea, Blyth, J. A. S. B. xiv. p. 573 (*ex* Hay MS.).

Hemixus cinereus (Blyth), Sharpe, Cat. Bds. Brit. Mus. vi. p. 52 (1881); Hartert, loc. cit. p. 388.

a–c. ♂ ♀ ♀. Gunong Inas, Perak. Dec. 1899.

+22. IOLE TICKELLI (Blyth).

Hypsipetes tickelli, Blyth, J. A. S. B. xxiv. p. 275.

Iole tickelli (Blyth), Sharpe, Cat. Bds. Brit. Mus. vi. p. 60 (1881); Oates, op. cit. i. p. 179; Sharpe, P. Z. S. 1887, p. 436; Hartert, loc. cit. p. 388.

Iole tickelli peracensis, Hartert et Butler, Nov. Zool. v. p. 506.

a, b. ♂ ♀. Gunong Inas, 4000 ft., Perak. Dec. 1899.

Iole tick. peracensis, of which these specimens are practically topotypes, is distinguished by the crown being darker and less rufous, ear-coverts more dingy grey, and the breast and flanks more ashy.

+23. CRINIGER PHÆOCEPHALUS (Hartl.).

Ixos phæocephalus, Hartl. Rev. Zool. 1844, p. 401.

Criniger phæocephalus (Hartl.), Sharpe, Cat. Bds. Brit. Mus. vi. p. 74 (1881); Oates, op. cit. i. p. 183.

a. ♀. Perak. 26th Dec., 1899.

Feet pink; bill and iris brown.

24. CRINIGER GUTTURALIS (Bp.).

Trichophorus gutturalis, Bp. Consp. i. p. 262 (*ex* Müll. MS. in Mus. Leyd.).

Criniger gutturalis (Bp.), Sharpe, Cat. Bds. Brit. Mus. vi. p. 80 (1881); Oates, op. cit. i. p. 185

a. No particulars.

+25. TRICHOLESTES CRINIGER (Blyth).

Brachypodius criniger, Blyth, J. A. S. B. xiv. p. 577 (*ex* A. Hay MS.).

Tricholestes criniger (Blyth), Sharpe, Cat. Bds. Brit. Mus. vi. p. 89 (1881); Oates, op. cit. i. p. 186.

a. ♂. Aring, Kelantan. 2nd Sept., 1899.

Bill blue-black; feet dirty yellow.

26. Trachycomus ochrocephalus (Gm.).

Turdus ochrocephalus, Gm. Syst. Nat. i. p. 821 (*ex* Browne).

Trachycomus ochrocephalus (Gm.); Sharpe, Cat. Bds. Brit. Mus. vi. p. 93 (1881); Oates, op. cit. i. p. 188; Sharpe, P. Z. S. 1888, p. 272.

a. Blembing, Legeh. 27th July, 1899.
b, c. ♀. Aring, Kelantan. 6th Sept., 1899.

27. Pycnonotus analis (Horsf.).

Turdus analis, Horsf. Tr. Linn. Soc. xiii. p. 147.

Pycnonotus analis (Horsf.); Sharpe, Cat. Bds. Brit. Mus. vi. p. 140 (1881); Oates, op. cit. i. p. 191; Hartert, loc. cit. p. 388.

a. ♂. Biserat, Jalor. 14th May, 1899.
b. ♀. Tringganu. 28th Oct., 1899.
c. ♂. Ulu Selama, Perak. Dec. 1899.
d. No particulars.

28. Pycnonotus findlaysoni Strick.

Pycnonotus findlaysoni, Strick. Ann. Nat. Hist. xiii. p. 411; Sharpe, Cat. Bds. Brit. Mus. vi. p. 144 (1881); Oates, op. cit. i. p. 193.

a. ♂. Aring, Kelantan. 2nd Sept., 1899.
b. No particulars.

29. Pycnonotus blanfordi Jerdon.

Pycnonotus blanfordi, Jerdon, Ibis, 1862, p. 20; Sharpe, Cat. Bds. Brit. Mus. vi. p. 151 (1881); Oates, op. cit. i. p. 195.

a. ♀. Biserat, Jalor. 13th May, 1899.

30. Pycnonotus simplex Less.

Pycnonotus simplex, Less. Rev. Zool. 1839, p. 167; Sharpe, Cat. Bds. Brit. Mus. vi. p. 153 (1881); Oates, op. cit. i. p. 196.

a. ♂. Aring, Kelantan. 6th Sept., 1899.

31. Otocompsa jocosa (Linn.).

Lanius jocosa, Linn. Syst. Nat. i. p. 138 (*ex* Briss.) (1766).

Otocompsa jocosa (L.), Sharpe, Cat. Bds. Brit. Mus. vi. p. 157 (1881); Oates, op. cit. i. p. 198.

a, b. ♀. Biserat, Jalor. 14th May, 1899.
c. ♀. Biserat, Jalor. June 1899.

32. Irene puella (Lath.).

Coracias puella, Lath. Ind. Orn. i. p. 171.

Irene puella (Lath.); Sharpe, Cat. Bds. Brit. Mus. vi. p. 177 (1881); Oates, op. cit. i. p. 209.

Irene malayana, Moore ; Hartert, loc. cit. p. 389.

a. ♂. No particulars.
b. ♀. Aring, Kelantan. 6th Sept., 1899.

+ 33. Myiophoneus eugenii Hume.

Myiophoneus eugenii, Hume, Str. Feathers, 1873, p. 475 ; Sharpe, Cat. Bds. Brit. Mus. vii. p. 9 (1883); Oates, op. cit. i. p. 17.

a. Imm. Biserat, Jalor. 5th July, 1899.

+ 34. Trochalopterum peninsulæ Sharpe.

Trochalopterum peninsulæ, Sharpe, P. Z. S. 1887, p. 436, pl. xxxvii. ; Hart. et Butl. Nov. Zool. v. p. 506.

a, b. ♀. Gunong Inas, Perak. 13th Dec., 1899.

Iris and feet dark brown. Feeds on rattan fruit.

+ 35. Copsychus saularis (Linn.).

Gracula saularis, Linn. Syst. Nat. i. p. 165 (1766).

Copsychus saularis (Linn.), Sharpe, Cat. Bds. Brit. Mus. vii. p. 61 (1883); Oates, op. cit. i. p. 20 ; Hartert, loc. cit. p. 381.

a. ♀. Biserat, Jalor. 13th May, 1889.
b. ♀. Blembing, Legeh. 28th July, 1899.
c, d. ♂ ♀. Aring, Kelantan. 13th & 30th Aug., 1899.
e. ♀. Kedah. 1st May, 1900.

+ 36. Hydrocichla ruficapilla (Temm.).

Enicurus ruficapilla, Temm. Pl. Col. iii. pl. 534 (1832).

Hydrocichla ruficapilla (Temm.), Sharpe, Cat. Bds. Brit. Mus. vii. p. 319 (1883); Oates, op. cit. i. p. 28 ; Sharpe, P. Z. S. 1886, p. 352.

a. Blembing, Legeh. 24th July, 1899.

+ 37. Sibia simillima (Salvad.).

Heterophasia simillima, Salvad. Ann. Mus. Civic. Genov. xiv. p. 232 (1879).

Sibia simillima (Salvad.), Sharpe, Cat. Bds. Brit. Mus. vii. p. 402 (1883); id. P. Z. S. 1886, p. 352; id. P. Z. S. 1888, p. 274; Hartert, loc. cit. p. 382.

a, b. ♂ ♀. Gunong Inas, Perak. Dec. 1899.

+ 38. Rhinocichla mitrata (S. Müll.).

Timalia mitrata, S. Müll. Nat. Tijdschr, 1835, p. 345, pl. 5. fig. 3.

Rhinocichla mitrata (S. Müll.), Sharpe, Cat. Bds. Brit. Mus. vii. p. 452 (1883) ; id. P. Z. S. 1886, p. 352 ; id. P. Z. S. 1888, p. 274 ; Hartert, loc. cit. p. 383.

a. ♀. Gunong Inas, 4000 ft., Perak. 16th Dec., 1899.

Iris dark brown ; bill orange ; bare skin under eyes white ; feet yellow.

39. TURDINUS ABBOTTI (Blyth).

Malacocincla abbotti, Blyth, J. A. S. B. xvi. p. 601 (1845).
Turdinus abbotti (Blyth), Sharpe, Cat. Bds. Brit. Mus. vii. p. 541 (1883); Oates, op. cit. i. p. 58.
Trichostoma abbotti (Blyth), Hartert, loc. cit. p. 383.
a. ♀. Bukit Besar, Jalor, 30th April, 1899.

40. MIXORNIS GULARIS (Raffles).

Motacilla gularis, Raffles, Tr. Linn. Soc. xiii. p. 312 (1822).
Mixornis gularis, Sharpe, Cat. Bds. Brit. Mus. vii. p. 576 (1882); id. P. Z. S. 1888, p. 275; Oates, op. cit. i. p. 51.
a. Biserat, Jalor. 16th May, 1899.

41. MIXORNIS ERYTHROPTERA (Blyth).

Timalia erythroptera, Blyth, J. A. S. B. xi. p. 794 (1842).
Mixornis erythroptera (Blyth), Sharpe, Cat. Bds. Brit. Mus. vii. p. 580 (1883); Oates, op. cit. i. p. 51.
a. ♂. Ulu Selama, Perak. Dec. 1899.
Iris dark brown; bill black; feet greenish grey.

42. CORYTHOCICHLA LEUCOSTICTA Sharpe.

Corythocichla leucosticta, Sharpe, P. Z. S. 1887, p. 438.
a. ♀. Gunong Inas, Perak. 17th Dec., 1899.
Iris dark brown; feet yellowish brown; beak brownish black.

43. PTERUTHIUS ÆRALATUS Tickell.

Pteruthius æralatus, Tickell, J. A. S. B. 1855, p. 267; Sharpe, P. Z. S. 1887, p. 440; id. ibid. 1888, p. 276.
a, *b*. ♂ ♀. Gunong Inas, 4000 ft., Perak. 18th Dec., 1889.
Iris slate-colour; feet yellowish brown; bill, upper mandible black, lower slate-colour.

44. SIVA CASTANEICAUDA Hume.

Siva castaneicauda, Hume, Str. F. 1877, p. 100; Sharpe, Cat. Bds. Brit. Mus. vii. p. 369 (1883); Oates, op. cit. i. p. 145; Sharpe, P. Z. S. 1888, p. 275.
a. ♂. Gunong Inas, 5000 ft., Perak. Dec. 1899.

45. ÆTHOPYGA SIPARAJA (Raffles).

Certhia siparaja, Raffles, Tr. Linn. Soc. xiii. p. 299 (1822).
Æthopyga siparaja (Raffles), Oates, op. cit. i. p. 316; Gadow, Cat. Bds. Brit. Mus. ix. p. 21 (1884).
a. ♂. Aring, Kelantan. 21st Aug., 1899.

46. ARACHNOTHERA CRASSIROSTRIS (Reichenb.).

Arachnocestra crassirostris, Reichenb. Handb., Scansoriæ, p. 314, no. 747, pl. 592. fig. 4016 (1854).

Arachnothera crassirostris, Reichenb., Gadow, Cat. Bds. Brit. Mus. ix. p. 102 (1884).

a. ♂. Aring, Kelantan. 17th Sept., 1899.
b–d. ♀. Aring, Kelantan. 17th, 22nd, 26th Sept., 1899.

47. Anthrothreptes malaccensis (Scop.).

Certhia malaccensis, Scop. Del. Flor. et Faun. Insubr. ii. p. 91 (1786) (*ex* Sonnerat).

Anthreptes malaccensis (Scop.), Oates, op. cit. i. p. 324 (1883).

Anthrothreptes malaccensis (Scop.), Gadow, Cat. Bds. Brit. Mus. ix. p. 122 (1884).

a. ♂. Biserat, Jalor. 16th May, 1899.
b. ♀. Bukit Besar, Jalor. 6th May, 1899.
c, d. ♂. Pulau, Bidang. 14th Dec., 1899.

48. Dicæum cruentatum (L.).

Certhia cruentata, Linn. Syst. Nat. i. p. 187 (1766).

Dicæum cruentatum (Linn.), Anders. Zool. Res. Yunnan, p. 663 (1879); Oates, op. cit. i. p. 332; Sharpe, Cat. Bds. Brit. Mus. x. p. 15 (1885).

a–d. ♂. Aring, Kelantan. 21st Aug. and 13th Sept., 1899.
e–g. ♀. Aring, Kelantan. 23rd Aug. and 10th & 15th Sept., 1899.
h. No particulars.

49. Dicæum trigonostigma (Scop.).

Certhia trigonostigma, Scop. Del. Flor. et Faun. Insubr. ii. p. 91 (1786).

Dicæum trigonostigma (Scop.), Oates, op. cit. i. p. 336; Sharpe, Cat. Bds. Brit. Mus. x. p. 38 (1885).

a, b. ♂. Aring, Kelantan. 21st Aug. and 13th Sept., 1899.
c. ♀. Aring, Kelantan. 18th Aug., 1899.
d. ♂. No particulars.

Bill orange below, black above; feet blue-black; iris pale brown.

50. Dicæum ignipectus (Hodgs.).

Macrura ignipectus, Hodgs. Icon. ined. in Brit. Mus., Passeres, pl. 36. fig. 393.

Myzanthe ignipectus (Hodgs.), Oates, op. cit. i. p. 337.

Dicæum ignipectus (Hodgs.), Sharpe, Cat. Bds. Brit. Mus. x. p. 4 (1885); Scl. P. Z. S. 1887, p. 441.

a. Patelung. April 1899.
b. ♀. Aring, Kelantan. 26th Aug., 1899.
c. ♂. Gunong Inas (4000 ft.), Perak. 15th Dec., 1899.

51. Dicæum chrysorrheum Temm.

Dicæum chrysorrheum, Temm. Pl. Col. iv. pl. 478, fig. 1 (1829);

Anders. Zool. Res. Yunnan, p. 663 (1879); Oates, op. cit. i. p. 335; Sharpe, Cat. Bds. Brit. Mus. x. p. 44 (1885).

a. ♂. Aring, Kelantan. 11th Sept., 1899.

52. Hirundo badia (Cass.).

Cecropis badia, Cass. Proc. Philad. Acad. 1853, p. 371.

Hirundo badia (Cass.), Sharpe, Cat. Bds. Brit. Mus. x. p. 166 (1885); Hartert, loc. cit. p. 390.

a. ♂. Biserat, Jalor. 27th May, 1899.
b–d. ♀. Biserat, Jalor. 27th May, 1899.

53. Anthus rufulus Vieill.

Anthus rufulus, Vieill. N. Dict. d'Hist. Nat. xxvi. p. 494 (1818); Sharpe, Cat. Bds. Brit. Mus. x. p. 574 (1885).

Corydalla rufula, Oates, op. cit. i. p. 168.

a. Tringganu. 31st Oct., 1899.

54. Acridotheres fuscus (Wagler).

Acridotheres fuscus (Wagler), Oates, op. cit. i. p. 380; Sharpe, Cat. Bds. Brit. Mus. xiii. p. 86 (1890).

a. ♂. Singgora, Patelung. 22nd April, 1899.
b. ♂. Bukit Besar, Jalor. 7th May, 1899.
c. Biserat, Jalor. 16th May, 1899.
d–f. ♂, ♀ ♀. Tringganu. 22nd Oct., 1899.
Native name, "Gembala Kreban" (Buffalo-bird).
Feet, beak, iris yellow.

55. Mainatus javanensis (Osbeck).

Corvus javanensis, Osbeck, Iter, p. 102 (1757).

Gracula javanensis (Osbeck), Oates, op. cit. i. p. 393; Hartert, loc. cit. p. 391.

Mainatus javanensis (Osbeck), Sharpe, Cat. Bds. Brit. Mus. xiii. p. 102 (1890).

a. ♀. Sungei Lebeh, Kelantan. 5th Aug., 1899.

56. Mainatus intermedius (A. Hay).

Gracula intermedia, A. Hay, Madr. Journ. xiii. pl. 2, p. 157 (1844); Oates, op. cit. i. p. 391.

Mainatus intermedius (A. Hay), Sharpe, Cat. Bds. Brit. Mus. xiii. p. 104 (1890).

a, b. ♂ ♀. Biserat, Jalor. 11th May, 1899.
c. ♂. Ulu Krian, Kedah. Dec. 1899.

57. Calornis chalybea (Horsf.).

Turdus chalybeus, Horsf. Trans. Linn. Soc. xiii. p. 148 (1820).

Calornis chalybea (Horsf.), Hartert, loc. cit. p. 391; Sharpe, Cat. Bds. Brit. Mus. xiii. p. 143 (1890).

a. ♂. Tale Nowy, Patelung. April 1899.
b, c. Imm. Khota Bharu, Kelantan. 14th June, 1899.
d, e. ♀. Tringganu. 26th Oct., 1899.
Iris red.

58. MUNIA MAJA (L.).

Loxia maja, Linn. Syst. Nat. i. p. 301 (1766).
Munia maja, Sharpe, Cat. Bds. Brit. Mus. xiii. p. 332 (1890).
a–c. ♂. Biserat, Jalor. 17th May, 1899.
d. ♀. Biserat, Jalor. 20th May, 1899.

59. MUNIA ATRICAPILLA (Vieill.).

Loxia atricapilla, Vieill. Ois. Chant. p. 84, pl. 53 (1805).
Amadina atricapilla, Oates, op. cit. i. p. 366.
Munia atricapilla, Anders. Zool. Res. Yunnan, p. 598 (1879); Sharpe, Cat. Bds. Brit. Mus. xiii. p. 334 (1890).
a. ♂. Biserat, Jalor. 14th May, 1899.
b. No particulars.

60. PLOCEUS ATRIGULA Hodgs.

Ploceus atrigula, Hodgs. Icon. ined. in Brit. Mus., Passeres, pl. 278. figs. 1 & 2 (no. 743); Sharpe, Cat. Bds. Brit. Mus. xiii. p. 491 (1890).
Ploceus baya, Anders. Zool. Res. Yunnan, p. 597 (1879); Oates, op. cit. i. p. 358; Hartert, loc. cit. p. 391.
a–c. ♂. Khota Bharu, Kelantan. 24th June and 10th July, 1899.

61. PITTA CYANOPTERA Temm.

Pitta cyanoptera, Temm. Pl. Col. 218 (1823); Sclater, Cat. Bds. Brit. Mus. xiv. p. 420 (1888).
Pitta moluccensis, P. L. S. Müll., Oates, op. cit. i. p. 415.
a. Aring, Kelantan. Oct. 1899.
b, c. ♂. Tringganu. 31st Oct., 1899.
Bill black; feet flesh-coloured; iris brown.

62. PITTA CUCULLATA Hartl.

Pitta cucullata, Hartl. Rev. Zool. 1843, p. 65; Oates, op. cit. i. p. 414; Sclater, Cat. Bds. Brit. Mus. xiv. p. 442 (1888).
a. ♀. Tringganu. 31st Oct., 1899.
Bill black; feet flesh-coloured; iris brown.

63. CALYPTONEMA VIRIDIS Raffl.

Calyptonema viridis, Raffl. Trans. Linn. Soc. xiii. p. 295; Oates, op. cit. i. p. 442; Sclater, Cat. Bds. Brit. Mus. xiv. p. 456 (1888).
a. ♂. Aring, Kelantan. 2nd Sept., 1899.
b. ♀. Singapore. Nov. 1899.
Bill and feet dirty green; iris pale.

64. Eurylæmus ochromelas Raffles.

Eurylæmus ochromelas, Raffles, Trans. Linn. Soc. xiii. p. 297 (1822); Oates, op. cit. i. p. 426; Sharpe, P. Z. S. 1887, p. 432; Sclater, Cat. Bds. Brit. Mus. xiv. p. 465 (1888); Hartert, loc. cit. p. 391.

a. Aring, Kelantan. 8th Sept., 1899.

65. Cymborhynchus macrorhynchus (Gm.).

Todus macrorhynchus, Gm. Syst. Nat. i. p. 446.

Cymborhynchus macrorhynchus, Oates, op. cit. i. p. 428; Sclater, Cat. Bds. Brit. Mus. xiv. p. 468 (1888); Hartert, loc. cit. p. 393.

a. ♀. Biserat, Jalor. 16th May, 1899.
b, *c*. ♂ ♀. Aring, Kelantan. 1st Sept., 1899.
d, *e*. ♀. Tringganu. 29th Oct., 1899.

Bill above blue, below yellowish brown; feet blue-black; iris green. "Rain-bird," so called because its note is heard at the opening of the rainy season. Nests said to be rare.

66. Upupa indica Reichenb.

Upupa indica, Reichenb. Handb. Scansores, p. 320, Taf. dxcvi. fig. 4037 (1853); Hartert, Cat. Bds. Brit. Mus. xvi. p. 10 (1892).

Upupa nigripennis, Anders. Zool. Res. Yunnan, p. 578 (1879).

Upupa longirostris, Jerd., Oates, op. cit. ii. p. 62.

a. Singgora?

67. Collocalia innominata Hume.

Collocalia innominata, Hume, Stray Feath. i. p. 294 (1873); Oates, op. cit. ii. p. 7; Hartert, Cat. Bds. Brit. Mus. xvi. p. 503 (1892).

a, *b*. No particulars.

68. Caprimulgus macrurus Horsf.

Caprimulgus macrurus, Horsf. Trans. Linn. Soc. xiii. p. 142 (1821); Oates, op. cit. ii. p. 20; Hartert, Journ. für Orn. 1889, p. 401; id. Cat. Bds. Brit. Mus. xvi. p. 537 (1892).

a, *b*. ♀. Aring, Kelantan. Aug. 1899.

69. Eurystomus orientalis (Linn.).

Coracias orientalis, Linn. S. N. i. p. 159 (1766).

Eurystomus orientalis (Linn.), Oates, op. cit. ii. p. 70; Sharpe, Cat. Bds. Brit. Mus. xvii. p. 33 (1892).

a, *b*. ♂ ♀. Bukit Besar, Jalor. 7th May, 1899.
c. ♀. Biserat, Jalor. 10th May, 1899.
d. ♂ juv. Khota Bharu, Kelantan. 24th June, 1899.
e. ♂. Khota Bharu, Kelantan. 4th Oct., 1899.
f. ♂. Aring, Kelantan. 31st Aug., 1899.

Bill and feet orange-red.

70. Merops sumatrensis Raffles.

Merops sumatrensis, Raffles, Trans. Linn. Soc. xii. p. 294 (1822); Sharpe, Cat. Bds. Brit. Mus. xvii. p. 61 (1892).

a, b. ♂. Biserat, Jalor. 15th May, 1899.
c, d. ♀. Biserat, Jalor. 5th & 14th May, 1899.

71. Nyctiornis amicta (Temm.).

Merops amictus, Temm. Pl. Col. iv. pl. 310 (1824).

Nyctiornis amictus (Temm.), Oates, op. cit. ii. p. 64; Sharpe, Cat. Bds. Brit. Mus. xvii. p. 90 (1892).

a, b. ♂. Aring, Kelantan. 4th Sept., 1899.

72. Pelargopsis fraseri Sharpe.

Pelargopsis fraseri, Sharpe, P. Z. S. 1870, p. 65; id. Cat. Bds. Brit. Mus. xvii. p. 106 (1892).

a. ♂. Parit Buntar, Perak. 17th Jan., 1900.

Bill and feet red.

73. Alcedo ispida Linn.

Alcedo ispida, Linn. Syst. Nat. i. p. 179 (1766); Anders. Zool. Res. Yunnan, p. 580 (1879); Sharpe, Cat. Bds. Brit. Mus. xvii. p. 141 (1892).

Alcedo bengalensis, Oates, op. cit. ii. p. 72.

a. Perak. Dec. 1899.

74. Ceyx euerythra Sharpe.

Ceyx euerythra, Sharpe, Cat. Bds. Brit. Mus. xvii. p. 179 (1892).

a. ♂. Aring, Kelantan. 26th Aug., 1899.
b, c. Aring, Kelantan. 31st Aug., 1899.

75. Halcyon smyrnensis (Linn.).

Alcedo smyrnensis, Linn. Syst Nat. i. p. 181 (1766).

Halcyon smyrnensis (Linn.), Anders. Zool. Res. Yunnan, p. 579 (1879); Oates, op. cit. ii. p. 182; Sharpe, Cat. Bds. Brit. Mus. xvii. p. 222 (1892).

Halcyon fusca, Hartert, Journ. für Orn. 1889, p. 401.

a, b. ♂ ♀. Bukit Besar, Jalor. 1st May, 1899.
c. Biserat, Jalor. 21st May, 1899.
d, e. Tringganu. 29th Oct., 1899.
f. No particulars.

Bill and feet red; iris brown.

76. Halcyon humii Sharpe.

Halcyon humii, Sharpe, Cat. Bds. Brit. Mus. xvii. p. 281 (1892).

a. Patani. 28th June, 1899.
b, c. ♀ ♀. Khota Bharu, Kelantan. 4th Oct., 1899.
d, e, f. ♂ ♀ ♀. Tringganu. 26th Oct., 1899.
g, h. No particulars.

Bill black above, bluish white below; feet bluish black; iris brown.

77. BUCEROS RHINOCEROS L.

Buceros rhinoceros, Linn. Syst. Nat. i. p. 153 (1766); Grant, Cat. B. Brit. Mus. xvii. p. 352 (1892).

a. ♂. No particulars.

78. DICHOCEROS BICORNIS (Linn.).

Buceros bicornis, Linn. Syst. Nat. i. p. 153 (1766).

Dichoceros bicornis (Linn.), Oates, op. cit. ii. p. 87; Hartert, Journ. für Orn. 1889, p. 402; Grant, Cat. Bds. Brit. Mus. xvii. p. 355 (1892).

a. ♂. Biserat, Jalor. 16th May, 1899.
b, *c*. Imm. Biserat, Jalor. 18th May, 1899.

79. ANTHRACOCEROS CONVEXUS (Temm.).

Buceros convexus, Temm. Pl. Col. ii. p. 82, pl. 530 (♀) (1832).

Anthracoceros convexus (Temm.), Grant, Cat. Bds. Brit. Mus. xvii. p. 364 (1892).

a. ♀ juv. Bukit Besar, Jalor. 8th May, 1899.
b. Biserat, Jalor. 17th May, 1899.
c. Tremangam. 12th July, 1899.
d. ♂. Aring, Kelantan. 12th Aug., 1899.
e. ♂ juv. Aring, Kelantan. 6th Oct., 1899.
f. No particulars.

80. ANTHRACOCEROS MALABARICUS (Gm.).

Buceros malabaricus, Gm. S. N. i. p. 359 (1788).

Anthracoceros albirostris, Oates, op. cit. ii. p. 90.

Anthracoceros malabaricus (Gm.), Grant, Cat. Bds. Brit. Mus. xvii. p. 365 (1892).

a. Koh Nam Kam, Patelung. 12th April, 1899.
b. Tremangam. 12th July, 1899.
c. No particulars.

81. ANORRHINUS GALERITUS (Temm.).

Buceros galeritus, Temm. Pl. Col. ii. p. 78, pl. 520 (1824).

Anorrhinus galeritus (Temm.), Oates, op. cit. ii. p. 95; Grant, Cat. Bds. Brit. Mus. xvii. p. 391 (1892).

a. ♀. Gunong Inas (4000 ft.), Perak. 17th Dec., 1899.

Feet black; iris dull red; bare skin blue-black.

82. HARPACTES DUVAUCELI (Temm.).

Trogon duvauceli, Temm. Pl. Col. no. 291 (1824).

Harpactes duvauceli (Temm.), Oates, op. cit. ii. p. 101; Sharpe, P. Z. S. 1886, p. 353; Grant, Cat. Bds. Brit. Mus. xvii. p. 491 (1892).

a. ♂. Aring, Kelantan. 11th Sept., 1899.
b. No particulars.

Bill bluish black; feet black; iris bluish.

83. CHRYSOPHLEGMA MALACCENSE (Lath.).

Picus malaccensis, Lath. Ind. Orn. i. p. 241 (1790).
Callolophus malaccensis, Oates, op. cit. ii. p. 147.
Chrysophlegma malaccense, Sharpe, P. Z. S. 1887, p. 442; Hargitt, Cat. Bds. Brit. Mus. xviii. p. 122 (1890).

a. ♂. Aring, Kelantan. 30th Aug., 1899.
b. ♀. Khota Bharu, Kelantan. 4th Oct., 1899.

Bill black above, pale below; feet dirty green.

84. CHRYSOPHLEGMA WRAYI Sharpe.

Chrysophlegma wrayi, Sharpe, P. Z. S. 1888, p. 279; Hargitt, Cat. Bds. Brit. Mus. xviii. p. 130 (1890).

a. ♂. Gunong Inas (4000 ft.), Perak. 16th Dec., 1899.

Bill slate-colour; feet black; iris red-brown.

This specimen, which is, so far as I am aware, the first male known, is somewhat larger than the type; its dimensions being: head and body 180 mm., tail 126, wing 150, tarsus 25. It differs from the female in the malar stripe being light buff instead of chestnut, and is still further distinguished in having the chin (which in the males of *C. styani* and *C. ricketti* is dark) of the same colour, viz. light buff, separated from the malar stripe by a narrow line of dark brown. The crown of the head is more rufous than in the female and the bill lighter, being bluish slate in colour; the quills and tail are black, *not* dark brown.

With regard to *C. flavinucha*, apart from size (for *C. wrayi* is considerably smaller) it differs in the presence of the brown band separating the buff malar stripe from the buff of the chin. The colour of the nape, which is of a golden yellow in *C. wrayi*, is of a deep orange in *C. flavinucha*, and the buff of the throat in the last named is also of a much deeper tint. As regards the primaries, taking the outer web of the 2nd primary for comparison, we find that in *C. ricketti* there are six complete chestnut bars, in *C. styani* five, in *C. pierri* from Cochin China four, and in *C. wrayi* and *C. flavinucha* three; in all cases there is *in addition* a small incomplete bar or dot at the distal end.

In regard to the size of these species, *C. ricketti* is the largest, then come *C. pierri* and *C. flavinucha* in order, and lastly *C. styani* and *C. wrayi*, which are about equal, but it is noticeable that *C. styani* has the largest bill of any.

85. MIGLYPTES GRAMMITHORAX (Malh.).

Phaiopicus grammithorax, Malh. Picidæ, ii. p. 12, pl. xlviii. figs. 4 & 5 (1862).
Miglyptes grammithorax (Malh.), Sharpe, P. Z. S. 1887, p. 443; Hargitt, Cat. Bds. Brit. Mus. xviii. p. 385 (1890).

a. ♀. Ulu Aring, Kelantan. Sept. 1899.

86. MIGLYPTES TUKKI (Less.).

Picus tukki, Less. Rev. Zool. 1839, p. 167.

Miglyptes tukki (Less.), Oates, op. cit. ii. p. 61; Sharpe, P. Z. S. 1888, p. 279; Hargitt, Cat. Bds. Brit. Mus. xviii. p. 388 (1890).

a. ♂. Biserat, Jalor. 16th May, 1899.
b. ♂. Aring, Kelantan. Aug. 1899.
c. ♀. Aring, Kelantan. 4th Sept., 1899.

Bill black above, grey below; feet dirty green; iris chocolate.

87. MICROPTERNUS BRACHYURUS (Vieill.).

Picus brachyurus, Vieill. Nouv. Dict. d'Hist. Nat. xxvi. p. 103 (1818).

Micropternus brachyurus (Vieill.), Oates, op. cit. ii. p. 58; Sharpe, P. Z. S. 1888, p. 279; Hargitt, Cat. Bds. Brit. Mus. xviii. p. 396 (1890).

a. ♂. Biserat, Jalor. 27th May, 1899.
b. ♀. Aring, Kelantan. 22nd Aug., 1899.

88. TIGA JAVANENSIS (Ljung).

Picus javanensis, Ljung, Mem. Acad. Roy. Stock. 1797, p. 134, pl. vi., ♀.

Tiga javanensis (Ljung), Oates, op. cit. ii. p. 55; Hargitt, Cat. Bds. Brit. Mus. xviii. p. 412 (1890).

a. ♂. Biserat, Jalor. 21st May, 1899.
b. ♀. Biserat, Jalor. 10th May, 1899.
c, d. ♂ ♀. Biserat, Jalor. 5th July, 1899.
e. ♂. Ulu Selama, Perak. 10th Jan., 1900.

Bill and feet dark brown; iris brown.

89. CHRYSOCOLAPTES VALIDUS (Temm.).

Picus validus, Temm. Pl. Col. 378, ♂ (1825).

Chrysocolaptes validus (Temm.), Hargitt, Cat. Bds. Brit. Mus. xviii. p. 458 (1890).

a. ♂. Aring, Kelantan. 8th Sept., 1899.

Bill above dark brown, below yellow; feet and iris yellow.

90. CHOTORHEA CHRYSOPOGON (Temm.).

Bucco chrysopogon, Temm. Pl. Col. iii. 1824, p. 285.

Chotorhea chrysopogon (Temm.), Shelley, Cat. Bds. Brit. Mus. xix. p. 57 (1891).

a. ♀. Bukit Besar, Jalor. 5th May, 1899.
b. Ulu Selama, Perak. Jan. 1900.

91. CYANOPS HENRICI (Temm.).

Bucco henrici, Temm. Pl. Col. iii. pl. 524 (1831).

Megalæma henrici (Temm.), Hartert, Journ. für Orn. 1889, p. 402.

Cyanops henrici (Temm.), Shelley, Cat. Bds. Brit. Mus. xix. p. 67 (1891).

a. ♂. Aring, Kelantan. 7th Sept., 1899.

Bill and iris black; feet greenish grey.

+92. Cyanops ramsayi (Wald.).

Megalæma ramsayi, Wald. Ann. Mag. Nat. Hist. (4) xv. p. 400 (1876).

Cyanops ramsayi (Wald.), Oates, op. cit. ii. p. 135; Sharpe, P. Z. S. 1887, p. 442; Shelley, Cat. Bds. Brit. Mus. xix. p. 70 (1891).

a, b. ♂ ♀. Gunong Inas (4000 ft.), Perak. 17th Dec., 1899.

Iris dark brown; feet slaty brown.

+93. Cyanops mystacophanes (Temm.).

Bucco mystacophanes, Temm. Pl. Col. iii. p. 315 (1824).

Chotorhea mystacophanes (Temm.), Oates, op. cit. ii. p. 130.

Cyanops mystacophanes (Temm.), Shelley, Cat. Bds. Brit. Mus. xix. p. 72 (1891).

a. ♂. Bukit Besar (2000 ft.), Jalor. 5th May, 1899.
b, c. ♂ ♀. Biserat, Jalor. 19th May, 1899.
d. ♀. Aring, Kelantan. 7th Sept., 1899.
e. ♂. Ulu Selama, Perak. 6th Jan., 1900.

Feet and bill black; iris dark brown.

+94. Cyanops lineata (Vieill.).

Capito lineata, Vieill. N. Dict. d'Hist. Nat. iv. p. 500 (1816).

Megalæma hodgsoni, Bp., Anders. Zool. Res. Yunnan, p. 583 (1878).

Cyanops hodgsoni (Bp.), Oates, op. cit. ii. p. 132.

Cyanops lineata (Vieill.), Shelley, Cat. Bds. Brit. Mus. xix. p. 81 (1891).

a. Kedah. 6th May, 1900.

+95. Mesobucco duvauceli (Less.).

Bucco duvauceli, Less. Traité, p. 164 (1831).

Megalæma duvauceli (Less.), Hartert, Journ. f. Orn. 1889, p. 402.

Mesobucco duvauceli (Less.), Shelley, Cat. Bds. Brit. Mus. xix. p. 85 (1891).

a. ♂. Aring, Kelantan. 7th Sept., 1899.
b. ♂ imm. Aring, Kelantan. 7th Sept., 1899.
c, d. ♂ ♀. Ulu Selama, Perak. Jan. 1900.

Bill and feet black; iris dark brown.

+96. Xantholæma hæmatocephala Marshall.

Xantholæma hæmatocephala, Marshall, Monogr. Capit. p. 101, pl. 42 (1871); Shelley, Cat. Bds. Brit. Mus. xix. p. 87 (1891).

Xantholæma hæmacephala, Oates, op. cit. ii. p. 136.

a. Tringganu. 26th Oct., 1899.

Bill black; feet brownish red; iris brown; skin round eye striped with brownish-red stripes.

97. Surniculus lugubris (Horsf.).

Cuculus lugubris, Horsf. Tr. Linn. Soc. xiii. p. 179 (1822).

Surniculus lubugris (Horsf.), Anders. Zool. Res. Yunnan, p. 587 (1879); Oates, op. cit. ii. p. 112; Shelley, Cat. Bds. Brit. Mus. xix. p. 227 (1891).

a, b. ♂ imm. Aring, Kelantan. Aug. 1899.

98. Cuculus micropterus Gould.

Cuculus micropterus, Gould, P. Z. S. 1837, p. 137; Shelley, Cat. Bds. Brit. Mus. xix. p. 241 (1891).

Cuculus striatus, Drap., Oates, op. cit. ii. p. 105.

a. ♀. Blimbing, Legeh. 24th July, 1899.
b. ♂. Aring, Kelantan. 2nd Sept., 1899.

Bill above black, below yellowish; feet yellow; eyelid yellow.

99. Cacomantis merulinus (Scop.).

Cuculus merulinus, Scop. Del. Flor. et Faun. Insubr. ii. p. 89 (1786).

Cacomantis rufiventris (Gray), Anders. Zool. Res. Yunnan, p. 587 (1879).

Cacomantis threnodes (Cab.), Oates, op. cit. ii. p. 111.

Cacomantis merulinus (Scop.), Shelley, Cat. Bds. Brit. Mus. xix. p. 268 (1891).

a. Khota Bharu, Kelantan. 14th Oct., 1899.
b. ♂. Tringganu. 28th Oct., 1899.

Bill black, yellowish at base of lower mandible; feet yellow; eye purplish brown.

100. Eudynamis honorata (Linn.).

Cuculus honorata, Linn. Syst. Nat. i. p. 179 (1766, *ex* Briss. pl. ii. fig. 2).

Eudynamis malayana, Cab., Oates, op. cit. ii. p. 119.

Eudynamis honorata (L.), Shelley, Cat. Bds. Brit. Mus. xix. p. 316 (1891).

a, b. ♂. Bukit Besar, Jalor. 30th April, 1899.
c. ♂. Biserat, Jalor. 5th July, 1899.
d, e. ♂ ♀. Khota Bharu, Kelantan. 8th July, 1899.

101. Centropus sinensis (Steph.).

Polophilus sinensis, Steph. Gen. Zool. ix. p. 51 (1815).

Centrococcyx intermedius, Hume, Oates, op. cit. ii. p. 126.

Centropus sinensis (Steph.), Shelley, Cat. Bds. Brit. Mus. xix. p. 343 (1891).

a. ♂. Bukit Besar, Jalor. 6th May, 1899.
b. ♂. Aring, Kelantan. 31st Aug., 1899.
c. Nestling (no particulars).

The nestling, which has unfortunately no data, is in an interesting stage of plumage, and I therefore add a short description:—The feathers of the crown, nape, and neck are black, glossed with greenish and barred with chestnut. Scapulars, wings, and primaries chestnut, narrowly barred with black; down on the rump tipped with rufous; tail barred with white. The whole of the underparts and sides of the head barred with whitish. The white bars below and the black bars on the scapulars persist long after the rest of the plumage is adult.

102. CENTROPUS JAVANICUS (Dumont).

Cuculus javanicus, Dumont, Dict. Sc. Nat. xi. p. 144 (1818).
Centropus javanicus (Dumont), Shelley, Cat. Bds. Brit. Mus. xix. p. 354 (1891).

a. ♂ imm. Kedah. 18th May, 1900.

103. ZANCLOSTOMUS JAVANICUS (Horsf.).

Phœnicophæus javanicus, Horsf. Trans. Linn. Soc. xiii. p. 178 (1822).
Zanclostomus javanicus (Horsf.), Oates, op. cit. ii. p. 125; Shelley, Cat. Bds. Brit. Mus. xix. p. 380 (1891).

a. ♀. Aring, Kelantan. 28th Aug., 1899.
b, c. ♂ ♀. Aring, Kelantan. 8th Sept., 1899.
Bill red; feet bluish black.

104. RHOPODYTES TRISTIS (Less.).

Melias tristis, Less. Traité Orn. 1831, p. 132.
Rhopodytes tristis (Less.), Oates, op. cit. ii. p. 121; Shelley, Cat. Bds. Brit. Mus. xix. p. 386 (1891).

a. ♀. Khota Bharu, Kelantan. 8th July, 1899.
b, c. ♀. Khota Bharu, Kelantan. 5th Oct., 1899.
d, e. ♀. Kedah. 3rd May, 1900.
Bill green; feet blue-black; skin round eye red.

105. RHOPODYTES DIARDI (Less.).

Melias diardi, Less. Traité, p. 132 (1831).
Rhopodytes diardi (Less.), Oates, op. cit. ii. p. 122; Shelley, Cat. Bds. Brit. Mus. xix. p. 390 (1891).

a. ♂. Biserat, Jalor. 13th May, 1899.
b. ♀. Blimbing, Legeh. 28th July, 1899.
c, d. ♂. Aring, Kelantan. Aug. 1899.
e, f. ♂ ♀. Aring, Kelantan. 2nd Sept., 1899.
g. ♀. Aring, Kelantan. 7th Sept., 1899.
Bill green; feet black; skin round eye red.

106. RHINORTHA CHLOROPHÆA (Raffles).

Cuculus chlorophæus, Raffles, Tr. Linn. Soc. xiii. p. 288 (1822).
Rhinortha chlorophæa (Raffles), Oates, op. cit. ii. p. 120; Shelley, Cat. Bds. Brit. Mus. xix. p. 393 (1891).

a. ♀. Blimbing, Legeh. 24th July, 1899.
b, c. ♂ ♀. Kuala Lebeh, Kelantan. 17th Aug., 1899.
d, e. ♂. Aring, Kelantan. 28th Aug., 1899.

f–k. ♀. Aring, Kelantan. Aug. 1899.
m. No particulars.

Bill green; feet blue-black.

107. Urococcyx erythrognathus (Hartl.).

Phœnicophæus erythrognathus, Hartl. Ver. Mus. Brem. 1844, p. 95.

Urococcyx erythrognathus (Hartl.), Oates, op. cit. ii. p. 124; Shelley, Cat. Bds. Brit. Mus. xix. p. 398 (1891).

a. ♂. Blembing, Legeh. 28th July, 1899.
b. ♀. Aring, Kelantan. 29th Aug., 1899.

Bill green, red at base of lower mandible; feet black; skin round eye red.

108. Palæornis longicauda (Bodd.).

Psittacus longicauda, Bodd. Tabl. Pl. Enl. p. 53 (1783).

Palæornis longicauda (Bodd.), Oates, op. cit. ii. p. 144; Salvad. Cat. Bds. Brit. Mus. xx. p. 475 (1891).

a. ♂. Ulu Selama, Perak. Dec. 1899.

Bill and feet dark grey.

109. Psittinus incertus (Shaw).

Psittacus incertus, Shaw, Nat. Misc. pl. 769 (1790).

Psittinus incertus (Shaw), Oates, op. cit. ii. p. 147; Salvad. Cat. Bds. Brit. Mus. xx. p. 501 (1891).

a. ♂. Biserat, Jalor. June 1899.
b, c. ♂ ♀. Aring, Kelantan, 12th Sept., 1899.
d, e. ♂ ♀. Kwala Selama, Perak. Dec. 1899.

Bill, ♂, above red, below yellowish black; ♀, above brown, below yellowish grey; feet green; iris yellow.

110. Loriculus galgulus (Linn.).

Psittacus galgulus, Linn. Amœn. Acad. iv. p. 236 (1754).

Loriculus galgulus (Linn.), Salvad. Cat. Bds. Brit. Mus. xx. p. 531 (1891).

a. Patelung. April 1899.
b. ♂. Patani. 26th April, 1899.
c. No particulars.

111. Butreron capelli (Temm.).

Columba capelli, Temm. Pl. Col. 143 (livr. 24, 1823) (Java).

Butreron capelli (Temm.), Salvad. Cat. Bds. Brit. Mus. xxi. p. 32 (1893).

a. ♀. Aring, Kelantan. 5th Sept., 1899.

Bill pale green; feet deep yellow.

112. Osmotreron vernans (Linn.).

Columba vernans, Linn. Mant. p. 526 (1771) (*ex* Briss.).

Osmotreron vernans (Linn.), Oates, op. cit. ii. p. 309; Salvad. Cat. Bds. Brit. Mus. xxi. p. 60 (1893).

a. ♀. Biserat, Jalor. 12th May, 1899.
b. No particulars.

113. Osmotreron olax (Temm.).

Columba olax, Temm. Pl. Col. 241 (livr. 41, 1823) (Sumatra).
Osmotreron olax (Temm.), Salvad. Cat. Bds. Brit. Mus. xxi. p. 64 (1893).

a. ♂. Aring, Kelantan. 31st Aug., 1899.
Bill green; feet red; iris whitish.

114. Ptilopus jambu (Gm.).

Columba jambu, Gm. S. N. ii. 2, p. 784, no. 63 (1788).
Ptilopus jambu (Gm.), Sharpe, P. Z. S. 1887, p. 432; Salvad. Cat. Bds. Brit. Mus. xxi. p. 80 (1893).

a, b. Aring, Kelantan. 18th Sept., 1899.
Bill and iris orange; feet magenta.

115. Turtur tigrinus (Temm.).

Columba tigrina, Temm. & Knip, Pig. i. p. 43 (1808–1811).
Turtur tigrinus (Temm. & Knip), Anders. Zool. Res. Yunnan, p. 665 (1897); Oates, op. cit. ii. p. 290; Salvad. Cat. Bds. Brit. Mus. xxi. p. 440 (1893).

a. ♂. Tale Nowy, Patani. 3rd April, 1899.
b. ♀. Aring, Kelantan. 16th Aug., 1899.
c. Ulu Aring, Kelantan. Sept. 1899.
d. ♂ imm. Khota Bharu, Kelantan. 5th Oct., 1899.
e. Tringganu. 22nd Oct., 1899.
f. No particulars.

116. Chalcophaps indica (Linn.).

Columba indica, Linn. S. N. i. p. 284, no. 29 (1766) (*ex* Edwards).
Chalcophaps indica (Linn.), Anders. Zool. Res. Yunnan, p. 677; Oates, op. cit. ii. p. 297; Salvad. Cat. Bds. Brit. Mus. xxi. p. 514 (1893).

a. ♀. Biserat, Jalor. 22nd May, 1899.
b. Imm. Aring, Kelantan. 4th Sept., 1899.

117. Calœnas nicobarica (Linn.).

Columba nicobarica, Linn. S. N. i. p. 283, no. 27 (1766).
Calœnas nicobarica (L.), Salvad. Cat. Bds. Brit. Mus. xxi. p. 615 (1893).

a. ♀. Khota Bharu, Kelantan. Oct. 1899.

118. Excalfactoria chinensis (L.).

Tetrao chinensis, Linn. S. N. i. p. 277 (1766).

Excalfactoria chinensis (Linn.), Oates, op. cit. ii. p. 334; Grant, Cat. Bds. Brit. Mus. xxii. p. 250 (1893).

a. ♂. Bukit Besar, Jalor. 30th April, 1899.
b. ♂. Biserat, Jalor. 11th May, 1899.

119. Gallus gallus (L.).

Phasianus gallus, Linn. S. N. i. p. 270 (1766).
Gallus ferrugineus (Gm.), Anders. Zool. Res. Yunnan, p. 669 (1879); Oates, op. cit. ii. p. 322.
Gallus gallus (L.), Grant, Cat. Bds. Brit. Mus. xxii. p. 344 (1893).

a. ♀. Khota Bharu, Kelantan. 8th July, 1899.
b. ♂. Kwala Selama, Perak. 15th Jan., 1900.

120. Polyplectron bicalcaratum (L.).

Pavo bicalcaratum, Linn. S. N. i. p. 268 (1766).
Polyplectron bicalcaratum (L.), Grant, Cat. Bds. Brit. Mus. xxii. p. 358 (1893).

a. ♀. Sungei Lebeh, Kelantan. 5th Aug., 1899.
b. ♂. Aring, Kelantan. 17th Sept., 1899.

Bill and feet black; iris white; skin round the eye orange.

121. Argusianus argus (Linn.).

Phasianus argus, Linn. S. N. i. p. 272 (1766).
Argusianus argus (L.), Oates, op. cit. ii. p. 313; Grant, Cat. Bds. Brit. Mus. xxii. p. 363 (1893).

a, b. ♂. Biserat, Jalor. May 1899.
c. ♀. Sisa Kwani.
d. ♀. Aring, Kelantan. 17th Sept., 1899.
e. Pull. No particulars.

122. Pavo muticus Linn.

Pavo muticus, Linn. S. N. i. p. 268 (1766); Anders. Zool. Res. Yunnan, p. 668 (1879); Oates, op. cit. ii. p. 312; Grant, Cat. Bds. Brit. Mus. xxii. p. 372 (1893).

a–c. 5 specimens, no particulars.

123. Turnix taigoor (Sykes).

Hemipodius taigoor, Sykes, P. Z. S. 1832, p. 155.
Turnix plumbipes, Hodgs., Anders. Zool. Res. Yunnan, p. 673 (1879); Oates, op. cit. ii. p. 337.
Turnix taigoor (Sykes), Grant, Cat. Bds. Brit. Mus. xxii. p. 530 (1893).

a. ♂. Patelung. 31st March, 1899.
b. ♀. Bukit Besar, Jalor. 3rd May, 1899.
c. ♀. Aring, Kelantan. 20th Aug., 1899.

124. Rallina fasciata (Raffles).

Rallus fasciata, Raffles, Tr. Linn. Soc. xiii. p. 328 (1822).

Rallina fasciata (Raffles), Oates, op. cit. ii. p. 341; Sharpe, Cat. Bds. Brit. Mus. xxiii. p. 75 (1894).

a. Patani. April 1899.
b, c. ♂ ♀. Biserat, Jalor. 18th May, 1899.

+125. Porzana pusilla (Pall.).

Rallus pusillus, Pall. Reis. Russ. Reichs, iii. App. p. 700 (1776).

Porzana bailloni, Oates, op. cit. ii. p. 334.

Porzana pusillus (Pall.), Sharpe, Cat. Bds. Brit. Mus. xxiii. p. 106 (1894).

a. ♀. Patelung. 7th April, 1899.

+126. Gallicrex cinerea (Gm.).

Fulica cinerea, Gm. Syst. Nat. i. p. 702 (1788).

Gallicrex cinerea (Gm.), Oates, op. cit. ii. p. 349; Sharpe, Cat. Bds. Brit. Mus. xxiii. p. 183 (1894).

a. ♂. Bangkok, Patelung. 4th April, 1899.
b. ♀. Parit Buntar, Perak. 17th Jan., 1900.

+127. Heliopais personata (Gray).

Podica personata, Gray, P. Z. S. 1848, p. 90.

Heliopais personata (Gray), Oates, op. cit. ii. p. 353; Sharpe, Cat. Bds. Brit. Mus. xxiii. p. 232 (1894).

a. ♀. Biserat, Jalor. 19th May, 1899.

+128. Glareola orientalis Leach.

Glareola orientalis, Leach, Trans. Linn. Soc. xiii. p. 132, pl. xiii. (1822); Oates, op. cit. ii. p. 361; Sharpe, Cat. Bds. Brit. Mus. xxiv. p. 58 (1896).

a. ♀. Ana Bukit, Kedah. 12th May, 1900.
b, c. Kedah. 10th May, 1900.

+129. Charadrius dominicus Müll.

Charadrius dominicus, P. L. S. Müll. Syst. Nat. Anhang, p. 116 (1776); Sharpe, Cat. Bds. Brit. Mus. xxiv. p. 195 (1896).

Charadrius fulvus, Gm., Anders. Zool. Res. Yunnan, p. 675 (1879); Oates, op. cit. ii. p. 364.

a, b. ♂ ♀. Patelung. 2nd April, 1899.
c. ♀. Tringganu. 31st Oct., 1899.

+130. Ægialitis alexandrina (Linn.).

Charadrius alexandrinus, Linn. S. N. i. p. 258 (1766).

Ægialitis alexandrina (L.), Sharpe, Cat. Bds. Brit. Mus. xxiv. p. 275 (1896).

a. ♀. Tringganu. 29th Oct., 1899.
b. ♀. Pulau Bidang. 10th Dec., 1899.
Malay name, "Kedidi."

131. Tringoides hypoleucus Linn.

Tringa hypoleucus, Linn. S. N. i. p. 250 (1766).
Tringoides hypoleucus (L.), Oates, op. cit. ii. p. 399; Sharpe, Cat. Bds. Brit. Mus. xxiv. p. 456 (1896).
a. ♀. Pulau Bidang. 10th Dec., 1899.

132. Rhyacophilus glareola (L.).

Tringa ochropus, β. glareola, Linn. S. N. i. p. 250 (1766).
Totanus glareola (L.), Oates, op. cit. ii. p. 401.
Rhyacophilus glareola (L.), Sharpe, Cat. Bds. Brit. Mus. xxiv. p. 491 (1896).
a. ♂. Patelung. 7th April, 1899.
b, c. ♀. Tringganu. October 1899.

133. Sterna sinensis Gm.

Sterna sinensis, Gm. S. N. i. p. 608 (1788, *ex* Lath.); Saunders, Cat. Bds. Brit. Mus. xxv. p. 114 (1896).
a. ♀. Patelung. 7th April, 1899.

134. Phoyx manillensis Sharpe.

Phoyx manillensis, Sharpe, Bull. B. O. Club, iii. p. xxxviii (1894); id. Cat. Bds. Brit. Mus. xxvi. p. 63 (1898).
Ardea purpurea, Linn., Oates, op. cit. ii. p. 245; Hartert, Journ. für Orn. 1886, p. 406.
a. ♀. Tale Nowy, Patelung. 2nd April, 1899.

135. Bubulcus coromandus (Bodd.).

Cancroma coromanda, Bodd. Tabl. Pl. Enl. p. 54 (1783).
Bulbucus coromandus (Bodd.), Oates, op. cit. ii. p. 251; Hartert, Journ. für Orn. 1889, p. 406; Sharpe, Cat. Bds. Brit. Mus. xxvi. p. 217 (1898).
a, b. ♂ ♀. Tale Nowy, Patelung. 2nd April, 1899.

136. Podicipes philippensis (Bonnat.).

Colymbus philippensis, Bonnat. Tabl. Encycl. Méth. i. p. 58, pl. 46. fig. 3 (1790).
Podicipes philippensis (Bonnat.), Grant, Cat. Bds. Brit. Mus. xxvi. p. 511 (1898).
a. ♀. Patelung. 30th March, 1899.

137. Asarcornis scutulata (S. Müll.).

Anas scutulata, S. Müll. Verh. Land- en Volkenk. p. 159.
Anas leucoptera (Blyth), Oates, op. cit. ii. p. 281.
Asarcornis scutulata (S. Müll.), Salvadori, Cat. Bds. Brit. Mus. xxvii. p. 61 (1895).
a. ♀. Patelung. April 1899.

Resembles in all respects a female from the Hume Collection, but is rather more mottled on the neck. According to Mr. R. Evans, it is a migratory species in Patelung.

+ 138. Nettopus coromandelianus (Gm.).

Anas coromandelianus, Gm. S. N. i. 2, p. 556 (1788).
Nettopus coromandelianus (Gm.), Oates, op. cit. ii. p. 272; Salvad. Cat. Bds. Brit. Mus. xxvii. p. 68 (1895).

a, *b*. ♂ ♀. Patelung. 30th March, 1899.

+ 139. Dendrocycna javanica (Horsf.).

Anas javanica, Horsf. Tr. Linn. Soc. xiii. p. 199 (Java) (1821).
Dendrocycna javanica (Horsf.), Salvad. Cat. Bds. Brit. Mus. xxvii. p. 156 (1895).

a. ♀. Tale Nowy, Patelung. 2nd April, 1899.
b. ♀. Tremangam. 12th July, 1899.

7. On a Freshwater Annelid of the Genus *Bothrioneuron* obtained during the "Skeat Expedition" to the Malay Peninsula. By Frank E. Beddard, M.A., F.R.S.

[Received January 14, 1901.]

(Text-figures 8–10.)

There are at present only two species of this peculiar genus of Tubificidæ known: they come from such widely separated localities as the neighbourhood of Prague[1] and the neighbourhood of Buenos Ayres[2]. I believe that the facts ascertained from an examination of specimens from the Malay Peninsula justify me in the creation of a third species.

The worms are of about the same size as average specimens of *Tubifex rivulorum*, and thus present no divergence from the two other species of *Bothrioneuron*.

The prostomium is conspicuous and of the ordinary form that it exhibits among the Tubificidæ, as will be seen from an inspection of the two drawings (text-fig. 8, A, B, p. 82).

Prostomial sense-organs.—I find in the present species the same prostomial sense-organ which I described and figured (in section) in *Bothrioneuron americanum*. It is, moreover, also unpaired in the present species. The position of the organ, however, varies: it is usually on one side, which is preferably the left, just at the junction of the convex upper surface of the prostomium with the lower surface. In one specimen, however, it is exactly in the middle of the lower surface, and in another it is as distinctly upon the upper surface, and also fairly median in position. The organ is very decidedly upon the prostomium itself; it is not situated at the junction of the prostomium with the peristomial segment, as is the case with the corresponding organ of *B. americanum*.

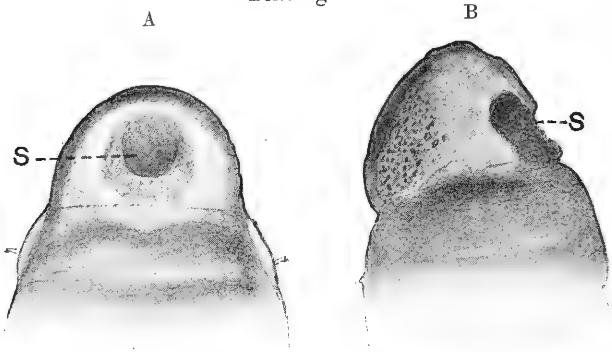
The one specimen in which the sense-organ happened to be ventral in position is shown in the accompanying drawing, by

[1] Stolc, "Mon. Ceskych. Tubificid.," Abh. Ges. Böhm. (2) vii. p. 43.
[2] Beddard, Hamburg. Magalh. Sammelreise, Naiden &c. p. 6.

which it will be seen that a semicircular depression with the concavity directed forwards is the external manifestation of the organ, of which the mass of cells lie behind.

In a specimen in which the prostomial organ is lateral in position (text-fig. 8, B), an external depression is to be seen with equal clear-

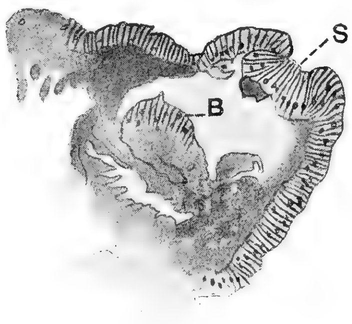
Text-fig. 8.



Bothrioneuron iris.

Fig. A. Prostomium from below. Fig. B. Ditto from above.
S, sense-organ symmetrically placed in A, asymmetrically in B.

Text-fig. 9.



Bothrioneuron iris.

Longitudinal section through the prostomium.
S, sense-organ; *B*, supra-œsophageal ganglion.

ness, but naturally in profile. In a longitudinal section (text-fig. 9) of a specimen in which the sense-organ happens to be median and quite anterior in position, the following appearances are observable: the supposed sense-organ consists of a mass of cells which are rather deeper than are those of the surrounding epidermis; this is especially to be seen at the periphery of the organ, the central part corresponding to the external depression consisting of rather less elongated cells. The considerable size of the organ as compared with the entire prostomium is apparent from the figure and is rather remarkable. It is probable, therefore, that a corresponding organ in other Tubificidæ has not been overlooked.

The *setæ* are, as in the other species, all uncinate and without further complications; there are no subsidiary hooklets between the two prongs in which the free extremity of the seta ends. There appear to be not more than four setæ to a bundle, and very often there are only two.

In this species, as in other Oligochæta, there would appear to be no setæ upon the first segment of the body. However, in longitudinal sections I was able to observe a small mass of muscles upon the first segment of the body, entirely similar in appearance to those which upon ensuing segments enwrap the setæ, and corresponding exactly in position. The mass of muscular fibres was small, but I regard it as a vestige of the seta-bundles of that segment. Setæ are certainly absent ventrally in the neighbourhood of the male pore—a feature in which the present species agrees with *B. americanum*, and differs from the European *B. vejdovskyanum*, in which there are specially modified genital setæ of peculiar form replacing the ventral bundles. The lateral setæ, however, corresponding to the missing ventral setæ are present.

Clitellum.—*Bothrioneuron iris* differs from its allies in the position of the clitellum, which is pushed back a segment and occupies segments xii. and xiii. In the middle of segment xii. lies the

Male generative pore.—This aperture, single and median, is also a segment farther back than it is in *B. vejdovskyanum* and *B. americanum.* It is interesting to note that there is an apparent connection between the male pore and the clitellum in that an alteration in the position of one is accompanied by an alteration in the position of the other.

The *oviducal pores* I have not seen.

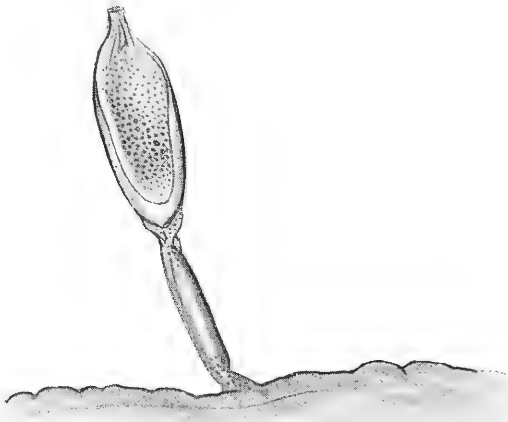
Spermathecal pores are not present. The absence of spermathecæ is one of the characters of the genus.

Spermatophores.—Dr. Stolc figures in *B. vejdovskyanum* a crowd of spermatophores attached to the body-wall round the male generative pore. In *B. americanum* I did not find these structures, though perhaps I was a little premature [1] in using their absence as a specific character. In three out of six mature examples of *B. iris,* I find a single spermatophore apiece also attached close to the male pore. The structure of these spermatophores is similar to those of *B. vejdovskyanum.* There is a thick stalk by which they are attached to the body-wall, which is of a yellowish colour. This stalk is merely attached to the epidermis superficially: it does not penetrate between the cells. Nor can I find any evidence of its

[1] Monogr. Oligochæta, Oxford, 1895. The comparative rarity of the occurrence of spermatophores in *B. iris* may explain the failure to find them in *B. americanum.* They are probably distinctive of the genus.

being hollow; so far at any rate "hypodermic impregnation" is improbable. The accompanying drawing (text-fig. 10) illustrates the form of the spermatophore, whose structure I have also investigated by transverse sections. Above the stalk it swells out into an oval cup, which is, roughly, of about the same length as the stalk. This narrows rapidly to form a short tube, which appears to be open at the free end. The thickness of the walls of this—the sperm-holding part of the spermatophore—are much thicker below and diminish gradually towards the free tubular extremity of the structure. This part of the spermatophore, as shown in the drawing, does not look as if continuous with the stalk; a slight prolongation of the latter seems to embrace it. The deeply staining contents of the cup appear to be spermatozoa, but their condition of preservation is not sufficiently good to show histological details.

Text-fig. 10.



Spermatophore of *Bothrioneuron iris* in situ.

Integumental vascular network.—A striking feature of the other two species of this genus is the existence of an integumental network of blood-capillaries. This was so easily to be seen in the examples of *Bothrioneuron americanum* which I examined, that I have some confidence in stating that a vascular integument is not to be found in *Bothrioneuron iris*. I have examined ten or a dozen specimens in glycerine with and without treatment by potash, and I can find no trace of blood-capillaries in the skin. It occurred to me of course that the posterior end of the body might be vascular if the anterior end was not, since the tail in the Tubificidæ seems to be often used for respiratory purposes. But here, as elsewhere, I could find no evidence of blood-capillaries in the skin. A specific difference in a feature of such apparent importance is somewhat unexpected. But, as has been, and as will be, seen, the present species is in many ways divergent from its congeners.

Male organs of generation.—As will have been gathered from the account of the external features of the present species, the segments occupied by the various parts of the male generative system are a segment behind those which are occupied by the corresponding organs in the other two species of the genus. In *Bothrioneuron iris* the testes are in segment xi. instead of x. Excepting in their position, there is nothing especially noteworthy about these gonads. The male efferent apparatus, as in other species of the genus, is complicated and specialised into a number of regions. In transverse sections of the body the ventral surface was seen to be flattened, and thus to contrast with the semicircular dorsal region. At the sides of the body, the flattened under surface was limited by a slightly projecting ridge, so that the outline of a section was somewhat that of a round hat with a brim also in section. In the middle of this area opens the single pore.

When a specimen of the worm is examined in its entirety, the actual orifice is seen to be small and accurately median. In longitudinal sections the smallness of the orifice is also striking. But in transverse sections it appears to be larger owing to the fact that the incurving sides of the body-wall diverge from each other considerably laterally in their course.

The relative size of the male pore would seem to be much that of *B. vejdovskyanum* as figured by Stolc. But this author does not figure microscopical sections of his species. A noteworthy difference between the two species, which has already been referred to in dealing with external characters, is the total absence of genital setæ in *B. iris*. In this it agrees with its nearest ally *B. americanum*. It is unlikely that I should have overlooked these setæ in two species which have been both of them examined in sections as well as in their entirety mounted in glycerine. There are, in fact, no setæ in the immediate vicinity of the male pore. The terminal male apparatus of *B. iris* is divisible into the same regions as those which are to be found in *B. vejdovskyanum*; but their relative dimensions are decidedly different, and there seem to be also differences in their histological structure. The sperm-duct is divided into two different sections as in *B. vejdovskyanum*. The proximal part, that which immediately arises from the funnel, is about as long as the region which follows, and is much coiled in the middle of a mass of cells which represents a thickened peritoneal investment. This proximal section is of less calibre, and its cells are equally stained by the borax-carmine used in the preparation of the sections; the tube is also of less calibre. The remaining part of the vas deferens also coils about in the midst of the cells mentioned: but it is of larger calibre, and the cells are not so thoroughly stained by the carmine; it is, in fact, of a more glandular appearance. This section of tube widens a little before it becomes continuous with the first part of the spermiducal gland proper. The latter is quite different again from the terminal part of the spermiducal gland, a fact which appears to distinguish *B. iris* from *B. vejdovskyanum*. In the latter there is, judging from Stolc's figure, no difference whatever between the proximal and the distal regions of the spermiducal gland. In the species with which I am here concerned, the proximal section of the glandular tube is of rather limited extent. Its lumen is fairly wide and is lined by tall columnar cells, which are crowded with rounded spherules of secretion. They are not much stained. In Stolc's figure the "paratrium" is represented as arising from the terminal male tube at about halfway between its commencement and the external orifice. In *B. iris* the same is the case, and the point of origin nearly represents the passing of the purely glandular part of the spermiducal gland into the distal region, which has quite other characters. The distal part of the tube is wide and has collapsible walls, a fact which is due to their thinness. The epithelium lining the tube here is quite non-glandular. It is a low columnar epithelium which is covered externally by a rather lax covering of muscles.

The paratrium has the egg-shaped form which it exhibits in the other species of the genus. There is, however, no cap of divergent "prostatic" cells such as are figured in *B. vejdovskyanum*. The paratrium has very thick muscular walls, and its lining of cells becomes deeper and more glandular in appearance at the blind end of the sac.

Where the spermiducal glands open on to the exterior of the body they naturally have to burrow beneath the nerve-cord. The latter is raised to near the intestine, and a slip of muscles forming a thick septum connects it with the ventral body-wall after the two spermiducal glands are separated from each other.

The *ovaries* lie in the xiith segment; but I have not discovered the oviducts.

The genus *Bothrioneuron* may be defined and its species discriminated as follows:—

Genus Bothrioneuron, Stolc.

Tubificids of 40–50 mm. in length. Setæ entirely uncinate. Prostomium with an unpaired, often asymmetrical sense-organ [1]. Male pore single and median or paired; atrium with a lateral diverticulum, the paratrium. Spermathecæ absent. Oviducal pores paired [2]. Spermatophores of peculiar form attached to neighbourhood of male orifice.

Hab. Europe; S. America; Malay Peninsula.

[1] *Fide* Michaelsen, "Oligochæten" in 'Tierreich,' Berlin, 1890, for statement that the sense-organ characterizes the genus. I am unable to read Stolc's paper, which is in Bohemian.

[2] In *B. vejdovskyanum*. They are not known in the other species.

1. BOTHRIONEURON VEJDOVSKYANUM Stolc.

B. vejdovskyanum, Stolc, S.B. Böhm. Ges. 1885, p. 647; id. Abh. Böhm. Ges. (2) vii. p. 43; Beddard, Monogr. Olig. 1895, p. 269.
Bothrioneurum vejdovskyanum, Michaelsen, "Oligochæten" in Tierreich, 1890, p. 54.

Body covered with papillæ. Male pores single and median in xi. Clitellum xi., xii. An integumental vascular network present. Genital seta present on xi. Spermatophores numerous, attached to body-wall in neighbourhood of male pore.

2. BOTHRIONEURON AMERICANUM Beddard.

B. americanum, Beddard, Ann. Nat. Hist. (6) xiii. p. 206; Hamb. Magalh. Sammelreise, Naiden &c., 1896, p. 6; Monogr. Olig. 1895, p. 269.
Bothrioneurum americanum, Michaelsen, "Oligochæten," Tierreich, 1900, p. 54.

Male pores paired on xi. Clitellum xi., xii. An integumental vascular network present. No genital setæ. Spermatophores absent (?).

3. BOTHRIONEURON IRIS, n. sp.

Male pore single and median on xii. Clitellum xii., xiii. No integumental vascular system. No genital setæ. Spermatophores only present to the number of one.

February 19, 1901.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

Mr. F. E. Beddard, F.R.S., exhibited the skin of a female Monkey (*Cercopithecus schmidti*) from a specimen lately living in the Society's Gardens (received September 25th, 1900; died February 17th, 1901), which showed a pair of additional mammæ below and slightly to the inside of the normal pair. One of the supplementary mammæ, that of the right side, was fully as large as the normal mammæ.

Dr. W. G. Ridewood exhibited under the microscope mounted slides of the hairs of two Zebras, *Equus burchelli* and *E. zebra*, for comparison with the hairs of the recently described *E. johnstoni* Sclater (see P. Z. S. 1901, p. 50), and called attention to the fact that no differences in structure could be observed between the hairs of these three species.

With reference to the same subject the following extracts from a letter addressed by Prof. J. C. Ewart to Mr. Beddard, who had forwarded to Prof. Ewart a piece of the skin of *E. johnstoni*, were read:—

"I have compared the hair from the piece of skin you kindly sent with the hair of antelopes, oxen, deer, and other Ruminants, and with the hair of zebras and other Equidæ.

"The conclusion arrived at is that the pieces of skin sent home by Sir Harry Johnston belong to a Zebra.

"In all the Equidæ the hair has the same general structure, but yet it is possible to distinguish zebra-hair from that of the horse and the ass. In wild asses even the light hairs are longitudinally striped, in zebras only the coloured hairs are striped, while in horses neither the light nor the dark hairs show any stripings. In being striped the hairs from the Congo skin differ from the hairs of antelopes, and agree with those of the asses and zebras. As in the Congo skin the white hairs show no longitudinal striping, it may be assumed it belongs to a zebra rather than to one of the asses. To which of the known zebras does the Congo one most closely resemble?

"Judging by the hairs on the piece of skin sent it decidedly differs from the Quagga (*Equus quagga*), the Mountain Zebra (*E. zebra*), and the Burchell's Zebras (*E. burchelli*) of East and South Africa."

The following papers were read:—

1. Notice of an apparently new Estuarine Dolphin from Borneo. By R. Lydekker.

[Received January 17, 1901.]

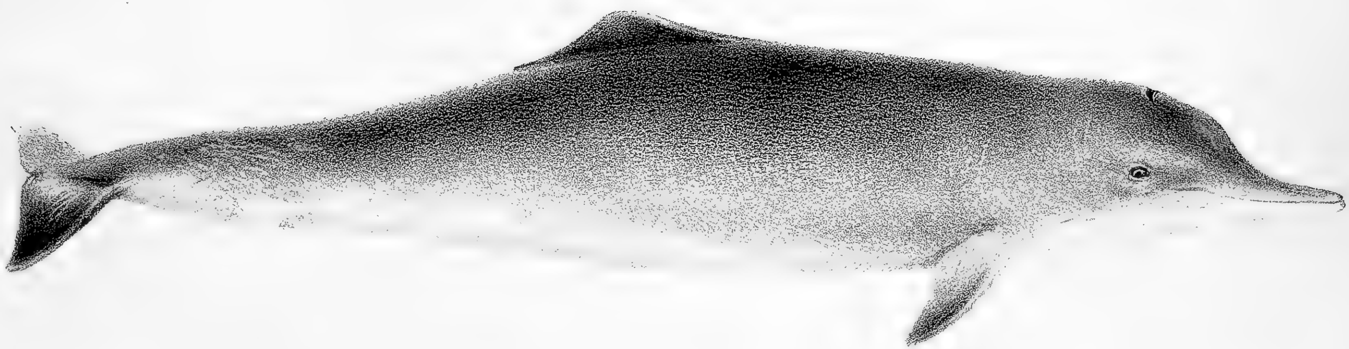
(Plate VIII.)

(Text-figure 11.)

The skin and skeleton of a female Dolphin from Borneo, recently purchased by the British Museum from Mr. E. Hose, do not accord with the description of any species with which I am acquainted, and therefore seem to indicate a new form. The specimen was obtained at Sipang, on the mouth of the Sarawak River.

The total length of the skin is approximately $5\frac{1}{2}$ feet. The beak is comparatively long and narrow, and at the base the forehead rises very abruptly, showing a distinct prominence or boss some distance in advance of the blow-hole. The flippers are falcate, but the dorsal fin is obtuse, low, and continued both in front and behind as a low ridge extending for a length of about fourteen inches along the back.

The general colour of the upper-parts is blackish; but the under-parts are much mottled with a light tint, which is yellow in the dried state, but during life was probably buffish white or whitish. Nearly the whole of the chin is of this light tint, and there are patches of it at the roots of the flippers; in the hinder half of the body and tail it extends some way up the sides.



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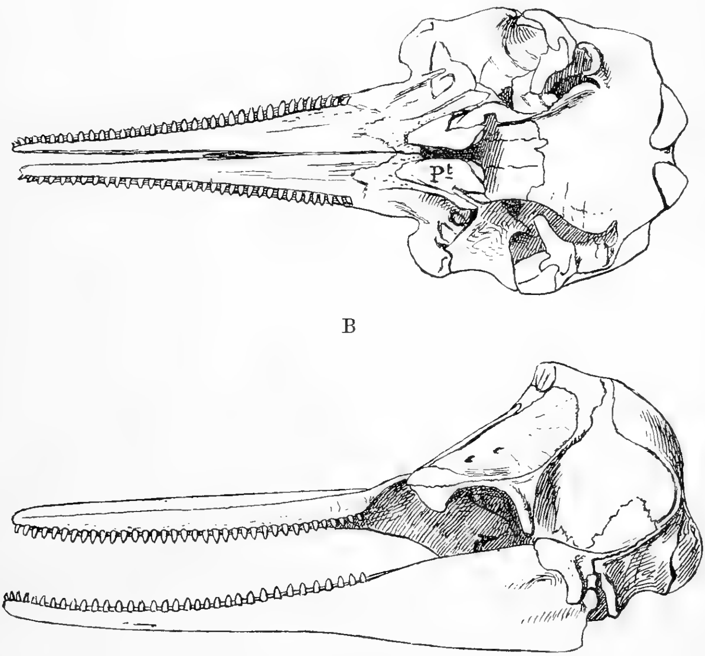
SOTALIA BORNEENSIS.

The skull (text-fig. 11) at once shows that the specimen belongs to the *Sotalia-Steno* group of Dolphins, to which comparison may accordingly be restricted. The pterygoids are widely separated from one another in the middle line; and the teeth, which are of medium size, smooth, and antero-posteriorly compressed, number 36 in the upper, and 34 in the lower jaw. Unfortunately the skeleton is somewhat incomplete posteriorly, so that the total number of vertebræ cannot be ascertained. There are, however, 30 in the precaudal series.

Text-fig. 11.

A



Lower view (A) and lateral view (B) of the skull of *Sotalia borneensis*.
Pt. Pterygoid.

As regards the distinction between *Steno* and *Sotalia*, Messrs. Flower[1] and True[2] included all the forms with divided pterygoids in the latter, and those with conjoint pterygoids in the former. Mr. Blanford[3], however, has transferred the three Indian species *S. plumbeus*, *S. perniger*, and *S. lentiginosus* from *Sotalia* to *Steno*,

[1] List of Cetacea in Brit. Mus. pp. 31 & 32 (1885).
[2] Bull. U. S. Nat. Mus. No. 36, pp. 153 & 156 (1889).
[3] Fauna of Brit. India: Mammalia, pp. 582–585.

although they have divided pterygoids, stating that he thinks it desirable to await the examination of the complete skeleton before placing them in the typical South-American genus *Sotalia*. All three differ from the present form by their much larger teeth; while *S. plumbeus* and *S. perniger* (*gadamu*) are further distinguished by their tall and falcate dorsal fins, and *S. lentiginosus* by its speckled skin. The other Indian form, *S. frontatus*, is a true *Steno*, with conjoint pterygoids and rugose teeth. There are also many other differences, such as variation in the number of teeth.

As already mentioned, the specimen agrees with *Sotalia* and differs from *Steno* (exclusive of the Indian forms referred to that genus by Mr. Blanford) in the separation of the pterygoids. It further agrees with the former in the relatively large number of teeth and the smoothness of their enamel; Mr. True giving the number of teeth in *Sotalia* as from 26 to 35, and in *Steno* from 20 to 27. In *Sotalia* the number of vertebræ varies from 51 to 55, of which 29 are precaudal; but in *Steno* the number is increased to 66, of which 35 are precaudal. In its 30 precaudals the present specimen agrees sufficiently well with *Sotalia*.

It may therefore be taken that the specimen is not only referable to the last-named genus, but likewise to the typical Brazilian section of the same. The Indian forms (referred by Mr. Blanford to *Steno*) have been already differentiated, while the white *Sotalia sinensis*, in addition to its larger teeth, is readily distinguishable by its coloration.

The South-American species, especially those from the Upper Amazons, are probably sufficiently distinguished by their geographical distribution, but a few words may be added in regard to them. Both *Sotalia pallida* and *S. fluviatilis*, of the Upper Amazons, are broadly distinguished by the smaller number of their teeth, there being $\frac{30}{31}$ in the former and $\frac{28}{28}$ in the latter. *S. pallida* further differs by the whitish colour of the upper-parts, while the peculiar distribution of the colours forms another point of difference in *S. fluviatilis*.

Comparison is more difficult in the case of the three forms respectively known as *S. tucuxi*, *S. guianensis*, and *S. brasiliensis*. The former of these is typified by two skulls in the British Museum from the Upper Amazons, the number of teeth in which is $\frac{30}{30}$. This form, if not identical with *S. pallida*, is probably very closely allied.

Sotalia brasiliensis, from Rio de Janeiro, was described on the evidence of an immature specimen, and is said to be blackish above, with the sides fulvous, the belly white, and the flippers coloured like the back; the number of the teeth being $\frac{34}{33}$. In many respects this form appears to come very close to the one under consideration. Sir William Flower was, however, of opinion that *S. brasiliensis* might prove to be the young of *S. fluviatilis*. And apart from this, the figures given by Van Beneden (reproduced in pl. iii. of Mr. True's memoir) seem to indicate that the dorsal fin of

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CAPRA SIBIRICA SACIN.

brasiliensis is more pointed than that of the Bornean Dolphin, and lacks the anterior ridge-like extension of the latter. Moreover, the head is less elevated above the beak than is the case in the present form, although it is true that this may be due to immaturity. In the skull of the Brazilian species the beak appears to be much wider than in the specimen under consideration, while the teeth seem relatively larger. *S. guianensis*, which is said to have $\frac{32}{29}$ teeth, may be identical with one of the foregoing; and, in any case, is too imperfectly known to admit of exact comparison, in the absence of the type specimens.

I have not been able to identify the Brazilian specimen with any of the South-American Dolphins recently described by Dr. R. A. Philippi[1], and am indeed doubtful whether any of them belong to *Sotalia*.

Under these circumstances I see no other course but to make the Bornean Dolphin, at least provisionally, the type of a species, for which the name *S. borneensis* will be appropriate. The specific characters will be apparent from the description above given.

The specimen was captured on September 12th, 1900.

2. Note on the Kashmir Ibex (*Capra sibirica sacin*). By R. Lydekker.

[Received January 22, 1901.]

(Plate IX.)

(Text-figure 12.)

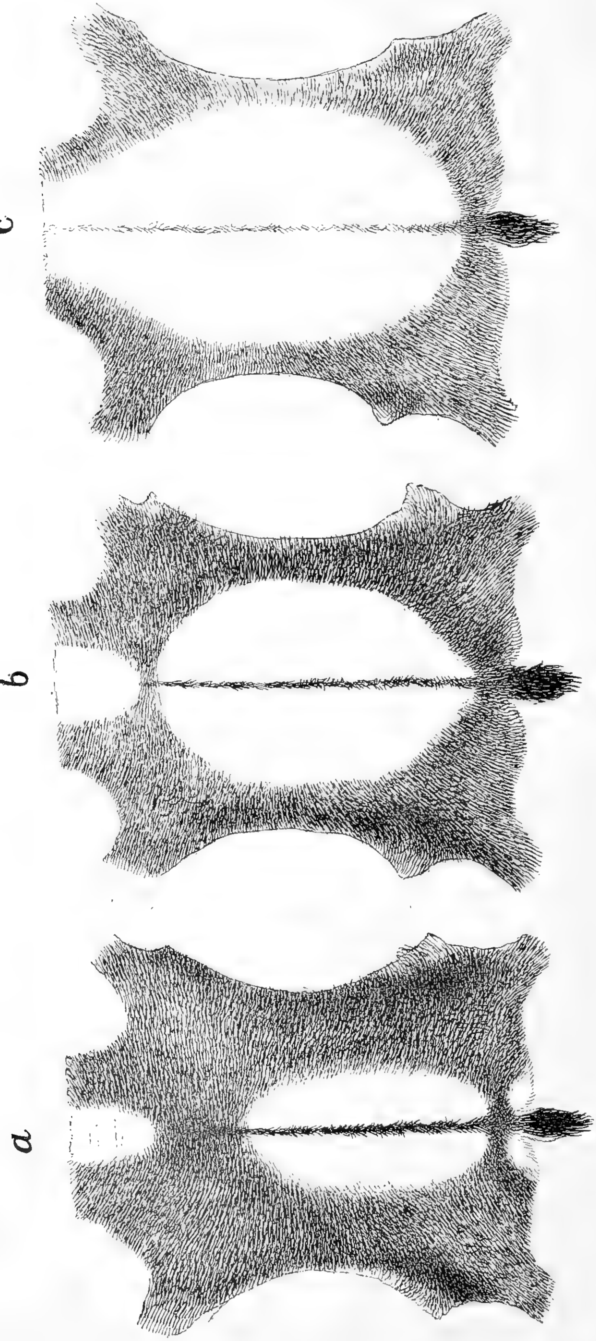
So far as I am aware, no coloured figure of the Ibex inhabiting the mountains which border the northern and eastern sides of the Valley of Kashmir has ever been published, and I accordingly desire to direct attention to a skin which, through the intervention of Rowland Ward, Ltd., will shortly be acquired by the British Museum. The animal (a male) to which this skin belonged was shot by Captain E. F. Holden below the Zogi-la, the pass on the Leh route dividing the Sind Valley of Kashmir from the Tibetan district of Dras. Captain Holden has had the head mounted for his own collection, and the remainder of the skin he has kindly offered to present to the Museum.

This animal was in the winter coat at the time of its death; and is, I take it, the *Capra sakeen* of Blyth, which is generally described as of a dirty white colour in winter, with dark underparts and legs, and browner in summer. Few naturalists, I think, have, however, any idea that it is really as white as is shown to be the case by the present example, which may be briefly described as follows:—

Whole of back and the basal portion of the neck creamy buffish white, with a very faint and incomplete light brown dorsal streak, becoming broader and darker towards the tail, which is

[1] An. Mus. Chile, 1893 and 1896 (No. 12).

Text-fig. 12.



Body-skins of (*a*) Irtish, (*b*) Baltistan, and (*c*) Kashmiri races of the Asiatic Ibex.

black, with chestnut tips to the hairs. A narrow band of very pale greyish fawn along each flank; thighs and shoulders a darker fawn; legs deep golden brown, with a small patch of brownish buff on the back of the hinder pair, above the lateral hoofs. The head, as in all the allied forms, is brownish.

Here it may be mentioned that I regard the Kashmir Ibex not as a distinct species, but as a local race of the Asiatic Ibex, under the name of *C. sibirica sacin* (see text-fig. 12, *c*, p. 92).

Recently I have described[1] a second race of the species, from Baltistan, as *C. sibirica wardi*. Of this race the Museum possesses the mounted type example presented by Mr. Rowland Ward, and an imperfect skin given by Mr. St. George Littledale; both specimens being in the winter dress. Contrasted with the foregoing race, this form presents the following distinctive features:—

Buffish-white area on back considerably smaller, with a more distinct and darker dorsal streak, and thus forming only a "saddle." Another patch of buff on nape of neck also buffish white. Whole of remainder of upper-parts, under-parts (except abdomen, which is whitish), limbs, and tail dark brown, varying somewhat in shade in different parts; in some cases (as in Mr. Littledale's example) a patch of brownish buff on the posterior surface of the hind legs above the hocks (see text-fig. 12, *b*).

A third (Irtish) race, from farther north in Cental Asia, has been described by Mr. Walter Rothschild[2] as *C. sibirica lydekkeri* (see text-fig. 12, *a*).

In this form (which is also represented by specimens in the winter coat), the light saddle is reduced to a still smaller size than in the last, and the light nape-patch is likewise smaller, and separated by a longer interval from the saddle; the brown tail is bordered with white, and there are also small patches of white on the buttocks adjacent to the tail; the whole of the rest of the upper-parts, as well as the limbs and under-parts, are brown, of a somewhat lighter shade than in the Baltistan race.

Finally, we have what I take to be the typical race of the species, as represented in the British Museum by two mounted male examples in the winter coat, one of which is from the Thian Shan, and the other from Siberia. These specimens have the whole of the upper-parts uniformly coloured, the tint being a full brown in the one first mentioned, but somewhat lighter in the second. Both are further distinguished by the circumstance that the whole of the posterior surface of the metatarsal segment of the hind leg is white.

It seems, therefore, that not only are all the aforesaid four races perfectly easy of definition, but that, so far as coloration is concerned, there is a transition from the Kashmiri to the Thian-Shan form; the one being the lightest, and the other the darkest of the four.

And in this connection it may be remarked that the light-

[1] Great and Small Game of India, Burma, and Tibet, p. 101 (1900).
[2] Novitates Zoologicæ, vol. vii. p. 277 (1900).

coloured Kashmir race of the Asiatic Ibex inhabits the great Snowy Range of the Himalaya, where the snowfall is heaviest. The darker Baltistan Ibex, on the other hand, is a dweller in a district where the fall of snow is less; while the Thian-Shan and Siberian race, at least in part of its habitat, is found in arid districts where the snowfall is still more limited. It would thus seem probable that the type of coloration characteristic of each of the four forms of the Asiatic Ibex mentioned above is directly correlated with the environment of each particular race.

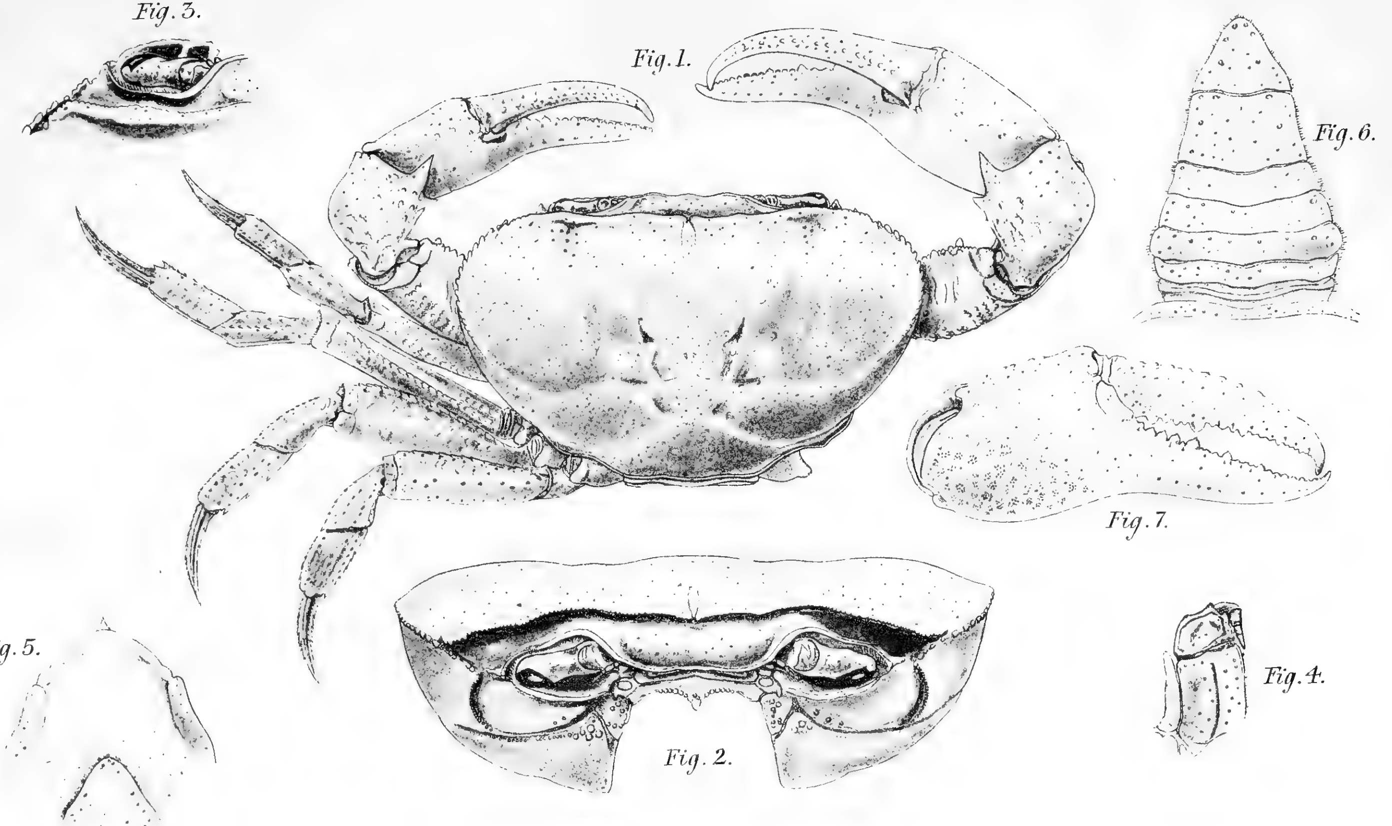
3. Description of a new Freshwater Crustacean from the Soudan; followed by some Remarks on an allied Species. By Dr. J. G. DE MAN, of Ierseke, Zeeland, Holland.

[Received January 21, 1901.]

(Plate X.)

A male specimen of a Crab from the Bahr-el-Gebel, in the Soudan, obtained by Capt. S. S. Flower, F.Z.S., in April 1900, has been sent to me for examination. Though apparently belonging to a species not yet described, it was, for the sake of certainty, sent successively to Prof. Pfeffer at Hamburg and to Prof. Hilgendorf at Berlin, who both informed me that in their opinion it represented a new species. I therefore venture now to describe it as such.

The carapace is very wide, the greatest breadth, just in the middle between the postfrontal crest and the transverse groove separating the mesogastric and urogastric regions from one another, being in proportion to the length as 5 : 3. The carapace is rather strongly convex from before backwards, and somewhat convex transversely. The prominent and sharp postfrontal crest extends to the antero-lateral margins much as in *Potamon* (*Potamonautes*) *aubryi* A. M.-E., a type specimen of which, a male from the Gaboon, was kindly sent me by Prof. Bouvier. The postfrontal ridge is interrupted by the mesogastric suture, that appears roof-like ("dachförmig," Hilgendorf, 'Die Land- und Süsswasser-Dekapoden Ostafrikas,' 1898, p. 5). From this suture the crest proceeds sinuously towards, but without uniting with, the lateral margin of the cephalothorax, a narrow suture remaining between the lateral margin and the lateral extremity of the crest, and this lateral extremity for a very short distance curves backwards (Plate X. fig. 3). In *Potamon aubryi* A. M.-E., on the contrary, the postfrontal ridge unites with the lateral margin of the carapace. When the cephalothorax is looked at from above, the postfrontal crest appears quite smooth, only a few crenulations being observed near the lateral extremities. In a front view (fig. 2) the free edge of the ridge appears finely crenate, the crenulations slightly, though rather irregularly, increasing in size towards the lateral



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POTAMON (POTAMONAUTES) FLOWERI.

extremities; but between the orbits the crest appears smooth. The mesogastric suture, 6 mm. long, does not extend to the middle of the space between the postfrontal crest and the transverse groove limiting the mesogastric and the urogastric regions from one another; and this groove, visible immediately behind the middle of the carapace, is very shallow and hardly distinguishable. A little further backwards a similar shallow groove is observed separating the urogastric area from the cardiac. The lateral grooves of the H-shaped figure are somewhat deeper, and likewise the two >-shaped grooves that bound the anterior cardiac region laterally. The lateral portions of the cervical suture, which in other species run obliquely forward and outward, are quite indistinct in *Potamon floweri*; their direction, however, is still indicated by impressed punctures, that are somewhat larger than the minute punctures scattered on the upper surface of the carapace; the latter are very fine, only distinguishable by means of a magnifying-glass, and rather few in number.

The antero-lateral margins of the carapace are strongly arcuate, almost semicircular, bulging out very much laterally; they extend as far beyond the external orbital angles as the breadth of the orbits. They are defined by a distinctly granulated line that extends backwards as far as the urogastric area. The postero-lateral margins are rounded and smooth and appear very slightly concave, when the carapace is looked at obliquely from above. An epibranchial tooth is wanting. The granulated line that defines the antero-lateral margins, posterior to the postfrontal ridge, is formed by fifteen or sixteen rather large granules, that are not sharp, gradually decrease in size backwards, and finally disappear. The distance between the epibranchial angles measures four-fifths, and that between the extraorbital angles about two-thirds of the width of the carapace.

The front is somewhat convex longitudinally, but almost straight transversely, and the width of the free border measures one-fourth the breadth of the cephalothorax; the upper surface is smooth, rather closely punctate, and the punctures are slightly larger than those of the upper surface of the carapace. When the latter is looked at from above, the free border of the front appears widely emarginate in the middle; this anterior margin forms very obtuse, though not rounded, angles with the very oblique lateral margins of the front; the latter are somewhat thickened, whereas the transverse external portions of the upper orbital margins are thinner.

The sharp, dentiform, outer angles of the orbits are rather prominent and forwardly directed. Between the extraorbital tooth and the epibranchial angle there is a granulated tooth or prominence immediately behind the groove that separates the suborbital and subbranchial areas from one another; this tooth, however, is a little smaller than the extraorbital tooth.

The postfrontal crest lies far forwards, so that when the carapace is looked at from above a small portion of the upper margin of the orbits and the granulated tooth between the extraorbital and epibranchial angles are covered and concealed by it. The furrow between the postfrontal crest and the upper margin of the orbits is very concave and deep (Plate X. fig. 2).

The whole upper surface of the carapace is smooth and shining, and presents, under an ordinary lens, a very fine punctuation, but is nowhere granulated. The orbits (fig. 2) are large, their width measures three-fourths of the free border of the front, and they are one and a half times as broad as high. In a front view of the carapace (fig. 2), the somewhat concave external portion of the upper margin of the orbits runs obliquely downwards; whereas the lower margin, which is somewhat punctate but otherwise smooth, has a transverse direction, being but very little arcuate; the lower margin of the orbits shows a deep notch or hiatus just below the extraorbital tooth. The superior margin of the orbits and the free edge of the front are also smooth.

The suborbital area is separated by an arcuate, rather deep sulcus from the subbranchial region; the posterior margin of this groove is granulate or crenate, presenting about twenty rather small crenulations; there are three or four granules on the suborbital area close to the groove that separates it from the branchiostegite, but for the rest this region and the branchial floor also are smooth. The branchiostegite bears a few smooth, rounded granules on its anterior extremity (fig. 2), and the suture that separates it from the subhepatic and subbranchial regions is bordered by a row of granules that gradually grow smaller from before backwards; its anterior part is rather deep.

The epistome is smooth. The median triangular process of its posterior border is large and salient, and its lateral margins have seven or eight coarse granules on each side; the slightly concave external portions of the posterior border of the epistome are smooth and rather sharp, but the median process bears also a few granules on its surface. For the rest the epistome, the basal plate, and the basal joints of the outer antennæ are smooth.

The ischium of the external maxillipede (fig. 4) is smooth, rather coarsely punctate, and has a deep furrow that does not reach to the anterior margin of this joint but ends just behind it; it runs distinctly somewhat closer to the internal than to the external margin, and almost parallel with the former; the merus-joint is also smooth and finely punctate, though somewhat more coarsely on the thickened posterior margin.

The sternum shows a fine, not close punctuation, but is for the rest smooth; quite anteriorly a transverse groove unites the postero-external angles of the ischium-joints of the outer foot-jaws with one another. Along the insertion of the chelipedes the lateral margin of the sternum is thickened or raised, just as in *P. infravallatum* Hilg. (Hilgendorf, *l. c.* fig. 2 *a*).

The male abdomen (fig. 6) resembles that of *P. suprasulcatum* Hilgendorf (*l. c.* fig. 5 *a*). The terminal segment is triangular with obtuse extremity; the lateral margins are somewhat concave posteriorly, and the posterior margin is one-third longer than the length of this segment. The penultimate segment is just as long as the terminal, and trapezoidal; the anterior margin is in proportion to the posterior as 4 : 5, and the lateral margins are a little concave. The abdomen is smooth, punctate, especially near the anterior margin of the segments.

The chelipedes (Plate X. fig. 1) are unequal, the right being the larger. The merus of the right chelipede extends but little beyond the lateral margin of the carapace. The upper margin is covered, except at the base, with transverse tubercular rugosities, and on the inner surface, close to and parallel with the smooth proximal part of the upper margin, is seen a row of six or seven small rounded tubercles that decrease in size anteriorly; this row reaches almost to the middle of the arm, and next to each of the first three tubercles there exists a much smaller tubercle. The anterior edge bears a double row of rounded tubercles; the internal row is formed by nine or ten that are not contiguous to one another; the external series bounding the anterior surface of the joint consists of about twice as many tubercles, but these are smaller, unequal, and contiguous to one another. About 2 millimetres from the anterior margin there is, on the anterior surface near the carpal articulation, a somewhat larger tubercle, with convex sides and rather a sharp point; around it several smaller granules are distributed, and a row of five or six larger ones extends from this tubercle to the lower margin of the arm. The lower margin bears along its whole length a row of fourteen or fifteen rounded smooth tubercles, that slightly increase in size distally and are somewhat larger than those of the anterior margin of the joint. The outer surface is finely punctate, but otherwise smooth. The carpus is a little tubercular along its internal margin, behind the acute, slightly depressed spine at the inner angle; beneath the latter there is another spine, only half as large and making a right angle with the larger. A little behind this smaller spine, on the lower border of the inner surface, there is a trace of a third in the form of a small blunt tubercle. The upper and outer surface of the wrist is punctate and smooth. The larger hand (fig. 7) resembles that of *P. hilgendorfi* Hilgendorf (*l. c.* fig. 3). It is almost exactly as long as the cephalothorax is broad, and the fingers, that are somewhat less gaping than on the quoted figure 3, measure three-fifths of the whole length of the hand. The palm, near the articulation of the fingers, is about as high as it is long, measured horizontally; it is somewhat granular along the inner margin of its upper surface, but for the rest it appears smooth and shining; by means of a lens a fine punctuation is, however, observed, the punctures being disposed partly in longitudinal rows. The internal surface is also smooth, only a few granulations are seen close to and on its lower border, but these granulations are not visible when the hand is looked at from the outer side. The rather strongly compressed fingers are somewhat bent inward; they are regularly tapering and end in rather sharp, curved extremities that cross one another. The dactylus is somewhat granular along the inner border of its upper surface, but for the rest both fingers appear smooth and shining externally; they are not furrowed, but each finger is marked with two or three longitudinal rows of small impressed punctures. On the inner surface, however, the dactylus appears at base distinctly furrowed just beneath the upper margin, but this groove also gradually changes, on the middle of the finger, into a row of punctures; the immobile finger shows likewise on its inner surface a rather shallow longitudinal furrow that extends almost to the extremity. The dactylus is armed with about 20 or 21 small teeth, the fifth of which is the largest; the first tooth is but little smaller, the three following gradually decrease in size; beyond the fifth 15 or 16 very small teeth extend nearly to the pointed tip, two or three of them being a little larger than the remaining. The immobile finger bears also 21 small teeth, the sixth of which is the largest and nearly of the same size as the fifth tooth of the dactylus. The first four gradually increase in size, the fifth is quite small, beyond the sixth there are three or four teeth smaller than the sixth, slightly decreasing in size and separated from one another by two or three very small teeth. The latter appear on both fingers, are somewhat compressed, with a straight or slightly arcuate upper edge; the larger teeth are more pointed.

The smaller chela measures four-fifths of the other, but fully agrees with it in shape and characters.

The ambulatory legs are of moderate length, those of the last pair being little longer than the cephalothorax is broad. The meropodites of the last pair are exactly three times as long as broad, also those of the penultimate pair, which are 20 mm. long and $6\frac{2}{3}$ mm. broad. Along their anterior edge the meropodites are covered with depressed acute granules, and they appear a little granular on their outer surface, especially near the anterior margin, except those of the last pair, which are quite smooth. The following two joints are likewise beset, on their fore edge, with small acute teeth or granules, and a few occur on the posterior margin of the propodites. The slender and slightly arcuate dactylopodites taper regularly towards their pointed tips, and are longitudinally ridged both on their outer and inner surfaces. Those of the second and third pairs are furnished, at the base of their posterior margin, only with one spinuliform tooth, those of the fourth and fifth pairs with two or three; several spinuliform teeth are observed along the anterior edge of these joints.

In colour the cephalothorax is of an olive-green, that is lighter on the gastric region and on the sternum than elsewhere. The postfrontal crest, the margins of the orbits and of the front, the granules of the antero-lateral margin, and the tooth of the epistome are yellow. The chelipedes are greenish yellow, the ambulatory legs reddish yellow.

Potamon (*Potamonautes*) *aubryi* H. M.-E. is a different species.

The carapace is somewhat less enlarged and, according to A. Milne-Edwards, "aplatie transversalement" (in the specimen that lies before me the upper surface of the carapace is broken!). The postfrontal crest shows different characters. When the carapace is looked at from above, the whole upper margin of the orbits, the whole extraorbital tooth, and also that between the latter and the small epibranchial tooth remain visible. The postfrontal crest is somewhat obliquely bent backwards a little beyond the outer angle of the orbits, and unites with the antero-lateral margin, which shows here a very small, granuliform, epibranchial tooth. The extraorbital tooth is *larger*, slightly concave, obtuse, directed forward, and its outer margin is slightly convex and makes a right angle with the upper margin of the orbits. The distance between the outer angle of the orbits and the epibranchial tooth is proportionately *longer* than in *Potamon floweri*, namely almost as long as the orbits are broad; the tooth between the outer angle of the orbits and the epibranchial tooth is *much longer* and has a different shape. This tooth is *longer*, but lower, less salient than the extraorbital tooth, its outer margin is slightly arcuate and its very short *anterior* margin measures only one third the length of the outer margin. The granulations of the antero-lateral margin are *smaller* and *less prominent* than in the new species from the Soudan. The lower margin of the orbits runs almost transversely in *P. floweri*, but somewhat obliquely upwards in *P. aubryi*. The sternum of the male is *not thickened* along the insertion of the chelipedes. The abdomen of the male has a different form. The terminal segment measures only two-thirds of the penultimate, and its length measures two-thirds of the width of its posterior margin. The penultimate segment is, in the specimen of *Pot. aubryi* lying before me, 9 mm. long, the anterior margin measures $9\frac{1}{4}$ mm., the posterior 12 mm., namely the straight line that unites its lateral angles, the margins being concave: the penultimate segment is as long as its anterior margin is broad.

The tubercles with which the margins of the meri of the chelipedes are furnished are, in *P. aubryi*, smaller, less prominent, and the tubercle on the under surface of these joints near the carpal articulation appears as a rounded granule, scarcely larger than those that surround it. The fingers are *somewhat shorter* in proportion to the length of the palm, and the dactylus is not granulate on its upper margin. The meropodites of the ambulatory legs are a little more enlarged, those of the fifth pair are 20 mm. long and $7\frac{1}{2}$ mm. broad; the dactylopodites finally present one spinule more on their posterior margin.

Potamon (*Potamonautes*) *pelii* Herklots, from the Gold Coast, is also a different species. A young male, type, from the Leyden Museum, is lying before me. The carapace is *much less* enlarged; the postfrontal crest runs otherwise, as each half does not extend from the mesogastric suture, transversely outward, but somewhat obliquely backward; the postfrontal ridge, as in *P. aubryi*, *unites* with the antero-lateral margin of the carapace, and this antero-lateral margin is *very faintly crenulate*; the granules are much less prominent than in the Soudan species. The postfrontal crest is situated more backwards, so that in this species also the upper margin of the orbits, the extraorbital tooth, and that between the latter and the epibranchial tooth are visible when the carapace is looked at from above. The extraorbital tooth has about the same shape as in *Potamon aubryi*, but the tooth between it and the epibranchial one is much smaller. The orbits have a different shape; there is no hiatus near the outer angle, the lower edge of the extraorbital tooth making only an obtuse angle with the lower margin of the orbits. The distance between the inner angle of the infraorbital margin and the front is in *Potamon pelii* slightly larger, but in *Pot. floweri* a little shorter than half the height of the orbit.

The sternum of the male is not thickened near the insertion of the chelipedes, and the male abdomen is also different, the penultimate segment being just as long as its anterior margin is broad.

I will not describe the legs, the specimen being still young, but they also do not fully agree with those of *P. floweri*.

Measurements of *Potamon floweri* in millimetres :—

	♂.
Width of the cephalothorax	49½
Length of the cephalothorax	30
Distance between the extraorb. angles	31
Distance between the epibranchial angles	39
Breadth of the anterior margin of the front	12½
Distance, in the middle, between the anterior margin of the front and the postfrontal crest	4¼
Height of the orbits	6
Breadth of the orbits	9¼
Distance between the extraorbital and the epibranchial angle	5½
Breadth of the posterior margin of the cephalothorax	14½
Distance between the anterior margin of the front and the transverse groove that separates the mesogastric region from the urogastric	16
Length of the terminal segment of the abdomen	6
Length of the penultimate segment	6¼
Breadth of the anterior margin of this segment	8
Breadth of the posterior margin	10½
Length of the larger chela	44
Length of the fingers	27
Height of the palm at the articulation of the fingers	17
Length of the smaller chela	35½
Length of the fingers	22
Height of the palm at the articulation of the fingers	12

Length of the legs of the last pair	53
Length of the meropodites of these legs	17
Breadth of the meropodites of these legs	$5\frac{3}{4}$
Length of the dactylopodites	11
Thickness of the cephalothorax	21

Remarks on Potamon (Potamonautes) hilgendorfi *Pfeffer.*

Prof. Pfeffer, of the Naturhistorisches Museum of Hamburg, was so kind as to present me with two type specimens of *Telphusa hilgendorfi* Pfeffer, both males from Ungúu. As Pfeffer's description ('Uebersicht der von Herrn Dr. Fr. Stuhlmann in Aegypten, auf Sansibar und dem gegenüberliegenden Festlande gesammelten Reptilien, Amphibien, Fische, Mollusken und Krebse,' Hamburg, 1889, p. 32) is very short, the following remarks will, I think, be welcome.

The larger specimen has lost its chelipedes; in the other both are present, but Dr. Pfeffer had added two *detached* chelipedes, that, as regards their size, should belong to the larger male. In the first place I will remark that, as Pfeffer likewise writes to me, the true *Pot. hilgendorfi* Pfeffer is *a different species* from that which has recently been described under the same name by Hilgendorf ('Die Land- und Süsswasser-Dekapoden Ostafrikas,' 1898, p. 9, fig. 3), and which inhabits the country around Kilimanjaro.

The cephalothorax of both males is *depressed*, especially behind the cervical suture. The gastric region appears, however, very slightly arcuate, both transversely and from before backwards. Hilgendorf, on the contrary, describes the cephalothorax of his species as "deutlich gewölbt." In Hilgendorf's species the antero-lateral margin of the carapace is described as extending laterally beyond the outer orbital angle somewhat farther than the orbits are broad, but in the type specimens of *Pot. hilgendorfi* Pfeffer they extend laterally *somewhat less than the orbits are broad.* In the species described by Prof. Hilgendorf the lateral portions of the cervical suture are *indistinct* and invisible; in Pfeffer's types, however, they are *deep* and *distinctly developed*, though not reaching to the postfrontal crest. In *both* species an epibranchial tooth is *wanting*. That part of the lateral margin which is situated between the rather acute extraorbital angle and the lateral extremity of the postfrontal crest is *very oblique*, distinctly granulated, and makes a right angle with the upper margin of the orbits; in Hilgendorf's species, on the contrary, the outer orbital angle is described as "stumpfwinklig." In the young male the lower margin of the orbits presents no trace of a hiatus; but just below the extraorbital angle in the larger male I observe a quite shallow incision only on the left side; in the species from Kilimanjaro, however, the incision is small, but usually deep.

The antero-lateral margin, the postfrontal crest, and the orbital margins are distinctly granular or crenate, the postfrontal crest is rather prominent and only interrupted by the mesogastric suture;

it extends laterally to the antero-lateral margin. The lateral margins of the front, which is strongly deflexed, are very oblique in both males and curve regularly into the anterior margin, which is slightly emarginate in the middle; the upper surface of the front is finely granular and appears a little concave in the middle. The anterior half of the gastric region is distinctly granulate, and the lateral parts of the upper surface show the usual finely-granulate, transverse rugæ. The rest of the upper surface is smooth and punctate. The suborbital area is finely granulate and separated from the branchial floor, which is covered with short, transverse, granulate rugæ, by a rather shallow groove; this groove, however, is bordered by a finely-granulate line. The pleural suture limiting off the subhepatic and subbranchial regions from the branchiostegite is defined anteriorly by *two* granulate lines, just as in *P. suprasulcatum* Hilgd.

The outer foot-jaws are furnished with a *distinct* furrow on the ischium-joint in Hilgendorf's species; but in the true *P. hilgendorfi* Pfeffer the "ischial line" is completely *wanting*, at least in the two males lying before me.

The carpus of the anterior legs is covered above with very fine granulate rugæ, and is armed at the inner angle with a *conical* tooth, beneath which a much smaller one is seen. The immobile finger of the chelipedes shows a deep longitudinal groove a little below the middle of its outer surface, and above this groove still another one that is less deep; the outer surface of the dactylus is also marked with two longitudinal grooves, the lower of which is, however, rather shallow. Pfeffer describes these furrows as "einen breitern und einen schmalern Längseindruck." In the species that was described by Hilgendorf there are *no furrows* on the fingers, at least none on the immobile. One observes on the outer surface of the palm very short, vertical, finely-granulate lines that gradually pass into very fine granules towards and on the fingers.

Measurements of the two specimens of *Potamon hilgendorfi* Pfeffer in millimetres :—

	♂.	♂.
Greatest width of the carapace	26	14
Length of the carapace	19	$10\frac{1}{2}$
Distance between the extraorb. angles ..	$18\frac{1}{2}$	$10\frac{3}{4}$
Breadth of the anterior frontal margin ..	8	$4\frac{1}{2}$
Length of the front, in the median line of the cephalothorax	$2\frac{1}{4}$	$1\frac{1}{2}$
Thickness of the carapace	9	5
Breadth of the orbits	5	3
Height of the orbits	$3\frac{1}{4}$	$1\frac{3}{4}$
Length of the meropodites of the penultimate pair	12	$7\frac{1}{2}$
Breadth of these meropodites	4	$2\frac{3}{4}$
Length of the meropodites of the fifth pair	$10\frac{1}{2}$	6
Breadth of these meropodites	$4\frac{2}{5}$	2

The measurements of the detached chelipedes are the following: of one of them the palm and the fingers are respectively $8\frac{1}{2}$ mm., the height of the palm at the articulation of the dactylus measures $7\frac{1}{2}$ mm; in the other leg the palm is $7\frac{1}{2}$ mm. long, and 7 mm. high at the articulation of the fingers, which measure 9 mm.

I have also before me a type specimen of *Potamon* (*Potamonautes*) *cristatum* A. M.-E., from the Paris Museum, a species the habitat of which is still unknown (A. Milne-Edwards in Nouv. Archives du Muséum, t. v. p. 180, pl. xi. figs. 1 & 1 *a*). As this species is still insufficiently known, I will compare it with *P. hilgendorfi* Pfeffer.

The carapace of *P. cristatum* appears *somewhat longer* in proportion to its width than that of *P. hilgendorfi*, and the antero-lateral margins project less laterally, so that the cephalothorax is not so wide. The upper surface appears a little convex from before backwards and the lateral portions of the cervical suture are *completely wanting*, but the median semicircular part of it is distinct though not very deep. The postfrontal crest passes in a somewhat sinuous line to the lateral margin; that of *P. hilgendorfi*, however, in an almost straight line. The gastric region is also anteriorly, as everywhere, *smooth, without granulation*. The front has the same form in both species, but that of *P. cristatum* appears *somewhat broader* in proportion to the distance between the external orbital angles. The antero-lateral margins are *more finely* granulate than those of *P. hilgendorfi* Pfeffer, and that part which is situated between the extraorbital and epibranchial angles appears in *P. cristatum less oblique, a little arcuate*, and though not toothed makes *a distinct angle* with the postfrontal ridge when the cephalothorax is looked at from above, whereas in *P. hilgendorfi* Pfeffer this part passes without any interruption into the rest of the margin.

The lower margin of the orbits fully agrees in both species, for also in *P. cristatum* there is no incision or hiatus near the outer angle. In *P. cristatum* the ischium-joint of the outer foot-jaws is *distinctly furrowed*, and this groove runs somewhat closer to the inner than to the outer margin.

The suborbital and subbranchial regions, together with the grooves that define them, fully agree in both species.

The chelæ of the male of *P. cristatum* are of equal size and shape. The fingers are somewhat gaping at base, whereas those of *P. hilgendorfi* Pfeffer are in contact throughout their length; they are distinctly longer than the palm and *deeply furrowed*. On the outer surface of the immobile finger two deep grooves are observed near one another, on that of the dactylus three or four. These furrows are less deep in *P. hilgendorfi* Pfeffer. The meropodites of the ambulatory legs of *P. cristatum* finally are *more enlarged*.

Measurements of the type of *Potamon cristatum* A. M.-E. in millimetres :—

	♂.
Greatest breadth of the carapace	$16\frac{1}{2}$
Length of the carapace	13

Distance between the extraorb. angles	$13\frac{3}{4}$
Width of the free border of the front	6
Length of the front in the middle..............	$1\frac{4}{5}$
Thickness of the carapace	6
Breadth of the orbits........................	$3\frac{3}{4}$
Height of the orbits	$2\frac{1}{4}$
Length of the chelæ	$8\frac{3}{4}$
Length of the fingers	$4\frac{3}{4}$
Height of the chelæ at the articulation of the dactylus	$3\frac{1}{5}$
Length of the meropodites of the penultimate pair	$8\frac{1}{2}$
Breadth of these meropodites	$3\frac{3}{5}$

EXPLANATION OF PLATE X.

Fig. 1. *Potamon (Potamonautes) floweri*, n. sp. $\times 1\frac{1}{4}$.
2. Front view of the cephalothorax. $\times 1\frac{2}{3}$.
3. The left orbit and the surrounding part of the upper surface, showing a portion of the postfrontal crest and the tooth between the extra-orbital and epibranchial angles, viewed from above. $\times 1\frac{2}{3}$.
4. Outer foot-jaw. $\times 1\frac{2}{3}$.
5. Anterior part of the sternum and terminal joint of the abdomen. showing the thickened ridges near the insertion of the chelipedes, $\times 1\frac{2}{3}$.
6. Abdomen. $\times 1\frac{2}{3}$.
7. Larger chelæ. $\times 1\frac{1}{4}$.

4. A Contribution to the Myology and Visceral Anatomy of *Chlamydophorus truncatus*. By R. H. Burne, B.A., F.Z.S., Anatomical Assistant in the Museum of the Royal College of Surgeons.

[Received February 1, 1901.]

(Text-figures 13–20.)

The anatomy of *Chlamydophorus* has received so much attention at the hands of various anatomists that the following notes of the dissection of a specimen[1] need some apology.

This small Armadillo is not only of extreme rarity, a fact that in itself would warrant as many descriptions of its anatomy as possible, but in certain of its features—particularly the dermal armature—is so remarkably aberrant, that the determination of its relation to the other Edentates becomes a matter of peculiar interest. There seems little doubt that, from their general similarity of structure, the Armadilloes should all be grouped within one family, and that, within this family, *Chlamydophorus* lies some-

[1] I owe the opportunity of dissecting this specimen to the kindness of Mr. F. W. Lucas to whom it belonged, and of Prof. Stewart who entrusted me with it.

where in the neighbourhood of the subfamily *Dasypodinæ*—nearest of all probably to the genus *Dasypus*; although, on account of its peculiar armature, it requires to be placed in a separate subfamily of its own—the *Chlamydophorinæ*. A third subfamily is occupied by the genus *Tatusia*, distinct in many important features from both *Dasypodinæ* and *Chlamydophorinæ*. Such, in brief, is the position assigned to *Chlamydophorus* by Flower [1]; but in the settlement of this position there has been in Macalister's well-known monograph [2] a discordant note. This memoir is mainly devoted to an exhaustive description of the myology; and as the result of a very careful comparison with a large number of other Edentates, the author concludes that "the position of *Chlamydophorus* will be seen from the foregoing description to be plainly among the *Dasypodidæ* and *very close to Tatusia*." [3] Now it is well known that in most of its viscera *Chlamydophorus* shows far more resemblance to *Dasypus* than to *Tatusia*, so that, in view of Macalister's conclusions, any Dasypine muscular features possess considerable importance. The occurrence in my specimen of several features of this kind constitutes the chief excuse for bringing forward this paper, while a minor one consists in the want of clear drawings of the myology of this rare animal and the opportunity that is offered of incorporating with the remarks upon its viscera certain hitherto unnoticed details in the visceral anatomy of *Dasypus*, *Tatusia*, and *Bradypus* that have from time to time come under observation in the Museum work-room of the Royal College of Surgeons [4].

Myology.

In addition to the chapter on Myology in Hyrtl's [5] classical monograph on *Chlamydophorus*, this subject, as mentioned above, has been dealt with in great detail by Macalister. It will be necessary here to describe only those muscles that differ in some way from these previous descriptions; in other cases the name only of the muscle will be mentioned to indicate that its presence was observed.

Panniculus carnosus.—The only part of this muscle seen was a narrow slip (text-fig. 13, *p.c.*)—noticed by both Macalister and Hyrtl—that rises from the head-shield and is inserted into the spine of the scapula superficial to the trapezius.

Muscles of the Head and Neck.—The muscles of the snout and upper lip are well developed, and agree fairly well with Hyrtl's

[1] Flower: "On the Mutual Affinities of the Animals composing the Order Edentata." Proc. Zool. Soc. 1882, p. 360.

[2] Macalister: "On the Anatomy of *Chlamydophorus truncatus*." Trans. R. Irish Acad. xxv. 1895, p. 219.

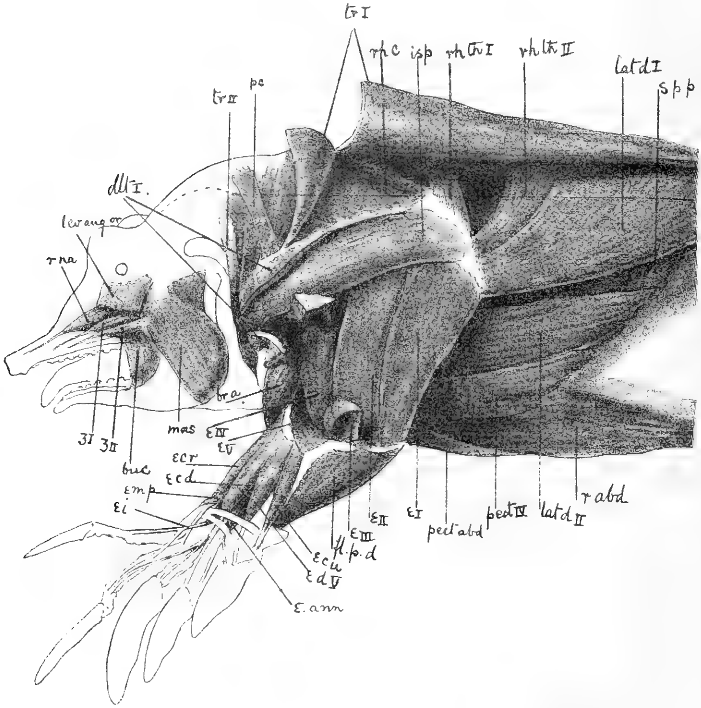
[3] The italics are mine.

[4] These specimens were dissected by the Prosector to the College (Mr. William Pearson).

[5] Hyrtl: "Chlamydophori truncati ... anatomicum examen." Denkschr. k. Akad. Wiss. Wien, ix. 1855, p. 29.

description and entirely so with Murie's account of the face-muscles of *Tolypeutes*[1].

Text-fig. 13.



Muscles of anterior region of *Chlamydophorus truncatus*.

br.a., brachialis anticus.
buc., buccinator.
dlt. I, scapular deltoid.
e. I, II, III, IV, V, the several heads of the extensor antebrachii.
e.ann., extensor annularis.
e.c.d., extensor communis digitorum.
e.c.r., extensor carpi radialis.
e.c.u., extensor carpi ulnaris.
e.d. V, extensor minimi digiti.
e.i., extensor indicis.
e.m.p., extensor metacarpi pollicis.
fl.p.d., flexor profundus digitorum (band).
i.sp., infraspinatus.
lat.d. I, II, two parts of latissimus dorsi.
lev.ang.or., levator anguli oris.
mas., masseter.
p.c., panniculus carnosus.
pect. IV, pectoralis quartus.
pect.abd., abdominal part of pectoralis.
r.abd., rectus abdominis.
rh.c., rhomboideus capitis.
rh.th. I, II, two parts of rhomboideus thoracicus.
r.na., retractor naris.
s.p.p., serratus posticus posterior.
tr. I, II, two parts of trapezius.
z. I, II, zygomatici.

[1] Murie. "The Habits, Structure, etc. of *Tolypeutes conurus*." Trans. Linn. Soc. xxx. 1875, p. 105.

Those observed were:—*Levator anguli oris* (text-fig. 13, *lev.ang.or.*), answering to Hyrtl's muscle of the same name (its insertion was destroyed in removing the skin). *Retractor naris* (text-fig. 13, *r.na*), a large fusiform muscle rising from the anterior margin of the zygomatic arch close to the lower border of the orbit and under cover of the levator anguli oris; it is inserted by a round tendon into the snout. A pair of *Zygomatici* (text-fig. 13, *z.* I & *z.* II), running parallel to one another and to the preceding muscle from the anterior border of the zygoma to the upper lip.

The *Depressor mandibulæ* (digastric) was, as in Hyrtl's specimen, absent. Macalister describes a very delicate depressor. Windle & Parsons[1] mention that this muscle was absent in two specimens of *Dasypus* examined by them, although it is described for this genus by Macalister and Cuvier. It is present in *Tatusia*.

The *Stylohyoid* (text-fig. 14, *st.hy.*) answers closely to Hyrtl's description and has (as in his specimen) an expanded tendinous connection with the mylohyoid. A connection of the same kind is of such frequent occurrence among other mammals between the central tendon of the depressor and the mylohyoid, that the absence of this stylohyoid-mylohyoid connection in Macalister's specimen, in which there was a definite depressor, suggests the possibility of a fusion of the depressor with the stylohyoid in Hyrtl's specimen and mine.

The following muscles belonging to this region were also observed: *Buccinator* (text-fig. 13, *buc.*). *Masseter* (text-fig. 13, *mas.*). *Temporalis*. *Pterygoidei*. *Sterno-maxillaris* (text-fig. 14, *st.max.*). *Mylohyoid* (text-fig. 14, *myh.*). *Styloglossus* (text-fig. 14, *st.gl.*). *Sterno-mastoid* (text-fig. 14, *st.m.*). *Cleido-mastoid* (text-fig. 14, *clm.*).

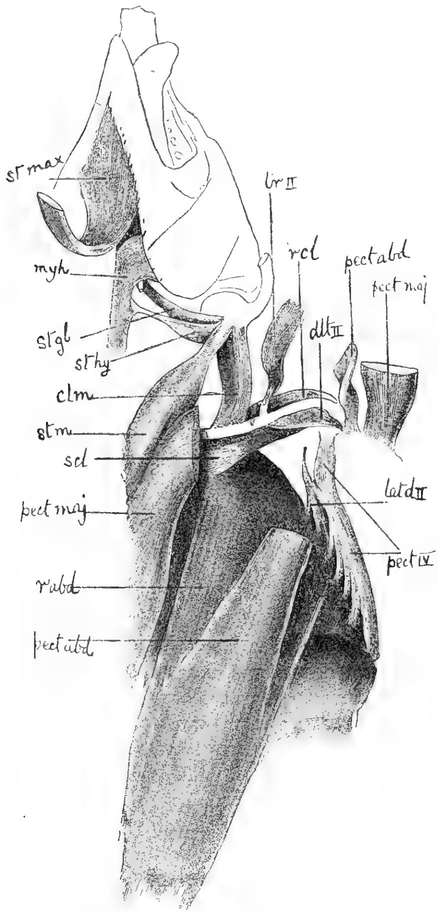
MUSCLES OF THE TRUNK.—The *Trapezius* consisted of two parts: (i) a continuous sheet (text-fig. 13, *tr.* I) with an origin that extends from the occiput to the third lumbar vertebra, and an insertion upon the anterior part of the scapular spine and the base of the acromion: it seems to correspond to the major part of both Macalister's divisions. (ii) a narrow slip (text-figs. 13 & 14, *tr.* II) rising from the occiput anterior to part i. and inserted upon the inner surface of the clavicle on a level with the clavicular origin of the deltoid. This answers to Hyrtl's clavicular trapezius.

Rhomboideus thoracis (text-fig. 13, *rh.th.*) consisted of two parts, and differed somewhat in arrangement on either side. On the left, both portions were small, separated from one another by a considerable interval, and rose respectively from the neural spines of 1, 2 and 6, 7 thoracic vertebræ. On the right, the posterior part rose from the neural spines of the 6 anterior thoracic vertebræ, and the anterior part from the dorsal mid-line of the neck close along the dorsal margin of the rhomboideus capitis. This latter arrangement corresponds approximately to Macalister's account. The posterior border of this muscle was not, as in *Tatusia*[2], overlapped by the latissimus dorsi.

[1] Windle & Parsons: "On the Myology of the Edentata." Proc. Zool. Soc. 1899, p. 318.
[2] Macalister, l. c. p. 236.

The *Latissimus dorsi* agreed with previous accounts in being in two parts. Part I (text-fig. 13, *lat.d.* I) was similar to that described by Macalister. Part II (text-fig. 13, *lat.d.* II) had a more extended

Text-fig. 14.



Muscles of neck and chest of *Chlamydophorus truncatus*.

clm., cleido-mastoid.
dlt. II, clavicular deltoid.
lat.d. II, part of latissimus dorsi.
myh., mylohyoid.
pect. IV, pectoralis quartus.
pect.abd., abdominal part of pectoralis.
pect.maj., pectoralis major.
r.abd., rectus abdominis.
r.cl., retro-clavicularis.
scl., subclavius.
st.gl., styloglossus.
st.hy., stylohyoideus.
st.m., sterno-mastoideus.
st.max., sterno-maxillaris.
tr. II, part of trapezius.

origin than in either Macalister's or Hyrtl's specimens. In Macalister's it rose from the last 5 ribs, in Hyrtl's from the last 6, in mine from the last 9. Upon the left side there was a connection between this muscle and the pectoralis quartus (text-fig. 14). I notice that Windle & Parsons [1] state that in the Dasypodidæ the latissimus dorsi frequently rises from all the ribs posterior to the 3rd or 4th, and when this extensive origin occurs there is a close union with the insertion of the pectoralis forming a more or less complete floor to the axilla—in fact a well-developed "Achselbögen."

Dorso-epitrochlearis (text-fig. 15, *d.epit.*) corresponds with Macalister's description, but is without insertion upon the inner condyle of the humerus. It is attached (as in *Dasypus*) [2] entirely to the superficial fascia of the forearm.

The *Splenius capitis* was in two parts:—(i) a small triangular muscle rising from the fibrous septum in the dorsal mid-line of the neck and inserted upon the occiput; (ii) a narrow band of muscle, lying in the same plane as part i., with origin from the neural spines of the anterior one or two thoracic vertebræ and inserted upon the skull close above the ear-tube. These two parts agree exactly with the drawing of *Dasypus sexcinctus* given by Cuvier and Laurillard [3].

I saw no *Rectus thoracis lateralis*, a characteristic Edentate muscle. It was not seen by Hyrtl, and in Macalister's specimen it was very small. Possibly I may have overlooked it although fully aware of its importance.

The *Serratus magnus* rose (as in Hyrtl's specimen) from 8 ribs. In Macalister's it took origin from 7.

The following trunk-muscles were observed, and agreed with Macalister's description:—*Rhomboideus capitis* (text-fig. 13, *rh.c.*). *Serratus posticus posterior* (text-fig. 13, *s.p.p.*). *Trachelo-mastoid. Rectus capitis anticus major. Rectus capitis anticus minor. Longus colli. Rectus abdominis* (text-figs. 13 & 14, *r.abd.*). *Levator anguli scapulæ.* The *Serratus posticus anterior*—as stated by Macalister—was absent.

Muscles of the Fore-limb.—The *Pectoralis major* (text-fig. 14, *pect.maj.*) had no clavicular origin. In this point it agrees with the pectoralis of *Dasypus* but differs from that of *Tatusia* [4].

Pectoralis quartus (text-figs. 13 & 14, *pect.* IV) rose from ribs 5–9 (in Macalister's specimen its origin was restricted to 2 ribs); on the right side it was, as described by Macalister, inserted in conjunction with the abdominal part of the pectoralis major, but proximal to it on the left (text-fig. 15). In *Tatusia* the pectoralis quartus rises from 6 ribs, in *Dasypus* from 4 [5].

The *Subclavius* (text-fig. 14, *scl.*), as in Hyrtl's specimen, had no

[1] Windle & Parsons, l. c. p. 322.

[2] Galton: "The Muscles of the Fore and Hind Limbs of *Dasypus sexinctus*." Trans Linn. Soc. xxvi. 1870, p. 531.

[3] Cuvier & Laurillard, Planches de Myologie, pl. 259. fig. 3. 1, +1.

[4] Macalister, l. c. p. 240.

[5] Macalister, l. c. p. 241.

clavicular insertion. In this point it apparently agrees with both *Dasypus* and *Tatusia*.

Like Hyrtl I saw no *coraco-brachialis*. Macalister records a small coraco-brachialis brevis.

Extensor antebrachii (triceps).—This muscle was of great size and consisted of four very definite heads—two from the scapula (text-fig. 13, *e.* I & *e.* II) and two from the humerus (text-fig. 13, *e.* III & *e.* IV). In their arrangement they agree very well with Galton's description of the extensor of *Dasypus*[1]. The two scapular heads rise from the superficial surface of the vertebral half of the posterior border of the scapula. The external humeral head (*e.* III) rises from the outer and posterior surfaces of the neck of the humerus, and the inner humeral head (*e.* IV) from nearly the entire length of the posterior surface of the humerus; towards its insertion it is easily separable into superficial and deep layers, the deeper part (text-fig. 13, *e.* V) being apparently the representative of an anconeus quartus. In Macalister's specimen there were three scapular heads and one humeral, of which the third scapular head answers in all save its origin to my external humeral. Hyrtl mentions two scapular heads and one humeral.

The flexors of the digits are difficult of interpretation. Macalister describes a *Palmaris longus*, which, although easily recognizable in my specimen (text-fig. 15, *fl.s.*), shows in its distribution to the fingers a great resemblance to a flexor sublimis; it passes over the palmar ossicle as a tendinous expansion, and splits into four fairly definite tendons, that are inserted (after dividing to form an ensheathment for the deep tendons) into the proximal phalanges of digits II, III, IV, V. Galton[2] gives a description of a superficial flexor in *Dasypus* that tallies very well with this description, and regards it as a combination of *Palmaris longus* and *Flexor sublimis*. I am inclined to apply the same interpretation to this somewhat questionable muscle in *Chlamydophorus*.

I was unable to identify Macalister's flexor sublimis, unless it is the humeral head of the flexor profundus described below.

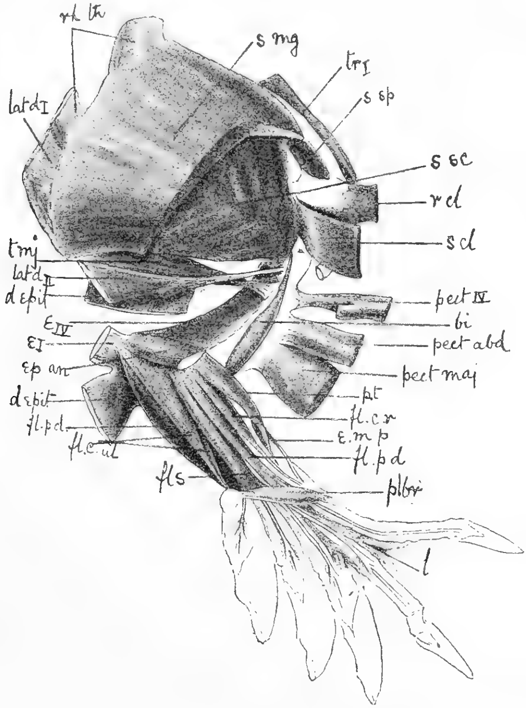
Flexor profundus digitorum (text-fig. 15, *fl.p.d.*).—This muscle consists of two very definite parts:—(i.) (? Flexor sublimis, Macalister) rises from the inner condyle of the humerus between the flexor carpi radialis and flexor sublimis + palmaris longus, is attached firmly to the inner (radial) surface of the palmar ossicle, and is finally inserted by a long slender tendon to the terminal phalanx of digit I. (ii.) A muscle of great size rising from the whole flexor surface of both radius and ulna and attached by a very stout tendon to the palmar ossicle; from the distal surface of the ossicle four tendons go to the terminal phalanges of digits II, III, IV, V. This part, except that it has no tendon for digit I, seems to agree with Macalister's flexor profundus and flexor pollicis.

Lumbricals (text-fig. 15, *l.*).—Four slender muscles, rising from the palmar ossicle between the deep flexor tendons and inserted upon the lateral surfaces of the proximal phalanges with the exception

[1] Galton, l. c. p. 539. [2] Galton, l. c. p. 545.

of the inner (radial) surface of digit I. These muscles evidently answer to Macalister's 7 short flexors. I notice that Windle & Parsons[1] speak of them as lumbricals, and certainly their origin from the ossicle in the deep flexor tendon and insertion between

Text-fig. 15.



Muscles of inside of fore-limb of *Chlamydophorus truncatus*.

bi., biceps.
d.epit., dorso-epitrochlearis.
e. I, IV, heads of the extensor antebrachii.
e.m.p., extensor metacarpi pollicis.
ep.an., epitrochleo-anconeus.
fl.c.r., flexor carpi radialis.
fl.c.ul., flexor carpi ulnaris.
fl.p.d., flexor profundus digitorum (hand).
fl.s., flexor sublimis + palmaris longus.
l., lumbricalis.
lat.d. I, II, two parts of latissimus dorsi.
pect. IV, pectoralis quartus.
pect.abd., abdominal part of pectoralis.
pect.maj., pectoralis major.
pl.br., palmaris brevis.
p.t., pronator teres.
r.cl., retro-clavicularis.
rh.th., rhomboideus thoracicus.
scl., subclavius.
s.mg., serratus magnus.
s.sc., subscapularis.
s.sp., supraspinatus.
t.mj., teres major.
tr. I, part of trapezius.

[1] Windle & Parsons, l. c. p. 334.

the fingers would seem to warrant the name. Lumbricals as described by Macalister I was unable to find, and in this agree with Hyrtl.

Professor Wilson [1], in a critical survey of the myology of the fore-limb—called forth by an examination of the muscles of *Notoryctes typhlops*—notices Macalister's description of these muscles in *Chlamydophorus*, and expresses the belief that probably Macalister's flexor sublimis is part of the flexor profundus, a belief in which I entirely concur. He accepts Macalister's palmaris longus, and finally suggests that Macalister's short flexors are in reality the flexor sublimis still confined entirely to the hand as it is found in *Ornithorhynchus* and Reptiles. This suggestion is one of great interest if well founded, but it is, I fear, not borne out by my dissection.

The two heads of the *Flexor carpi ulnaris* (text-fig. 15, *fl.c.ul.*) were far more separate than in Macalister's specimen; in fact the humeral head formed an independent little muscle with an independent, though very delicate tendon inserted with that of the ulnar head on the pisiform. This muscle seems in Edentates to be liable to considerable subdivision, *e. g.*, in *Cyclothurus* it consists of 4 separate bundles [2].

The intrinsic muscles of the hand were not observed with sufficient accuracy to warrant any statement, except that, roughly speaking, they agreed with Macalister's description.

There is a superficial muscle (palmaris brevis, text-fig. 15, *pl.br.*) of some size running diagonally across the palm of the hand from the base of the pisiform bone to the base of metacarpal I. This muscle does not appear to have been previously noticed.

The *Extensor carpi radialis* (text-fig. 13, *e.c.r*) was inserted into the bases of metacarpals II, III by a single tendon situated exactly between them. In Macalister's specimen the tendon was double, and in Hyrtl's single and inserted upon metacarpal II only.

The *Extensor carpi ulnaris* (text-fig. 13, *e.c.u.*) had an origin from the upper part of the ulna, not mentioned by Macalister.

The following muscles were also present:—*Retro-clavicularis* (text-fig. 14, *cl.*). *Deltoid* (text-figs. 13 & 14, *dlt.*). *Supraspinatus*. *Infraspinatus* (text-fig. 13, *i.sp.*). *Teres major* (text-fig. 15, *t.mg.*). *Subscapularis* (text-fig. 15, *s.sc.*). *Biceps* (text-fig. 15, *bi.*). *Brachialis anticus* (text-fig. 13, *br.a.*). *Supinator brevis*. *Extensor communis digitorum* (text-fig. 13, *e.c.d.*). *Extensor annularis* (text-fig. 13, *e.ann.*). *Extensor minimi digiti* (text-fig. 13, *e.d.*V). *Extensor ossis metacarpi pollicis* (text-fig. 13, *e.m.p.*). *Extensor indicis* (text-fig. 13, *e.i.*). The *Supinator longus* was absent.

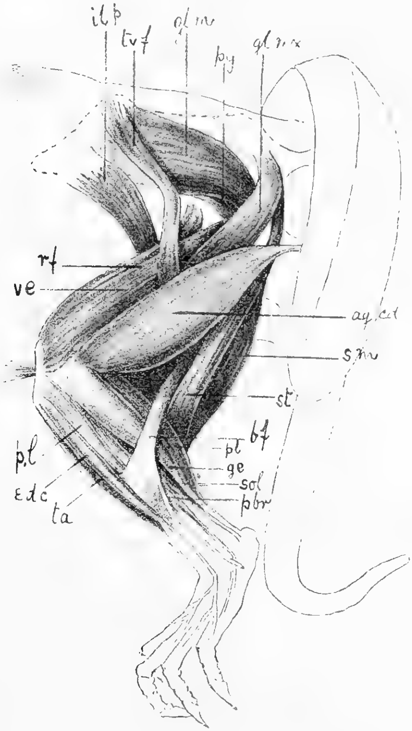
Muscles of the Hind-limb.—*Obturator externus* (text-fig. 17, *obt.ex.*) is a well-marked triangular muscle rising from the ventral border of the obturator foramen, deep to the adductors and inserted by a round tendon upon the femur just proximal to the lesser

[1] Wilson: "On the Myology of *Notoryctes typhlops*." Trans. R. Soc. South Australia, xviii. 1894, p. 44.

[2] Macalister, l. c. p. 249.

trochanter opposite the insertion of the ilio-psoas. This muscle was not present in Hyrtl's or Macalister's specimen.

Text-fig. 16.



Muscles of outer side of hind-limb of *Chlamydophorus truncatus.*

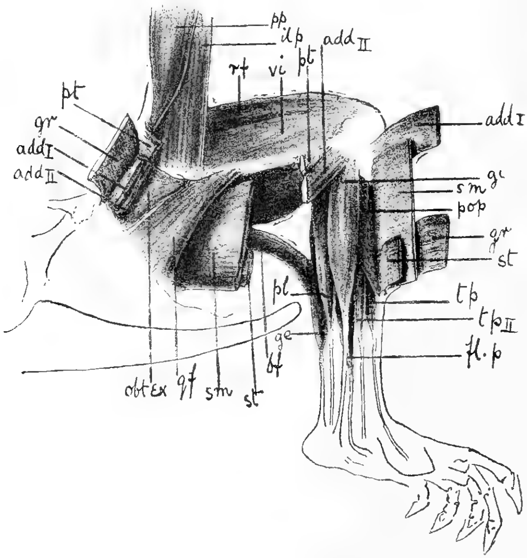
ag.cd., agitator caudæ.
b.f., biceps femoris.
e.d.c., extensor digitorum communis.
g.e., external head of gastrocnemius.
gl.m., gluteus medius and minimus.
gl.mx., gluteus maximus.
il.p., ilio-psoas.
p.br., peronæus brevis and extensor quinti digiti.
p.l., peronæus longus.
pl., plantaris.
py., pyriformis.
r.f., rectus femoris.
sm., semimembranosus.
sol., soleus.
st., semitendinosus.
t.a., tibialis anticus.
t.v.f., tensor vaginæ femoris.
v.e., vastus externus.

The *Biceps femoris* (text-figs. 16 & 17, *b.f.*) had an insertion upon the fibula as well as the insertion mentioned by Macalister into the superficial fascia of the leg. The *Semitendinosus* (text-fig. 16, *st.*) showed no sign of an insertion.

I saw no *Sartorius* in either leg. Macalister speaks of this muscle as "wide, thick, and fleshy"[1], so that it is unlikely that it was removed unobserved. Hyrtl says that in his specimen it was incorporated with the adductors.

Rectus femoris (text-fig. 16, *r.f.*) rose, as in *Tatusia* and *Dasypus*[2], by a single origin from the dorsal brim of the acetabulum. In Macalister's specimen it had the more usual double origin.

Text-fig. 17.



Muscles of inside of hind-limb of *Chlamydophorus truncatus*.

add. I, II, adductor primus and secundus.
b.f., biceps femoris.
fl.p., flexor profundus (foot).
g.e., external head of gastrocnemius.
g.i., internal head of gastrocnemius.
gr., gracilis.
il.p., ilio-psoas.
obt.ex., obturator externus.
pl., plantaris.
pop., popliteus.
p.p., psoas parvus.
pt., pectineus.
p.t., pronator teres.
q.f., quadratus femoris.
r.f., rectus femoris.
sm., semimembranosus.
st., semitendinosus.
t.p., tibialis posticus.
t.p. II, tibialis posticus accessorius.
v.i., vastus internus.

Adductor secundus (text-fig. 17, *add.* II) differed from Macalister's description in rising from the pubis superficial to the obturator externus, and not from the ventral support of the sphæroma.

The *Gastrocnemius* and *Soleus* (text-figs. 16 & 17, *ge.*, *gi.*, *sol.*) did

[1] Macalister, l. c. p. 263.
[2] Macalister, l. c. p. 264.

not differ from previous descriptions, but it may be noted that the component tendons of the tendo Achillis showed no signs of the spiral twist around one another, that seems to occur to a greater or less extent among the generality of mammals [1].

The *Plantaris* (text-figs. 16 & 17, *pl.*), as in *Dasypus* [2], has no direct attachment to the heel; its tendon passes through a foramen in the calcaneum (a gutter in *Dasypus*) and divides in the sole of the foot into separate tendons inserted upon the proximal phalanges and the expanded navicular.

The *Peroneus longus* and *brevis* (text-fig. 16, *p.l.* & *p.br.*) differ from the same muscles in the previously described specimens and in *Tatusia* by respectively rising partly from the knee-cap and external condyle of the femur as in *Dasypus sexcinctus* [3]. The peroneus longus rises from the outer side of the knee-cap and from the proximal part of the outer surface of the fibula; it is inserted as usual upon the base of metatarsal I.

The *Peroneus brevis* and *extensor brevis* V. rise by a common origin from the external condyle of the femur, the external lateral ligament, and the proximal part of the antero-lateral surface of the fibula. The single belly terminates, in two delicate tendons, inserted respectively on the base of the metatarsal and of the penultimate phalanx of digit V.

In view of the speculations that have arisen concerning the origin of the external lateral ligament as a modification of a femoral tendon of origin of the peroneus longus [4], one might expect the origin of the peroneus brevis and extensor brevis V from the ligament itself as well as from the femur to throw some light upon the question, but apparently it does not. For, with the facts as they stand, it can be argued with equal propriety that the ligament in question is a structure originally independent of the muscle, but in this case serving as part of its area of attachment, or that it is part of the femoral tendon of origin of the muscle in process of transformation—functionally a ligament but not yet completely divorced from the muscle.

The *Tibialis anticus* (text-fig. 16, *t.a.*) had an origin (not mentioned by Macalister) from the anterior inner border of the fibula. A similar origin is found in *Dasypus*, *Cyclothurus*, *Bradypus*, and *Cholœpus* [5].

The *Tibialis posticus accessorius* (text-fig. 17, *t.p.* II) took origin from the proximal part of the hollow on the inner surface of the fibula, and was inserted upon the inner surfaces of the astragalus. According to Macalister's description, it rises from the tibia and is inserted on the entocuneiform.

The *Extensor digitorum communis* (fig. 16, *e.d.c.*) sends a tendon

[1] Parsons: "On the Morphology of the Tendo Achillis." Journ. Anat. & Physiol. xxviii. 1894, p. 414.
[2] Galton, l. c. p. 556.
[3] Galton, l. c. p. 559; also No. C 208, Physiol. Series, R. Coll. Surg. Museum.
[4] Bland Sutton: 'Ligaments, their Nature and Morphology,' 1887, p. 34.
[5] Macalister, l. c. p. 268. Galton, l. c. p. 558.

to each of the toes; in Macalister's specimen to the four outer toes only.

The following muscles were present and agreed with Macalister's description:—*Tensor vaginæ femoris* (text-fig. 16, *t.v.f.*). *Gluteus maximus* (text-fig. 16, *gl.mx.*). *Agitator caudæ* (text-fig. 16, *ag.cd.*). *Gluteus medius+minimus* (text-fig. 16, *gl.m.*). *Pyriformis* (text-fig. 16, *py.*). *Quadratus femoris* (text-fig. 17, *q.f.*) *Semimembranosus* (text-figs. 16 & 17, *sm.*). *Gracilis* (text-fig. 17, *gr.*). *Pectineus* (text-fig. 17, *pt.*). *Vastus externus* (text-fig. 16, *v.e.*). *Vastus internus* (text-fig. 17, *v.i.*). *Psoas parvus* (text-fig. 17, *p.p.*). *Ileo-psoas* (text-fig. 17, *il.p.*). *Adductor primus* (text-fig. 17, *add.* 1). *Popliteus* (text-fig. 17, *pop.*). *Tibialis posticus* (text-fig. 17, *t.p.*). *Extensor hallucis longus*. *Flexor profundus* (text-fig. 17, *fl.p.*).

In this review of the muscles, it will be noticed that in several particulars this specimen approaches *Dasypus* more nearly than those dissected by Macalister and Hyrtl. One may take as instances:—The extensive origin of part 2 of the latissimus dorsi. The twofold nature of the splenius capitis. The want of a clavicular origin to the pectoralis major. The absence of a direct insertion of the plantaris to the heel, and lastly the mode of origin of the peronei—an origin, so far as I know, hitherto found only in *Dasypus*.

Joints.

Temporo-maxillary joint.—This is of a very feeble character with small flattened articular surfaces. It is remarkable for the absence of an interarticular fibro-cartilage. Parsons [1], in his Hunterian Lectures on Mammalian joints, records three examples of temporo-maxillary joint among the lower orders of mammals without an interarticular cartilage (e. g. *Ornithorhynchus*, *Dasyurus*, and *Dasypus*). It is interesting to find that *Chlamydophorus* shares this exceptional character with *Dasypus*.

Shoulder-joint.—There is a stout accessory ligament that passes, superficial to the capsule, from the coracoid process downwards and backwards to the outer surface of the head of the humerus. This ligament is noticed by Hyrtl, and can still be seen attached to his preparation of the skeleton (R. C. S. Osteol. Series, No. 3582), and I only mention it to draw attention to a similar ligament in *Dasypus* and *Tatusia* (R. C. S. Physiol. Series, Nos. B 125, B 126).

The Viscera.

On the coarse anatomy of the viscera there is little to be said, for this subject has been dealt with in detail by Hyrtl, and any gaps left in his descriptions have been filled by Macalister and Watson [2]. I shall thus mainly confine my remarks to certain

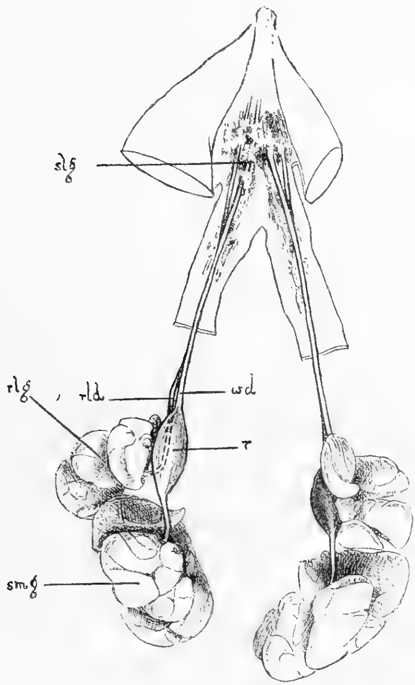
[1] Parsons: "The Joints of Mammals." Journ. Anat. & Physiol. xxxiv. 1899, p. 41.

[2] Watson: "On the Male Generative Organs of *Chlamydophorus truncatus*, &c" Proc. Zool. Soc. 1878, p. 673.

details in the salivary apparatus and aortic arch that appear to have escaped observation.

The Salivary Glands.—Hyrtl describes parotid, buccal, and submaxillary glands, but there is also a sublingual gland of considerable size with the usual position and characters. It may be mentioned in passing that Hyrtl's figure of the relations between Stensen's duct and the buccal gland is misleading. He suggests that probably the buccal gland pours its secretion into this duct and figures it as running close along the upper border of the gland. In point of fact there is no connection between the two; Stensen's duct takes quite the usual course across the masseter at a very considerable distance above the buccal gland, while the latter in all probability opens independently into the mouth in the ordinary way.

Text-fig. 18.



Salivary glands of *Dasypus sexcinctus.*

r., muscular reservoir.
rl.d., duct of retro-lingual gland.
rl.g., retro-lingual gland.
sl.g., sublingual gland.
sm.g., submaxillary gland.
w.d., Wharton's duct.

With regard to the submaxillary gland there is a feature of some little interest. The secretion is collected (as described by Hyrtl) into two main ducts, each of which receives the secretion of one of the two lobes into which the gland is divisible. After a short course free of the gland-substance, the ducts are said to open into a spindle-shaped muscular reservoir, from the anterior extremity of which a single duct (Wharton's duct) leads to an opening in the floor of the mouth beneath the tongue. This description is only partially true, for, of the two main collecting-ducts, one only (*i. e.* that coming from the larger and most posteriorly situated lobe of the gland) opens into the muscular reservoir and continues from its anterior extremity to the opening beneath the tongue; the other, although it enters the wall of the reservoir, has no communication with its cavity, but courses down its dorsal margin close beneath the lining epithelium and continues as a separate duct, intimately connected with the first, to an opening beneath the tongue. (It was not seen whether these two ducts opened into the mouth by a common aperture or separately.)

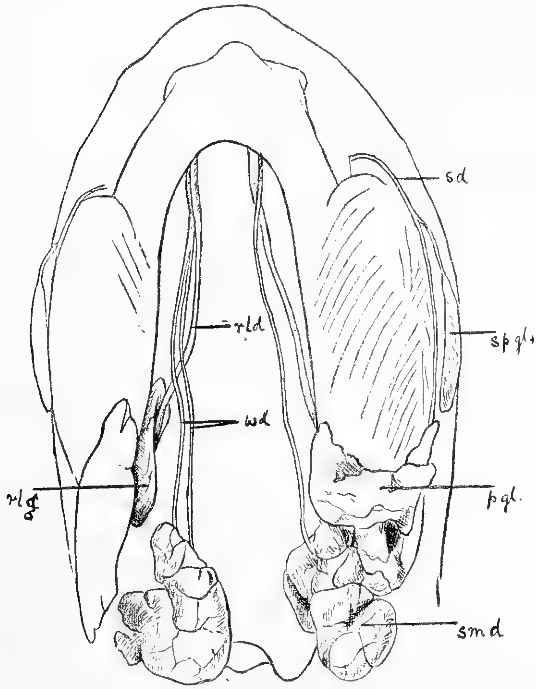
An arrangement of the submaxillary gland and ducts precisely similar to this was found in *Dasypus sexcinctus* (text-fig. 18), but, owing to the greater size of the creature, the individuality of the ducts was more easily seen. Somewhat similar features were also observed in the Three-toed Sloth (*Bradypus tridactylus*, text-fig. 19). The submaxillary gland in this animal is divisible, as in the above-mentioned Dasypodidæ, into two well-marked lobes each provided with its own duct. The two ducts run side by side (with, however, no muscular reservoir on either of them) to the floor of the mouth beneath the tongue. The duct from the smaller and more anteriorly situated lobe of the gland is remarkable for its large calibre and for the thinness of its walls—in fact at first sight it had very much the appearance of a vein. The duct from the larger and posterior lobe was double throughout its length on the right side, but single on the left. The meaning of the conditions observed in the submaxillary glands and ducts of these three Edentates becomes, I think, clear on reference to a paper by Ranvier[1], in which, in addition to numerous observations of his own, he collects and harmonizes the previously confused statements concerning the relations that subsist between the sublingual and submaxillary glands. It is well known that frequently in Man there occurs a large duct (duct of Bartholini) that arises from a posterior portion of the sublingual gland and runs alongside Wharton's duct to open with it or near it under the tongue. Bartholini himself[2] described and figured a similar duct in the Lioness, having its gland in close connection with the submaxillary, and Ranvier adds a large number of mammals in which the same gland (called by him Retro-lingual) is found with great constancy. According to Ranvier the retro-lingual gland lies always posterior to the lingual nerve, and for this reason (a somewhat arbitrary one it

[1] Ranvier: "Etudes anatomiques des Glandes connues sous les noms de sous-maxillaire et sublinguale, chez les Mammifères." Arch. de Physiol. xviii. 1886, p. 223.

[2] Bartholini: De ductu salivali hactenus non descripto observatio anatomica, 1685.

seems[1]) cannot be identified with the part of the sublingual gland in connection with Bartholini's duct in Man, although in structure it agrees with the sublingual.

Text-fig. 19.



Salivary glands of Three-toed Sloth (*Bradypus tridactylus*).

p.gl., parotid gland. | *s.d.*, Stensen's duct.
s.p.gl., socia parotidis.

Other letters as in text-fig. 18.

Now, apart from the question of the identification of the retro-lingual gland with part of the sublingual, which does not actually concern us here, there can be no doubt, I think, that the two ducts coming from each submaxillary gland in these Edentates are in reality the ducts of a retro-lingual and submaxillary gland, and that, of the two lobes of the gland, the anterior is from its position the retro-lingual, and the larger posterior lobe the true submaxillary[2].

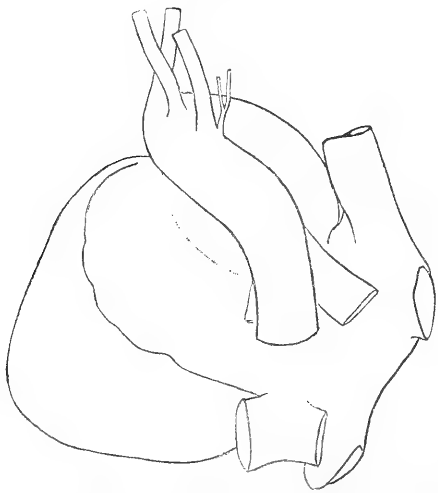
[1] In this connection see Ranvier's figure of the retro-lingual gland of the Pig. in which the anterior end of the gland extends in front of the lingual nerve.

[2] The tissues were not sufficiently well preserved to allow of microscopic examination.

Before leaving the salivary glands, it may be mentioned that in the Sloth the socia parotidis (text-fig. 19, *s.p.gl.*) is very large and of unusually definite shape. It is a long pear-shaped body situated at some distance dorsal to Stensen's duct, into which it opens by a single duct 9 mm. in length, that emerges from its anterior pointed end.

The Heart.—I have nothing to add to Hyrtl's description of the heart, and I find in two specimens that the great vessels rise from the aortic arch in a manner similar to that previously recorded; but there is a slight peculiarity in the conformation of the arch itself that merits a brief description, not so much for its intrinsic importance in *Chlamydophorus*, as because a similar though exaggerated modification forms a very striking feature in the aorta

Text-fig. 20.



Heart of Three-toed Sloth (*Bradypus tridactylus*).

of the Sloth. The peculiarity in question consists of a marked depression of the transverse part of the arch towards the ventral surface. The ascending aorta is short, and at the commencement of the transverse part bends sharply forward towards the ventral surface of the heart, and then curves round towards the dorsum compressed between the base of the heart and the trachea. The convexity of the arch thus lies in the transverse plane of the heart, instead of approximately in its longitudinal plane as is usually the case. In two other Edentates (*Tamandua* and *Myrmecophaga*) that I have examined, the arch lies in the longitudinal plane as usual, but in the Sloth (*Bradypus tridactylus*) there is a ventral depression of the aortic arch of a most marked character (text-fig. 20). In both cases, the depression appears to be due to the pressure of the trachea upon the arch, occasioned by the position of the heart, which lies with its longitudinal axis much more nearly at right angles to the long axis of the body than in most mammals.

The *Alimentary Canal* has been already fully described, but in examining this system one is much struck by the great resemblance the different parts bear to the corresponding organs of *Dasypus*. This perhaps is specially the case with the liver, which is almost an exact counterpart on a small scale of that of *Dasypus villosus*. The liver of *Tatusia*, on the other hand, differs materially from those of *Dasypus* and *Chlamydophorus*; it is much rounder and more compact in form; the left lateral lobe shows no great preponderance in size over the rest, and the caudate lobe is very much smaller.

I have nothing to add to previous descriptions of the respiratory or generative organs.

5. Notes on the Broad-nosed Lemur, *Hapalemur simus*. By Frank E. Beddard, M.A., F.R.S.

[Received January 31, 1901.]

(Text-figures 21–25.)

Some years since[1] I was enabled to add to the existing knowledge of *Hapalemur griseus* by the examination of two specimens that had died in the Society's Gardens. I am now able to compare the facts which I then ascertained with the structure of the only other species of the genus—*H. simus*. The individual which I have dissected was an example deposited in the Society's Gardens by the Hon. Walter Rothschild, M.P., F.Z.S., last year. After living for some months it died of a diseased condition of certain of the lymphatic glands of the abdominal cavity. The spleen also was invaded by pus, but in other respects the carcase showed no pathological conditions. The animal was a female.

Our present knowledge of the anatomy of this Lemur is due to Gray, Jentink, and Milne-Edwards. The species was founded by Gray[2], who described as well as figured the entire animal; besides external characters, Dr. Gray dealt with and figured the skull and the dentition. So far as they go, the facts set down by Gray do not appear to me to be in want of correction. Later Dr. Jentink again figured[3] the skull of *H. simus*, comparing it with that of *H. griseus* by means of other figures. These drawings also seem to me to represent the distinctions between the skulls of the two species accurately. Finally, the late Prof. A. Milne-Edwards in the last issued volume of his and Grandidier's 'Histoire naturelle de Madagascar,' has figured not only the skulls of the two species,

[1] P. Z. S. 1884, p. 391, and ibid. 1891, p. 449.

[2] "Notes on *Hapalemur simus*, &c.," P. Z. S. 1872, p. 829.

[3] "On some rare and interesting Mammals," Notes Leyd. Mus. vii. 1885, p. 33.

but the rest of the skeleton and the principal viscera of *Hapalemur simus*. This volume, however, consists merely of the "Atlas"; the corresponding letterpress has not yet, so far as I am aware, been published. I believe that the above list exhausts the memoirs which deal anatomically with *Hapalemur simus* at first hand. I judge that the late Dr. Mivart in writing of "*Hapalemur simus*" should have written "*Hapalemur griseus*," since the structural facts which he uses in the definition of the genus *Hapalemur*[1] are those of *H. griseus* and not those of *H. simus*. The peculiarities of the teeth of the latter, which are plainly enough shown in the bulk of the figures of the skull to which I have already referred, are not included by Dr. Mivart in his generic definitions. As these teeth peculiarities have not yet been emphasized in words, I shall perhaps not be performing an unnecessary task in calling attention to them.

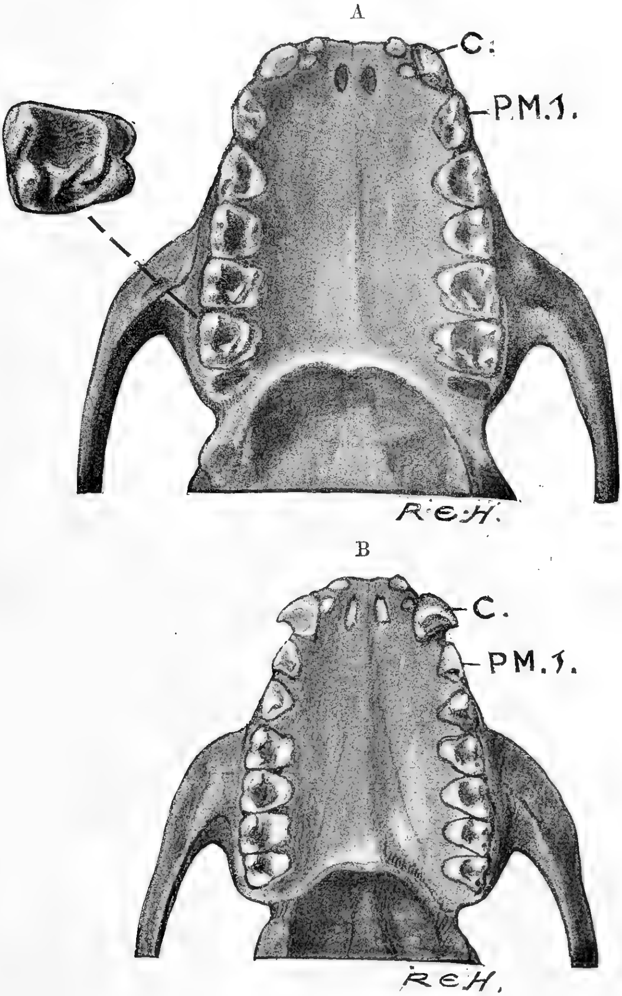
In *Hapalemur simus*, which has a much more truncated as well as a much broader snout than has *H. griseus*, both the incisors are sheltered by the canine so as to be invisible on a lateral view. This state of affairs is correctly figured by Gray[2]. In *H. griseus*, on the other hand, as figured by Mivart in his early paper on the structure of Lemurs[3], only the posterior of the two incisors is thus sheltered, the anterior incisor being decidedly in front, though also to the side, of the canine. In a young skull in my possession both incisors are in front of the canine, and in this particular the young *Hapalemur griseus* resembles the adult *Lemur*. At least most species of that genus, for in *Lemur brunneus* (a note by my predecessor Mr. Forbes informs me) the condition is like that of *Hapalemur*. The line of the molars is straighter in *H. simus* than in *H. griseus*, where it is slightly concave inwards—the line of the teeth following that of the palate, which is in that species a little narrowed posteriorly; it is not so in *H. simus*. The molars of the upper jaw in *H. simus* have an additional cusp not found in *H. griseus*; it is the inner posterior cusp, and the molars are thus quadricuspid instead of tricuspid. This seems to me to be a rather important distinction. It is, as I have remarked, correctly figured by previous authors but has not been described. The molars of *H. simus* are larger than the premolars; this is not the case with *H. griseus*, in which species the third premolar is the largest tooth of the cheek-teeth series. In *H. simus* pm. 2 and pm. 3 are subequal in size.

The first point to which I directed my attention was the condition of the forearm. It will be recollected that I was able to show in the case of its congener *H. griseus* that the male was distinguished by the existence close to the hand of a patch of spine-like structures associated with a large gland lying beneath

[1] "On *Lepidolemur* and *Cheirogaleus* and on the Zoological Rank of the Lemuridæ," P. Z. S. 1873, p. 500.
[2] P. Z. S. 1870, p. 830, fig. 3.
[3] "Notes on the Crania and Dentition of the Lemuridæ," P. Z. S. 1864, p. 613. See also P. Z. S. 1867, p. 960.

the integument. In the female of *H. griseus* those spines are not present, but, as I was informed by Dr. Jentink and the late Prof. Milne-Edwards, there is a patch of skin which is recognizable

Text-fig. 21.



A. Upper jaw of *Hapalemur simus*. B. Upper jaw of *H. griseus*.
C., canine; P.M. 1., first premolar.

as distinct from the rest of the integument upon the arm. Since I received this information, the arm of this species has been figured by Milne-Edwards [1]. Both of the gentlemen to whom I referred further informed me that in *H. simus* there were no traces of these peculiar modifications of the skin of the wrist. But in dried skins, structures of this kind might conceivably be missed. I am therefore glad to have the opportunity of stating that in the fresh *H. simus*, which forms the subject of the present communication, there are no traces at all of any modification of the skin of the forearm such as characterizes *Hapalemur griseus*. These two species are regarded by most systematists as perfectly distinct, though it may be admitted that the general aspect of the two is not very different [2]. Influenced probably by this latter consideration, Mr. Lydekker observed in the 'Royal Natural History' (vol. i. p. 217) that the Broad-nosed Lemur (*H. simus*) does not appear to be more than a variety of the Gentle Lemur (*H. griseus*). The above-stated facts, even if there were no others, seem to show plainly that the two forms of *Hapalemur* are distinctly entitled to separate specific names. There is one other fact of external structure which distinguishes the present species from its congener. Shortly after my description of the arm-gland and patch of spines upon the forearm of the male *H. griseus*, Mr. Bland Sutton discovered and figured [3] in this Lemur and in some others a tuft of long hairs in close proximity to the patch of spines. Since that time I have found a similar tuft of hairs on the arms of mammals belonging to other orders than the Lemures [4], and have expressed the opinion that they are possibly general in such creatures as use their forearms as grasping or climbing organs. It had appeared to me further, that this tuft of long, often black, hairs, which are quite unmistakable, are not to be looked upon as a sexual character. I was therefore much surprised at being totally unable to detect the faintest vestige of them in the female *Hapalemur simus* upon which I comment in the present communication. I believe that there is no doubt about their absence; I looked with extreme care for them and removed the skin in order to find—if it were present—the strong nerve-twig which is at least often associated with them in other mammals. This was totally absent. Having by me a number of carefully sexed skins of other Lemurs, I investigated this question further.

In females of *Lemur albifrons*, *L. anjuanensis*, *L. brunneus*, *L. coronatus*, and *L. mongoz* I found a tuft of three or four long hairs upon the forearm shown with perfect distinctness; I also observed the same in males of the species *L. albimanus*, *L. brunneus*, *L. albifrons*, and *L. rufifrons*. On the other hand, in a female skin of each of the species *L. mongoz*, *L. nigrifrons*, and *L. anjuan-*

[1] Histoire Naturelle &c. de Madagascar.

[2] Dr. Gray (P. Z. S. 1872, p. 852) observed that "it has been suggested that the colour of *H. griseus* and *H. simus* are so alike that they are only the sexes of the same species."

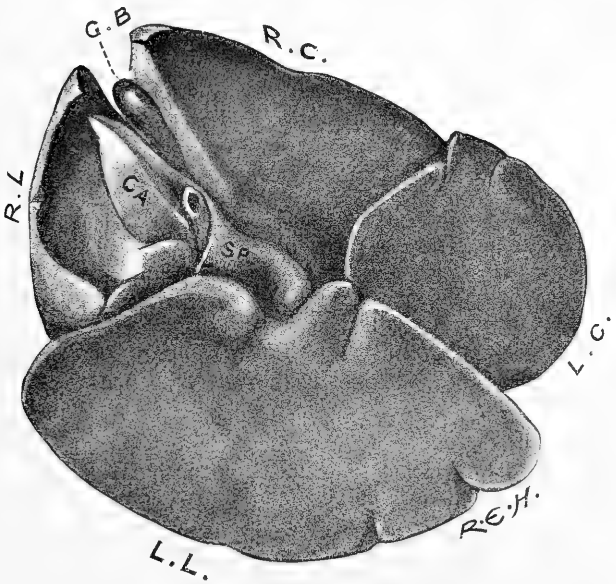
[3] "On the Arm-gland of Lemurs," P. Z. S. 1887, p. 369.

[4] "On the Anatomy of *Bassaricyon*," P. Z. S. 1890, p. 661, and 'Nature,' vol. lxii. p. 523.

ensis, I failed to find these structures. I do not lay much stress upon the value of this observation, since it is less satisfactory to deal with dried skins than with the recently dead animal. But the possibility must be borne in mind that these tactile hairs may be less constant in the female of certain Lemurs than in the male. And that, therefore, the character to which I refer as possibly distinguishing the two species of *Hapalemur*—if it really does distinguish the male from the female in *H. simus*—may not be of great value as a mark of specific difference. The matter must be settled later.

Cæcum.—I noticed certain small, but definite, differences in the viscera of the two species of *Hapalemur*. The alimentary canal

Text-fig. 22.



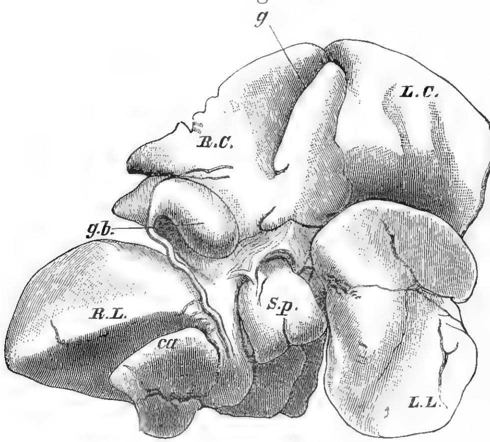
Liver of *Hapalemur simus*.

G.B., gall-bladder; R.C., right central lobe; R.L., right lateral; L.C., left central; L.L., left lateral; CA., caudate; Sp., Spigelian.

of *H. simus* seems to be longer in proportion to the body than in the other species. The specimen of *H. simus* which I dissected had a body-length (exclusive of tail) of 14 inches, it being thus not much, if any, larger than *H. griseus*. But the intestinal measurements were as nearly as possible double the length of those of the example of *H. griseus* recorded by myself. In *H. simus* the several lengths were as follows:—Small intestine 4 ft. 9 inches; large intestine 2 ft. 4 inches. The alimentary canal of course differs widely in actual lengths in different individuals; but I think that so large a difference as this would be unusual, and may be perhaps looked upon as a valid mark of specific distinction. The second point respecting the alimentary canal concerns the mesenteries which support the cæcum. In most Lemurs, the cæcum is tied to the small intestine by a single anangious fold lying between two bloodvessel-bearing folds, which run on to the large intestine. In *Hapalemur griseus* I found that the median anangious fold was absent. The two lateral folds were quite normal and like those of other Lemuroids. I suggested that the absence of this frenum might conceivably be connected with the shortened cæcum of *Hapalemur*. It is clear that this explanation must fall to the ground, since in *H. simus* the cæcum is of quite the same form, but it *does* possess the median anangious cæcal frenum.

The *liver* of *H. simus* is shown in the accompanying drawing (text-fig. 22, p. 125), which does not altogether agree with the figure given by Milne-Edwards, and may be compared with the annexed sketch of that of *H. griseus* (text-fig. 23), which was published in illustration of my notes upon the anatomy of that Lemur. It will be seen that there are a few small points of difference.

Text-fig. 23.



Liver of *Hapalemur griseus*.

(From P. Z. S. 1884, p. 396.)

g. umbilical fissure. Other letters as in text-fig. 22 (p. 125).

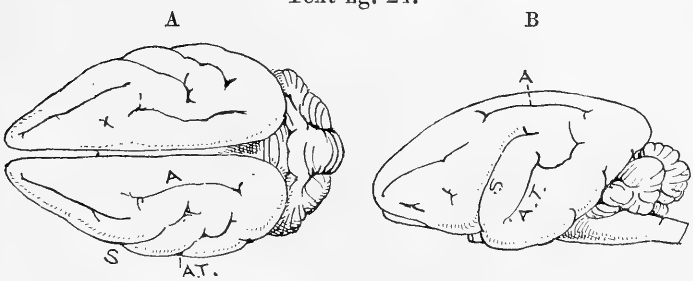
The most salient difference is that the left lateral lobe, instead of being quite small, no larger than the remaining chief lobes of the organ, is quite twice the size of the left central. The right central lobe, moreover, is rather larger than the left central. The gall-bladder has the same anomalous position that it has in *H. griseus*, and in many if not most other Lemurs; the ductus choledochus arises from the end of the gall-bladder which is turned away from the intestine.

The *brain* of this species has been figured by Milne-Edwards; as might be supposed, it hardly differs from that of its congener. Seeing that that of *Hapalemur griseus* again is extremely like the brain of the genus *Lemur*, any differences are scarcely to be looked for. In the brief remarks which follow, the minute divergences in structure between the two species which I record here must be considered to be possibly subject to revision when more abundant material is at the disposal of some anatomist. Since describing the brain of *Hapalemur griseus*, I have come into possession of a second brain of that species; in some respects the second brain differs from that originally described. It is, in the first place, rather larger, a fact which goes some way to removing one apparent difference between the brains of the two species of *Hapalemur*. The following measurements of the three brains of which I shall speak here show that the proportions of length to breadth are much the same in the two species; they are:—

	Length of cerebral hemispheres.	Breadth of cerebral hemispheres.
Hapalemur griseus No. 1	33 mm.	26 mm.
Hapalemur griseus No. 2	35 „	28 „
Hapalemur simus	40 „	31 „

The contour of the brain hardly differs in the two species nor the proportions of the several regions. The accompanying drawing

Text-fig. 24.



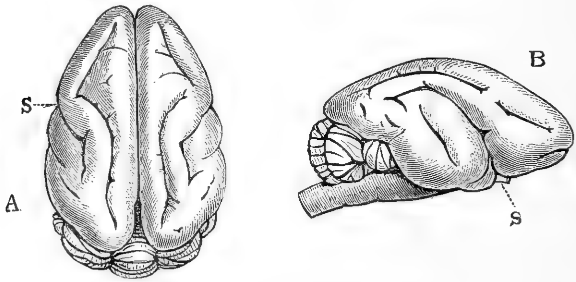
Brain of *Hapalemur simus*.

A. Dorsal view. B. Lateral view.

A, supra-angular fissure; S, Sylvian fissure; A.T., antero-temporal.

shows the furrows of the brain of *Hapalemur simus* (text-fig. 24), which differs in some minute particulars from that figured by Milne-Edwards. It will be noticed that the Sylvian fissure is slightly different in this species. The upper end of that furrow does not slope backwards parallel to the angular fissure as it does in *H. griseus*. On the contrary, its tendency is rather to bend forwards; the upper end is at least slightly hooked. This was more marked upon the right than upon the left side. The olfactory region of the brain was much compressed ventrally in the way which characterizes so many Apes. It presents the appearance of having been squeezed between the fingers while in a plastic condition. The compression seemed to me to be more marked in *H. simus* than in the other species; but this particular feature is sometimes lost during preservation. However, this and the other brains were most carefully extracted from the skull; they have been but very slightly altered in shape during the process of hardening with alcohol.

Text-fig. 25.

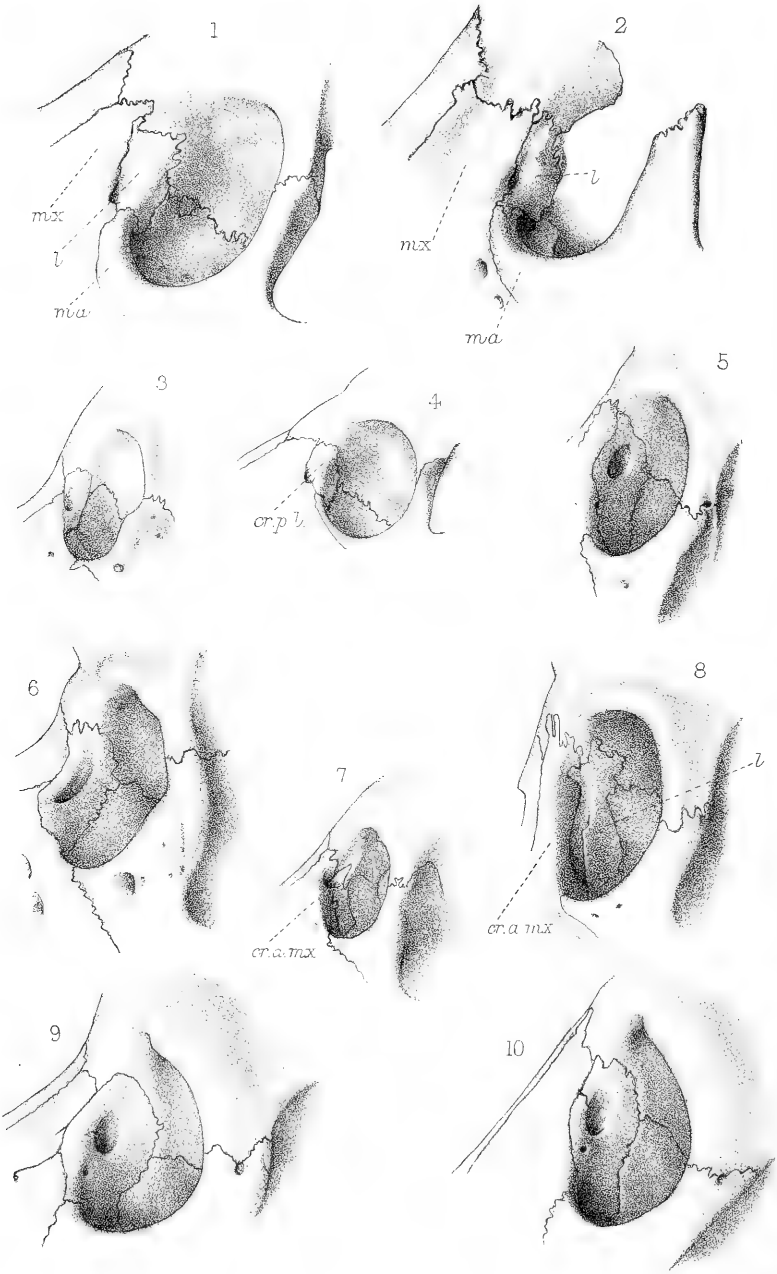


Brain of *Hapalemur griseus.*

A. From above. B. Lateral view.
S (in both figures), Sylvian fissure.
(From P. Z. S. 1891, p. 457.)

The antero-temporal fissure also differs slightly in its form. In *H. griseus* this fissure is sometimes broken into two, the upper piece joining the top of the Sylvian, as I have figured. In *H. simus* the fissure is not thus broken, but the upper end, which corresponds to the detached piece in *H. griseus*, curved forward in a hook-like fashion and in a direction parallel to the end of the Sylvian fissure.

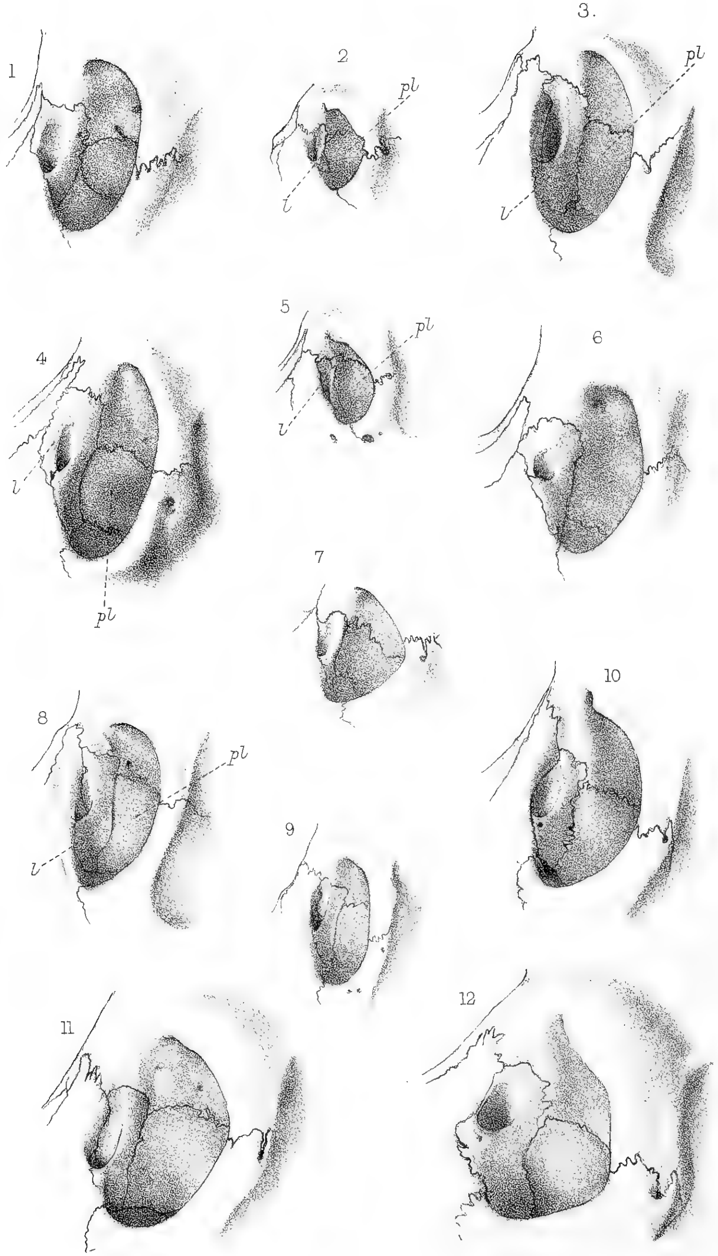
In originally describing the brain of *H. griseus* I laid some emphasis upon the fact that the angular and the infero-frontal fissures form one continuous fissure. This emphasis is justified to some extent, since in other Lemurs the two fissures are quite distinct. But in the genus *Lemur*, which comes of course very close to *Hapalemur*, some species show a continuity and others a discontinuity between these two fissures. So, too, does this genus *Hapalemur*. In *H. simus*, as the drawing shows, the two fissures are not only discontinuous, but the two ends—the anterior of one and the posterior of the other—if continued in a straight line would hardly meet. This is quite different from what is found in *H. griseus*: in the first specimen of the brain of this animal which I studied, the two fissures were continuous at least on the left side, there being a faint gap on the right side of the brain; but in a second example of this species



G.M.Woodward lith.

West, Newman imp

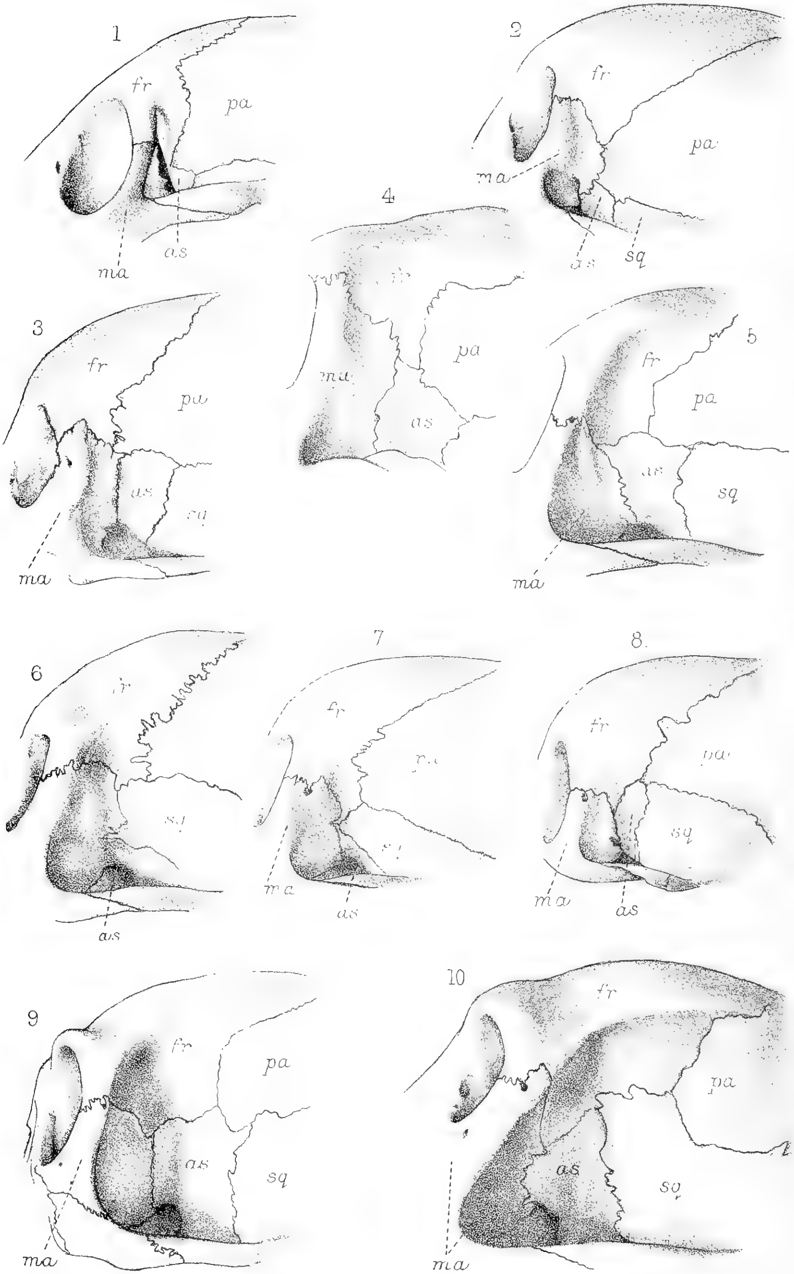
LACRYMAL REGION OF LEMURS AND MONKEYS.



G. M. Woodward lith.

West, Newman imp.

LACRYMAL REGION OF MONKEYS.



G.M. Woodward del. West, Newman imp.

POST ORBITAL REGION OF LEMURS AND MONKEYS.

which is before me, a distinct break separates the angular from the infero-frontal fissure. This break, however, is not so thorough that a faint groove cannot be detected bridging the chasm, and the posterior end of the infero-frontal fissure is exactly in the same line with the anterior end of the angular; if produced they would plainly meet. In the shape of the angular sulcus there are differences in the two species. In *H. griseus* this fissure is much like an elongated **S**. In *H. simus* the fissure is bracket-shaped, the concavity being turned towards the inter-cerebral fissure.

6. On some Characters of the Skull in the Lemurs and Monkeys. By C. I. Forsyth Major, F.Z.S.

[Received February 5, 1901.]

(Plates XI.–XIII.[1])

(Text-figures 26–46.)

I. The Os planum.

The *os planum*, or *lamina papyracea* of Human anatomy, is that part of the ethmoid which appears in the orbit, partaking in the formation of its inner wall. The presence of this bone is almost considered to be a prerogative of Man and Monkeys. Meckel denied it even to the latter; speaking of the ethmoid in Mammalia, he says:—" . . . dass es weit stärker entwickelt als bei den übrigen Wirbelthieren, aber sehr allgemein von den übrigen Knochen des Schädels verborgen wird, indem sich das Stirnbein durch den weit längern, senkrechten Abschnitt seines Augenhöhlentheiles zu Bildung der inneren Augenhöhlenwand über dasselbe weglegt und von oben an den obern Rand der grossen und kleinen Keilbeinflügel stösst. Daher fehlt auch sehr allgemein den Säugthieren, selbst noch den *Affen*, das äussere Seitenblatt des Riechbeins, welches sich beim *Menschen* an der Stelle des nach oben gerückten und horizontal gewandten Augenhöhlentheiles zur Vervollständigung der innern Augenhöhlenwand bildet . . . ." [2] Dursy, as late as 1869, holds the same view [3].

The presence of an *os planum* in Monkeys was well known to Cuvier. With regard to the Lemurs he has the following:—"La lame cribleuse de l'ethmoïde dans tous les *makis*, dans les *loris* et les *galagos*, vient toucher, comme dans l'homme, au sphénoïde antérieur, tandis que dans les singes elle en reste éloignée en arrière par le rapprochement des deux côtés du frontal. L'ethmoïde tout entier est enveloppé par le frontal et par le palatin, en sorte qu'il n'en paraît rien dans l'orbite, ou, en

[1] For an explanation of the Plates, see p. 152.
[2] J. F. Meckel, System. d. vergl. Anat. ii. 2, pp. 516, 517 (1825).
[3] E. Dursy, Zur Entwicklungsgesch. des Kopfes des Menschen und der höheren Wirbelthiere, p. 198 (1869).

d'autres termes, qu'il n'y a pas d'os planum, ce qui continue dans les carnassiers et les autres mammifères, [à un très petit nombre d'exceptions près; mais il existe encore dans les autres lémuriens]"[1].

The addition in brackets is from the pen of F. Cuvier, one of the editors of the second edition of the 'Leçons'[2].

Köstlin refers to the planum of Lemurs in the following sentence:—"Der Uebergang zu den Halbaffen geschieht (daher) . . . viel deutlicher von den Affen der alten, als von denen der neuen Welt, und es gehört hieher vor allen *Stenops*, bei welchem das Os planum in einem länglichen Ausschnitt des Stirnbeins liegt, und nur am untern Rande von diesem frei ist; ein ähnliches, niedres Os planum scheint *Galago* zu besitzen; dagegen fehlt es entschieden bei *Lemur*, *Lichanotus*, *Cheiromys* und wohl auch bei *Tarsius*"[3].

Schröder van der Kolk and Vrolik, referring to *Nycticebus tardigradus* and *N. javanicus*, repeat almost textually Cuvier's words:—"L'ethmoïde tout entier est enveloppé par le frontal et par le palatin, en sorte qu'il n'en paraît rien dans l'orbite où, par conséquent, il n'y a pas d'os planum"[4].

Flower says of the os planum of Monkeys:—"The os planum of the ethmoturbinals always forms part of the inner wall of the orbit, having the same relations as in Man"[5]. And with regard to the Lemurs:—"In the Common Lemur . . . the os planum of the ethmoturbinal does not enter into the inner wall of the orbit, but is shut out from it by the maxilla, as in most inferior Mammals . . . . Some of the *Lemurina* have much shorter faces than the common species, though still possessing all the essential characters of the group"[6].

We therefore see that the writers generally deny the presence of an os planum to the Lemurs, of which the genus *Lemur* is considered to be the prototype, and it has been taken for granted that the conditions found in this genus are those of the whole group. Köstlin is the only writer who gives some positive and on the whole fairly correct information on this point.

As a matter of fact, all the species of non-Malagasy genera, viz., *Tarsius* (text-fig. 35, p. 138), *Nycticebus* (text-fig. 41, p. 140), *Loris* (text-figs. 40, 42, p. 140), *Perodicticus* (text-figs. 31–33,

[1] G. Cuvier, Leçons d'Anat. Comp. 2e éd. t. ii. p. 319 (1837).

[2] It is difficult to understand what is meant here by "les autres lémuriens." *Tarsius* is out of the question, it being expressly stated that in the only specimen available all the sutures were obliterated. By "les loris" both *Nycticebus* and *Loris* are designated. *Chiromys* is placed among the Rodents. The only other Lemurs mentioned in the work are the "Indri" and *Avahis*, in both of which the os planum is united with the palatal at a very early date.

[3] O. Köstlin, 'Der Bau des knöchernen Kopfes in den vier Klassen der Wirbelthiere,' p. 93 (1844).

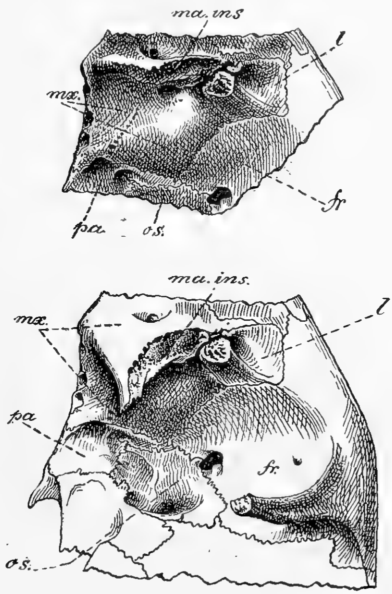
[4] T. L. C. Schroeder van der Kolk et W. Vrolik, "Recherches d'Anatomie comparée sur le genre *Stenops* d'Illiger," in Bijdragen tot de Dierkunde, uitgegeven door het Genootschap Natura Artis Magistra, i. 2, p. 39 (1851).

[5] W. H. Flower, 'An Introduction to the Osteology of the Mammalia,' 3rd ed. p. 161 (1885).

[6] *Op. cit.* p. 166.

p. 136), *Galago* (text-figs. 34, 36, 38, 39, pp. 138, 139), possess a large os planum, which very often is not even limited to the orbit; it seems to have been overlooked because in older individuals the sutures within the orbit disappear, as indeed is the case with almost all the cranial sutures. Amongst the Malagasy Lemurs a fairly large os planum is present in all the species of *Microcebus*. In the other genera the planum becomes fused with the palatal at a very early date (text-figs. 28 & 37). A distinct small os planum is often visible in young specimens of *Hapalolemur*, *Chirogale*, *Lepidolemur*, and *Avahis* (text-fig. 27), and sometimes in *Lemur*. *Chiromys* is the only Lemur in which I have not been able to trace the planum (text-fig. 26).

Text-fig. 26.

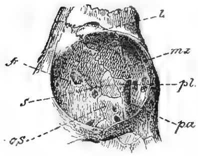


Orbital region of *Chiromys madagascariensis*. Nat. size.

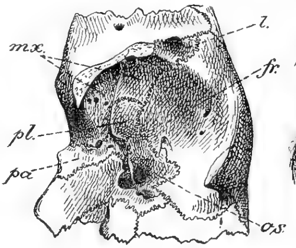
ma.ins.=insertion of the malar on the maxillary; *ma.*=malar; *mx.*=maxilla; *l.* = lacrymal; *pl.* = planum; *as.* = alisphenoid; *os.* = orbito-sphenoid; *fr.*=frontal; *pa.*=palatal; *x.*=intercalar bone; *s.*=intercalar bone.

In a general manner we can state that in those Lemuridæ which are provided with a large lacrymal, the os planum is reduced; *vice versa* the lacrymal is reduced or absent—at least from the orbit and the outer surface of the cranium—in those Lemurs which are provided with a large os planum. Further particulars with regard to this bone will therefore more suitably find their place in connection with the description of the lacrymal. Sketches of the os planum in various Lemurids are given in the text-figures. Of Monkeys I have only added those of *Callithrix* (text-fig. 46, p. 142) and *Chrysothrix* (text-fig. 29, below). It has been stated that the bone is missing in the latter genus [1]; as may be seen from the figure, it is a large bone, and as such has been mentioned already by Köstlin [2].

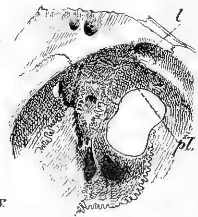
Text-fig. 27.



Text-fig. 28.



Text-fig. 29.



Text-fig. 27. Orbital region of *Avahis laniger*, young, nat. size.
Text-fig. 28. The same of *Propithecus coquereli* (Br. M. No. 91.1.22.1), about $\frac{3}{4}$ nat. size.
Text-fig. 29. The same of *Chrysothrix sciureus* (Br. M. No. 932 *c*), about nat. size.
(Lettering as in text-fig. 26.)

II. The Lacrymal Bone.

As one of the distinguishing features between Lemurs and Monkeys is considered the position of the lacrymal fossa, viz., on the facial part of the skull in Lemurs, inside the orbit in Monkeys and Man.

The only writer, to my knowledge, who has considered this condition more closely is Gegenbaur [3]; a summary of his views is given in the following.

In lower Mammals the lacrymal is one of the facial bones; in the Sauropsidæ particularly it is for the larger part situated on the surface of the skull. In Lemurs it has preserved this position in such a manner that not even the *canalis lacrymalis* begins within the orbit. The same remark applies to Insectivora and Chiroptera. In Monkeys, the bone has been stated by older anatomists (Köstlin, Stannius) to occupy the same position as in Man, having retreated within the orbit. Gegenbaur, however, points out that considerable variations occur amongst Monkeys. Of Platyrhinæ, three genera are taken in consideration: *Ateles*, *Mycetes*, and *Nyctipithecus*. In the former two "the lacrymal

[1] "Chez les Saïmiris, qui, seuls dans tout l'ordre des Primates, n'ont pas d'*os planum*, la place ne reste vide que par suite d'un défaut d'ossification." Alfr. Grandidier, Hist. phys., naturelle et politique de Madagascar; vol. vi. Hist. Nat. des Mammifères, par MM. Alph. Milne-Edwards et Alfr. Grandidier, Tome I.—Texte i. p. 16, footnote (1875).

[2] *Op. cit.* pp. 92, 93.

[3] C. Gegenbaur, "Ueber die Pars facialis des Lacrymale des Menschen," Morph. Jahrb. vii. pp. 173–176 (1882).

fossa is not yet situated within the orbit." In *Ateles* the lacrymal forms the greater part of the border of the fossa—including the upper half of the *crista anterior* and its antero-superior angle—and projects towards the nasal, so that there is only a narrow suture between the frontal and the frontal process of the maxillary.

In *Mycetes* the lacrymal projects farther still, uniting with the nasal; besides, the whole of the fossa is encircled by the very large lacrymal, "a position which most approaches to that of Lemurs."

In *Nyctipithecus* (*N. trivirgatus*), the third platyrhine genus mentioned, the whole of the *crista anterior* is formed by the maxilla, thus presenting a condition more closely approaching the Simiidæ and Man than even in the Cercopithecidæ. *Nyctipithecus* recalls *Mycetes* and *Ateles* only in the projecting of the antero-superior lacrymal portion, which separates almost completely the maxillary from the frontal.

In the Cercopithecidæ ("*Semnopithecus, Inuus, Cercopithecus, Cercocebus, Cynocephalus*"), although the position of the lacrymal fossa is undoubtedly orbital, it is almost entirely encircled by the lacrymal bone, the *crista anterior* being either entirely formed by the latter bone, or by the lacrymal together with the frontal process of the maxillary. All the Cercopithecidæ exhibit an enlargement of that part of the lacrymal (the *hamulus* of Human anatomy) which borders the fossa laterally, so that we find here an extensive plane. Various individual variations are mentioned, to which will be referred further on. Gegenbaur sums up in the following words:—"Das von Befunden an Thieren Angeführte genügt, um zu zeigen, dass dem Lacrymale in niederen Zuständen eine faciale Ausdehnung zukommt, und dass die Pars facialis in den höheren Abtheilungen Rückbildungen erleidet, wodurch die Pars orbitalis zur ausschliesslichen Repräsentanz gelangt. In dem Maasse als diese Rückbildung stattfindet und dadurch die vordere Umgrenzung des Canalis lacrymalis vom Thränenbein aufgegeben wird, tritt der Stirnfortsatz des Oberkiefers dafür ein, und gelangt vorn zur Umschliessung jener Grube. Das ist beim Menschen wie bei anthropoiden Affen zur Regel geworden: der Hamulus ist der Rest der Verbindungsstrecke von Pars orbitalis und P. facialis . . ." [1].

It is necessary to insist upon two results of this investigation: (1) the curious circumstance that, whilst of the three platyrhine genera mentioned, two represent the lowest stage in Monkeys, the third one on the contrary represents the highest, if we except the Simiidæ. And (2) that the encircling of the whole of the lacrymal fossa by the largely developed facial portion of the lacrymal—occurring in the Lemurs and in *Mycetes*—is considered to be the lowest condition, from which the condition in higher forms is said to be derived by a gradual reduction of the *pars facialis*, the reduction being initiated by the maxillary replacing the lacrymal in front of the fossa.

[1] *Op. cit.* p. 176.

Before proceeding to a review, one by one, of the genera of Primates, a few general remarks on the lacrymal region will be necessary.

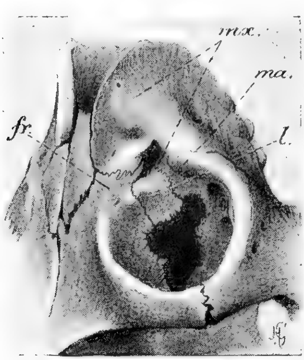
The *crista lacrymalis posterior* of Human anatomy is the vertical crest dividing the lacrymal into an anterior portion, the *sulcus lacrymalis*, and a posterior. The *crista lacrymalis anterior* is that part of the frontal process of the maxillary which in Man forms medially the lower orbital margin, in front of the *sulcus lacrymalis*. We can best describe the two fundamental types which interest us here, by stating that in Lemurs, *as a rule*, the *crista lacrymalis posterior* rides on the lower orbital margin, of which therefore it forms a portion (Pl. XI. fig. 4, text-figs. 27, 28, 31, 37); the anterior part of the lacrymal thus becoming the *pars facialis*, the posterior part the *pars orbitalis*. In Man and Simiidæ it is the *crista lacrymalis anterior* which rides on the lower orbital margin, descending posteriorly into the orbit, where it forms the anterior part of the *sulcus l.*, and, jointly with the *hamulus lacrymalis*, delimits the lacrymal fossa. As a result, we have the lacrymal fossa outside the orbit in the first type, inside the orbit in the second (Pl. XI. figs. 7 & 8).

Prosimiæ.

Adapis parisiensis.

The only Tertiary Lemur of which the lacrymal fossa is known to me is *Adapis parisiensis*. Two skulls from the French Phosphorites, in the Geological Department, show this region well

Text-fig. 30.



Orbital region of *Adapis parisiensis* (Br. M. Geol. Dep. No. M 1345), about $\frac{3}{2}$ nat. size.
(Lettering as in text-fig. 26.)

preserved, especially the younger one (text-fig. 30), which exhibits beautifully all the sutures.

The posterior portion of the lacrymal descends to a considerable extent into the orbit, forming a very open angle with the anterior portion—the homologue of the *sulcus lacrymalis*—which runs forward almost horizontally. *But there is no crest* (*crista posterior l.*) *dividing the two portions*; and the blunt *crista anterior* is exclusively formed by the maxilla, which delimits the lacrymal fossa in front, and at the same time forms the lower anterior margin of the orbit. The lacrymal fossa, therefore, is situated entirely inside the orbit. The malar bone, which laterally continues the lower orbital margin, proceeds farther medially than in Man and generally in Monkeys, without, however, reaching the lacrymal, from which it is separated by a process of the maxillary projecting laterally into the fossa. Medially, a similar process of the frontal enters also the fossa from behind, the lacrymal (the anterior part of which is broken in the specimen) being thus situated between the two processes.

P. Gervais, to whom we owe one of the earliest descriptions of the skull of *Adapis parisiensis* ("*Palæolemur*")[1], mentions as one of the Lemurine features of the skull "la position inféro-externe du trou lacrymal et son développement." In his figure 3 (pl. xvii.) are in fact represented two foramina situated on the facial part of the cranium and occupying approximately the position of the *fossa lacrymalis* in many recent Lemurs. The comparison of Gervais's figure with the skull in the British Museum (No. M 1345) shows, however, that these supposed lacrymal foramina are not foramina at all, but deep circumscribed depressions of the maxillary, in front of *crista anterior*, which exhibit the appearance of foramina when the shade falls into the hollow. In a subsequent publication by Gervais[2], either the author or the artist seems to have become aware of this fact, for the two supposed foramina are entirely omitted from the figure representing the very same cranium; the description is, however, reprinted[3] without alteration from the 'Journal.'

The skulls of *Adapis magnus* in the Geological Department show the cranial region which interests us here, in a broken condition, and in the same case are unfortunately the skulls of *Microchœrus* (*Necrolemur*). For the present, therefore, the oldest Lemurid exhibiting the lacrymal region shows it to be conformed exactly the inverse of what might have been anticipated and in fact has been supposed to be the case.

Since *Adapis parisiensis* agrees in several important features with recent, and most of all with the Malagasy, Lemurs[4], it may be fairly taken to be in their ancestral line. The condition of the lacrymal region in recent Lemuridæ is easily derivable from that obtaining in *A. parisiensis*, in supposing that by the flattening of the maxilla's *crista anterior* and the upraising of a *crista*

[1] Journ. de Zool. ii. p. 422, pl. xvii. (1873).
[2] Zool. et Pal. gén. ii. pl. viii. fig. 2 *a* (1876).
[3] *Op. cit.* p. 32.
[4] P. Z. S. 1899, p. 988.

posterior, the lacrymal fossa comes to be extra-orbital. Recent Lemuridæ show a considerable amount of variation in this respect, and we have therefore to examine them somewhat in detail.

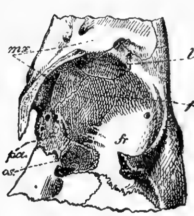
Perodicticus.

Here we meet with a *crista posterior*, separating a *pars facialis* and a *pars orbitalis*; the whole of the former's fossa is bordered by the maxilla. In none of the species does the malar reach the lacrymal.

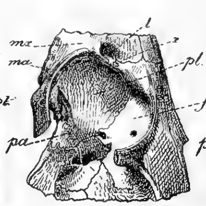
In the specimen which is the type of Bennett's "*P. geoffroyi*" (Br. M. Z. D. No. 55.12.26.230) (see text-fig. 33), the *pars facialis* has a very limited extent; the *pars orbitalis* starts from the crista posterior in a lateral and downward direction, till it reaches an unossified opening, a sort of irregularly-shaped fontanelle; in front it unites by a suture with the maxillary, behind with the os planum. On the medial side of the crista posterior, situated between the lacrymal, frontal and maxilla, is an intercalar bone (x).

In the *P. potto* (Br. M. Z. D. Nos. 56.11.10.5 and 46.12.5.1) (text-fig. 31) the orbital portion of the lacrymal is of moderate size, and delimited posteriorly—proceeding from the medial towards the lateral side—by the frontal, os planum, maxillary, lacuna, maxillary. On the orbital margin the lacrymal is raised to a crista posterior, and unites with the frontal and maxillary, which form the medial and lateral continuation, respectively, of the crista posterior. The lateral and anterior margins of the facial *fossa l.* are formed by the maxillary. In older specimens of the Potto the sutures are obliterated.

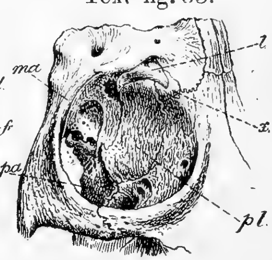
Text-fig. 31.



Text-fig. 32.



Text-fig. 33.



Text-fig. 31. Orbital region of *Perodicticus potto* (Br. M. No. 46.12.5.1), about nat. size.

Text-fig. 32. The same of *Perodicticus calabarensis* (Br. M. No. 46.11.10.5), about nat. size.

Text-fig. 33. The same of the type of "*Perodicticus geoffroyi* Benn." (Br. M. No. 55.12.26.230), about $\frac{3}{2}$ nat. size.

(Lettering as in text-fig. 26.)

In *Perodicticus calabarensis* (Br. M. Z. D. No. 0.11.30.1; ♀) the orbital part of the lacrymal is very narrow (transversely), and so is the *pars facialis*, which is, however, more elongate than in

P. geoffroyi. The extra-orbital fossa is encircled entirely by the maxilla. A small intercalar bone (x), in the same position as the one mentioned in *P. geoffroyi*, is on its way to become soldered to the frontal.

A second specimen of *P. calabarensis* (Br. M. Z. D. No. 46.11.10.5) is slightly older than the preceding. There is scarcely any pars orbitalis worth speaking of, the os planum reaching almost the crista posterior. On the right side it is almost completely joined to the lacrymal by synostosis, the suture being preserved only in the medial moiety; on the left side (text-fig. 32) a process of the maxillary—bounded in front by the lacrymal, behind by the os planum—forms more than half of the crista posterior (laterally); the medial extremity of this latter is formed by the frontal. So that the lacrymal contributes only in a slight measure to the formation of the crista posterior; it is, however, more developed on the right side. The pars facialis of the lacrymal and its fossa proceed diagonally in an antero-external direction, and are delimited by the maxillary, which in front and laterally forms a real crista anterior, the latter being flattened medially, as is the case also in the former specimen.

Tarsius.

The *crista post. l.* is formed by the lacrymal. The *pars orbitalis l.* is much reduced in size; the *pars facialis l.*, bearing the fossa, is for the greater part, in front, entirely encircled by the maxilla. A fronto-maxillary suture. The malar remains far behind on the orbital margin, its anterior end being above the anterior termination of m. 2.

Tarsius spectrum (Br. M. Z. D. No. 90.7.25.1). Teeth moderately worn.—Inside the orbit the os planum closely approaches the *crista post.*, so that there is scarcely any *pars orbit. lacr.* Laterally from the os planum occurs a fontanelle. Outside the orbit, the maxillary, besides encircling the fossa, advances into the latter on its lateral side.

Tarsius philippinensis, ♂ (Br. M. No. 97.3.1.1). Young specimen with deciduous dentition in place (text-fig. 35).—Similar to the preceding species, but the lateral part of the *pars orbitalis lacr.* has a larger extension.

Tarsius, therefore, on the whole closely resembles the other non-Malagasy Lemurs in the conformation of the lacrymal region.

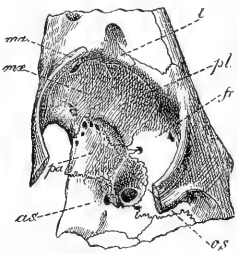
Galago.

The lacrymal is more reduced in size than in any of the Malagasy Lemuridæ. The anterior boundary of the *fossa lacrymalis*, situated on the cheek, is always provided by the maxilla, which forms the roof of the canalis l., and may also protrude more or less into the fossa.

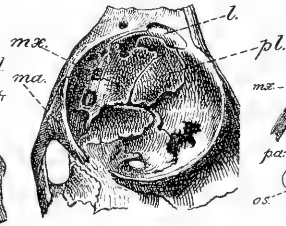
The malar may or may not reach the lacrymal. There never occurs a lacrymo-nasal suture.

In the group of large-sized Galagos (subgen. *Otolemur*) (text-fig. 34) the lacrymal is not only absolutely larger than in the other subgenera, but also comparatively so. Within the orbit the lacrymal is delimited laterally by the maxilla, medially by the os planum. The maxilla, besides bordering the *fossa lacrymalis* and forming the anterior roof of the *canalis l.*, penetrates also into the fossa, the bottom of which it forms jointly with the lacrymal. In young specimens the malar joins the lacrymal.

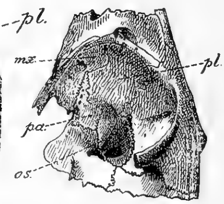
Text-fig. 34.



Text-fig. 35.



Text-fig. 36.



Text-fig. 34. Orbital region of *Galago* (*Otolemur*) *crassicaudatus* (Br. M. No. 92.10.18.10), about nat. size.

Text-fig. 35. The same of *Tarsius philippinensis* (Br. M. No. 97.3.1.1), about $\frac{3}{2}$ nat. size.

Text-fig. 36. The same of *Galago* (*Otolicnus*) *alleni* (Br. M. No. 99.4.6.5), about nat. size.

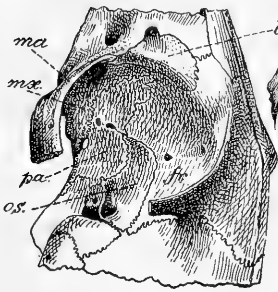
(Lettering as in text-fig. 26.)

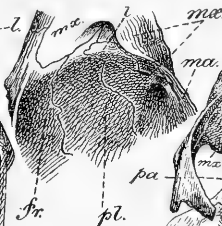
Galago (*Otolicnus*) *senegalensis* (four specimens).—In some individuals the *pars orbitalis l.* is extremely reduced, the maxillary (laterally) and the os planum (medially) almost reaching the *crista posterior*. The whole of the boundary of the fossa and part of its bottom is provided by the maxilla. In three young specimens the malar is separated from the lacrymal by a very thin process of the maxilla; in the fourth, an aged specimen, the bones are more widely separated.

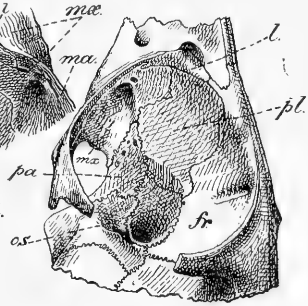
Galago (*Otolicnus*) *alleni* (four specimens) (text-fig. 36).—The portio orbitalis is slightly larger than in the preceding species. The whole of the fossa is encircled by the maxilla, which also enters the fossa, with the result that its bottom is only to a limited extent occupied by the lacrymal; in one instance the latter does not even reach the aperture of the *canalis l.* In one of the four specimens the malar is in contact with the lacrymal; in a second, young specimen, a strong lens is required to perceive the thin strip of maxillary dividing the two bones.

Galago (*Otolicnus*) *elegantulus* (four specimens).—In two of the skulls the lacrymal sutures are mostly obliterated, although the teeth are only moderately worn. In the two remaining specimens (Br. M. No. 1410 *a* & *b*) the lacrymal is either so much reduced in size, or so much covered by the adjoining bones, that it presents itself merely as a minute oblong splint of bone situated in the fossa, chiefly in front of the orbital margin, which it reaches almost or entirely. In front of this rudimentary lacrymal the whole of the bottom of the fossa and its raised anterior margin pertain to the maxilla. Behind it, the frontal and maxilla join on the orbital margin, thus forming the *crista posterior* and separating the lacrymal from the os planum, which latter also almost reaches the orbital margin from inside the orbit. There is therefore no trace of a *pars orbitalis lacrymalis*. Neither is there a lacrymo-malar suture, the latter bone being removed farther backward than in any of the preceding species.

Text-fig. 37. Text-fig. 38. Text-fig. 39.







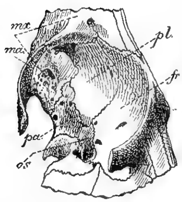
Text-fig. 37. Orbital region of *Opolemur thomasi* (Br. M. No. 91.11.30.50), about $\frac{2}{1}$ nat. size.
Text-fig. 38. The same of *Galago* (*Hemigalago*) *demidoffi* (Br. M. No. 97.12.1.5), about $\frac{2}{1}$ nat. size.
Text-fig. 39. The same of *Galago* (*Hemigalago*) *demidoffi* (Br. M. No. 98.5.4.3), about $\frac{2}{1}$ nat. size.
(Lettering as in text-fig. 26.)

Galago (*Hemigalago*) *demidoffi* (six specimens).—Here we find a moderately-sized *pars orbitalis lacrymalis*, and in most of the specimens the *crista posterior* is formed by the lacrymal alone (text-fig. 39). In one individual (Br. M. No. 97.12.1.4) the os planum encroaches on the orbital margin, between the lacrymal (laterally) and the frontal (medially), thus partaking to a slight extent in the formation of the *crista posterior*. On the right side it protrudes even on the facial part, by means of a slight process, which in the fossa is situated between the maxillary (medially) and the lacrymal (laterally). In another specimen (Br. M. No. 97.12.1.5) the conditions are very similar, the os planum of both sides protruding into the fossa, on the right side as far as the entrance of the canalis (text-fig. 38). In the younger specimens (Br. M. No. 811 *a* and No. 98.5.4.3) the malar reaches the lacrymal inside the orbit.

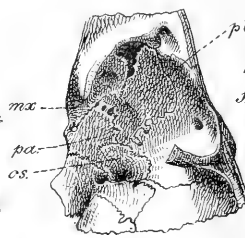
Loris.

Five specimens examined.—The lacrymal appears neither inside the orbit nor on the face. In front of the orbit there *is* a "fossa," entirely encircled by the maxilla. The *crista posterior* is also formed chiefly, in one case (Br. M. No. 67 *c*, left side) entirely, by two processes of the maxilla, which in the latter instance unite on the orbital margin, above the os planum, and are always continued forwards into the fossa. In most specimens these two processes are separated on the orbital margin by a minute process of the planum, which therefore partakes in the formation of the *crista posterior*. In the anterior part of the fossa—where the latter, being roofed over by the maxilla, has become the canalis—may be seen a thin bone which is either the free termination of the reduced lacrymal, covered by the maxillary in the anterior part of the fossa, or, may be, the termination of the os

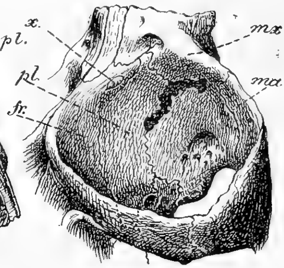
Text-fig. 40.



Text-fig. 41.



Text-fig. 42.



Text-fig. 40. Orbital region of *Loris gracilis* (Br. M. No. 48.10.31.3), about nat. size.

Text-fig. 41. The same of *Nycticebus tardigradus* (Br. M. No. 96.11.29.4), about nat. size.

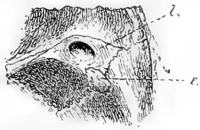
Text-fig. 42. The same of *Loris gracilis* (R. Coll. Surg. Lond. No. 290), about $\frac{3}{2}$ nat. size.

(Lettering as in text-fig. 26.)

planum. In one specimen (Br. M. No. 67 *d*) the process of the planum can be traced from the crista posterior forward to the anterior end of the canalis; in the absence of very young specimens it cannot be decided whether this anterior portion is the much reduced lacrymal united by synostosis with the planum, or the planum itself. In a specimen from the collection of the Royal College of Surgeons (No. 290), the condition displayed on the right side conveys the impression that the thin bony plate, visible in the canalis beneath the maxillary roof, is in fact the lacrymal. On both sides of the skull the planum creeps up on the orbital margin and separates the frontal from the maxillary, the former bone in this specimen partaking medially in the formation of the margin. In front of the os planum, a lateral and a medial process of the maxillary unite within the fossa, and separate again almost immediately, so as to include between each other the thin bony plate above mentioned.

In several of the younger specimens an intercalar bone is present as in *Perodicticus*. In specimen No. 67 *d* (Br. M.) it forms the medial continuation of the crista posterior, being limited anteriorly by the maxilla—with which it begins to co-ossify,—medially by the nasal, laterally by the planum, posteriorly by the frontal. In other slightly older specimens (Br. M. No. 67 *a*, No. 67 *c*; R. C. S. No. 290) the intercalar bone is almost completely overgrown by the frontal.

Text-fig. 43.



Lacrymal region of *Avahis laniger*, about $\frac{4}{3}$ nat. size.
(Lettering as in text-fig. 26.)

The malar terminates anteriorly above the interspace between m. 1 and the posterior premolar.

Nycticebus.

In this genus (see text-fig. 41) the crista posterior appears to be formed, either by the maxillary (laterally) and the frontal (medially)—joining in a suture in advance of, and above, the os planum,—or by two processes of the maxillary, joining in the same manner. Younger specimens show an intercalar bone which occupies the same position as in *Perodicticus* and *Loris*, and coalesces either with the maxillary or with the frontal. In some cases (*N. javanicus*, Br. M. No. 66 *e*; *N. tardigradus*, Br. M. No. 1550 *b*) a small process of the planum creeps upon the orbital margin between the maxilla and the frontal, or even advances into the fossa.

There is no trace of the lacrymal within the orbit, nor, as has just been stated, on the orbital margin, where it seems to have been entirely covered by the maxilla, os planum, and frontal. Neither can the lacrymal be traced in the groove which in front of the *crista posterior* represents the *fossa lacrymalis* of other Lemurs. With the exceptions before mentioned, when the planum encroaches on the fossa, the bottom of the latter is made up by two processes of the maxilla, which also encircles the *canalis l.* in front.

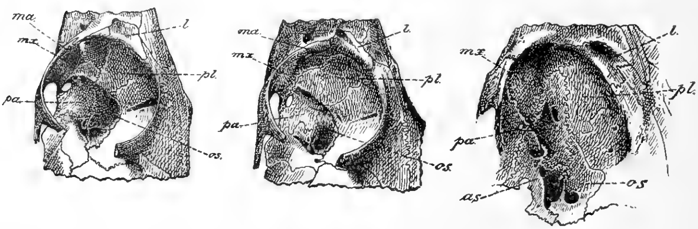
The malar does not advance on the orbital margin farther than above the posterior end or the middle of the posterior premolar.

In old specimens all the sutures are obliterated.

Microcebus.

Three species have been examined, viz., *M. smithi*, *M. minor*, and *M. coquereli*.—The fossa lacrymalis is on the facial portion; in all the species its anterior border is formed by the maxillary (text-figs. 44 & 45). The lower orbital margin is formed by the *crista posterior* of the lacrymal, with which the malar bone laterally articulates.

Text-fig. 44. Text-fig. 45. Text-fig. 46.



Text-fig. 44. Orbital region of *Microcebus smithi* (Br. M. No. 37.9.26.78), about $\frac{4}{3}$ nat. size.
Text-fig. 45. The same of *Microcebus smithi* (Br. M. No. 35.12.26.281), about $\frac{4}{3}$ nat. size.
Text-fig. 46. The same of *Callithrix personata* (Br. M. No. 45.4.2.11), about nat. size.
(Lettering as in text-fig. 26.)

M. smithi.—Out of twelve specimens examined, in six the lacrymal expands medially on the face, so as to reach the nasal, and form a sometimes rather elongate lacrymo-nasal suture (text-figs. 44 & 45). In the other six cases the frontal and maxillary separate the two bones mentioned before, so that we have a fronto-maxillary suture, which is always very short and in some cases nothing more than a mere touching of the two bones.

M. minor.—In the three specimens examined, a lacrymo-nasal suture is brought about by both the bones sending a process to meet one another; in one of the specimens, on one side a very thin process of the frontal joins the maxillary, so as to separate the nasal from the lacrymal.

Opolemur (text-fig. 37).

The anterior margin of the facial fossa lacr. is formed by the maxillary. The lacrymal does not reach the nasal, a broad junction of the frontal and maxillary taking place between the former two bones. The malar reaches the lacrymal; the lacrymo-malar suture is inside the orbit and continued on the orbital margin. The orbital portion of the lacrymal is broad, without, however, extending far into the orbit; behind it is limited by the frontal (medially) and the maxillary (laterally), no separate os planum being present.

Chirogale.

Ch. milii (5 specimens).—The lacrymal is broad and chiefly facial. Anteriorly the fossa lacrymalis is bordered by the maxillary. There is a fronto-maxillary suture, the lacrymal not meeting the nasal. The malar joins the lacrymal on the orbital margin and within the orbit. The small orbital portion of the lacrymal is delimited behind in the same manner as in *Opolemur*. In one youngish specimen only (Br. M. Z. D. No. 88.2.18.3) a very small distinct os planum appears between the maxillary and frontal, articulating besides in front with the lacrymal. In aged specimens the lacrymal sutures are mostly obliterated, the lacrymal uniting with the maxillary.

"*Chirogale*" *trichotis*, Günth. (Br. M. Z. D. No. 75.1.29.2).—The facial cranium is more drawn out than in the former species, and in connection with this the lacrymal fossa has a more anterior position; as usual, it is bordered in front by the maxillary.

Cebidæ.

Mycetes.

Forty-one skulls have been examined.—Only in fifteen specimens the lacrymal fossa is wholly encircled by the lacrymal bone, as described and figured [1] by Gegenbaur; the anterior boundary of the fossa, which protrudes on the cheek, increases with the age of the animal, the whole of the lacrymal assuming in old individuals (Pl. XI. fig. 6) a more oblique position, in accordance with the general direction of the facial cranium. In twenty-two cases the maxilla partakes to a slight extent in the forming of the antero-inferior margin of the fossa; this is nearly always the case in very young specimens (Pl. XI. fig. 3); but it may occur also in very old individuals (e.g., *M. seniculus*, Br. M. No. 44 *e*). A lacrymo-nasal suture occurs almost without exception; in very young specimens the two bones may barely touch each other, without a true suture being formed. In one of the two youngest specimens available (*M. seniculus*, Leyden Mus. *r*; d. 1 not quite protruded), a pointed process of the maxillary reaches the frontal on the left side, on the right a minute Wormian bone is interposed. In the second specimen, which I owe to Prof. Rud. Burckhardt (the deciduous incisors and d. 3 alone in place), a comparatively elongate lacrymo-nasal suture is present on both sides.

As in the following genus, it is sometimes a matter of mere individual appreciation whether to consider the lacrymal fossa as intra- or extra-orbital; in fact in some cases it is neither inside nor outside the orbit. Of course, it depends where we draw the limits of the orbita; but when there are no definite limits, this becomes a matter of some difficulty.

[1] *Op. cit.* p. 175, fig. II A.

Ateles.

In 14 out of 25 specimens examined, the *fossa lacrymalis* was completely encircled by the lacrymal (Pl. XII. figs. 4 & 6), in six more cases the maxilla merely touched the fossa near its antero-inferior border. Only in five specimens was found a slightly more extended maxillary margin of the fossa, such as figured by Gegenbaur[1]. The supero-anterior angle of the lacrymal also protrudes more on the face than suggested by the mentioned figure. A lacrymo-nasal suture was found in 12 cases (Pl. XII. figs. 4 & 6); a mixed condition, viz. a lacrymo-nasal suture on one side only, in three cases. Only in eight cases did I find a fronto-maxillary suture, which is always very limited, as described by Gegenbaur.

It cannot be said that in every case the *fossa lacrymalis* is decidedly extra-orbital; this condition is rather an exception in *Ateles*, occurring when the crista posterior is more than usually prominent. Where the orbit presents no marked limits in this region, it is, as with *Mycetes*, a matter of mere individual appreciation whether we have to regard the fossa as lying inside or outside the orbit. That there are variations in this respect in *Ateles*, was already known to G. Fischer, who says that in a skull of *A. paniscus* the aperture of the lacrymal canal was situated "auf der Grenze der Augenhöhle, oder auf seinem (sic!) Rande, aber doch immer mehr nach innen," whilst other skulls of the same species presented the same conformation as in the other species[2].

Brachyteles.

The skull of this rare monkey, of which I could examine only seven specimens—one in Leyden, six in the Natural History Museum—exhibits a very broad interorbital region, due in a great measure to the large development of the lacrymal. In spite of this, the anterior boundary of the fossa is for the greater part—in one case entirely—formed by the maxilla, which in two cases even protrudes into the fossa. In the upper region the lacrymal advances on the face, so that the fronto-maxillary suture is either very limited, or in two cases—*B. hypoxanthus*, Leyden; *B. arachnoides*, Br. M. No. 43.10.12.2 (Pl. XII. fig. 1)—a lacrymo-nasal suture is present.

Callithrix.

Sixteen skulls examined.—The anterior margin of the lacrymal fossa is always bordered by the maxilla, at least on its lower half (Pl. XII. fig. 7), and sometimes (*C. donacophila*) on its whole extension. The antero-superior angle of the lacrymal protrudes forwards, least of all in *C. donacophila*, which therefore exhibits a very broad fronto-maxillary suture; in all the other species there is

[1] *Op. cit.* p. 175, fig. II B.
[2] G. Fischer, Anatomie der Maki, p. 90 (1804).

also a fronto-maxillary suture, although of less extent. In *Callithrix* the lacrymal therefore occupies a more backward position than in the preceding genera. Notwithstanding this, the *crista post.* is generally very strong, the *crista ant.*, on the contrary, much flattened, especially in its upper region; so that in some cases—*C. nigrifrons*, Br. M. No. 51 *c*; *C. personata*, Br. M. No. 45.4.2.11 (Pl. XII. fig. 7) and No. 51 *d*—the fossa appears quite as much outside the orbit as in extreme cases of *Ateles*.

Nyctipithecus.

Fourteen skulls.—As described by Gegenbaur in *N. trivirgatus*, the whole of the *crista posterior* belongs to the maxilla, which, moreover, generally descends into the fossa. In the only skull of *N. trivirgatus* available (Br. M. No. 1459 *b*)—in a second skull of this species the sutures are obliterated—the antero-superior angle of the lacrymal advances so far forwards, that the maxillary becomes separated from the frontal, and a lacrymo-nasal suture is brought about. The same occurs in two skulls of *Nyctipithecus* sp. (Br. M. No. 97.10.3.8 and No. 92.2.18.1), in the latter of which the suture between the two bones is chiefly due to the breadth of the nasal in this place. In all other skulls—*N. felinus* (seven specimens), *N. rufipes* (one), *N.* sp. inc. (two)—the frontal and maxillary join between the lacrymal and nasal, so as to form a comparatively broad fronto-maxillary suture.

Brachyurus.

Three skulls of *B. calvus*.—The conformation of the lacrymal is on the whole similar to that of the preceding genus. The *crista anterior* of the maxilla forms the lower orbital margin and the anterior boundary of the fossa. In one skull (Br. M. No. 806 *b*) the lacrymal extends its antero-superior angle towards the nasal, which, in its turn, sends backwards a process, so that—on the left side—lacrymal and nasal join each other.

Pithecia.

Seven skulls.—Similar to the preceding genus. In two cases, viz. *P. leucocephala* (Br. M. No. 66.8.6.1) and *P.* sp. (Br. M. No. 1294 *a*), the lacrymal forms the upper margin of the fossa and at the same time joins the nasal anteriorly.

The remaining genera of Cebidæ, *Lagothrix*, *Chrysothrix*, and *Cebus*, present essentially the conditions of the Simiidæ.

Lagothrix.

Twenty-two skulls.—The lacrymal fossa is decidedly within the orbit. The whole of the *crista anterior* is formed by the maxilla, forms the orbital margin, and, moreover, descends into the fossa. In a few cases the antero-superior angle of the lacrymal advances on the facial region, but only once (*L.* sp., Br. M. No. 0.11.5.17) a naso-lacrymal suture occurs, which, however, is due to a backward extension of the nasals. In four skulls the lateral region of the fossa—the hamulus-region of the human lacrymal—formed by the lacrymal is considerably enlarged.

Chrysothrix.

Ch. sciureus (Pl. XI. fig. 7) and *Ch. entomophagus*; 9 skulls.—The lacrymal fossa and the whole of the lacrymal bone are completely within the orbit. The maxilla, besides forming the lower orbital margin, protrudes far below into the fossa, throwing back the lacrymal. The frontal also generally advances into the fossa, from above. It is a characteristic feature of *Chrysothrix* that the frontal descends unusually far below on the dorsum nasale and inside the orbit, so that the fronto-maxillary suture becomes very large and often extends backwards into the upper part of the *fossa lacrymalis.*

Cebus.

Forty-one skulls.—The lacrymal region is eminently "anthropomorphous" in all the species. The *crista posterior* is situated at a lower level than the *crista anterior*, which is convex forwards and exclusively formed by the maxilla; the latter not only delimits the whole anterior margin of the fossa, but descends into it and occupies besides the whole of the antero-superior region, so that there is generally a very broad fronto-maxillary suture. (An exception is presented by one skull, *C. capucinus*, Br. M. No. 1049, in which the nasal extends from its root backwards along the upper margin of the maxillary, so that we have a lacrymo-nasal suture within the fossa.) The upper part of the fossa appears continued on the frontal, the *crista posterior*, and sometimes (*C. xanthocephalus*) both the *c. ant.* and *c. post.*, being continued on that bone.

Hapalidæ.

The fossa lacrymalis is decidedly orbital. As a rule, the whole of the *crista anterior* is formed by the maxillary, which descends into the fossa.

Hapale.

Nineteen skulls examined.—A lacrymo-nasal suture occurs in 6 out of the 19 specimens. The os planum encroaches upon the lacrymal from behind; the crista posterior is formed solely by the lacrymal as a rule, but sometimes the os planum partakes in its formation. In *H. jacchus* the upper part of the *crista anterior* is rather flattened, so that the lacrymal encroaches upon the face, and the fronto-maxillary suture either becomes very shortened or is replaced by a lacrymo-nasal suture (in three specimens of this species). The os planum helps to join the crista posterior in one specimen of this species (Br. M. No. 1216 *b*). In two out of four specimens of *H. aurita* we have a lacrymo-nasal suture; besides in one of them the upper part of the *crista anterior* is formed by the lacrymal and maxillary jointly. In one of the four specimens of the same species (Br. M. No. 56 *b*) the os planum partakes in the formation of the crista posterior.

Midas.

Fifteen skulls (Pl. XII. figs. 2 & 5).—On the whole similar to *Hapale*, but the supero-anterior angle of the lacrymal encroaches less upon the cheek; the fronto-maxillary suture is generally broad, sometimes it is somewhat reduced by the advance of the lacrymal; but I have not met with a lacrymo-nasal suture. The lacrymal is also otherwise reduced in size; from above, the frontal sends a process into the fossa; from behind, the os planum encroaches upon the crista posterior (e. g. *M. mystax*, Br. M. No. 992 *a*, *M. rufiventer*, Br. M. No. 45.4.2.8) (Pl. XII. fig. 5). In one skull of *M. chrysomelas* (=*M. flavifrons*, Br. M. No. 1528 *a*) the *crista posterior* is chiefly formed by the os planum.

Cercopithecidæ.

Semnopithecus.

With regard to this genus, my material discountenances Gegenbaur's statement, who says that, like in the rest of the family, in *Semnopithecus* almost the whole of the fossa is encircled by the lacrymal, so that the *crista anterior* is either entirely supported by this bone, or by the lacrymal in conjunction with the frontal process of the maxillary. And again: " A small portion of the maxillary forms the anterior border of the fossa in *Semnopithecus* (*S. nasicus*) "[1].

I have examined the lacrymal region of 93 skulls of *Semnopithecus,* with the result that only in four cases the conditions are similar or nearly so as described by Gegenbaur; so that I apprehend that he had no true *Semnopithecus* at his disposal. In fact the only species mentioned is " *S. nasicus*," the *Nasalis*, in which the conditions are somewhat different from those of *Semnopithecus.*

If we except *Miopithecus* and *Rhinopithecus* (Pl. XI. fig. 8), *Semnopithecus* is the most anthropoid of the Cercopithecidæ with regard to its lacrymal. Not only is the *crista anterior* supported by the maxilla alone, in 89 out of 93 specimens, but generally the latter bone penetrates also into the fossa, thus throwing back the lacrymal. In several cases the participation of the lacrymal in the formation of the fossa is further restricted by the frontal penetrating into it from above (e.g., *S. pyrrhus*, Br. M. No. 55.12.24.11, *S. obscurus*, Br. M. No. 79.11.21.298, *S. priamus*, Br. M. No.79.9.5.4); but generally the antero-superior angle of the lacrymal advances slightly towards the face (Pl. XII. fig. 8). In four cases only (*S. entellus*, Br. M. No. 13 *j* & 13 *p*; *S. cristatus*,

[1] *Op. cit.* p. 175.

Br. M. No. 78.8.30.4 ; *S. sabanus*, Br. M. No. 93.3.4.3) the lacrymal shares with the maxillary the anterior boundary of the fossa.

Colobus (Pl. XII. fig. 3).

The lacrymal is slightly more developed in front than in *Semnopithecus*, thus more approaching the condition attributed to the latter genus by Gegenbaur.

Nasalis.

In *Nasalis* (Pl. XII. fig. 11) the antero-superior angle of the lacrymal and its lateral portion—the hamulus-region—extend forwards ; between them, the maxilla borders the fossa and sometimes even descends into it. As the *crista anterior* is, however, much flattened, a condition approaching *Ateles* is the result.

Papio.

Papio is the very reverse of *Semnopithecus*. In the 52 specimens examined, the anterior margin of the fossa is, almost without any exception, formed by the lacrymal alone (Pl. XI. figs. 9 & 10). In ten specimens the *crista anterior* is supported exclusively by the lacrymal, which in several individuals expands forwards beyond the crista; so that, whenever the *crista ant.* is flattened—an occurrence met with in young and adult specimens (Pl. XI. fig. 9)—the fossa is as much extra-orbital as in many cases of *Mycetes* and *Ateles*.

In the majority of specimens the *crista anterior* is formed by the lacrymal in conjunction with the maxilla.

Cynopithecus.

In *Cynopithecus* the conditions nearly resemble those of the preceding genus. In the seven skulls examined, the lacrymal, however, never protrudes on the face, the *crista anterior* being always formed by both lacrymal and maxilla. In three cases the boundary of the anterior margin of the fossa is supplied exclusively by the lacrymal.

Macacus.

Seventy-nine skulls have been examined. In eight specimens the condition of the lacrymal was found to be similar to that prevailing in *Semnopithecus*, viz., the *crista anterior* formed by the maxillary alone, which generally descends also into the fossa. The eight specimens belong to *M. philippinensis* (2), *M. cynomolgus*, *M. radiatus*, *M. pileatus*, *M. rhesus*, *M. speciosus*, *M.* sp. (Br. M. No. 45.1.8.4). In six cases—*M. silenus*, *M. philippinensis*, *M. cynomolgus* (2), *M. rhesus*, *M.* sp. (Br. M. No. 69.3.5.15)—the maxillary forms the larger portion of the anterior boundary of the fossa. Conversely in one instance, an old individual of *M. nemestrinus* (Br. M. No. 28 *c*) (Pl. XII. fig. 12), the extreme condition of some specimens of *Papio* is approached, the lacrymal encircling completely the fossa and protruding on the face above and below the former. The whole of the fossa is likewise encircled by the lacrymal in a specimen of "*M. sinicus*" (Br. M. No. 1102 *b*), but here both maxilla and lacrymal participate in the formation of the *crista anterior*.

In the remnant of the skulls of *Macacus* (63) (Pl. XII. fig. 10) the conditions are those described by Gegenbaur ("*Inuus*"). The same is the case in the few specimens of *Inuus ecaudatus* at my disposal.

Cercopithecus.

Ninty-five specimens examined.—Here too, as in *Macacus*, we meet with the two extremes. In 12 skulls—*C. cephus* (4), *C. nictitans*, *C. melanogenys*, *C.* sp. (Br. M. No. 67.4.12.15), *C. erxlebeni*, *C. sabæus*, *C. cynosurus*, *C. mona*, *C. schmidti*,—young and old, the *crista anterior* is entirely supported by the maxilla, which generally descends into the fossa. In seven skulls the opposite takes place, the fossa being entirely encircled by the lacrymal; and as the *crista anterior* is generally flattened, the fossa cannot be said to be inside the orbit—"*C. sabæus*" (Br. M. No. 20 *h*), *C. cephus* (No. 783 *e*), *C. samango* (Br. M. No. 14 *a*), *C. campbelli* (Br. M. No. 1078 *a*), *C. albogularis* (Br. M. No. 0.2.1.4, No. 92.10.18.8, and No. 92.10.18.9) (Pl. XI. fig. 5). In five skulls—viz.: *C. schmidti* (Br. M. No. 98.10.10.1), "*C. cephus*" (Br. M. No. 783 *a*), *C. albogularis* (Br. M. No. 17 *c*, No. 92.10.18.7, and No. 17 *a*)—the *crista anterior* is almost exclusively supported by the lacrymal. It will be observed that the extreme development of the lacrymal chiefly occurs in the "Melanochiri" group of the genus.

Cercocebus.

Five skulls.—In the few specimens of which I have examined the condition of the lacrymal—two of *C. æthiops*, one of *C. albigena*, two of *C. fuliginosus*—the fossa is completely or almost completely encircled in front by the lacrymal.

Miopithecus.

Only four skulls have been examined, a young specimen with the deciduous teeth in place, and three adult, one of which has the teeth much worn. In all of them the *crista anterior* is entirely supported by the maxillary, which encroaches also on the fossa, behind (Pl. XII. fig. 9).

Nesopithecus.

For the sake of comparison with both Lemurs and Monkeys, I have reserved for the end the Malagasy subfossil *Nesopithecus*. As shown by the figures (Pl. XI.), the two species, *N. australis* and *N. roberti*, present differences in their lacrymal region, dependent on the facial cranium being somewhat more produced in the former than in the latter, in which the profile is steeper.

In *N. australis* (Pl. XI. fig. 1) we have the *crista posterior lacr.* —less flattened than the *crista ant.*—dividing the lacrymal into an intra-orbital and a slightly extra-orbital portion. The whole anterior margin of the fossa l. is formed by the maxilla, to a larger extent than is the case in *Propithecus* (Pl. XI. fig. 4). As the comparison of the figures will show, the lacrymal and its fossa are less produced on the face than in the extreme cases of platyrhine and catarhine monkeys.

In *Nesopithecus roberti* (Pl. XI. fig. 2) the crista anterior is stronger than the crista posterior, of which the antero-inferior portion is much flattened. The fossa and the whole of the lacrymal bone remain within the orbit. The lower part of the crista anterior, which forms the anterior boundary of the fossa, is supported by the maxilla. In the upper part the lacrymo-maxillary suture runs on the crista anterior, both bones consequently partaking in its formation. This is precisely the condition presented by some platyrhine monkeys (e. g. *Brachyurus* and some species of *Nyctipithecus*) and by the majority of the lower Catarhinæ.

Summary and Conclusions.

It has been said that in the lower Mammalia the lacrymal belongs to the bones of the face (" Antlitzknochen "), and that in the Sauropsida it is likewise situated mostly on the surface of the cranium [1]. I am not so sure that what we call lacrymal in the Sauropsida is exactly the homologue of the Mammalian lacrymal; but apart from that, the great elongation of the facial cranium, where it occurs in the Reptilia, may or may not be the primitive condition. Leaving therefore aside the Sauropsida, and coming to the Mammalia, it is not a character of Insectivora generally [2] to have their lacrymal for the greater part, and the *canalis lacrymalis* as well, on the surface of the skull. In the Insectivora with a largely produced facial portion, e. g. *Erinaceus* and *Centetes*, the first stages, if W. K. Parker's [3] figures are to be relied upon, have the canalis inside the orbit.

As to the Prosimiæ, if in the future we come upon forms in the Middle or Lower Tertiaries exhibiting a facial expansion of the lacrymal, and a facial fossa l., it will then be the time to ventilate the question, whether a similar condition might after all be the primitive one in the Prosimiæ. For the present we have to reckon only with the known facts. In *Adapis parisiensis* we have found the fossa lacrymalis as well as the whole bone to be inside the orbit; the lacrymal is fairly large. From this condition, the form of the lacrymal of recent Lemurs generally can have been arrived at by the development of a *crista posterior;* that of the non-Malagasy Lemurs, besides, by a gradual reduction of the lacrymal;

[1] Gegenbaur, *op. cit.* p. 174. [2] *Id. ibid.*

[3] W. K. Parker, "On the Structure and Development of the Skull in the Mammalia, III. Insectivora," Phil. Trans. R. Soc. 1885, pl. 20. fig. 3, pl. 32. fig. 3.

that of the Malagasy Lemurs, on the contrary, by an increase in size of the *pars facialis*. The large expansion of the lacrymal on the face and the anterior bordering of the canalis by the latter bone, both characters which amongst the Prosimiæ occur only in the Malagasy Lemurs, are rather an exception within this group; they go hand in hand with the elongation of the facial cranium generally. As a rule in the Malagasy Lemurs the *pars facialis* is of moderate size, and the anterior boundary of the fossa is provided by the maxilla. In the Oriental and Ethiopian Lemurs the maxilla *always* borders the fossa to a large extent and chiefly in front; the *pars facialis* is reduced to a minimum; the *pars orbitalis* is also reduced, owing chiefly to the encroachment by the planum. In two genera (*Loris*, *Nycticebus*) the lacrymal disappears entirely from the outer surface of the cranium, outside and inside the orbit.

Amongst the Platyrhinæ, only in *Mycetes* and *Ateles*, and, up to a certain extent, in *Brachyteles* and *Callithrix*, the fossa l. shows a tendency to expand upon the face; whilst in all the other genera, at the top of which are *Lagothrix*, *Chrysothrix*, and *Cebus*, the lacrymal remains inside the orbit. The *crista anterior* being formed by the maxilla, the same condition as in Anthropoid Apes and Man is arrived at, and, as in them, it coincides with the reduced size of the facial cranium.

In the lower Catarhinæ the anthropoid condition is verified in *Miopithecus*, *Rhinopithecus* (Pl. XI. fig. 8), and *Semnopithecus*, in a minor degree in *Colobus*. In all the other genera of Cercopithecidæ—*Nasalis*, *Cercopithecus*, *Cercocebus*, *Inuus*, *Macacus*, *Cynopithecus*, *Papio*—the condition of the lacrymal region is, as a rule, further removed from that of Simiidæ and *Homo* than in the great majority of Platyrhine genera. In extreme cases, when the facial region is lengthened, in these Cercopithecidæ also the lacrymal expands on the face and the fossa tends towards a preorbital position.

Summing up, and in order to arrive at a generalization, the following points are to be insisted upon:—

A great facial expansion of the lacrymal, and particularly its extension beyond the *fossa lacrymalis*,—

1. Does not occur, the converse being the case, in the one Tertiary Lemur of which the lacrymal region is known;
2. It is scarcely more frequent in Lemurs than in the higher groups; the greatest reduction of the lacrymal occurs precisely within the Prosimiæ;
3. It is at its minimum in young individuals;
4. The genera of each group in which this character is presented have certainly no closer relationship with those of another group;
5. It can always be traced back to an elongation of the facial cranium, necessitated by a more powerful dentition.

The conclusion is, that a great facial expansion of the lacrymal, and particularly its extension beyond the *fossa lacrymalis*, is, in the Lemurs, as well as in the Monkeys, not a primitive condition, but an extreme specialization.

The postorbital region, to which the figures of Plate XIII. refer, has been examined in about 1100 skulls of Monkeys (exclusive of the Anthropoids, except *Hylobates*) and 300 of Lemurs; so that the ten figures are only just sufficient to give a general idea of the gradual changes. For all the particulars the reader is referred to a separate publication. In the characters of this region the Lemurs do not stand apart as has been supposed (Virchow); they represent the most generalized condition, closely related to what obtains in the majority of the platyrhine Monkeys. From the Lemurs to the higher Monkeys takes place a gradual restriction and throwing back of the parietal, brought about by the greater extension, first of the malar, and subsequently of the frontal, alisphenoid, and squamosal. Phases in this whole process of evolution are the differences between the Platyrhinæ and Catarhinæ (discussed by Cuvier, Joseph, Anutschin, W. A. Forbes), and the union of the squamosal with the frontal; the latter being the terminal stage. As regards Man, the fronto-squamosal union is not an atavism; where it occurs it is—apart from pathological cases—a specialization, just as in Monkeys. What has rather the appearance of an atavism is the spheno-parietal union when it occurs in the Gorilla and the Chimpanzee.

EXPLANATION OF THE PLATES.

Plate XI.

Lacrymal region of Lemurs and Monkeys.

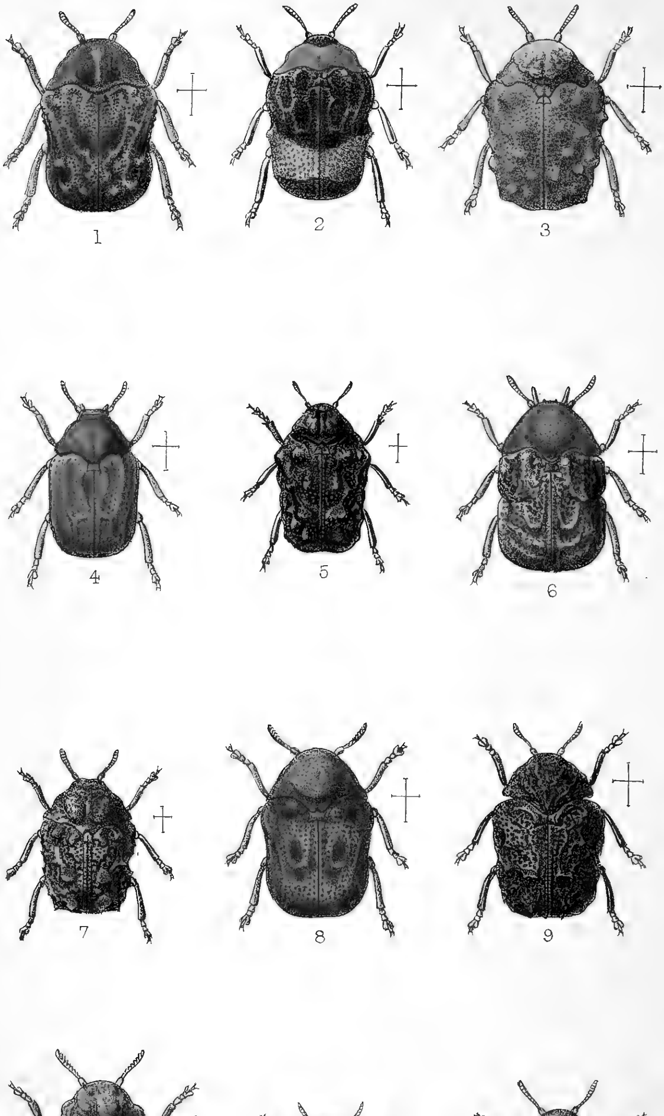
l.=lacrymal; *mx.*=maxillary; *ma.*=malar; *pl.*=planum; *cr.a.mx.*=crista anterior of the maxillary; *cr.p.l.*=crista posterior (of the lacrymal).

Fig. 1. *Nesopithecus australis* Maj. (Br. M. Geol. Dep.).
2. *Nesopithecus roberti* Maj. (Br. M. Geol. Dep.).
3. *Mycetes palliatus,* young (Br. M. Z. D. No. 96.6.1.1).
4. *Propithecus edwardsi*, young (Br. M. No. 75.1.29.6).
5. *Cercopithecus albogularis* ♂ (Br. M. No. 92.10.18.9).
6. *Mycetes palliatus* (Br. M. Salvin's Coll.).
7. *Chrysothrix sciureus* (Br. M. No. 45.8.5.8).
8. *Rhinopithecus roxellanæ* ♀ (Br. M. No. 99.3.1.2).
9. *Papio anubis* (Br. M. No. 45.6.17.14).
10. *Papio* sp. inc. (Br. M. No. 0.1.3.2).

Plate XII.

Lacrymal region of Monkeys.

Fig. 1. *Brachyteles arachnoides* (Br. M. No. 43.10.12.2).
2. *Midas geoffroyi* ♀ (Br. M. No. 0.5.1.63).
3. *Colobus caudatus* ♂ (Br. M. No. 0.2.1.1).
4. *Ateles fusciceps* (Br. M. No. 1514 *a*).
5. *Midas rufiventer* (Br. M. No. 54 *a*).
6. *Ateles vellerosus* ♀ (Br. M. No. 89.12.7.2).
7. *Callithrix personata* (Br. M. No. 45.4.2.11).
8. *Semnopithecus natunæ,* ♂ type (Br. M. No. 94.9.28.1).
9. *Miopithecus talapoin* ♂ (Br. M. No. 0.2.5.8).
10. *Macacus rhesus* (Br. M. No. 58.6.24.144).
11. *Nasalis nasicus* (Br. M. No. 13 *e*).
12. *Macacus nemestrinus* (Br. M. No. 28 *c*).



W. Purkiss del. et lith.

West, Newman imp.

PHYTOPHAGOUS COLEOPTERA (CHLAMYDÆ.)

PLATE XIII.

Postorbital region of Lemurs and Monkeys.

fr.=frontal; *pa.*=parietal; *sq.*=squamosal; *ma.*=malar; *as.*=alisphenoid.

Fig. 1. *Propithecus edwardsi* (Br. M. No. 75.1.29.6).
2. *Cebus* sp. inc., young (Br. M. No. 96.8.1.1).
3. *Hylobates syndactylus* (Br. M. No. 84.4.24.8).
4. *Cebus* sp. inc. (Br. M. No. 67.4.12.57). This is the only skull, out of 42 of *Cebus*, in which the parietal is separated from the malar by the union of the frontal with the alisphenoid.
5. *Cercopithecus patas* ♂ (Br. M. No. 99.7.7.1).
6. *Brachyteles arachnoides* (Br. M. No. 43.10.12.2).
7. *Brachyteles arachnoides* (Br. M. No. 48.10.25.3), young (deciduous dentition).
8. *Semnopithecus cristatus*, very young (deciduous dentition). (R. Coll. Surg. London, No. 102).
9. *Rhinopithecus roxellanæ* ♀ (Br. M. No. 99.3.1.2).
10. *Papio* sp. inc., ♂ young (tooth-change) (Br. M. No. 0.1.3.2).

7. Descriptions of some new Species of Phytophagous Coleoptera of the Family *Chlamydæ*. By MARTIN JACOBY, F.E.S.

[Received February 11, 1901.]

(Plate XIV.[1])

Amongst all the Phytophagous Coleoptera there is perhaps no group more difficult in regard to the description and determination of the species than the *Chlamydæ*. A very large number of species, the majority of which have in common a similar arrangement in regard to their elytral sculpturing (often very complicated, ill-defined, and interrupted by larger or smaller tubercles), makes the descriptions extremely difficult to render so that other students can follow the arrangement; to make matters worse, all the published figures of the *Chlamydæ* are, with but few exceptions, unrecognizable, and neither those of Klug nor Kollar give any clear idea of the true sculpturing of these insects. The figures published by Messrs. Godman and Salvin in their great work on Central America are the only reliable ones available. In the present paper I have tried to describe those species which I believe to be new to science, and which are represented in my collection, as clearly as I am able to; and I hope that the determination of some of the more important forms will be much assisted by the figures, the last three of which (Plate XIV. figs. 10–12) are those of species previously described.

CHLAMYS LACORDAIREI, sp. n. (Plate XIV. fig. 8.)

Flavous, the elytra darker, terminal joints of the antennæ black; head and thorax finely reticulate, the former with one, the latter with several obscure fulvous spots, its posterior portion slightly raised, bounded by a transverse ridge behind; elytra closely and strongly punctured, with three ferruginous spots at the middle of

[1] For explanation of the Plate, see p. 164.

each, the base with one tubercle, the middle with a short transverse ridge.

Length 5 millim.

Head very finely rugose, flavous, the vertex with an obscure fulvous spot, the mandibles black; antennæ black, the lower three joints fulvous, the fourth and the following strongly transversely serrate; thorax entirely covered with fine reticulations, the posterior portion slightly raised into a round lobe, which near the base terminates in a transverse ridge, the top of the lobe not sulcate but rather more strongly reticulate, the surface coloured like the head, with four obscure fulvous spots placed transversely and anteriorly and another spot at the middle of the lobe; scutellum impunctate; elytra subquadrate, very slightly narrowed posteriorly, more strongly reticulate than the thorax throughout, with the usual longitudinal ridge very indistinct, except near the suture at the posterior half of the elytra, this ridge commences or is bounded at the middle by a short strongly marked transverse ridge which includes an oval-shaped space stained with dark fulvous, below which there is another smaller similar spot, as well as one placed at the middle near the lateral margin, the extreme basal margin is black and a distinct tubercle is placed at the middle of the base, the shoulders are likewise strongly raised but have besides two very small tubercles near the apex, the rest of the surface is without them, the suture is very finely crenulate at the posterior half; the pygidium and the underside are flavous, very finely rugose, the first named part with a fine central ridge; legs fulvous; prosternum strongly narrowed posteriorly.

Hab. Brazil, Goyaz.

I cannot identify this species with *C. ferrugata* Lac., to which it is no doubt closely allied; but the description of the author and those of other equally closely allied species do not agree with the four specimens I have before me. In *C. ferrugata* only the last three or four joints of the antennæ are black, the thorax has two dark bands, the elytral ridges are described as distinct, which is not the case in the present species, and there are two elytral well-marked bands, which are absent here but replaced by the spots at the middle of the elytra as is the case in *C. maculata* Klug. That species is, however, much smaller and differs in other detail; the specimens which I received from M. Deyrolle show no differences of any importance.

CHLAMYS DENTIPES, sp. n. (Plate XIV. fig. 5.)

Black and shining, the labrum, palpi, and the antennæ fulvous; thorax finely punctured, the posterior portion strongly raised and divided, the sides with two round tubercles; elytra with five highly raised tubercles, one at the base, one below and three near the apex, the intermediate space with high ridges of irregular shape, the suture dentate; the anterior tibiæ with a distinct tooth at the apex.

Length 3 millim.

Head sparingly but distinctly punctured, longitudinally sulcate between the eyes, the latter nearly divided by the intruding portion of the head, clypeus more closely punctured, labrum fulvous; antennæ fulvous, the terminal joints slightly darker, the basal joint stained with black above, the third joint very small, the fifth and the following two joints transversely widened, terminal joints of equal width, not dilated; thorax with the middle portion raised into two high round humps, each of which has a slight transverse sulcus anteriorly, the sides with two other strong and round tubercles, the entire surface shining, finely and sparingly punctured, the basal lobe broadly but not deeply triangularly emarginate; scutellum transversely subquadrate, smooth; elytra with a high conical tubercle at the middle of the base, a smaller one near the suture before the middle, an oblique ridge from the shoulders to the suture, where it ends in another high tubercle below the middle, this ridge sends off two short transverse costæ below the shoulders, the latter are likewise highly tuberculiform, near the apex two more strong tubercles are placed, and the preceding space shows some other short longitudinal ridges; below closely punctured, the abdomen with two small elevations at the sides; the legs comparatively long, the apex of the anterior tibiæ produced into a tooth, the tarsi broad, clothed with fulvous pubescence below; pygidium finely and closely punctured, shining, the base with two obsolete foveæ.

Hab. Brazil, Goyaz.

There will not be much difficulty in distinguishing this species; I know of no other similarly structured: the eyes are nearly divided in two halves, and the entire insect is of a deep and shining black colour and finely punctured; the tibiæ are elongate and distinguished by the tooth at the apex of the anterior pair.

CHLAMYS DEYROLLEI, sp. n. (Plate XIV. fig. 3.)

Subquadrate, broad and robust, below flavous, above fulvous, opaque, the posterior portion of the thorax moderately elevated, rounded and limited behind by a semicrescent of six tubercles, anteriorly strongly elevate-reticulate; elytra with about ten high flavous tubercles and a high short transverse curved ridge at the middle; abdomen with a feeble callosity at the sides.

Length 6 millim.

Head flat, finely rugose, flavous, the vertex and the base of the antennæ with a small obscure fulvous spot, antennæ entirely flavous; thorax flavous, with some small fulvous spots here and there, the middle portion raised into a rounded elevation and surrounded by a crescent of six strongly raised tubercles, which form a ridge at the posterior and lateral portion, the included space darker than the rest of the surface and strongly elevate-reticulate, which extends to the anterior margin, the sides simply rugosely punctate; scutellum with the apex strongly pointed; elytra simply tuberculate, finely punctured, the punctures dark brown, as well as some of the tubercles, these placed as follows:—a large one at the middle of the base and a smaller one near the scutellum, one below the latter near the suture, two below the shoulders, six below the middle, placed in two transverse rows, and another near the apex, which is connected with the preceding ones by a sinuate ridge near the lateral margins; at the middle of each elytron is a sinuate transverse short and strongly raised ridge, the suture is finely serrate at its posterior portion as is the case with most species of this group; pygidium finely reticulate, flavous, with an elongate depression near the apex at the sides; abdomen of the same colour and sculpturing, with a slight elevation at the sides of the first segment; legs slightly stained with fulvous.

Hab. Brazil, Goyaz (*Deyrolle*).

C. buqueti Lac. seems to be a more nearly allied species to the present insect than any other on account of the sculpture of the thorax, which is nearly the same; but Lacordaire describes this part as marked with black, of which there is no trace in the three specimens I have for examination; the elytra in *C. deyrollei* are also furnished with some tubercles and there is no oblique humeral ridge of which Lacordaire speaks; the elytral tubercles are very nearly placed at regular intervals and all are acutely raised.

Chlamys discipennis, sp. n. (Plate XIV. fig. 1.)

Subquadrate, broad, flavous, the thorax with two fulvous bands, strongly raised posteriorly, the top of the elevation tuberculate, the sides finely rugose; elytra with numerous flavous tubercles, the space below the scutellum, the sides, and the interior of all the punctures purplish brown.

Length 6 millim.

Head finely rugosely punctured, flavous as well as the antennæ, the fourth and the following joints of the latter transversely serrate; the thorax with the posterior portion strongly raised into a round hump, which is abruptly terminated behind, the top of the elevation is sulcate to a slight degree and each side terminates in a short ridge, which is provided with small but acutely raised tubercles; the sides of the thorax are finely rugose like the head and of flavous colour, but at each side of the elevation is a dark brown band, which extends indistinctly towards the anterior margin; scutellum flavous, impunctate; elytra subquadrate, with about ten small flavous tubercles, of which three or four are placed transversely below the base and the others near the apex, these tubercles are connected for the most part by strongly raised flavous ridges, which enclose a broad flat space below the scutellum of purplish-brown colour extending downwards below the middle, another more irregular band is placed at the sides, broken up into spots at its lower portion, which does not reach the apex, the rest of the surface is sculptured like the thorax, with the punctures of a dark brown colour; the pygidium is covered with longitudinal reticulations and has a central longitudinal ridge, the breast and abdomen are likewise strongly rugose and of a flavous transparent colour; the legs are of similar coloration.

Hab. Brazil, Goyaz (*Deyrolle*).

In coloration this species resembles somewhat *C. rubicunda* Koll. and allied forms, but may be known at once by the broad discoidal purplish space below the scutellum; the entirely flavous antennæ, the tubercles at each side at the top of the thoracic elevation and its two dark fasciæ, the design of the elytra, and, most characteristic of all, the highly flavous ridges of the elytra which connect their tubercles will separate the species from any other. I may further add that in regard to the above ridges, those most prominent run from the shoulders to below the middle, where a small tubercle is placed at the sides and near the suture in a transverse line, the rest of the tubercles are situated near the apex at the base. There are four specimens before me, which scarcely show any variation.

Chlamys brasiliensis, sp. n.

Flavous below, above obscure dark greenish, opaque; thorax closely and finely punctured, the posterior portion strongly raised, deeply sulcate; elytra finely and very remotely punctured, without tubercles, the usual ridges distinct, transversely connected at and below the middle, the intermediate spaces depressed; legs flavous, spotted with black.

Length 4 millim.

Head distinctly but finely punctured at the vertex, flat, the emarginate portion of the eyes and the labrum and palpi flavous; antennæ with the fifth and following joints transversely dilated, blackish, the lower five joints flavous, the second and the following three joints small; thorax strongly raised at the middle, the elevated portion sulcate at the top, the sides of the elevation in shape of obsolete ridges, when viewed sideways, closely punctured like the rest of the surface, the interstices not raised nor reticulate, of an opaque blackish-green colour; scutellum impunctate; elytra constricted below the shoulders, the suture finely serrate throughout, each elytron with a short longitudinal ridge near the suture, another one from the middle of the base to the apex, where it curves round towards the lateral margin, and a third ridge from the shoulder to the middle, where it joins the second one, other short transverse ridges connect the longitudinal ones before and below the middle, the interstices between them appear excavated and are all sparingly punctured, the colour is that of the thorax; below bright flavous, the anterior femora and their tibiæ with some black spots; pygidium flavous, obsoletely punctate.

Hab. Rio Janeiro.

This species is not difficult to recognize on account of its coloration, which would place it in Lacordaire's 5th group; it quite differs, however, in structural characters, as the antennæ are only transversely dilated from the sixth joint onwards, and there are no tubercles visible at the elytra, only ridges.

Chlamys insularis, sp. n.

Pale flavous, the punctures piceous, thorax with the posterior portion raised into a rounded, undivided elevation; elytra with about ten small tubercles, the ridges obsolete.

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

Head rather sparingly punctured, the vertex with a small black spot; antennæ with the fifth and following joints thickened and transverse, the lower joints flavous, the terminal ones fuscous (the apical joint wanting); thorax irregularly punctured in patches, the punctures of piceous colour, the posterior portion raised into a round hump, which is more crowded with black punctures than the rest of the surface, at the sides two or three small obsolete tubercles are placed; elytra remotely impressed with dark punctures, without ridges, the basal margin near the scutellum deep black, each elytron with about ten small tubercles, one at the middle of the base, another (obsolete) on the shoulders, three placed transversely before the middle, one close to the suture below the middle and more strongly raised than the others, another tubercle near the lateral margin and in a transverse line with the preceding one, lastly one near the apex near the suture and two very obsolete tubercles still nearer to the apex at the sides, the interstices between these latter tubercles are slightly costiform, the suture finely serrate throughout; pygidium somewhat rugose and spotted like the rest of the surface with dark punctures; below and the legs flavous, strongly punctured, the tibiæ with a small obsolete piceous spot at the middle.

Hab. Haiti.

Chlamys cordovensis, sp. n. (Plate XIV. fig. 7.)

Obscure cupreous, the labrum and the antennæ fulvous; posterior portion of the thorax raised into two high elevations, acutely ridged at the apex and preceded by another rounded callosity at each side, sparingly punctured; elytra with three tubercles at the base and four or five near the apex, sparingly punctured; pygidium metallic cupreous, remotely punctured.

Length 3 millim.

About one half longer than broad; the head opaque, obscure cupreous, finely rugosely punctured, longitudinally depressed at the middle; eyes very deeply but narrowly notched; labrum fulvous; antennæ fulvous, the basal joint cupreous above, the third and following joints gradually transversely widened; thorax sculptured like the head, the basal portion highly raised into two ridges of oblique direction, the inner depression finely strigose in different directions, the sides of the elevations swollen, forming a callosity, near the lateral margins are two less distinctly marked swellings, the entire surface is finely granulate and sparingly punctured; scutellum finely rugose or granulate, not broader than long; elytra slightly constricted at the sides near the middle, the usual elongate ridges almost absent, the base with three tubercles, one representing the humeral callus, another at the middle of the base, both highly raised, and a small tubercle near the scutellum, another small tubercle is also placed near the suture before the middle, six other more or less highly raised tubercles occupy the posterior portion of the elytra, the intermediate spaces are sparingly but rather deeply punctured, but anteriorly some slight ridges are seen which connect partly some of the tubercles, the suture is finely crenulate for two thirds its length; the pygidium is of a much more bright cupreous gloss than the rest of the surface and is longitudinally sulcate near the margins, two small foveæ are also seen at the basal portion, the rest of the disc is sparingly punctured and shining; the entire underside is closely and finely foveolate-punctate, the legs extremely finely punctured and of the same sombre cupreous colour.

Hab. Argentine R., Cordova.

The acute and ridge-like elevations of the thorax, the absence of elytral costæ, and the metallic cupreous pygidium distinguish this species from any other of similar coloration and size.

Chlamys clypeata, sp. n. (Plate XIV. fig. 6.)

Fulvous; thorax with the middle portion raised, rounded, the surface rugosely reticulate, with four small black spots; elytra deeply punctured, the anterior half piceous, the rest fulvous, the disc with the usual strongly raised ridges, without tubercles.

Mas. The head smooth and shining, the clypeus with a long triangular spike at each side.

Length 5 millim.

Mas. Head entirely impunctate, flavous, shining, the vertex with two short pointed teeth, the clypeus with a long spike at each side, which is strongly widened at the base; antennæ entirely fulvous; thorax with the middle portion strongly raised, round, the posterior portion with a short sulcus at the middle, the entire surface finely reticulate-rugose, with four small black spots, two at each side; scutellum piceous, smooth; elytra with two strongly raised ridges near the suture, which are joined at the middle by a short transverse ridge, two other short costæ are placed at the sides from the base to below the shoulders, the posterior portion of the elytra is also furnished with some short transverse costæ, the interstices deeply punctured, the suture finely serrate throughout; the pygidium longitudinally strigose and finely punctured; the abdomen nearly similarly sculptured; the breast strongly punctured.

Hab. Brazil. (Collection British Museum and my own.)

The male of this species differs from every other in the two large spikes of the clypeus, which are entirely absent in the female; there is otherwise no other difference of importance in the sexes; the entirely smooth, shining, and impunctate head is another character of rare occurrence in members of this group.

Chlamys boliviana, sp. n. (Plate XIV. fig. 2.)

Flavous or fulvous, the base of the head, a spot at the anterior part of the thorax, and the legs black, the middle portion of the thorax feebly raised; elytra foveolate-punctate, the anterior portion with acute oblique ridges and transverse shorter ones at the middle, black, followed by a narrow transverse flavous band, the apex also black.

Length 6 millim.

One of the handsomest and most easily recognizable species of the family, of subquadrate robust shape, the vertex of the head finely rugose and black, the eyes nearly divided in half by the intruding portion of the sides of the head, the lower portion of the face flavous, the anterior margin of the clypeus and the labrum black, antennæ black; thorax strongly narrowed anteriorly, the sides straight, the posterior portion of the middle of the disc raised into a feeble hump bounded at the sides by a shallow oblique groove, the space near the lateral margins with another very slight elevation, the entire surface finely and evenly rugose, reddish fulvous or flavous with a broad, subquadrate, black patch at the middle of the anterior portion, the extreme basal margin likewise narrowly black; scutellum impunctate; elytra sculptured like the majority of species and in the following way:—a strongly raised oblique sinuous ridge from the shoulders to the suture below the middle, where it terminates in a short transverse ridge and runs upward again towards the base, marked in its way by two more distinctly raised tubercles, another tubercle is placed at the middle of the base and continues downward in another feeble ridge which joins the oblique one at the middle, at this place a third ridge runs downward and is lost towards the apex, all these ridges include foveolately punctured spaces, but there are no tubercles at the apical portion of the elytra; the latter may be described as black, with a very regular transverse flavous band near the apex; below fulvous, finely rugose, the legs and part of the sides (more or less) black; the pygidium flavous, similarly sculptured at the lower portion.

Hab. Bolivia.

Of this handsome insect I received two specimens from Dr. Staudinger. I know of no other species of *Chlamys* with which to compare it.

Chlamys amazonica, sp. n. (Plate XIV. fig. 4.)

Subquadrate, light red; the head, the anterior angles of the thorax, and the tarsi flavous; thorax rugose-punctate, slightly raised posteriorly, the middle with two points; elytra without tubercles, with four strongly raised ridges, the interstices strongly punctured.

Length 5 millim.

Head finely rugose, flavous, as well as the palpi and the basal joints of the antennæ (the other joints wanting); thorax with the basal portion raised in a triangular-shaped elevation ending in two points at the middle of the posterior margin, the top of the raised portion with a short sulcus posteriorly and bounded at the sides by another oblique sulcation which does not extend to the middle of the thorax; the sides of the latter and the entire surface finely reticulate or rugose, the extreme anterior margin and the anterior angles flavous, the rest bright reddish; scutellum smooth;

elytra sculptured like the thorax but rather more strongly so, with the usual four ridges strongly marked, of which the first and second are connected by a transverse ridge below the middle, the third runs parallel with the second and commences at the middle of the base, it is likewise connected with the fourth ridge by a transverse costa below the base, less strongly marked than the first transverse ridge; pygidium flavous, reticulate throughout; abdomen and legs reddish, sculptured like the pygidium; the tarsi broad, flavous.

Hab. Amazons, Cavallo-Cocho (my collection).

This is a species of easy recognition on account of the absence of any elytral tubercles and the bright red coloration. *C. kermes* agrees in this respect with the present species, but has distinctly tuberculate elytra. Klug has described and figured a species under the name of *C. granulata* which seems to come very near to the one here described; but Lacordaire, who gives a more detailed description of it under the name of *C. gysseleni* Koll., speaks of tubercles and numerous other elytral obscure ridges of which I can see no trace; he also gives the length as 1½ line, while Klug says 2 lines as the size of his species; the structure of the thorax also differs, inasmuch as *C. gysseleni* has no sulcus at the top of the elevation.

CHLAMYS TUBERCULICOLLIS, sp. n.

Bluish or violaceous black, the head, the anterior part of the thorax (more or less), and the anterior legs fulvous; thorax with a truncate elevation, bituberculate in front; elytra rugose-punctate, with a strongly raised subsutural, sinuate ridge joined to a straighter ridge from the base to the apex, the latter with two tubercles; legs spotted.

Length 3–3½ millim.

Of elongate and parallel shape, the head finely rugose and punctured, flavous, the extreme vertex blackish; antennæ flavous, the apical joints slightly darker, third and fourth joints comparatively thin and elongate, the others but slightly thickened for this genus; thorax with the middle portion strongly raised, the top truncate, strongly rugose, the anterior portion terminating in two compressed tubercles of large size, between which a smaller one is placed, the sides likewise furnished with two small callosities, the anterior margin more or less flavous, the rest of the surface violaceous black, the posterior margin in front of the scutellum truncate, the latter impunctate; elytra with the suture crenulate throughout, the ridges strongly raised, the first strongly sinuate, is placed near the suture, where it joins the second ridge below the middle, this latter is nearly straight and commences as usual at the middle of the base, at its middle it sends off a short transverse branch which unites with the fourth ridge near the lateral margins, the third ridge runs close and parallel to the second for a short distance below the middle; below the point of juncture with the first, the second ridge again curves round to the suture, enclosing an oblong cavity; an elongate tubercle at the apex near the suture and another smaller one near the margin complete the sculpture of the elytra, which are closely punctured and of a violaceous black colour; the pygidium and the underside are rugosely punctured, the anterior legs nearly entirely fulvous, the posterior ones more or less stained with black, the tarsi are broad and transverse.

Hab. Brazil, Goyaz (*Deyrolle*).

This species must surely be closely allied to *C. lima* Lac. and several others contained in that section, but does not agree with either of them; the elongate shape and the coloration are similar to those of *C. elongata*, but it is a very much smaller species and the sculpturing of the thorax is quite different. In *C. lima* the latter part is likewise provided with three tubercles, but they are placed at the sides and not in front; the elytra in the last-named species are likewise provided with six tubercles, while here no tubercles are visible except near the apex and the ridges are very distinct and acute; the general colour is not black, but bluish or violaceous. In one of the specimens the thorax shows no trace of fulvous except at the apex of the two frontal tubercles; if looked at sideways, its elevated portion ends in a somewhat triangular ridge posteriorly.

CHLAMYS PERUANA, sp. n.

Obscure cupreous, the antennæ and tarsi fulvous; thorax with the middle portion strongly raised, canaliculate at the top with transverse ridges, sparingly punctured and finely strigose; elytra deeply and sparingly punctured, the suture entirely smooth, the disc with some strong tubercles, notably two transverse ones at the middle and four or five near the apex.

Length 3 millim.

Head with a longitudinal depression at the vertex, scarcely punctured and finely strigose; antennæ pale fulvous, the last six joints thickened but not very strongly transverse; thorax with the middle portion strongly raised into a round elevation, the middle of which is canaliculate and bounded laterally at the posterior portion by acute ridges (if viewed sideways), which extend downwards at the sides in a kind of network, a slight callosity is also visible between the elevation and the lateral margins, the interstices are very sparingly punctured but finely strigose, the anterior margin is also accompanied by a row of distinct punctures; scutellum of usual shape, strongly transverse; elytra subquadrate, scarcely constricted at the middle, each elytron with two short longitudinal ridges (near the suture and at the middle), which are joined at the middle in shape of a semicircle, forming strongly raised acute tubercles; if looked at sideways, another compressed ridge runs from the middle to the apex, where it ends in three or four highly raised tubercles, the interstices are strongly but remotely punctured and, like the other parts, finely strigose; the underside and legs very obscure cupreous, the breast strongly punctured, the abdomen with a tubercle or callosity at the sides, the pygidium with a deep sulcus at the sides and a feeble central ridge, the apex of the tibiæ and tarsi more or less fulvous.

Hab. Peru.

A small species, principally distinguished by the very highly raised and deeply canaliculate posterior portion of the thorax in connection with the obscure general cupreous colour.

CHLAMYS INDICA, sp. n. (Plate XIV. fig. 9.)

Subquadrate and broad, black, opaque; the basal joint of the antennæ, the labrum, the anterior femora, and the tarsi fulvous; thorax finely rugose, the middle portion but moderately raised with longitudinal sinuate ridges; elytra more strongly rugose, with a central transverse and compressed tubercle at the middle and another below the latter, and some longitudinal short tubercles at the base and near the apex; pygidium tricarinate.

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

Head flat, variegated with black and fulvous, closely and finely punctured, each puncture provided with a short yellow hair; labrum and palpi fulvous; antennæ fuscous, the basal joint fulvous; thorax very closely punctured, the sides with a small callosity, the middle portion very moderately and obliquely raised, narrowly sulcate at the top of the posterior portion, with two sinuate but little raised ridges running downwards at each side towards the anterior margin, the inner one of them forms the limit of the median sulcus above; scutellum finely carinate; elytra with the suture crenulate throughout, the middle of the base with a compressed tubercle, a sinuate ridge runs parallel with the suture from the base and ends below the middle in another strongly raised transverse tubercle, a similar tubercle precedes the latter one at the middle of the outer disc and forms a ridge which extends upwards to the shoulders, a third and less strongly marked ridge is placed near the lateral margins, the apical portion of the elytra is occupied by another semicircular strong ridge, which is highly raised near the suture, from where it turns outwards and is lost near the margins, the interstices between all these ridges are strongly rugose or uneven; the breast closely rugose-punctate, the anterior femora and the tarsi fulvous, the pygidium with a central and a lateral sinuate ridge, finely punctured.

Hab. India orient.

Allied to *C. fulvipes* Baly, likewise from India, but larger, the head pubescent, the sculpturing of the elytra quite different as well as the colour of the legs.

CHLAMYS SUMATRANA, sp. n.

Elongate, black, the head and thorax closely and finely reticulate-rugose, the basal portion of the latter feebly raised, not divided, more strongly transversely rugose; elytra closely and deeply foveolate-punctate, with a single distinct tubercle at the apex near the suture, the latter finely crenulate; pygidium finely rugose.

Length 4 millim.

Of rather elongate, medially constricted shape, the head entirely and closely rugose, the anterior portion obscure fulvous, the rest black; eyes deeply and elongately notched; antennæ obscure dark fulvous; thorax with the posterior portion gradually raised into a round elevation, the latter not sulcate but more strongly reticulate-rugose than the rest of the surface and of a deeper black colour, the sides and the anterior margin very obsoletely stained with fulvous; scutellum impunctate, strongly transverse; elytra very closely and deeply punctured, with a very obsolete ridge from the middle of the base to the apex, where it ends near the suture in a tubercle of moderate size, there are traces of other ridges also at the sides but they are very indistinct, and the whole surface presents more the appearance of reticulations in different directions; pygidium of oval shape, the margins acutely raised, the surface rugose; entire under surface and the legs finely rugose, of more piceous or paler colour than above.

Hab. West Central Sumatra.

From the Malayan region only two or three species of *Chlamys* are known, which quite differ in sculpturing from the present insect, described from a single example in my collection.

Besides the species already mentioned, I have added to the drawings accompanying this paper figures (Plate XIV. figs. 10–12) of three other well-marked species of *Chlamys* from Brazil. These are:—

C. hirta Kollar, Mon. Chlam. p. 7.
C. luteola Germ. Ins. Spec. nov. p. 554.
C. smaragdina, Klug, Entom. Monogr. p. 154.

These and most of the other species have also been well described in Lacordaire's Monograph of the Phytophagous Coleoptera (vol. ii. p. 649).

EXPLANATION OF PLATE XIV.

Fig. 1. *Chlamys discipennis*, p. 156.
2. " *boliviana*, p. 159.
3. " *deyrollei*, p. 155.
4. " *amazonica*, p. 160.
5. " *dentipes*, p. 154.
6. " *clypeata*, p. 159.
7. " *cordovensis*, p. 158.
8. " *lacordairei*, p. 153.
9. " *indica*, p. 163.
10. " *hirta*, p. 164.
11. " *luteola*, p. 164.
12. " *smaragdina*, p. 164.

March 5, 1901.

W. T. Blanford, Esq., LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of February 1901:—

The total number of registered additions to the Society's Menagerie during the month of February was 118, of which 38 were by presentation, 27 by purchase, 4 were received in exchange and 49 on deposit. The total number of departures during the same period, by death and removals, was 139.

Among the additions special attention may be called to:—

(1) An August Amazon (*Chrysotis augusta*) from Dominica, obtained by purchase on February 11th. Upon one occasion only have we previously received a living example of this fine bird, viz. on May 12th, 1865 (see P. Z. S. 1865, p. 437). We have now no less than three of these rare Antillean Parrots represented in the Society's Collection, viz., *Chrysotis versicolor*, from St. Lucia (received Oct. 2, 1900), *C. bouqueti*, from Dominica (obtained Oct. 31, 1900), and the present species *C. augusta*.

(2) A Guinea-fowl obtained from Rabat, Morocco, and presented to the Society by G. E. Neroutsos, Esq., H.B.M. Vice-Consul at that Port, on February 15th.

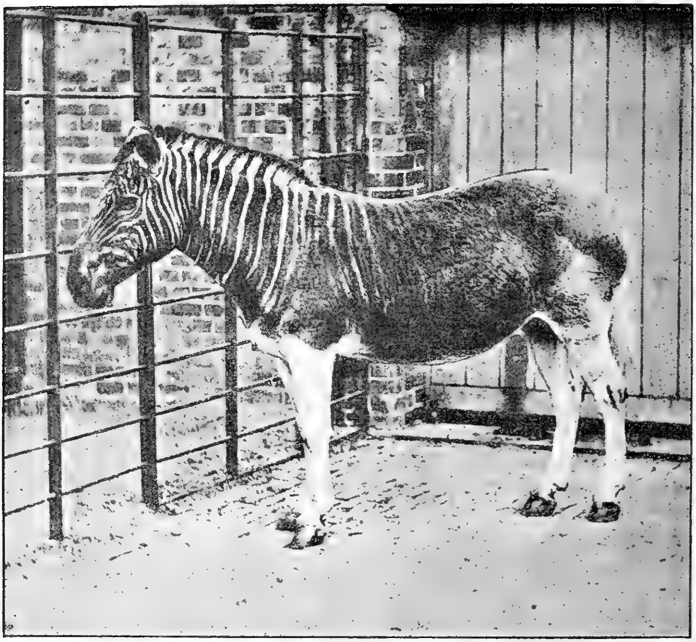
When staying at Tangier in October last I was informed of the occurrence of a wild Guinea-fowl in the vicinity of Rabat, and requested the assistance of Mr. H. E. White, C.M.Z.S., H.B.M. Consul, to obtain specimens for the Society. Mr. White kindly wrote to Mr. Neroutsos on the subject, and, after several ineffectual shipments, we have, through his kindness, received a single specimen. I was hoping that, from the locality, it would turn out to be something new, but so far as I can tell at present, it appears to be nothing more than the ordinary *Numida meleagris*. However, the locality, so far as I know, is a new one for this bird, unless, as is possible, it may have been introduced, as has been the case in some of the Cape de Verde Islands.

Several enquiries having been made as to the specimens of the Quagga (*Equus quagga*) that have lived in the Society's Menagerie, I may state that, on looking into the books, I can only discover records of three Quaggas having been received, as follows:—

1. Purchased Nov. 5th, 1831. There is no record as to the death of this animal, but it may probably be the same specimen that was afterwards in the Society's Museum. See Waterhouse's Cat. of Mamm. p. 37 (1838).
2. *Female.* Purchased March 15th, 1851. Died July 7th, 1872. The specimen was sold to Mr. E. Gerrard, and is now in the Zoological Museum at Tring. Of this animal I exhibit a photograph taken in the summer of 1870 by Messrs. York and Son (see text-fig. 47, p. 166).

3. *Male.* Presented by H.E. Sir George Grey, K.C.B., F.Z.S., Sept. 4th, 1858. Died June 10th, 1864. The skin and skeleton of this specimen are now in the British Museum.

Text-fig. 47.



Female Quagga, 1870.

Mr. Arthur Thomson, the Assistant-Superintendent of the Gardens, laid on the table a series of various Insects reared and exhibited in the Insect House in the Society's Gardens during the past year, and read the following report on the subject:—

Report on the Insect-house for 1900.

The following is a list of the Lepidoptera exhibited in 1900:—

Silk-producing Bombyces and their Allies.

Asiatic.

Attacus atlas.
—— *cynthia.*
Antheræa yama-mai.
Actias selene.
Rhodia fugax.
Caligula japonica.

American.

Samia cecropia.
—— *ceanothis.*
*—— *euryalus.*
Actias luna.
Telea polyphemus.
—— *promethea.*
Eacles imperialis.

Diurnal Lepidoptera.

European.

Papilio machaon.
Thais polyxena.

American.

Papilio asterias.
—— *ajax.*
—— *cresphontes.*
Limenitis disippus.
—— *ursula.*

Nocturnal Lepidoptera.

Acherontia atropos.
Deilephila euphorbiæ.
—— *elpenor.*
Smerinthus modestus.
Anisota stigma.
—— *rubicunda.*

Of the Lepidopterous Insects which I have the honour to place before the meeting, *Samia euryalus* is the only species of which examples are exhibited for the first time. This species was described and figured by Strecker in his 'Lepidoptera' (plate xii. fig. 2). In the British Museum Collection, this species is separated from *Samia californica*, but Mr. Kirby in his Catalogue has given both *S. euryalus* Streck. and *S. ceanothis* Berg as synonyms of *S. californica* Grote. The cocoons, I may say, were sent to me as those of *Samia gloveri*.

Orthoptera.

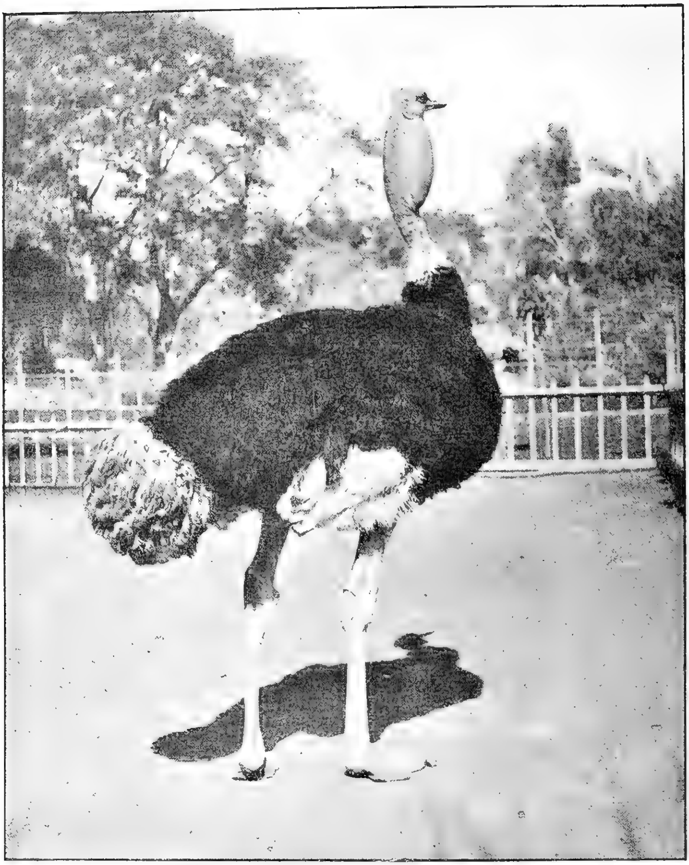
**Phymateus stolli.*
Acridium ægyptium.
Empusa capensis.

* New to the Collection.

On the 9th of May last we received a very beautiful and interesting Locust (*Phymateus stolli*). This Locust was captured by Mr. Sydney A. M. Fisk, C.I.V., near Belmont, on the Orange River, on the 31st March, 1900, and was forwarded by him to his parents, by whom it was kept a month, before it was presented to the Society. It fed well upon grass, lettuce, &c., and lived till the 1st of July. I exhibit the specimen this evening together with a coloured drawing taken from life, and also a photograph. I also exhibit a specimen of another Locust, *Acridium ægyptium*. This was sent to the Gardens by a fruiterer who found it amongst some fruit received from "Italy."

On the 16th of June we received a Mantis in the larval stage from South Africa, presented by Mr. W. L. Sclater, F.Z.S., of the South African Museum, Cape Town. This species, Mr. Kirby says, is "probably *Empusa capensis*, but there are several closely allied species not very well made out."

Text-fig. 48.

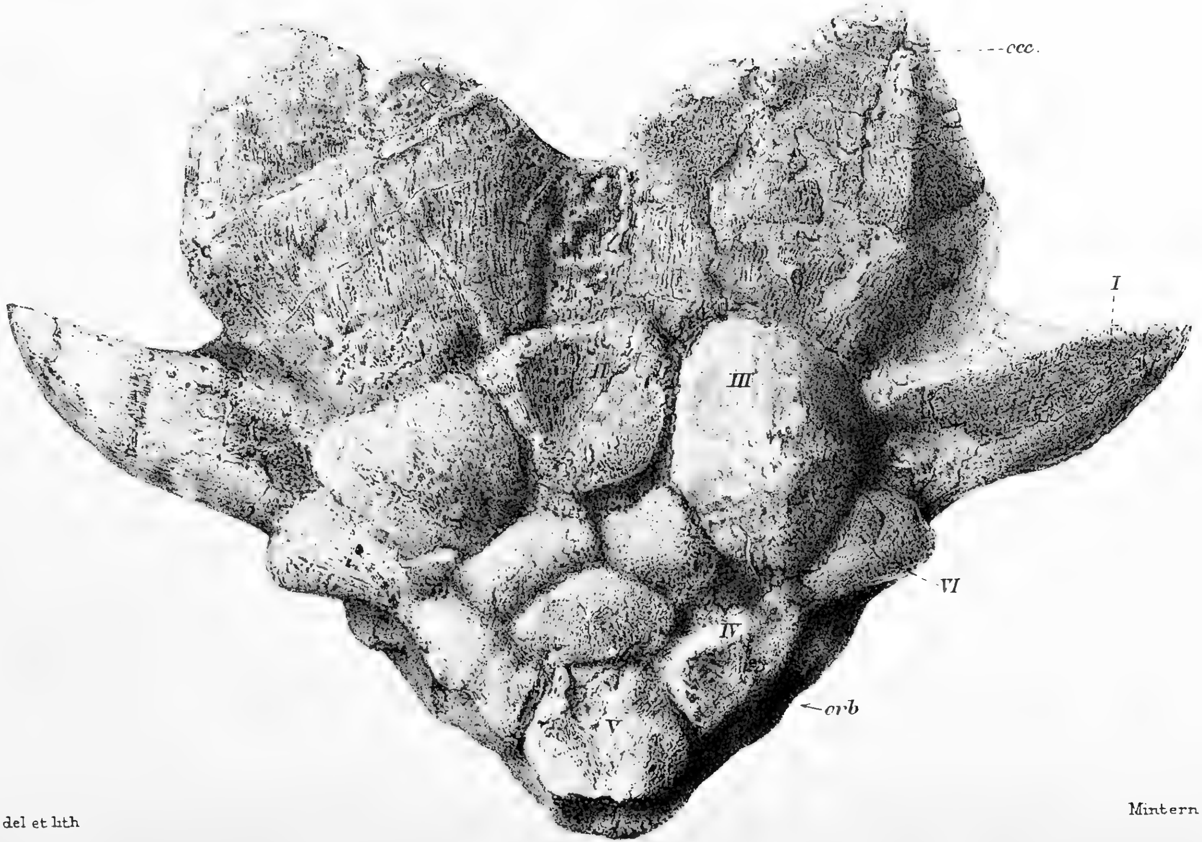


Male Ostrich with vocal sac extended.

During the night of July 23rd, the Mantis changed to the perfect state, and I exhibit this evening the specimen (which died early in September) together with its cast skin, and also a coloured drawing of the perfect insect taken from life.

Amongst other insects exhibited during the past season was a specimen of *Galeodes lucasi*, a species of False Spider, brought from the Soudan and presented by Mr. H. F. Witherby, F.Z.S., on the 6th of June. This curious creature did not feed very well and died early in the following month. I exhibit a photograph of it taken soon after its arrival.

In October 1898, Mr. H. R. Taylor presented to the Society a

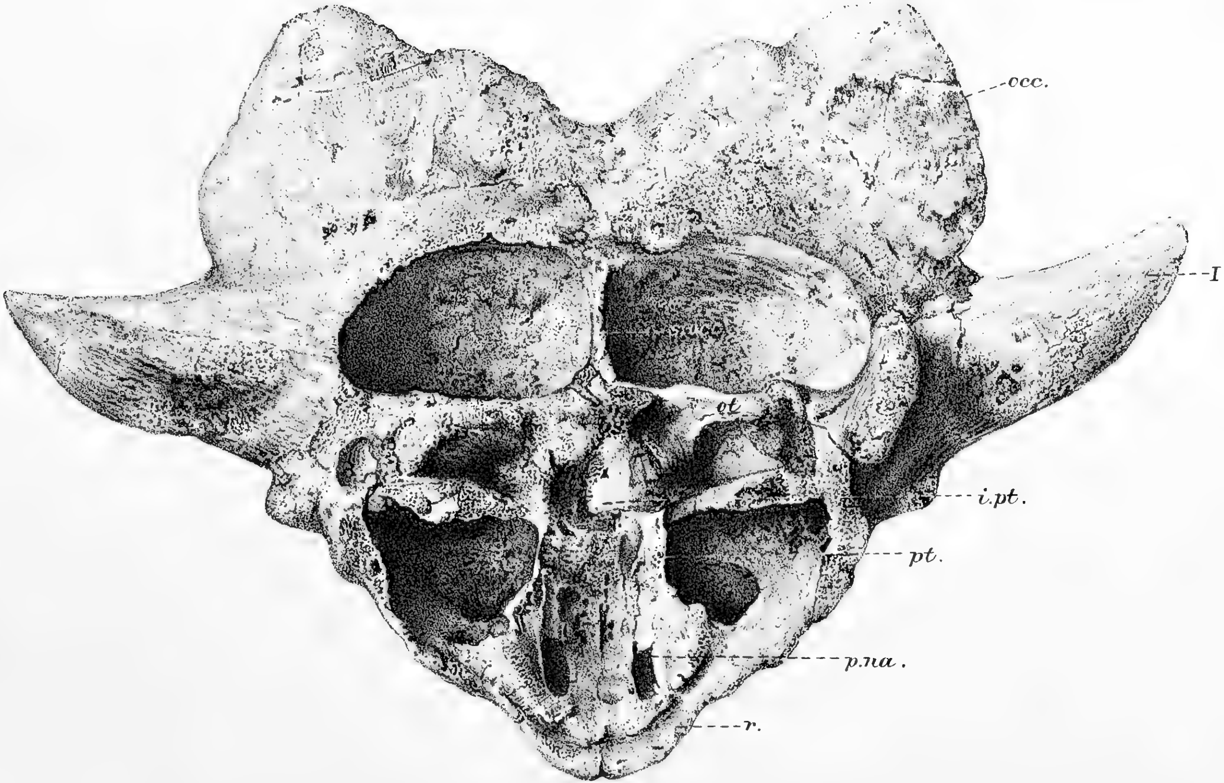


J Green del et lith

Mintern Bros. imp

MIOLANIA ARGENTINA.

Cranium upper aspect. ⅓ nat size.

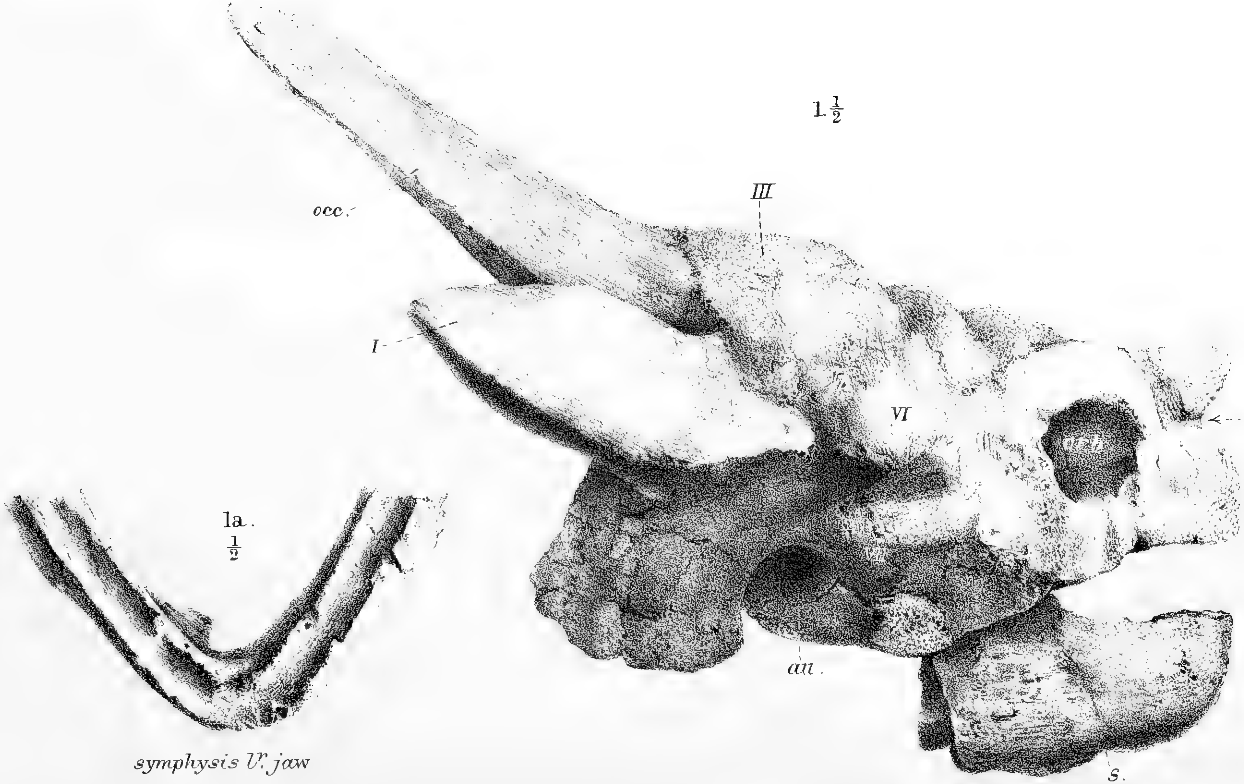


J. Green del. et lith.

Mintern Bros. imp.

MIOLANIA ARGENTINA.

Cranium lower aspect. ⅓ nat size.



J. Green del. et lith.

Mintern Bros. imp.

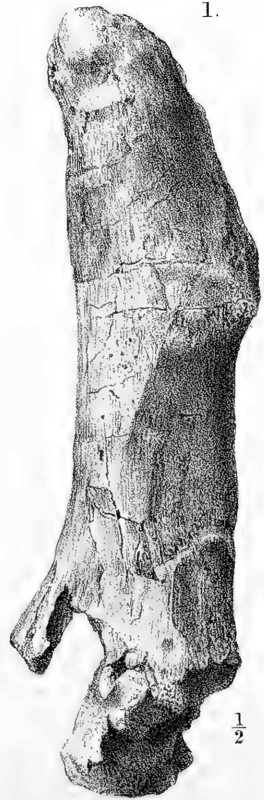
MIOLANIA ARGENTINA.

Profile of skull, &c. ½ nat. size.

3.

1/2

1.



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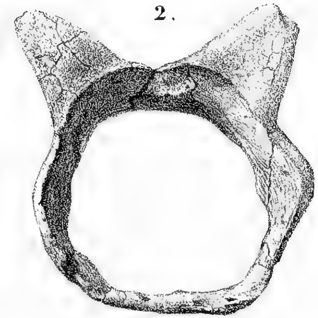
2.



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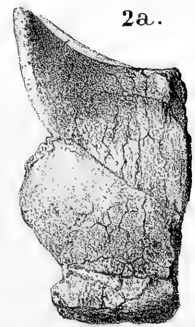
2a.



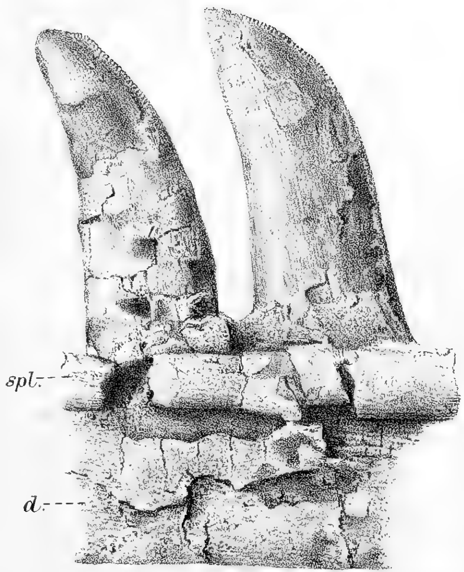
1/3

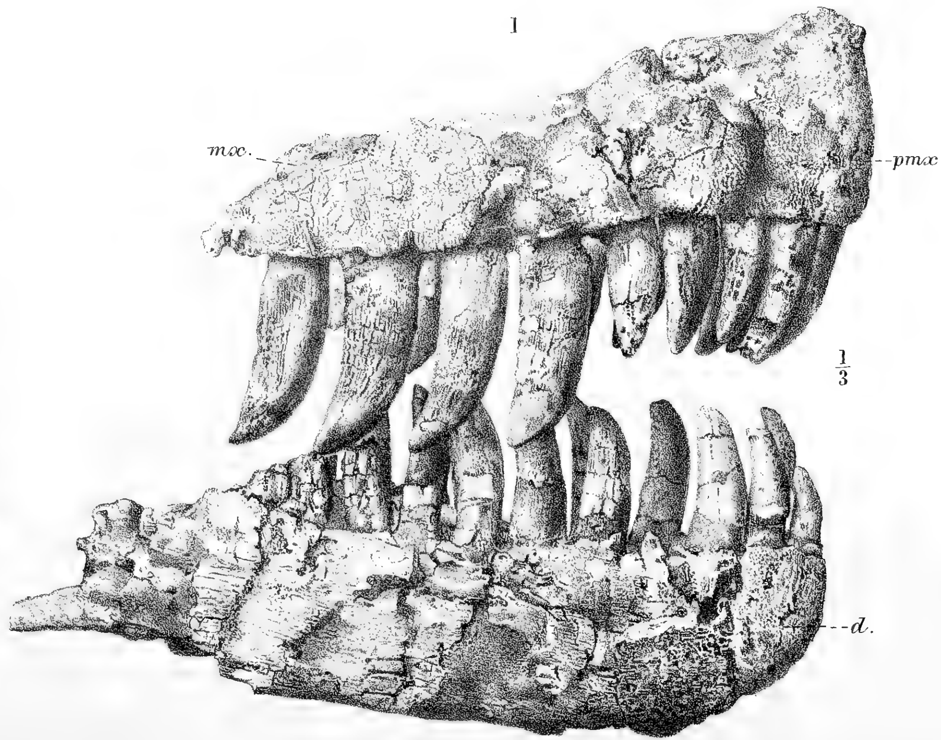
J. Green del. et lith.

Mintern Bros. imp.

1.2. MIOLANIA ARGENTINA.

3. GENYODECTES SERUS.

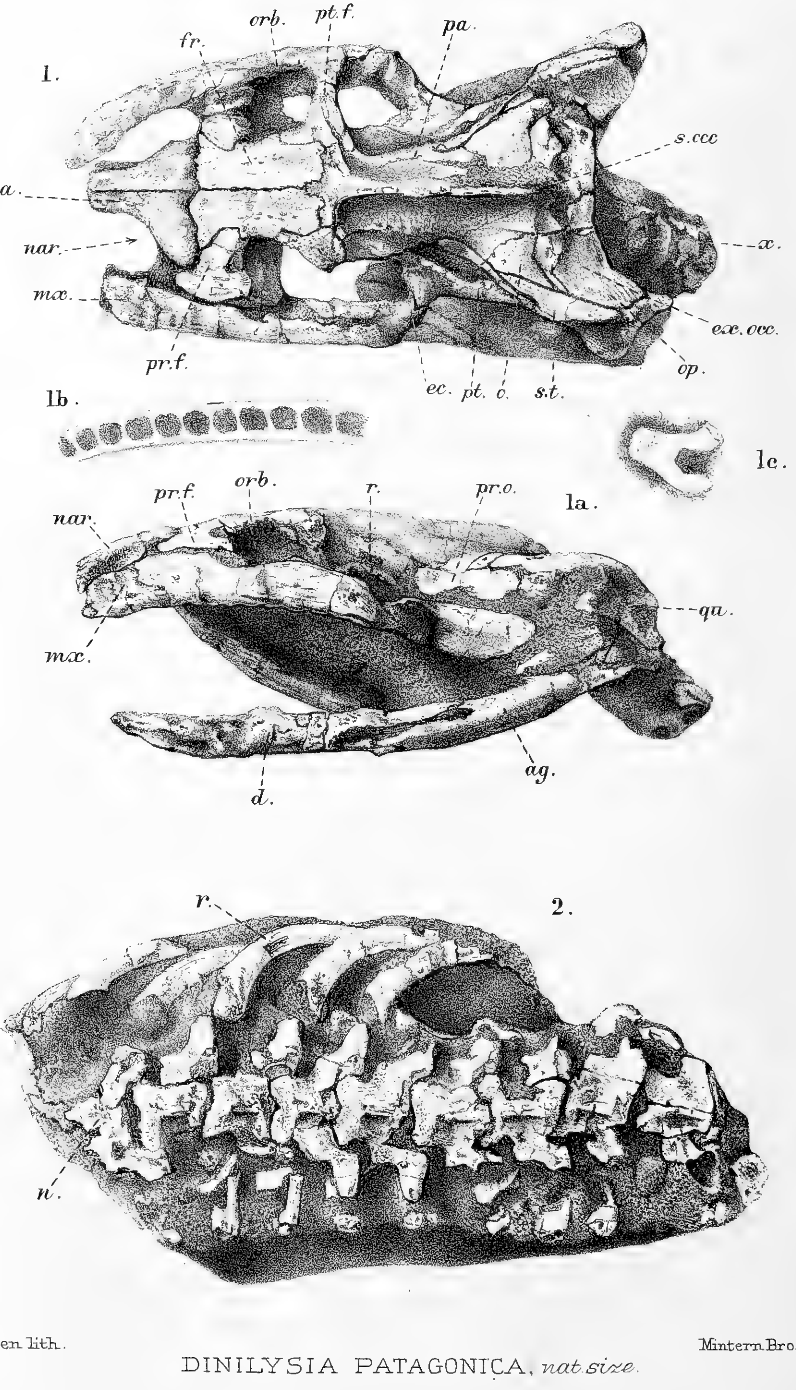




J.Green del. et lith.

GENYODECTES SERUS.

Mintern Bros. imp.



J. Green lith.

Mintern Bros. imp.

DINILYSIA PATAGONICA, *nat. size.*

specimen of one of the large Bird-catching Spiders (*Avicularia*). This Spider did well up to the end of August last, when it died soon after casting its "skin." This skin, which is perfect, I exhibit. The Spider itself was so soft when it died that I could not set it.

The process of casting the "skin" amongst the large Spiders is a very trying one, and most of the specimens we have had have died during the process or soon after.

On behalf of Captain Stanley Flower, F.Z.S., Mr. Sclater exhibited photographs of three fine animals living in the Zoological Garden at Ghizeh, taken by Captain F. H. Mackenzie, of the Army Pay Department. Mr. Sclater remarked that the photo of the young female Giraffe (*Giraffa camelopardalis typica*) and that of the young male White Oryx (*Oryx leucoryx*) represented the specimens brought by Captain Flower from the Soudan last year; the photo of the fine adult male Ostrich was of special interest as showing the vocal sac (text-fig. 48, p. 168) as extended in the breeding-season.

On behalf of Dr Einar Lönnberg, two photographs of the largest skull of the East Greenland Musk-ox obtained during Mr. G. Kolthoff's expedition were exhibited. The dimensions of the specimen were:—

Basal length	460 millim.
Greatest orbital length	280 ,,
Greatest occipital width	187 ,,
Length of boss of each horn........	205 ,,

The following papers were read:—

1. On some Extinct Reptiles from Patagonia, of the Genera *Miolania*, *Dinilysia*, and *Genyodectes*. By A. Smith Woodward, LL.D., F.R.S., F.Z.S.

[Received March 1, 1901.]

(Plates XV.–XX.[1])

To the north of Patagonia there is a widely distributed formation of red sandstone, supposed to be of Cretaceous age, containing important remains of extinct Reptiles in association with equally remarkable fragments of extinct Mammals. Many of these fossils have been skilfully collected by Mr. Santiago Roth for the La Plata Museum; while some of them, belonging to gigantic Dinosaurs and small Mesosuchian Crocodiles, have already been the subject of illustrated monographs[2]. A few of the most

[1] For an explanation of the Plates, see p. 183.

[2] R. Lydekker, "The Dinosaurs of Patagonia," Anales Mus. La Plata—Paleont. Argentina, no. ii. (1893). A. Smith Woodward, "On two Mesozoic Crocodilians, *Notosuchus* (genus novum) and *Cynodontosuchus* (genus novum), from the Red Sandstones of the Territory of Neuquen," *ibid.* no. iv. (1896).

important reptilian fossils, however, still await description; and Dr. F. P. Moreno, Director of the La Plata Museum, has kindly entrusted them to me for detailed study, of which the results appear in the following pages. The new specimens represent a species of the extinct armoured Chelonian *Miolania*; an undescribed extinct genus of Ophidians; and a large carnivorous Dinosaur.

I. An armoured Chelonian, *Miolania argentina*. (Plates XV.–XVIII.)

In the autumn of 1898, Mr. Santiago Roth sent me a photograph of a bony ring of a tail-sheath from the red sandstone of Chubut, which Dr. Moreno and he regarded as most closely resembling the caudal armour of the extinct Australian Chelonian, *Miolania* [1]. Early in 1899, Dr. Moreno brought the actual fossil to London for comparison with the original specimens from Queensland and Lord Howe's Island, now in the British Museum, with the result that his determination of the Patagonian fragment seemed to be confirmed. Microscopical sections, however, failed to prove identity, probably because the structure of the tissue of the new specimen was not well preserved. Dr. Moreno therefore sent another expedition under Mr. Roth to the locality whence the caudal ring was obtained; and this party was so fortunate as to find and disinter not only the skull and mandible, but also considerable portions of the carapace of a similar animal. A preliminary notice of this discovery was published in September 1899 by Dr. Moreno [2], who sent the original specimens for exhibition to the Dover Meeting of the British Association [3]. At the same time Dr. Florentino Ameghino [4] briefly recorded a similar discovery said to have been made by his brother Carlos Ameghino in the Guaranitic Formation of Sehuen and Chubut. He also placed his specimens in the family Miolaniidæ, but in a new genus and species, *Niolamia argentina*; although no detailed description was given to justify this arrangement.

Skull and Mandible.

The skull (Plates XV.–XVII.) is much depressed and triangular in shape, with the temporal fossæ completely roofed by bone, the orbits far forwards, and the single large narial opening terminal.

[1] R. Owen, "Description of Fossil Remains of two Species of a Megalanian Genus (*Meiolania*) from Lord Howe's Island," Phil. Trans. 1886, pp. 471–480, pls. xxix., xxx. Also "On Parts of the Skeleton of *Meiolania platyceps*, Owen," *ibid.* 1888 B, pp. 181–191, pls. xxxi.–xxxvii. A. Smith Woodward, "Note on the Extinct Reptilian Genera *Megalania*, Owen, and *Meiolania*, Owen," Ann. Mag. Nat. Hist. [6] vol. i. (1888), pp. 85–89.

[2] F. P. Moreno, "Note on the Discovery of *Miolania* and of *Glossotherium* (*Neomylodon*) in Patagonia," Geol. Mag. [4] vol. vi. (1899), pp. 385–388.

[3] F. P. Moreno and A. Smith Woodward, "Exhibition of and Remarks on a Skull of the extinct Chelonian *Miolania* from Patagonia," Rep. Brit. Assoc. 1899 (1900), p. 783.

[4] F. Ameghino, Sinopsis Geologico-Paleontologica—Suplem. (1899), p. 10.

Its peculiar contour is evidently due to the fusion of large dermal ossicles with the bones of the cranial roof and cheeks; but all the sutures are obliterated, except on part of the palate.

The hinder third of the skull, as seen from above (Plate XV.), is merely an occipital crest (*occ.*) consisting of two antero-posteriorly compressed, almost laminar bosses of bone, which meet for half their depth in the middle line and fuse together. This crest seems to be solid and is firmly anchylosed with the occipital border of the skull, from which it inclines both upwards and backwards. It is attenuated to a sharp edge at its upper and lateral margins, which seem to be complete on the right side of the fossil; and its upper margin shows a rounded median excavation at the meeting of the two elements of which it is composed. On either side an extremely thin lamina of bone connects the basal half of the occipital crest with a bovine-horn-shaped boss (I.) which projects laterally from the cranium just above the hinder part of the quadrate bone. This postero-lateral prominence is well-preserved on each side of the fossil, and its extent equals that of the crest just described. It is triangular in section, its antero-superior face being largest and flattened; and it exhibits a slight curvature which causes its acute distal extremity to point both backwards and outwards. Immediately in front of the occipital crest there are three bosses completely extending from side to side of the cranial roof. Of these the median or inter-parietal one (II.) is the smaller and ovate in shape, with its long axis antero-posteriorly directed, and its upper face concave in the middle. Of the lateral (or parietal) pair (III.) only that on the right side is complete. It is trapezoidal in shape, about as broad as long, and gently rises into a slight, blunt prominence near its middle. It extends nearly as far forwards as the orbit (*orb.*), above which the cranial roof is also thickened. This thickening is separated by a constriction both from the nasal region, which is flattened, and from a small median triangular area in the frontal region, which is occupied by three low bosses—a pair (IV.) behind, a median one (V.) in front, all broader than long. At the base of the postero-lateral horn-shaped prominence on each side there is also a well-preserved, small, laterally-directed boss (VI.), which is depressed and is about on the same level as the roof of the orbit.

All the bosses just described are also visible in a side view of the skull (Plate XVII.), which exhibits a still smaller, antero-posteriorly elongated, rounded boss (VII.) on the cheek immediately in front of the auditory opening. As shown on both sides of the fossil, there is no excavation of the cheek-plates between the orbit and the auditory opening, but the line of the alveolar border is continued directly backwards to the quadrate bone. The nasal roof does not extend farther forwards than the premaxillæ, but the lateral margin of the terminal narial opening (*na.*) is excavated by a constriction between the nasal and maxillary bones. This constriction is continued as a groove to the anterior margin of the orbit, which is a little longer than deep and of about the same size as the narial opening. The tympanic opening (*au.*) is almost quadrilateral and equilateral, with rounded angles. It is scarcely more than half as large as the orbit, and is specially remarkable as being bounded behind by a gently convex, thick plate of bone, which is as broad as deep. This bone is only preserved on the right side of the fossil, but even here is too imperfect for the determination of its constitution. It probably represents the hinder part of the quadrate and squamosal fused with a dermal bone.

Viewed from below (Plate XVI.), the cranium proper is seen to be a little broader than long, with the snout rounded, and a slight constriction of the sides below the orbits. The palatal expansion of the maxillæ and premaxillæ bears a large inner rounded ridge (*r.*) concentric with the comparatively acute margin of the jaw, thus indicating the herbivorous nature of the animal. The roof of the mouth between this tritural border is raised into a dome with the concavity downwards. The posterior nares (*p.na.*) thus face backwards rather than downwards, and are separated by a broad flattened bar, which seems to be formed by the premaxillæ in front and by the vomer behind. Immediately behind the posterior nares, the antero-posteriorly arched area, which appears to be an unusually large vomer, bears a sharp median longitudinal keel. The limits between all the elements are uncertain, but the palato-pterygoid region (*pt.*) of the palate is relatively very short and broad, while the lateral margin of the pterygoid, though incomplete on both sides, exhibits no trace of the curious rolled-up lateral process so characteristic of existing Pleurodira. The pterygoids clearly meet in the middle line, and there is a small, transversely extended interpterygoid vacuity (*i.pt.*). The relatively small basisphenoid (*b.s.*) is not quite in the same plane as the basioccipital, but inclines a little upwards in front. A long narrow buttress extends outwards from it on either side to the portion of the quadrate bone which would bear the articulation for the mandible; but this region is too imperfect for precise interpretation. The buttress is fused postero-superiorly with the otic bones (*ot.*), which form a great mass at the sides of the occiput in which no sutures are discernible. The basioccipital is concave on its lower face; and the occipital condyle, of uncertain constitution, is about twice as broad as deep. The foramen magnum is slightly deeper than broad, but comparatively small. The median crest of the supraoccipital (*s.occ.*) is a slender lamina, somewhat expanded above where it fuses with the roof of the temporal fossæ. Neither this nor any of the otic bones extend backwards beyond the plane of the occipital crest.

The inner part of the cranium is well divested of matrix, and two other interesting features are thus exposed. The hinder part of the pterygoid is connected with the parietal region by a small vertical lamina of bone on either side. The nasal cavity is completely separated from the orbit on each side by a thin bony septum, resembling that which in *Chelys* and *Chelodina* is formed by a downward process of the prefrontal joining the palatine.

Of the mandible (Plate XVII.) only the dentary-splenial portion is preserved, with a fragment of the articulo-angular on each side. The two rami are firmly fused at the symphysis (fig. 1 *a*), which is gently rounded and not produced into a beak. The oral margin is impressed with a broad, rounded groove, which is bordered inside and outside by a rather acute edge. The limit of the horny sheath is indicated by a distinct constriction (*s.*) on each ramus, which extends across the dentary obliquely downwards and forwards.

Scapula.

Except the scapulæ, all remains of the appendicular skeleton are too imperfect for description. The scapula of the right side (Plate XVIII. fig. 1) is nearly complete distally, while that of the left side is better preserved proximally. The bone is rather stout and laterally compressed, with a flattened outer face and an expanded proximal end. The latter portion closely resembles the proximal end of the scapula of *M. platyceps* in the British Museum. The tuberosity (*t.*) is remarkably prominent, while the contracted distal end is rounded.

Carapace.

The remains of the shell are very fragmentary, and parts only of the carapace can be recognized with certainty. The specimens are insufficient to determine the original degree of convexity of the armour, the pieces being not only too small but also probably a little distorted in fossilization. The trunk, however, seems to have been somewhat depressed. The bone of the carapace is thin, and its irregular outer face shows that it was completely covered with epidermal shields. The borders of the investing shields are marked on the carapace either by deep rounded grooves, or by differences in the elevation of the bone beneath adjoining shields.

The largest fragment represents the left postero-lateral portion of the carapace, and indicates that there were no fontanelles between the costal and marginal bones. As preserved, its convexity is very slight, while its outer face exhibits irregularities which denote the borders of the last vertebral and costal and three marginal shields. The edge of the row of marginal bones is excavated at intervals, so that the carapace is bordered by a series of large triangular prominences. The sutures between the component elements cannot be distinguished even on the inner face; but this aspect of the fossil is interesting as showing the expanded upper end of the relatively small left ilium fused with a costal bone. *Miolania* is thus proved to have been Pleurodiran in the fixation of its pelvis.

Caudal Sheath.

The bony ring of a tail-sheath (Plate XVIII. fig. 2), originally discovered by Mr. Santiago Roth in 1897, is fractured at its anterior margin, but is nearly complete at its overlapping hinder border. It evidently consists of three pairs of scutes firmly fused together, their lines of union on the outer face being marked by slight longitudinal grooves. As seen in end view (fig. 2), the ring is only very slightly wider than deep, and its form is rather hexagonal than cylindrical. The lower pair of scutes constitutes the flattened base of the ring, and curves upwards on either side to form the lower margin of the lateral face. Each of the lateral pairs of scutes tapers backwards into a blunt triangular prominence, which reaches very slightly beyond its hinder, overlapping facette. The upper scutes, forming the roof of the ring, are produced backwards and upwards into a divergent pair of antero-posteriorly compressed, pyramidal bosses, which project considerably above and behind their overlapping facette. Externally (fig. 2 *a*), all these scutes are quite smooth; internally, they do not exhibit any trace of contact or connection with the endoskeleton. As already mentioned, the microscopic structure of the bony tissue seems to have been destroyed.

Part of a second caudal ring, of similar type, was discovered along with the imperfect skeleton in 1899.

Generic and Specific Determination.

If the South American fossil skull and mandible now described be compared with the corresponding parts of the type species of *Miolania*, *M. platyceps*, from Lord Howe's Island, a remarkable resemblance in all essential features is observable. The skull of *M. platyceps* is nearly similar in shape, with its temporal fossæ completely roofed by bone, and its external contour modified by the fusion of dermal, bony bosses with several of its elements. It exhibits the same broad plate of bone on the cheek behind the tympanic cavity, a precisely similar palate, and the complete laminar septum between the nasal chamber and the orbit. Moreover, the nasal bones in *M. platyceps* scarcely project farther forwards than the premaxillæ. Several minor differences, however, may be noted. In *M. platyceps* all the bosses are relatively much smaller than in the new fossil. The occipital pair are two well-separated small thick bosses, apparently solid and connected with the postero-lateral "horns." The latter are ovoid or rounded in section, turned upwards as much as outwards, and considerably smaller in two of the specimens described and figured by Owen [1] than in a third specimen [2], which has also been described by Huxley under the name of *Ceratochelys sthenurus* [3]. Except the interparietal, all the bosses seen in the South American specimen also appear to have slight representatives in *M. platyceps*; but the latter exhibits an additional small prominence antero-inferiorly at the

[1] Phil. Trans. 1888 B, pls. xxxi.–xxxiv.

[2] Phil. Trans. 1886, pl. xxx.

[3] T. H. Huxley, "Preliminary Note on the Fossil Remains of a Chelonian Reptile, *Ceratochelys sthenurus*, from Lord Howe's Island, Australia," Proc. Roy. Soc. vol. xlii. (1887), pp. 232–238.

base of the postero-lateral "horn." The premaxillo-maxillary border of the palate in *M. platyceps* is also peculiar in bearing two sharp inner ridges concentric with the acute oral margin, instead of the one blunt ridge present in the new fossil: and there are indications of a slight pit for the reception of a pointed mandibular beak on the oral face of the premaxillæ. In conformity with this arrangement, the mandible is bevelled on its outer face at the oral margin. Finally, the nasal chamber in *M. platyceps* is partly divided by a vertical median septum.

The type skull of the comparatively large *Miolania oweni*, from the Pleistocene of Queensland, has been considerably mended and improved since it was described and figured by Owen [1]. It is now possible to observe most of its distinctive features; and comparison shows that in nearly all the particulars in which it differs from the new South American fossil, it agrees with *M. platyceps*. It is slightly less depressed than the latter, and its dermal bosses are relatively larger. The occipital crest does not occupy more than one quarter of the total length of the upper face of the skull; its two bosses are less antero-posteriorly compressed and less fused together than in the specimen now described; while they are peculiar in being hollow—possibly, however, by accidental disintegration in the fossil. The postero-lateral horns are ovoid in transverse section and point directly outwards, not being curved at the apex. They bear the small supplementary boss at the base, already mentioned in *M. platyceps*; and the interparietal dermal plate is absent, as in the latter species, while the parietal bosses are relatively very large. The bony lamina of the cheek behind the tympanic cavity is well preserved on the right side and evidently consists in large part of two fused dermal bones. The premaxillo-maxillary border of the palate agrees with that of *M. platyceps* in bearing two sharp inner ridges concentric with the acute oral border; and the premaxillary pit for the symphysial beak of the mandible is especially deep [2]. The median bony septum of the nasal chamber is incomplete, and thus intermediate in development between the conditions observed in the species from Lord Howe's Island and Chubut. The nasal bones differ from those of both these species in projecting forwards considerably beyond the premaxillæ.

It is thus evident that the new South American skull differs very little from that of the two Australian species of *Miolania* except in the relative development of its main features. It seems to lack one small pair of dermal bosses which are present in the latter. It differs more considerably in the comparatively simple ridging of the border of the palate and the absence of a sharply pointed beak at the symphysis of the mandible. The additional boss, however, is merely produced by a notching of the base of the postero-lateral "horn"; and Mr. Boulenger has pointed out to

[1] Referred to *Megalania prisca* by Owen, Phil. Trans. 1880, p. 1041, pls. xxxvii., xxxviii.

[2] Imperfectly shown by Owen, *loc. cit.* 1880, pl. xxxviii. fig. 3.

me that the relative development of the mandibular beak varies considerably in the Cryptodiran genus *Chelone* and in the Pleurodiran genus *Sternothærus*, while some species of *Podocnemis* have two marginal palatal ridges, others have only one. I therefore conclude that there is not yet sufficient reason to separate the South American species now made known from the genus *Miolania*, hitherto discovered only in the Australian region. It must be regarded merely as forming a very distinct species, characterized by the much-depressed form of the cranium, the enormous size of the occipital crest, the triangular shape of the postero-lateral "horns," the simple rounded ridge on the palate, and the total absence of an internasal septum. It may be appropriately named, following Ameghino, *Miolania argentina*.

It will also be observed that Mr. Boulenger's determination of the Pleurodiran nature of the genus *Miolania* [1] is now completely established.

II. An Extinct Ophidian, *Dinilysia patagonica*, gen. et sp. nov. (Plate XX.)

Mr. Roth's discovery of a fossil Ophidian in the red sandstone of Neuquen, associated with typical Mesosuchian Crocodiles, has already been recorded [2]; but the unique specimen referred to has not hitherto been studied. It comprises the greater part of the skull and mandible, and fragmentary remains of the anterior half of the vertebral column; the cranium being in an especially good state of preservation.

The skull (Plate XX. figs. 1, 1 *a*) is long, narrow, and depressed, with the cranial region as long as the facial region. It seems to have been widest at the occiput, where the otic region is very massive; and the maximum compression is immediately in front of this, where the parietals rise into a prominent sagittal crest. The constitution of the hinder part of the skull is best seen on the left side of the fossil, where there is only one slight antero-posterior crack (*x*) in the bones. The right postero-lateral angle, on the other hand, is fractured and displaced downwards. The foramen magnum, which is filled with matrix, is completed above by the exoccipitals (*ex.occ.*), which meet in the middle line. They are directly continuous on each side with a great, expanded piece of bone (*op.*), which curves backwards as well as outwards and abuts upon the bone at the upper end of the quadrate. This expansion of the exoccipital is probably the opisthotic, which is similarly fused with the exoccipital in Lacertilia and the extinct Mosasaurs. Above the exoccipitals is the short but laterally-extended supraoccipital (*s.occ.*), which completes the sagittal crest behind. Its lateral extremity on the left is in contact with a small trace of bone (*o.*),

[1] G. A. Boulenger, "On the Systematic Position of the Genus *Miolania*, Owen (*Ceratochelys*, Huxley)," P. Z. S. 1887, pp. 554, 555. Also "Remarks in reply to Dr. Baur's Article on the Systematic Position of *Miolania*," Ann. Mag. Nat. Hist. [6] vol. iii. 1889, pp. 138–141.

[2] A. Smith Woodward, Anales Mus. La Plata—Paleont. Argent. no. iv. (1896), p. 1.

which is exposed between the opisthotic, parietal, and the bone at the upper end of the quadrate. The fragment is doubtless the highest point of the anterior otic bone, of which the upper part is otherwise completely buried by the surrounding elements. The parietals (*pa.*) occupy nearly half the entire length of the cranium, curve downwards to form the side walls, are much compressed in their anterior two-thirds, and rise into a conspicuous sagittal crest. They are flattened in the middle line at their anterior end, and are not pierced by a pineal foramen. Each of the frontals (*fr.*) is nearly three times as long as broad, and slightly widest at its truncated anterior end. There is no supraorbital bone; but posteriorly and anteriorly the outer border of the frontal is slightly notched for the accommodation of the postfrontal and prefrontal respectively. The postfrontal (*pt.f.*) seems to have partly bounded the comparatively small orbit (*orb.*) behind; but this bar is broken away on both sides. The prefrontal (*pr.f.*), best preserved on the left (fig. 1 *a*), is flattened and triangular in shape, almost equilateral; it is only slightly in contact with the postero-lateral angle of the nasal bone. The nasals (*na.*) are also flattened and triangular in shape, but antero-posteriorly elongated and with a somewhat concave outer side which bounds the relatively large narial opening (*nar.*). They are widest at their articulation with the frontals. They are incomplete in front, and the premaxillæ are unfortunately not shown. The greater part of the palate is obscured by matrix or broken away, but some features at the postero-lateral angles of the cranium and in the facial region are well shown. As observed especially on the left side (fig. 1), a long and narrow plate of bone (*s.t.*) forms the postero-superior boundary of the parietal and otic region, and seems to constitute the articulation for the quadrate. This is doubtless the element commonly named supratemporal in Snakes, Lizards, and Mosasaurs. The quadrate (*qu.*) is evidently short and broad, but is only imperfectly shown in section on the left side. Its remains (Pl. XX. fig. 1 *c*) are not readily interpreted; but the upper end of the bone seems to be displaced outwards and incomplete in the fossil, while the more expanded lower end shows the large notch which usually forms a loose articulation for the pterygoid in Snakes. At first sight, it might be supposed that the quadrate was of the same form as that of the Mosasaurs, with a deep posterior notch for the auditory meatus; but closer study seems to make this interpretation impossible. At the side of the cranium, below the supratemporal and parietal, the upper border of a large prootic (*pr.o.*) is exposed; while between this bone and the orbit the downwardly curved portion of the parietal forms a sharp longitudinal lateral ridge (*r.*). There are no traces of temporal arcades. The short pterygoids (*pt.*) are partly exposed, and a portion of the palatine below the orbit on the left side bears traces of two comparatively minute teeth. There are distinct remains of an ectopterygoid or transverse bone (*ec.*) on each side between the pterygoid and maxilla; and a fragment on the left side seems to show that this element overlapped the maxilla to a considerable extent. The maxilla itself (*mx.*) is relatively large, and best preserved on the right side. It is stout and curves inwards in front. It articulates not only with the pterygoid behind by the intervention of the transverse bone, but also with the palatine by a broad articular palatal process which extends inwards from its middle. It likewise articulates directly with the prefrontal in an extensive suture. It shows 14 or 15 large shallow sockets for the implantation of teeth (fig. 1 *b*); and one dental crown preserved at the hinder end of the left maxilla is very slender and recurved. The fragmentary remains of the mandible show it to have been of the usual slender ophidian type, with a very loose articulation between the dentary (*d.*) and articulo-angular region (*ag.*); and the dentary exhibits a series of large shallow tooth-sockets like those of the maxilla.

Behind the skull there are remains of a long series of typical ophidian vertebræ, which do not present any features worthy of special note. The neural arches are shown to have borne delicate low spines, though nearly all of these have been broken away and are only represented by their bases in the fossil (Plate XX. fig. 2, *n.*). The ribs (*r.*) are very stout.

From this description it is evident that the Patagonian fossil in question represents a typical member of the order Ophidia. As shown, however, by the conformation of the occiput and the relatively small size of the quadrate, it belongs to one of the more generalized types. Its closest allies may therefore be sought among the Boidæ and Ilysiidæ, which still constitute so large and characteristic a part of the Ophidian fauna of South America. The skull bears much general resemblance to that of a *Boa constrictor*, but is readily distinguished from the latter by its non-projecting supratemporal and relatively small quadrate. It is similarly distinguished from the skull of all the other Boidæ [1]. In precisely this character, on the other hand, the fossil skull agrees with that of the existing Ilysiidæ; and its occipital region is almost identical with that of the South American genus *Ilysia* [2]. The resemblance to the latter, indeed, is so close that, although the coronoid region of the mandible is not observable in the fossil, there need be little hesitation in referring the extinct type now described to the family Ilysiidæ. It differs from the existing genera of the family in its more numerous marginal teeth and relatively smaller palatine teeth; in its elevated sagittal crest; and in the presence of well-developed neural spines on the vertebræ. It also differs from the South American *Ilysia*, though agreeing with the Javan *Cylindrophis*, in the possession of a small postfrontal bone. It may, in fact, be regarded as a comparatively gigantic forerunner of the Ilysiidæ, analogous to *Glyptodon* among the Armadillos and *Phororhachos* among the Cariamas.

[1] G. A. Boulenger, Catalogue of the Snakes in the British Museum (Natural History), vol. i. (1893).

[2] G. A. Boulenger, *tom. cit.* (1893), p. 132, fig. 8.

Whereas the modern representatives of the family are small and degenerate burrowing snakes, the largest less than a metre in length, the extinct Patagonian snake, judging by the size of its vertebræ, must have attained a length of at least two metres. It had a relatively large head, and probably resembled the modern Boas in habit.

This fossil evidently represents a hitherto unknown genus, which may be named *Dinilysia* and defined thus :—Marginal teeth of moderate size, about 14 or 15 in the maxillary series; palatine teeth relatively minute. Head rather large, the occipito-parietal region constituting half of the skull, with elevated sagittal crest; frontals longer than broad; small postfrontals present; prefrontals triangular, almost equilateral, only slightly in contact with nasals, which are long and narrow, tapering forwards. Vertebræ with low, delicate neural spines.

The type species, of which remains are now described, may be named *D. patagonica*, and defined by the minor characters of the head-bones already noted.

III. Jaws of a Carnivorous Dinosaur, *Genyodectes serus*, gen. et sp. nov. (Plates XVIII. & XIX.)

Interesting evidence of an unknown large carnivorous Dinosaur is furnished by the fragmentary jaws of one individual obtained by Mr. Roth from red sandstone in the Cañadon Grande, Chubut. The bones and teeth are friable and much fractured, but the specimen comprises the premaxillæ, the greater part of the maxillæ and dentaries, and most of the teeth in position. The teeth are implanted in the bone in a single series, and all are invested with a rather thin layer of enamel. They are much laterally compressed, with an acute recurved apex, and finely serrated on the anterior and posterior margins. When they are broken across at the base, a small pulp-cavity is exposed. The specimen is shown, of one-half nat. size, from the right lateral aspect in one drawing (Plate XIX. fig. 1), while a front view of the premaxillæ is given in another (Plate XVIII. fig. 3).

The premaxillæ (*pmx.*) are slightly displaced at their median symphysis, proving that they were not fused together; but their sutural connection with the maxillæ is not observable owing to fracture on the left side and displacement of the bone on the right. Each premaxilla is nearly as long as deep and its posterior upper portion is curved inwards, while antero-superiorly it rises into the slender, laterally compressed internarial bar which would meet the nasals. Its outer face is gently convex, and the snout, though bluntly rounded, must have been very narrow. There are no distinct indications of vascular foramina. The oral border bears four teeth, which are somewhat obliquely set and so crowded that they overlap each other. The foremost tooth is slightly smaller than the others; the second and third are taller and of nearly equal height; the fourth on the right side is shown to be shorter but broader. All these teeth are much broken; but it is clear that they are gently recurved, and fragments show that the anterior border is serrated for more than half its length below the apex at least in the first and third teeth. No successional teeth are visible.

Of the maxilla (*mx.*) only the oral border and some of its teeth remain. That of the right side is most extensively preserved, and bears seven of its teeth in a rather fractured state. Its outer face is flattened and does not exhibit any large vascular foramina. Its inner face does not bear any palatal extension. The teeth are arranged in a moderately spaced series, and fixed in distinct sockets, of which the inner wall is as much elevated as the outer wall and does not exhibit any vertical clefts. All the teeth are much laterally compressed, with a median indentation on each side near the base; and their long diameter exactly coincides with the long axis of the maxilla. The apex of the fully extruded teeth is much recurved. The marginal serrations, as in the premaxillary teeth, are disposed at right angles to a tangent to the border; and in the fifth tooth at least they are shown to extend for considerably more than half the length of the anterior border from the apex. The posterior border of the fourth tooth displays serrations as far as its base. The middle teeth are especially large and elevated, the height of the fourth and fifth being about one and two-thirds times that of the fourth premaxillary tooth. All the teeth, indeed, are larger and more laterally compressed than those of the premaxilla. Successional teeth are shown to arise at the inner side of the base of the functional teeth. One has just displaced the third maxillary tooth on the left, and another the seventh maxillary tooth on the right; while the second right maxillary tooth is not completely extruded. No other successional teeth are seen.

The mandible is represented only by its anterior half or dentary region, which is nearly similarly preserved on both sides. The rami must have been very loosely united at the symphysis, the symphysial facette being apparently narrow and smooth. The dentary bone (*d.*) is almost as deep as the premaxillæ and does not taper to the symphysis, where its inferior angle is rounded off, but probably less so than is indicated in the side view of the imperfect fossil. Its oral border must have been nearly straight, while its lower margin, which is satisfactorily preserved, seems to trend slightly downwards behind, where the bone becomes thinner. The teeth are shown to be inserted in complete and distinct sockets, with the inner wall as high as the outer wall, and neither cleft nor pierced by nutritive foramina. The upper inner border of the dentary bone itself, however, is much fractured and not well exposed; while the actual upper edge of the inner wall of the tooth-sockets is formed by a small and loosely-apposed, laterally compressed rod of bone (fig. 1 *a*, *spl.*), which doubtless corresponds with the curious anterior extension of the splenial described by Marsh in *Ceratosaurus*[1]. The teeth of the mandible are comparatively small, none being larger than those of the premaxilla.

[1] O. C. Marsh, "The Dinosaurs of North America" (16th Ann. Rep. U. S. Geol. Surv. 1896), p. 159.

The foremost pair at the symphysis is especially small, the tooth almost completely preserved on the right being only about two-thirds as high as the second tooth. Both these teeth are relatively thick, being compressed to a sharp edge only at their concave hinder border. The latter border seems to have been serrated quite to the base; but the anterior row of serrations scarcely extends more than halfway down the crown, and is slightly displaced from the median line towards the inner face of the tooth. The following teeth, so far as preserved, are more nearly bilaterally symmetrical, much compressed and indented near the base, with the anterior serrations also extending at least halfway down the crown. Except the third tooth on the left, and the fourth tooth on the right side, all are fully extruded and nearly equal is size; and no traces of successional teeth are exposed.

Simple compressed teeth, with more or less serrated edges, are common to all the genera of carnivorous Dinosauria, and it is difficult to discover diagnostic features solely in the jaws. Among known jaws of this type, however, it does not seem necessary to compare the new Patagonian specimen with any but those of *Megalosaurus* and *Ceratosaurus*—the former from Jurassic rocks in England, the latter from a corresponding geological formation in North America. If, as is commonly assumed, the number of teeth in the premaxilla may be regarded as a generic character, the fossil now described cannot be referred to *Ceratosaurus*, because the type species of this genus exhibits only three premaxillary teeth on each side[1]. In its possession of four premaxillary teeth, on the other hand, the Patagonian jaw agrees with that of *Megalosaurus*[2]; and it is difficult at first to perceive any essential differences between these two fossils. The upper anterior extension of the splenial bone has not hitherto been observed in *Megalosaurus*; but there is a vacant hollow in the known specimens which may have received it. There seem, however, to be important differences in the inner wall of the mandibular tooth-sockets and in the degree of development of successional teeth. Although the new specimen is somewhat fractured, the inner wall of the dentary completing the tooth-sockets appears to be continuous and as high as the outer wall; while in *Megalosaurus*, this inner wall consists only of low lappets divided at the middle of each tooth by a large cleft[3]. In the new specimen, moreover, very few successional teeth are exposed; whereas in *Megalosaurus* the apex of a successor is conspicuous at the base of nearly every functional tooth. These differences seem to necessitate the reference of the Patagonian Dinosaur to a new genus, *Genyodectes*; and its type species, represented by the jaw now described, may be named *Genyodectes serus*[4]. Unfortunately, nothing is known of the jaws which bore

[1] O. C. Marsh, *op. cit.* p. 158, pl. viii.

[2] R. Owen, History of British Fossil Reptiles, vol. iii. (1884), p. 169.

[3] R. Owen, *op. cit.* vol. i. p. 348, Dinos. pls. xxxiii., xxxiv.

[4] The so-called *Loncosaurus argentinus* (Ameghino, Anal. Soc. Cient. Argent. vol. xlvii. 1900, p. 61), a Megalosaurian from the Guaranitic Formation of the Rio Sehuen, is not yet defined or sufficiently described for comparison.

similar teeth during the Cretaceous period in the Northern hemisphere; but it seems probable that the completion of the tooth-sockets and the paucity of successional teeth in *Genyodectes* are characters indicating that it was one of the latest and most specialized members of its race.

IV. Conclusion.

The extinct reptiles discovered in the red sandstones of Northern Patagonia are now of special interest from two points of view. Firstly, there is a curious mixture of types which in other parts of the world belong to more than one geological period; secondly, the occurrence of *Miolania* seems to confirm the much-discussed theory of an old Antarctic continent and a former connection between South America and Australia.

The association of ancient with modern types of reptiles is especially remarkable. The nearest allies of the Crocodile *Notosuchus* occur in the Upper Jurassic of Europe, while the latest known Dinosaurs are undoubtedly Upper Cretaceous both in Europe and North America. *Miolania*, on the other hand, occurs in the latest Pleistocene deposits of Queensland, associated with extinct though typically Australian mammals; while the smaller species of the same genus found in Lord Howe's Island must be regarded as equally modern. *Dinilysia*, again, is a typical South American Snake, such as might have occupied an appropriate place in the fauna of that continent when the gigantic Glyptodonts and Ground-Sloths were flourishing. The anomaly may be explained either (i.) by supposing that the essentially Mesozoic land-reptiles survived to a later period in Patagonia than elsewhere; or (ii.) by assuming that geologists are mistaken concerning the age and apparent contemporaneity of some of the red sandstones of Neuquen and Chubut. The problem must be solved by future geological research.

Of all the similarities between the South-American and Australian faunas, perhaps none is more striking than the essential identity of the extinct *Miolania* in the two regions. There can be no doubt that this was a truly terrestrial or marsh Chelonian; while it seems at first highly improbable that so remarkably specialized a dermal armour as it possessed could be independently acquired by distinct animals in two different regions of the globe. The theory of a former land-connection between South America and Australia seems therefore to receive important support from the new discovery now described. It must, however, be remembered that during the late Mesozoic and early Cainozoic (Tertiary) periods, the Pleurodiran Chelonia had a much wider distribution than at present—were, in fact, perhaps nearly as cosmopolitan as are the Cryptodira in the existing world. It is known that the doubly-armoured Herring *Diplomystus*, now living in the rivers of Chile and New South Wales, was a widely distributed marine fish in the

Cretaceous period[1]. It is also known that the mud-fish *Ceratodus*, which now survives in Queensland rivers and once lived in Patagonia[2], belongs to a race which was cosmopolitan in the Jurassic period. In these two cases, Australia and South America are proved to be merely remote refuges for old types which have been lost by extinction elsewhere. It is therefore just possible that, if the direct ancestors of *Miolania* were known, this remarkable Chelonian would prove to have originated not on any old Antarctic continent, but in some other region of the globe from which scattered survivors wandered into the lands now named South America and Australia respectively.

EXPLANATION OF THE PLATES.

PLATE XV.

Miolania argentina (pp. 170–172); cranium, upper aspect, one-third nat. size.—From Red Sandstone, Chubut, Argentine Republic. *occ.*, occipital crest; *orb.*, orbit; I.–V., bony bosses.

PLATE XVI.

Miolania argentina (p. 172); same cranium, lower aspect, one-third nat. size. *bs.*, basisphenoid; *i.pt.*, interpterygoid vacuity; *ot.*, otic bones; *p.na.*, palato-nares; *pt.*, pterygoid; *r.*, palatal ridge; *s.occ.*, supra-occipital; other letters as above.

PLATE XVII.

Fig. 1. *Miolania argentina* (p. 171); same cranium with imperfect mandible, right lateral aspect, one-half nat. size. *au.*, auditory opening; *na.*, anterior nares; *s.*, hinder limit of horny beak; other letters as above.

1 *a*. Ditto; oral aspect of mandible, one-half nat. size.

PLATE XVIII.

Fig. 1. *Miolania argentina* (p. 173); right scapula, imperfect proximally, one-half nat. size. *t.*, tuberosity.

2. Ditto; bony ring of tail-sheath, posterior and right lateral (2 *a*) aspects, one-third nat. size.

3. *Genyodectes serus* (p. 179); premaxillæ, anterior aspect, one-half nat. size.—From Red Sandstone, Chubut.

PLATE XIX.

Fig. 1. *Genyodectes serus* (p. 179); imperfect jaws, right lateral aspect, one-half nat. size. *d.*, dentary; *mx.*, maxilla; *pmx.*, premaxilla.

1*a*. Ditto; two mandibular teeth of same specimen in position, inner aspect, nat. size. *d.*, dentary; *spl.*, anterior splenial extension.

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[1] A. Smith Woodward, Catalogue of Fossil Fishes in the British Museum, pt. iv. (1901), pp. 140–144.

[2] F. Ameghino, Sinopsis Geologico-Paleontologica—Suplem. (1899), p. 10.

PLATE XX.

Fig. 1. *Dinilysia patagonica* (pp. 176–179); imperfect skull and mandible, upper and left lateral (1 *a*) aspects, with oral aspect of right maxilla (1 *b*) and fractured quadrate bone (1 *c*), nat. size.—From Red Sandstone, Neuquen. *ag.*, angular; *d.*, dentary; *ec.*, ectopterygoid; *ex.occ.*, exoccipital; *fr.*, frontal; *mx.*, maxilla; *na.*, nasal; *nar.*, external narial opening; *o.*, projecting otic bone; *op.*, opisthotic; *orb.*, orbit; *pa.*, parietal; *pr.f.*, prefrontal; *pr.o.*, pro-otic; *pt.*, pterygoid; *pt.f.*, postfrontal; *qu.*, quadrate; *r.*, lateral ridge on parietal; *s.occ.*, supraoccipital; *s.t.*, supratemporal; *x*, fracture.

2. Ditto; portion of vertebral column of same specimen, nat. size. *n.*, neural spine; *r.*, rib.

All the original specimens are preserved in the La Plata Museum.

2. Note on the Innervation of the Supraorbital Canal in the Cat-fish (*Chimæra monstrosa*). By R. H. Burne, B.A., F.Z.S., Anatomical Assistant in the Museum of the Royal College of Surgeons.

[Received February 1, 1901.]

(Text-figure 49.)

An excellent historical *résumé* of the work that has hitherto been done upon the comparative anatomy and more particularly the innervation of the organs of the lateral line, with a discussion of the morphological conclusions that may be drawn from them, is to be found in two recent papers by Cole [1], so that for the purposes of this note it will be amply sufficient to briefly sketch certain ascertained facts with regard to the innervation of this sensory system. It has now been shown in several instances that the nerves that supply the lateral-line organs have no real relation to the cranial nerves in whose company they leave the brain, but arise within the brain in common with the auditory nerve from a particular centre—the tuberculum acusticum. Furthermore in almost all cases, when sufficient care is used in the examination, the lateral-line nerves are found to enter into a definite and constant relationship with certain of the cranial nerves. Thus the lateral-line nerve that supplies the supraorbital canal forms the Ramus ophthalmicus superficialis of the VIIth cranial nerve, that for the suborbital canal constitutes the R. buccalis VII, and that for the hyomandibular canal the Ramus hyomandibularis VII; while the main lateral canal of the trunk is innervated by the lateralis branch of the vagus. Although this connection of the lateral-line nerves with the VIIth and Xth cranial nerves only is almost universal, it is not so in every case. For instance, in many

[1] Cole: "Observations on the Structure and Morphology of the Cranial Nerves and Lateral Sense-organs of Fishes," Trans. Linn. Soc. vii. 1898, p. 187; and "On the Cranial Nerves of *Chimæra monstrosa*," Trans. R. Soc. Edinb. xxxviii. 1897, p. 635.

Teleosts and one or two Elasmobranchs the nerve to the anterior organ of the main trunk-canal emerges from the brain in connection with the glossopharyngeal; and in *Chimæra* two organs in the middle of the supraorbital canal are innervated by twigs from the Ramus ophthalmicus profundus of the Vth cranial nerve—apparently the only genuine case of connection between the nerves of the lateral line and the trigeminus. This anomaly in the innervation of the supraorbital canal in *Chimæra* was discovered by Cole[1], and evidently caused him considerable perplexity, for he does his best to minimise the awkwardness of the fact and calls to his aid a suggestion thrown out by Pollard to the following effect:—"I should prefer to say that some nerve-fibres had struck the path of the profundus but did not belong to it, just as, for instance, in Siluroids the fourth nerve accompanies the profundus, though I think everyone would hesitate to say that the fourth nerve was a branch of the profundus"[2].

This suggestion, ingenious as it is, cannot without further evidence be said to give us much practical help. In the following note I hope to be able to give that further evidence and to show that Pollard was upon the right track, although the details of the connection between the superficialis and profundus fibres do not exactly conform to the picture that he evidently had in mind.

During the last few months I have had occasion to dissect three heads of *Chimæra monstrosa* for various purposes connected with the Museum, and in all three specimens the branch of the profundus that is said by Cole to innervate two organs of the supraorbital canal was joined after leaving the orbit by two twigs from the Ramus ophthalmicus superficialis of the facial. The figure given below (text-fig. 49, p. 186) is compounded from two of the most satisfactory dissections, in one of which the connection between the nerves, and in the other their further distribution was seen to the best advantage.

On a level with the anterior border of the interorbital membrane, the Ramus ophthalmicus profundus of the trigeminal gives off a branch as described by Cole, which runs in an antero-dorsal direction towards the forehead closely applied to the perichondrium. Shortly after leaving the orbit it divides into two subsidiary branches (A and B). The branch A, after crossing the main trunk of the superficialis VII (at this point embedded in the cartilage of the skull), again divides into two smaller twigs (C & D). The twig C continues in an almost perpendicular line towards the dorsal surface of the head and is lost in the frontal clasper in the male[3], and in the female upon the skin in the corresponding position. The twig D, on the other hand, reunites at an acute

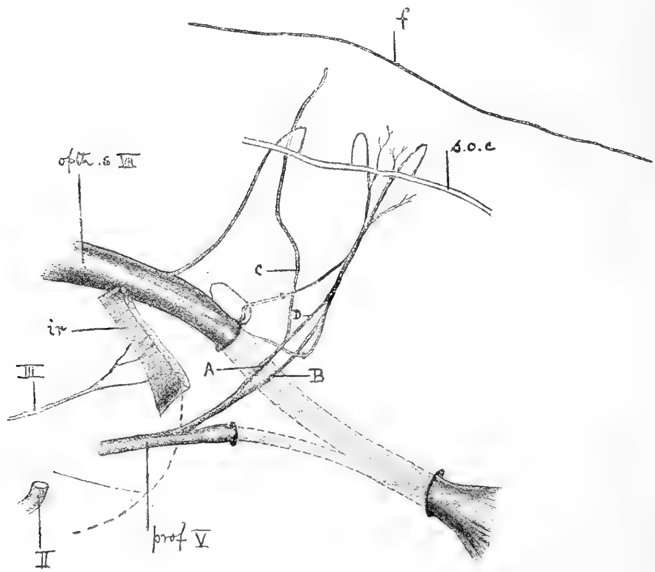
[1] Trans. R. Soc. Edinburgh, xxxviii. 1897, p. 645.

[2] Trans. R. Soc. Edinburgh, xxxviii. p. 638.

[3] In the male specimen, I was under the impression that this nerve to the clasper was joined by a filament from the superficialis—making, in all, three connections between the superficialis and profundus, but the dissection was not sufficiently good to be quite sure upon the point.

angle with the branch B of the previous division. Just before the union of the branches D and B of the profundus, the branch B is joined by a twig from the Ramus ophthalmicus superficialis VII, which rises from the main superficialis trunk just after its entry into the preorbital cartilage, and runs forward embedded in the cartilage to a point close in front of branch B; upon leaving the cartilage at this point it turns abruptly upwards to make the above-mentioned junction with branch B of the profundus.

Text-fig. 49.



Part of Ophthalmicus superficialis VII and profundus V of *Chimæra monstrosa.*

A, B, C, D, branches of the profundus; II, III, optic and oculo-motor nerves; *f*, outline of the forehead; *i.r.*, internal rectus; *opth.s.* VII, ophthalmicus superficialis VII; *prof.* V, ophthalmicus profundus V; *s.o.c.*, supraorbital canal.

The nerve, consisting now of fibres derived from both superficialis and profundus, continues its antero-dorsal course for a short distance, and is then joined by a second twig from the superficialis. This twig rises from the main trunk directly before its entry into the preorbital cartilage; it runs in an antero-dorsal direction buried for a short space in the skull; it emerges close behind branch C of the profundus and passes beneath that nerve without being in any way connected with it, to reinforce the compound superficialis and profundus nerve as previously stated. The compound nerve now soon divides into three branches: one of these I lost, after a short course, upon the perichondrium; each of the other two supplied a sense-organ of the supraorbital canal and sent a few twigs to the surrounding skin.

This somewhat complicated description when compared with the figure will, I trust, make it clear that these two supraorbital sense-organs in *Chimæra* do not, as was supposed, present an anomaly in their innervation, but receive their nerves in all likelihood from the superficialis as do the other organs of that canal, and in their mode of innervation show a close similarity to those that lie in front of them; for in both cases the actual nerve-trunk from which the filaments for the individual sense-organs arise is of a compound nature formed by an intimate blending of the superficialis VII with the profundus V, differing only in the fact that in the case of these two sense-organs the union occurs between the smaller branches of the nerves, while in that of the organs in front it involves their main trunks. In both cases the fusion is so complete, that it is impossible by simple dissection to say definitely that the fibres derived from the superficialis terminate in the lateral-line sense-organs, while those of the profundus are distributed to the skin; but the probabilities that such is the case are so great as to almost amount to certainty.

3. Contributions to the Knowledge of the Structure and Systematic Arrangement of Earthworms. By Frank E. Beddard, M.A., F.R.S.

[Received January 31, 1901.]

(Text-figures 50–58.)

1. *On* **Polytoreutus gregorianus.**

This species was very briefly defined by me five years ago in my Monograph of the Oligochæta[1]. Since then the publication of descriptions and illustrations of various new species of the genus has decided me to attempt an addition to our knowledge of this remarkable genus by a fuller account of the form which I named after Prof. Gregory of Melbourne, and which was collected by him in Africa during his expedition of 1894.

The worm measures 230 mm. in length by a diameter of 9 mm. The number of segments are between four and five hundred[2]. As might be supposed from their large numbers, the segments are very short; this is the case with all those lying behind the clitellum; those forming the clitellum and those lying in front of it are stout segments as in other earthworms.

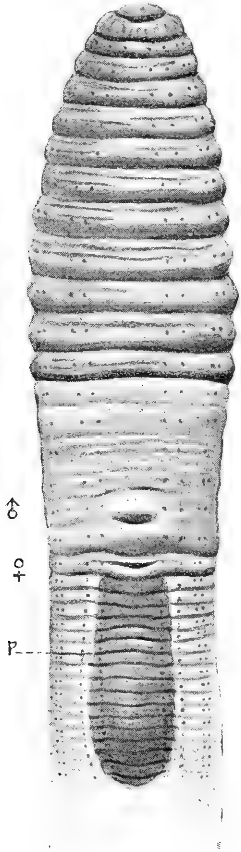
The *setæ*, as in other species of *Polytoreutus*, are in couples, of which the two lateral are more closely approximated to each other than the two ventral. The disproportion of the spaces separating the two lateral setæ from each other and the two ventral setæ is

[1] Oxford, Clarendon Press, 1895, p. 612.

[2] These measurements differ slightly from those which I originally gave.

greater in the present species than it is in some others. Thus in *P. arningi* Dr. Michaelsen observes[1]: "Die ventralen Paare sind sehr weit, ungefähr $\frac{2}{3}$ so weit wie die ventral mediane und die lateralen Borstendistanzen. Die dorsalen Paare sind eng, nicht ganz halb so weit wie die ventralen." In *Polytoreutus gregorianus*

Text-fig. 50.



Polytoreutus gregorianus. Head-end, × 2.
♂, male pore; ♀, female pore; P, papilla.

the interval between the two setæ of a ventral pair measures 2 mm., and is pretty nearly exactly half of the median ventral

[1] "Neue und wenig bekannte afrikanische Terricolen," Jahrb. Hamb. wiss. Anst. xiv. 1897, p. 53 (of memoir).

space lying between the ventralmost seta of each side. The lateral setæ are so closely approximated that they are not more than $\frac{1}{3}$ of a millimetre from each other. The distance of the lateral pair from the outermost seta of the ventral pair is about equal to that of the ventral median space. The dorsal median space measures 11 mm. The total circumference of the worm is thus about 27 mm. At the tail end of the body the space between the setæ of the ventral pair retains its width until the very extremity when it is narrowed. This, however, is simply a matter of the diminished calibre of the body; there is no proportional decrease in the interval. I could find no dorsal pores, which structures appear to be absent in the family *Eudrilidæ*.

The *nephridiopores* are very obvious and lie in front of the lateral setæ.

The *clitellum* occupies segments xiii.–xviii. and is completely developed all round the body.

Dotted over the segments, and often forming continuous lines with the setæ suggestive of a perichætous condition, are the numerous integumental sense-organs, well known to occur in this genus.

In my Monograph of the Oligochæta the position of the external generative apertures is accidentally reversed. In *Polytoreutus gregorianus*, as in all the other species of the genus, the male pore lies in front of the spermathecal pore.

The *male pore* (see text-fig. 50, p. 188) is placed accurately between segments xvii./xviii. It is transversely oval, indeed slit-like, and lies at the summit of a protuberance which occupies the middle part of segments xvii. & xviii. between the ventralmost setæ. On the xviiith segment this protuberance appeared to bear two faintly marked papillæ, one on either side.

The *spermathecal pore* is on the xixth segment, quite in the middle of that segment; it is rather a larger orifice than the male pore.

I append for the purposes of comparison drawings (text-figs. 51, 52, p. 190) of the external characters of the two species *Polytoreutus kilindinensis* and *P. finni*. Of neither of these species have the external characters been at present figured[1], though their internal structure has been dealt with by myself[2]. Figures of the external characters of the genus *Polytoreutus* are at present limited to a figure of *P. magilensis*[3].

It will be noticed that while *P. kilindinensis* entirely agrees with *P. gregorianus* in the position of the male pore and of the spermathecal orifice, *P. finni* differs in that the male pore is very distinctly in the middle of the xviith segment, and the spermathecal pore is situated on the boundary line of the xviiith and xixth.

It will be observed from the accompanying sketch (text-fig. 51)

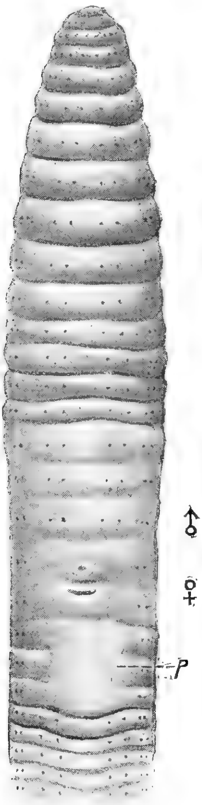
[1] Save for a quite rough sketch of *P. finni*.

[2] "Oligochæta of Tropical Eastern Africa," Quart. Journ. Micr. Sc. vol. xxxvi. p. 236.

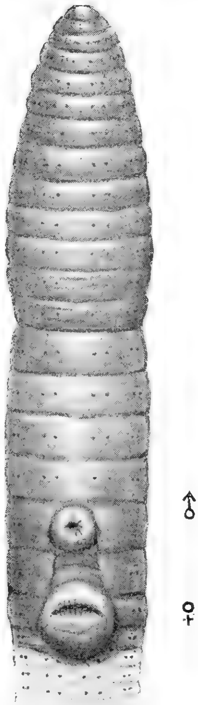
[3] "Some new Species &c. of Earthworms," ibid. vol. xxxiv.

of *P. kilindinensis*, that the area bearing the reproductive apertures is continued as a glandular swelling over the next four segments. The divisions between these segments, except that between the last two, *i.e.* xxii./xxiii., are obliterated over this area, which is seen on a lateral view of the body to protrude somewhat.

Text-fig. 51.



Text-fig. 52.



Text-fig. 51.—*Polytoreutus kilindinensis.* Head-end, × 3.
♂, male pore; ♀, female pore; P, papilla.

Text-fig. 52.—*Polytoreutus finni.* Head-end, × 5.
(Letters as in text-fig. 50.)

Polytoreutus gregorianus has a similar "Pubertätspolster," as Michaelsen has termed this structure. But in this species it is much more extensive. It presents, however, the same character of a swollen glandular eminence, which is seen on a lateral view of the worm to protrude considerably beyond the general level of the body. This glandular eminence is of a stronger yellow colour than the surrounding body-wall, and is therefore additionally conspicuous. The outer setæ of the ventral couples are just not embraced by it. It occupies all of segments xix.–xxiv., and the intersegmental furrows are perfectly plain throughout. In *P. violaceus* I described a somewhat similar modified area of integument upon the middle ventral region of segments xxii. & xxiii.; it is interesting to note that Michaelsen has found that in that species the position of the Pubertätspolster may vary from xxiii. or xxiv. to xxxii. or xxxiii., nearly the same area therefore that is *continuously* occupied in the present species.

The *oviducal pores* are very conspicuous upon segment xiv. They lie behind the lateral pair of setæ. They are asymmetrical in my specimen; the left-hand pore is nearer to the middle line than the right-hand pore.

As in other species of *Polytoreutus*, though the details are not always available in extant descriptions, a number of the anterior *septa* are thickened. The last of these bounds the xith segment posteriorly; this and the four septa lying in front of it are thickened to a very considerable extent; in front of the first there are two or three septa which are less pronounced. There is a gradual falling off in thickness in the case of the septa lying behind that which bounds the eleventh segment; the first of them, like the rest, is thin and diaphanous. It is only the septa in the immediate neighbourhood of the gizzard, and which closely enwrap it, that are much tied together by threads of muscle in the way that is prevalent among earthworms. The specially thick septa behind are not so interconnected.

The *nephridia* are regularly paired and furnished with a terminal sac.

It is perhaps not of importance as assisting in the definition of the species to note the double character of the dorsal vessel in certain segments. A continuously double dorsal vessel is, so far as I am aware, generally a specific and sometimes even (as in *Octochætus*) a generic character. But the fact that in *Pontoscolex* the dorsal vessel may be double for a segment or two, is perhaps not, as I was inclined to make it at one time, a specific character distinguishing *P. hawaiiensis*. However, in *Polytoreutus gregorianus*, as in *Polytoreutus kilindinensis*[1] (occasionally), the dorsal vessel is double in segments xii. & xiii. and again more anteriorly in segments viii. & ix.

The two halves were only separated for a short distance, again reuniting. The dorsal vessel is particularly stout and congested with blood in the three segments which immediately follow the last strong septum; and in these segments there are no hearts. The last of the hearts lie in segment xi., and they and the pair in front are the largest of the series.

[1] Beddard, Quart. Journ. Micr. Sc. vol. xxxvi (n. s.) p. 240.

The *alimentary canal* conforms to the type characteristic of this genus. The gizzard, which is distinctly stout, lies in the fifth segment. The œsophagus is rather a narrow tube up to the xivth segment, where it dilates, but still retains its comparatively thick walls and may therefore be still termed œsophagus. A segment or two later (I cannot unfortunately be precise) the thin-walled intestine begins. In the three segments ix., x., xi., there are—one on each—the usual three median and ventral calciferous pouches whose relations call for no special comment; they are apparently common to all the species of this genus. The calciferous glands of the xiiith segment are large and partly encircle the gut. They are imperfectly divided into a dorsal and a more ventrally situated half. From each arises a longish and slender duct which converges towards, and finally unites with the other before its opening into the œsophagus. The two orifices are laterally situated upon the œsophagus.

Organs of Reproduction.—As my specimen was rather too large, and not sufficiently well preserved to be conveniently studied by the method of transverse sections, I am compelled to limit myself in describing the structure of the organs of reproduction to such points as could be ascertained with the help of a lens.

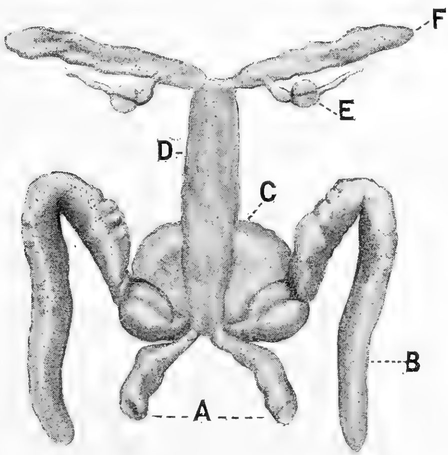
As in other species of the genus, the *sperm-duct* dilates into a large oval chamber immediately after leaving the funnel. This dilatation lies in the xith segment and is attached to its thick posterior wall.

In contact with and to the inside of each of these dilatations of the sperm-duct is a thin-walled sac. The two sacs are not fused or even in contact in the middle line, but they represent, I take it, the *sperm-reservoirs* of other earthworms. They appear to be continuous with the single pair of sperm-sacs through a deficiency in the thick septum, which also allows the œsophagus to pass into the next segment.

The *sperm-sacs*, as is the case with the other species of this genus, are of considerable length and are separable very distinctly into two regions. The total length of each of the two sperm-sacs, in the contracted condition of the worm, is about 30 mm. from the septum to which they are affixed anteriorly to the point upon the intestine where they terminate posteriorly. The posterior more swollen region of each of the two sacs is longer than the almost thread-like anterior portion; it measured 18 mm. The demarcation between the two regions is extremely abrupt, though the posterior part of the sperm-sac has not at that point acquired its full dimensions; it becomes gradually wider later until it again gradually narrows towards its posterior termination. The dilated region of the sperm-sacs occupies some thirteen segments, where they for the most part conceal the underlying dorsal vessel. Anteriorly and posteriorly, but only for one or two segments at each end, the sperm-sacs are not constricted by and do not bulge out between the intersegmental septa. In the middle of the course of the sacs there are these constrictions, which in the preserved and therefore contracted state of the worm render it a little difficult to map this portion of the sperm-sacs accurately. The reason is that the greatly bulged divisions of the sperm-sacs do not lie so plainly and simply side by side as they do both anteriorly and posteriorly; they are somewhat intertwined by the exigencies of space in relation to their own increasing bulk, but do not, at least so far as I have been able to ascertain, intercommunicate at these points. In any case there is no doubt that at the very end of their course the two sperm-sacs are perfectly continuous, there being no externally visible break where one passes into the other; the two sacs thus end posteriorly in a somewhat horseshoe-shaped loop.

The *spermiducal glands* measure about 20 mm. in length; but they do not occupy a corresponding length of the body since each is bent once and sharply upon itself; this bend does not mark off the spermiducal gland into two regions, though each gland can be so divided. When the gland emerges from the terminal bursa

Text-fig. 53



Polytoreutus gregorianus. Genitalia, × 2.

A, posterior lateral diverticula of spermathecal sac; F, anterior do.; E, receptaculum ovorum; D, median part of spermathecal sac; C, terminal bursa copulatrix, into which open B spermiducal glands.

copulatrix, through which it communicates with the exterior, it is at first narrow; it then gradually widens and forms an elongated heart-shaped tube, from the middle of the end of which arises the distal part of the spermiducal gland; the relations of the latter to the former part are very much those of a small intestine opening into a large intestine which is furnished at the junction of the two with two short blunt cæca. The point of junction of the two parts of the spermiducal gland is rendered stronger by some external strands of muscle, which run across the line of junction and tie both parts to each other. These are shown in the accompanying drawing (text-fig. 53, p. 193). These strands of muscle, which are accompanied by blood-vessels, can be seen to spring fan-shaped to be detached from the walls of the spermiducal gland posteriorly. Their general appearance is not unlike that of the muscles which accompany the penial setæ in those earthworms which possess them. In the present genus such setæ do not occur, and it would be interesting to know whether their muscles have remained and have been utilized for the extra strengthening of the muscular spermiducal glands. The posterior region of the glands is slightly and irregularly sacculated; its walls are thick and chiefly glandular. The single sperm-duct crosses over the terminal heart-shaped portion of the spermiducal gland, and is at once lost in the wall of the narrow distal portion. The two spermiducal glands open posteriorly into the nearly circular terminal bursa. The latter is of course overlain by the spermathecal sac; its walls are very thick and muscular.

Spermathecal sac.—The species of the genus *Polytoreutus* are mainly to be distinguished from each other by the form of the very variable spermathecal sac. The present species, as is the case with all the others, can be defined by this structural feature alone. The sac extends as usual from just behind the last thickened septum to its orifice on to the exterior just behind the bursa copulatrix. It dips down sharply behind the last-mentioned structure. The sac therefore occupies rather more than 7 segments; it is some 9 mm. in length. The median spermathecal sac lies of course below the nerve-cord; it is entirely single throughout its course and is not divided into right and left nearly independent halves as in *P. magilensis.* The general appearance of the spermathecal sac will be quite obvious from the accompanying drawing (text-fig. 53, p. 193). As is the case with other species of this genus, the median sac is furnished with lateral diverticula.

The anterior end of the sac is provided with two long diverticula of cylindrical form, each one of which is, when fully extended, quite as long as the unpaired median sac. They touch each other above the intestine, but they are not fused at that point. The posterior pair of diverticula arise from the median sac just before its opening on to the exterior. They are distinctly shorter than the anterior pair of diverticula, but more swollen. The drawing also illustrates the relations of the oviduct, egg-sac, and egg-tube to the spermathecal sac. It will be noticed that the latter opens into the neck of the anterior diverticulum, close to its junction with the median unpaired spermathecal sac. The oviduct is long and but slightly curved. The chamber into which the oviduct opens ("Eitrichterblase") is of about the same size as, and is situated exactly opposite to, the egg-sac (receptaculum ovorum).

The species may be thus defined:

Polytoreutus gregorianus [1].

P. gregorianus F. E. Beddard, Monogr. Oligoch. 1895, p. 612.

Length 230 mm., breadth 9 mm.; number of segments about 450. Setæ very widely apart in ventral couples, closely approximated in lateral. ♂ pore xvii./xviii.; spermathecal pore on xix. A glandular eminence upon median ventral surface of segments xix.–xxxiv. Dorsal blood-vessel double in some of anterior segments. Sperm-sacs thread-like for anterior two-fifths, wide and sacculated after, and fused at posterior extremity. Spermiducal glands hardly sacculated, divisible into a shorter terminal part and a longer cylindrical distal region. Spermathecal sac median, unpaired, with two anterior and two posterior diverticula.

Hab. Giriama, E. Africa.

2. *A Contribution to the Knowledge of the Earthworm genus* Typhoeus.

This genus of Earthworms was founded by me [2] some years since for the reception of a single specimen of an earthworm from India. Later [3] my own description of a second species as well as the investigations of Bourne [4], Rosa [5], and Michaelsen [6], fully established the validity of the genus, which the last naturalist would regard as the type of a separate subfamily. The name which I originally wrote, in conformity with the Greek, *Typhoeus*, was erroneously altered into *Typhœus*, and subsequently into *Typhæus*, both of which are clearly wrong. It should obviously be written as in the present communication.

This genus is Indian, Burmese, and Ceylonese in habitat. It is perhaps, as Michaelsen has pointed out, closely related to such an Acanthodrilid as *Octochætus*. But its characteristics do not allow of its being merged into that or any other genus, as the additional observations which I have to offer here amply confirm. I shall commence with the description of two new species lately received by me, and conclude with a revision of the whole genus, which now contains seven distinct species.

Typhoeus nicholsoni, n. sp.

Of this apparently new species of the genus, I have examined three fully mature individuals. These I have received through the

[1] Named after Prof. J. W. Gregory of Melbourne University.

[2] "Note on some Earthworms from India," Ann. Nat. Hist., Oct. 1883, p. 219.

[3] "On the Structure of three new Species of Earthworms, &c.," Quart. Journ. Micr. Sci. vol. xxix. p. 111.

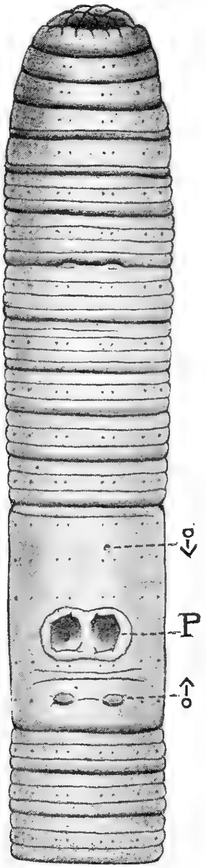
[4] "On certain Earthworms from the Western Himalayas and Dehra Dun," J. A. S. B. lviii. p. 112.

[5] "Viaggio di Leonardo Fea in Birmania e Regioni vicine: xxv. Moniligastridi, Geoscolicidi ed Eudrilidi," Ann. Mus. Civ. Genova, (2) ix. p. 23; and "Die exotischen Terricolen des k. k. naturh. Hofmuseums," Ann. k. k. Hofm. Wien, vi. p. 388.

[6] "Die Terricolenfauna Ceylons," JB. Hamb. wiss. Anst. x. p. 90; and "Oligochæten von Inseln des Pacific, &c.," Zool. Jahrb., Abth. f. Syst., xii. p. 241.

kindness of Mr. Nicholson, of the Royal Gardens, Kew, who has sent me a large number of accidentally imported earthworms. These specimens are from Calcutta, and arrived in company with a large number of specimens of *Amyntas posthumus* and a few examples of other species of the same genus, and of a second species of *Typhoeus*.

Text-fig. 54.



Typhoeus nicholsoni. Head-end, × 3.
♀, oviducal pore; ♂, male pores; P, papillæ.

External characters.—The largest of the three specimens measures 145 mm. in length, with a diameter of 5 mm. These measurements apply to the worm after contraction by alcohol.

I counted 190 segments, which—with the exception of the last few—are annulated. The first three segments, moreover, show no annulation. The fourth and fifth segments are each divided into two by a median furrow; the sixth is triannulate; the fact that the setæ occur in the middle ring of this segment, and on the anterior of the two which are biannulate, shows that it is the anterior annulus which is further subdivided. The three following segments have each four annuli, the setæ being implanted upon the second ring. Segments x., xi., xii. are again triannulate. After the clitellum the segments are more or less distinctly triannulate for a considerable distance back. The above description is drawn up from the specimen which I have regarded as the type; but the others show no differences save for incomplete additional furrows upon some of the segments.

The *prostomium* is broad, and does not at all impinge upon the first segment of the body. But a pair of furrows upon the first segment make with it a T-shaped piece.

There are naturally 8 *setæ* per segment, arranged in couples. The two couples of each side are close to each other and are quite ventral in position. The two setæ of the ventral couples are distinctly closer together than are those of the lateral couples. I found the lateral as well as the ventral setæ upon the clitellar segments; and setæ do not appear to be wanting upon the second segment of the body. It is not, however, easy to see them, since this segment, like the first, is marked by a number of short longitudinal furrows [1].

The *clitellum* of this species of *Typhoeus*, like that of others, occupies segments xiii.–xvii.

Dorsal pores are obvious after the clitellum, but seem to commence anteriorly to that part of the body.

As is the case with the majority of the already known species of the genus *Typhoeus*, *T. nicholsoni* possesses *genital papillæ*. There is a pair of these papillæ upon all of the three specimens in my possession, which are of a rather peculiar form. The area occupied by the papilla is, according to the state of contraction of the body, circular or more elliptical, the long axis of the ellipse being at right angles to the long axis of the body. A complete furrow separates the two papillæ from the surrounding integument, and they are separated from each other by a furrow. Their general appearance and relations can be gathered from an inspection of the accompanying drawing (text-fig. 54), which illustrates the ventral surface of this worm. The two papillæ occupy nearly the entire space between the ventral setæ of segments xv. and xvi. Laterally they extend for a very short way outside of the area thus defined. Each papilla has a central circular patch of different appearance from the peripheral part.

The *spermathecal pores* lie between segments vii./viii., and are very closely approximated ventrally; their orifices correspond in position to that of the innermost seta of the ventral couple.

The *male pores* are extremely conspicuous. They lie upon the

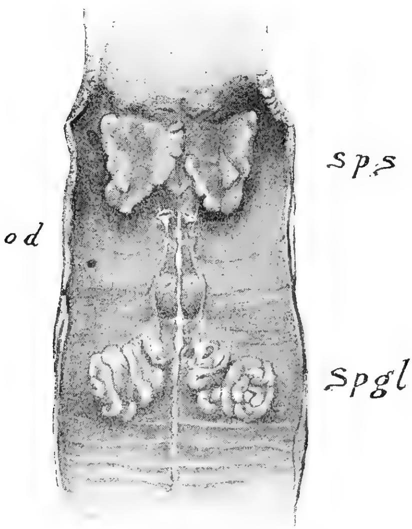
[1] This may possibly account for my failure to find them in *T. gammii*.

xviith segment and are close together like the spermathecal pores. The integument surrounding them is raised into a ridge. From each pore protrudes the everted end of the spermiducal glands.

The *oviducal pore*—for there is only one—offers a most remarkable case of asymmetry. In all three specimens there was but a single pore present, that of the left side. This pore is very conspicuous and lies just in front of the ventralmost seta of the fourteenth segment. There was no observable trace of a corresponding pore upon the opposite side of the body.

A dissection (shown in text-fig. 55) sketched without any instructions shows plainly that the oviduct of the right side is abbreviated and only just reaches the body-wall. Naturally, this

Text-fig. 55.



Typhoeus nicholsoni. Genitalia, × 3.

sp.s., sperm-sacs; *od.*, oviducts; *sp.gl.*, spermiducal glands.

anomalous state of affairs was further investigated by section-cutting; I found that the two oviducts had funnels of quite the same size, but that the lumen of the right oviduct gradually diminished, and that the tube ended blindly just at the body-wall, which it does not perforate. The wide lumen of the left oviduct, on the other hand, is very obvious where it perforates the body-wall.

Alimentary canal.—The *gizzard* appears to occupy both the seventh and the eighth segment, inasmuch as no recognizable septum divides those segments from each other.

The *œsophagus* extends back as far as the xvth segment, in which segment the intestine commences. The *calciferous glands*, of which there may be said to be a single pair in this as in other species of *Typhoeus*, do not present the appearance of discrete pouches opening into the gut; they form an oval reddish-coloured swelling situated in segment xii. The *intestine* has a typhlosole; but this is not apparent until segment xxx. (about). The characteristic *intestinal glands* of the genus are visible far back upon the intestine, commencing with segment lxxxiv. or thereabouts. They occupy in all five segments, and those of successive segments are separated by the septa. The dorsal vessel lies between the glands of the right and those of the left side.

Intersegmental septa.—A number of septa lying in front of and behind the gizzard are thickened. In front of the gizzard are two such septa; behind the gizzard are three thickened septa. The space occupied by the gizzard—the whole of the space formed by the cœlom of segments vii. and viii.—appears to be entirely undivided by any septum or even traces of that partition.

Vascular system.—The only point to which I direct attention in the structure of the vascular system is the number and the position of the "hearts." Of these there are six pairs, of which the first lie in the viiith and the last in the xiiith segment.

Nephridia.—These organs consist, as in the other species of the genus, of numerous micronephridia.

Reproductive organs.—The male gonads and their duct and the sperm-sacs are in this, as in other species of the genus, limited in number to a single pair. The *testes* and *funnels* lie in the xith segment, and the following one, whose capacity is thereby extended, contains the sperm-sacs. The *sperm-sacs* are of considerable size, measuring 6 mm. in extreme length; they are flattened and broad, and of a roughly triangular form, the apex of the triangle being posterior in position, the margins are somewhat lobulate. The *spermiducal glands* are each coiled into a tight mass, throughout which, however, the tubular structure of the gland is perfectly obvious. The muscular duct is of fair length, and its calibre is barely one third of that of the thicker parts of the gland-tube. Between the opening of the two glands the ganglionic swelling upon the nerve-cord is considerably larger than the corresponding swellings in other segments.

The penial setæ are rather longer than those of *T. incommodus*, of which a drawing is exhibited (text-fig. 57, p. 202), and they are remarkable for being apparently of a very delicate structure at the free end, which in all the setæ that I have examined was much bent and in different directions. The extremity is hardly sculptured, a very fine pitting being all that is visible.

The *spermathecæ* have a longish muscular duct, to the commencement of which upon the outside is affixed a somewhat fan-shaped diverticulum.

Typhoeus incommodus, n. sp.

Of this smaller species, which is from the same locality as the last, I have examined two individuals, one of which was larger than the other, both, however, being fully mature.

The length of the larger individual is 90 mm.; it has about 125 segments.

The first three segments are simple and without annuli. The next three segments are biannulate, and the rest in front of the clitellum have three annuli, upon the middle one of which are situated the setæ. After the clitellum up to nearly the end of the body the segments are also triannulate.

The *prostomium* is as in the last species. Its features are illustrated in the accompanying drawing (text-fig. 56). The couples of *setæ* are all of them farther apart, relatively speaking, than they are in the last species. But, as in *T. nicholsoni*, the two setæ of each ventral couple are nearer together than those of the lateral couples. The individual setæ of the lateral couples get rather farther away from each other towards the posterior end of the body.

The present species is also characterized by the number and position of the *genital papillæ*. There are four pairs of these in both specimens, which are found only upon the clitellar segments, the xiiith to the xvith inclusive. The papillæ are exactly on a line with the ventral couples of setæ, and their size is such that they occupy roughly the same amount of space upon the body. The papillæ lie close to the posterior border of their respective segments, but not actually on the border line as apparently they do in *T. orientalis*. The genital papillæ project somewhat from the general body surface and have a rim of white surrounding a darker central area. They are almost circular in outline.

The *male generative pores* lie upon the xviith segment, their position being a little to the outside of the ventral couples of setæ. They are borne upon prominent rounded papillæ of circular contour marked off by grooves from the surrounding integument.

The *oviducal pores* are unquestionably paired in the present species. They lie in front of the innermost seta of each ventral couple.

The *spermathecal pores* are conspicuous slit-like orifices with crenated lips. They lie farther apart than in *T. nicholsoni*, between the ventral and lateral couples of setæ.

The *alimentary canal* offers two points of difference from that of the last species. There is a definite pair of calciferous glands in segment xii., and the intestinal glands are situated farther forward, beginning in the lxviith segment. As in *T. nicholsoni*, the gizzard is large and lies mainly (? entirely) in segment viii.

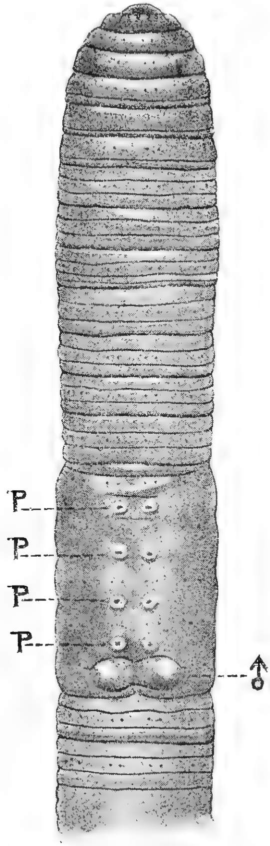
There are two specially thickened *septa* in front of the gizzard and three behind it. The last of the latter separates segments x./xi.

The last *heart* is in segment xiii.

The *nephridia* are numerous in each segment.

The *organs of reproduction* show one unexpected feature which has not hitherto been recorded in this genus and which serves to bring it nearer to *Megascolides*. There are two pairs of sperm-sacs which occupy what Dr. Michaelsen regards as the primitive position, *i. e.*, segments ix. and xii. They are roughly triangular-shaped sacs, and are lobulate; the two pairs are very different in size, those of segment xii. being rather the larger. There are, however, but a single pair of funnels, which are larger and lie as usual in the xith segment.

Text-fig. 56.

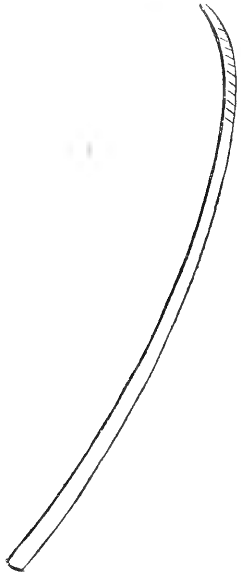


Typhoeus incommodus. Head-end, × 4.
♂, male pore; P, papillæ.

The coiled *spermiducal glands* present no remarkable features. The glandular part is a great deal thicker than the muscular duct. The latter is very short, much shorter than in the last species, and is only bent once on the right side and into a W on the left.

The *penial setæ* are illustrated by the accompanying drawing (text-fig. 57); the distal end of each seta is but faintly ornamented with a few transverse ridges.

Text-fig. 57.



Typhoeus incommodus, penial seta, greatly magnified.

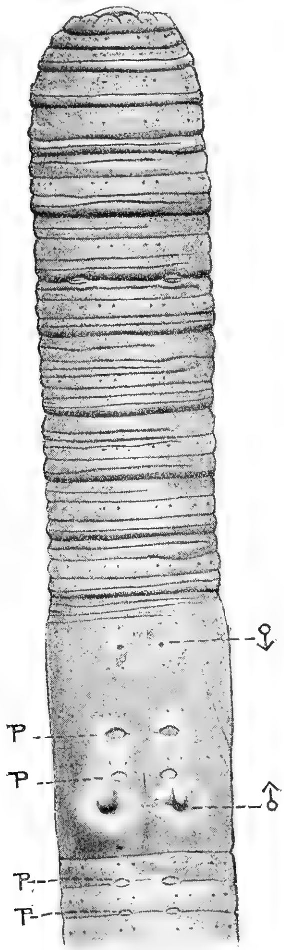
The *spermathecæ* are large globular sacs. The diverticula form a complete frill of small sacs round the duct of the spermatheca.

Typhoeus masoni Bourne.

Typhoeus masoni A. G. Bourne, J. A. S. B. lviii. p. 112.

Prof. Bourne examined and reported upon a single individual only of this species from Dehra Dun. I have acquired a second specimen, also fully mature, from the same locality and beg to offer a few notes thereon. My specimen measures 146 mm. in length. Beyond observing that the anterior segments are bi- to quadr-annulate, the description of the species gives no details of the annulation of these segments. As this matter appears to be of specific value, I give a detailed account of the annulation in elucidation of the accompanying woodcut (text-fig. 58). The first segment is simple; the second is fairly annulate, the third and fourth very decidedly so. In both of them the setæ are implanted upon the first of the two annuli. The fifth ring is primarily bi-annulate, but each annulus is again subdivided. The next segment is divided into three marked annuli, of which the middle one bears the setæ; the first and the third annulus are fairly subdivided, so that the somite may be said to have 5 annuli. The seventh and eighth segments have the same subdivisions as the last. Eight

Text-fig. 58.



Typhoeus masoni. Head-end, × 4.
♀, oviducal pores; ♂, male pores; P, papillæ.

annuli can be counted in the ixth segment, 6 in the xth, 5 in the next two, which brings us to the commencement of the clitellum.

The *genital papillæ* are, as figured by Bourne, four pairs. He does not mention, however, certain slight differences in the position of the different pairs. The first pair, *i. e.*, those lying between segments xv./xvi., and the last two pairs correspond in position to the outermost of the two ventral setæ ; that is to say, a line drawn from this seta would pass through the middle of the papilla. On the other hand, the second pair lie between the two setæ of the ventral couple. As Bourne states, the two anterior pairs of papillæ are much more marked than the two posterior pairs.

I find the position of the *oviducal pores* rather different from that illustrated by Bourne. Each lies in front of the inner seta of the ventral couple; it is noteworthy, perhaps—in connection with the remarks that I have made above concerning the asymmetry of the oviducal pores of *T. nicholsoni*—that in the present species the left-hand pore is decidedly the larger.

The excellent condition of preservation of my specimen enables me to add a few details to our knowledge of the internal anatomy of this species.

I find that the arrangement of the septa is a little different from that described by Bourne. The first plainly recognizable septum, which is also fairly thick, separates segments v. and vi. Then follows a much stouter septum, which limits anteriorly segment vii., in which segment lie the spermathecæ. Behind the spermatheca and attached to the anterior end of the gizzard is a thin and delicate septum. The gizzard therefore occupies segment viii. It is followed by three thickened septa, to the first of which it is attached by two symmetrically placed strap-shaped bands of muscle. The position of some of the organs of the body is a little difficult to ascertain, and appears to vary from what I have described above in *T. nicholsoni*.

I believe Bourne to be right in placing the anterior end of the sperm-sacs in segment xi.; they extend back to xiii. There is, however, no real anomaly inasmuch as these sacs are not attached to septum x./xi.; they may be considered to belong morphologically to segment xii., from which they have grown forwards as well as backwards. The calciferous glands I should place in segment xii. The last hearts are in xiii.

I find five pairs of intestinal glands—not four as Bourne has stated ; they are bilobed, the furrow being transverse.

The several species of the genus *Typhoeus* show a very considerable uniformity of internal structure, combined with a marked variation in the numbers and the arrangement of the genital papillæ. Unfortunately data are wanting as to the internal structure of *Typhoeus lævis*, and several details of importance from a systematic point of view have been left undescribed by myself in *T. orientalis*, which, however, as the first known species of the genus was amply characterized as such. The only real difference in the internal structure which can be deduced from our present knowledge is the fact that in *T. incommodus* there are the two pairs of sperm-sacs of many *Megasoclex* and *Megascolides* in segments ix. and xii., which Dr. Michaelsen has thought to be the primitive arrangement of those sacs among earthworms. That species also combines with this divergence in structure a peculiar disposition of the spermathecal diverticula, which are not arranged in a pair of trifid or multifid appendages as in other species, but in a continuous circle of sacs round the spermatheca. We may perhaps regard this form as the starting point of the genus, the other conditions being arrived at by a loss of one pair of sperm-sacs and a reduction of the spermathecal appendages. It is to be remarked that in other species the sole remaining pair of sperm-sacs has increased in size, which may be connected perhaps with the disappearance of the anterior pair.

The following is a complete definition of the

Genus **TYPHOEUS** Beddard.

Small to moderate-sized earthworms, with 8 setæ per segment arranged in couples. Prostomium large. Clitellum occupying segments xiii.–xvii., partly or entirely. Male pores very conspicuous and upon segment xvii., corresponding in position to ventral setæ. Spermathecal pores upon the interval vii./viii. Genital papillæ one to six pairs upon clitellar and neighbouring segments; rarely absent (?). Dorsal pores present. Gizzard single in viii.; one pair of calciferous glands in xii. Intestine furnished with six pairs of glands beginning at about segment lxxx. Excretory organs micronephridia. Dorsal vessel single. A single pair of testes, funnels, sperm-ducts, and (except in *T. incommodus*) sperm-sacs. Spermiducal glands tubular, with penial setæ. Spermathecæ one pair with one or two diverticula, or more.

Hab. India, Ceylon, Burmah.

The seven species may be thus briefly characterized:—

Typhoeus orientalis.

T. orientalis Beddard, Ann. Nat. Hist. (5) xii. p. 219.

Length about 100 mm. Genital papillæ between segments xiii./xvii. and xviii./xx. in line with ventral setæ. Spermathecal pores corresponding to ventral setæ. Spermathecæ with two small and trifid diverticula. Penial setæ with chevron-shaped striæ at free end.

Hab. Neighbourhood of Calcutta.

Typhoeus gammii.

T. gammii Beddard, Quart. Journ. Micr. Sci. xxix. p. 111.

Length 250 mm. Genital papillæ single and elongated between xix./xx., xx./xxi. Setæ paired ventrally, farther apart in lateral pairs. Spermathecal pores corresponding to interval between ventral and dorsal setæ. Spermathecæ with paired diverticula, which are multifid. Penial setæ with wavy ridges round distal end.

Hab. Darjiling.

Typhoeus masoni.

T. masoni Bourne, J. A. S. B. lviii. p. 112.

Length 146 mm. Genital papillæ paired between xv./xvii., xviii./xx., corresponding to ventral setæ. Setæ closer in ventral pairs; posteriorly lateral setæ get wider apart. Spermathecal pores correspond to interval between ventral and lateral setæ. Spermathecæ with two diverticula bifid or trifid. Penial setæ both smooth and with distal chevron-shaped striæ.

Hab. Dehra Dun.

Typhoeus lævis.

T. lævis Rosa, Ann. Mus. Civ. Genova, (2) ix. p. 388.

T. lævis Rosa, Ann. k. k. Hofmus. Wien, vi. p. 388.

Length 35 mm. Papillæ paired upon xvii. and xviii. Setæ of lateral pairs farther apart than those of ventral.

Hab. Burmah and Ceylon.

Typhoeus foveatus.

T. foveatus Rosa, Ann. Mus. Civ. Genova, (2) ix. p. 382.

Length 180 mm. No genital papillæ (?). Setæ of lateral pair farther apart than those of ventral. Spermathecal pores corresponding to ventral setæ. Spermathecæ with two simple diverticula. Penial setæ with minute points at end.

Hab. Rangoon.

Typhoeus nicholsoni, n. sp.

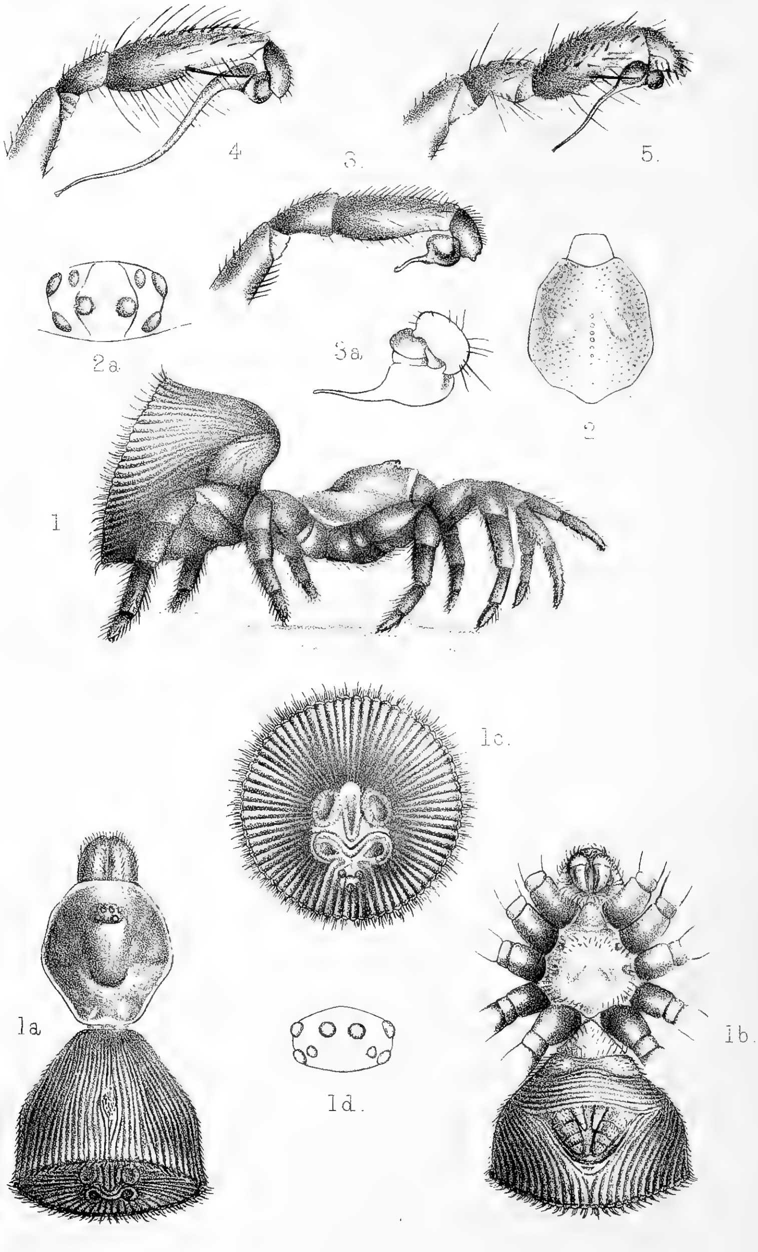
Length 135 mm. Genital papillæ one pair on xvi. Setæ of ventral pair closer than those of lateral; the latter a trifle wider apart posteriorly. Spermathecal pores correspond to ventral setæ. Spermathecæ with paired diverticula which are trifid. Penial setæ with very faint ornamentation.

Hab. Neighbourhood of Calcutta.

Typhoeus incommodus, n. sp.

Length 93 mm. Papillæ paired upon xiii.–xvi. behind ventral setæ. Setæ of lateral pairs farther apart than those of ventral, posteriorly considerably farther apart. Spermathecal pores between pairs of setæ. Spermathecæ with a ring of many diverticula. Two pairs of sperm-sacs in ix. and xii. Penial setæ with a few faint ridges.

Hab. Neighbourhood of Calcutta.



M. Horman-Fisher del. et lith.

West, Newman imp.

NEW SPIDERS FROM CHINA.

4. On some new Trap-door Spiders from China.

By R. I. Pocock, F.Z.S.

[Received February 11, 1901.]

(Plate XXI.[1])

The most interesting species described in this paper are the two discovered by Mr. J. La Touche and Mr. C. B. Rickett at Kuatun in North-west Fokien.

One of these, *Halonoproctus ricketti*, is the representative of a new genus belonging to a specialized group of Ctenizidæ, hitherto known only from the Sonoran area of North America; the other, *Latouchia fossoria*, is a more typical Ctenizoid apparently belonging to the same genus as the spider that Simon erroneously identified as *Acattyma roretzi* of L. Koch. The genus *Latouchia* is related to the Mediterranean genus *Cyrtocarenum*. The third genus, *Nemesia*, has hitherto been regarded as confined to the Mediterranean Region. The record of *Macrothele* from the Chinese area fills a gap in our knowledge of the distribution of the genus, the representatives of which were previously known from the Mediterranean Region, from Burma, Java, and New Zealand. Hence, assuming that it had a northern origin, it is admissible to suppose that *Macrothele* made its way into the Oriental Region and New Zealand by way of China. Further collecting will, in all probability, show that both this genus and *Nemesia* have a continuous distribution across Central Asia from China to the Mediterranean area.

Subfamily Halonoproctinæ, nov.

In Mexico and the Southern States of North America there are two peculiar genera of Spiders, referred to the family Ctenizidæ, and characterized by the remarkable modification in the shape and other structural points of the abdomen. In the typical Ctenizidæ, as in most other Trap-door Spiders, the abdomen is tolerably evenly oval, with the integument soft, smooth, and covered with silky grey pubescence, the sigilla, or muscular impressions, on the dorsal side being small and relatively inconspicuous.

But in the genera above mentioned, namely *Cyclocosmia* and *Chorizops*, the integument is of a leathery consistency, and is folded into a number of narrow ridges separated by corresponding grooves, which, except in the ventral area behind the epigastric fold where they are transverse, run in a longitudinal direction[2].

[1] For the explanation of the Plate, see p. 215.

[2] A possible exception to this character is met with in *Cyclocosmia theveneti* of Simon, which is said to have the integument ungrooved. The abdomen of the only known example, however, is described as "*valde detritum.*" Hence the absence of folds is perhaps attributable to badness of preservation. It is possible, too, that the integument is sufficiently elastic to admit of considerable stretching, in which case the folds might disappear under the influence of distension of the abdomen.

Furthermore, the posterior end of the abdomen is abruptly and obliquely truncate, the truncated area being perfectly circular, nearly flat, and separated from the rest of the abdomen by a rounded or somewhat sharply defined edge. From this edge to the centre of the disk radiate a number of grooves, corresponding to and continuous with those of the rest of the integument. In the lower half of the disk there are three pairs of conspicuous sigilla, which decrease in size from above downwards and indicate the presence of powerful dorso-ventral muscles, which have apparently migrated backwards from the fore part of the abdomen; the edge of the disk is festooned, each festoon being tufted with hairs, which form a continuous rim or crown round the disk. Lastly, the spinners and the anal tubercle lie in a depression on the underside of the abdomen.

In other respects these Spiders closely resemble the normal *Ctenizidæ*, and Simon classified them with the genus *Pachylomerus* on the strength of the presence of a depression on the upperside of the tibia of the 3rd leg. This depression, however, cannot be regarded as a certain sign of affinity between genera of this family, since it is also developed in *Heligmomerus*, one of the Idiopinæ, and in *Myrtale* and *Thyropœus*, which belong to the Miginæ. In the present instance it no doubt misled Simon into associating with *Pachylomerus* two genera which are probably not more nearly related to the latter than they are to *Bothriocyrtum*, or any other genus of the section Ctenizeæ, though no doubt they are a specialized offshoot from the latter. Since, however, the specialization has been carried to such an extreme and is shared by three well-marked genera, the latter, in the absence of intermediate types connecting them with the typical Ctenizidæ, may be regarded as constituting a special subfamily, which I propose to call Halonoproctinæ, from the new genus *Halonoproctus*.

Halonoproctus, gen. nov.

(ἅλων, a disk, and πρωκτός, hind-quarters.)

Carapace smooth; cephalic area high; fovea deep, strongly procurved; ocular area remote from the anterior margin; the clypeus about as long as the ocular area, the latter three times as wide as long. *Eyes* of anterior line almost straight, subequal, the laterals a little in advance of the medians; the medians less than a diameter apart and rather more than a diameter from the laterals; but space between median and lateral on each side not twice as great as that between the medians; eyes of posterior line almost straight, the medians less than two diameters of the anterior medians from the latter; the two laterals on each side about a diameter apart.

Rastellum consisting of a conical process studded with spiniform teeth. *Labium* armed with a few (8) teeth. *Maxilla* studded throughout its length with spiniform teeth. *Sternum* as broad as long; marked with the normal three pairs of sigilla, those of the first pair marginal, of the second pair their own diameter from the margin; of the third pair large, remote from the margin, their anterior ends narrowly separated.

Legs as in *Ctenizа* &c.; the anterior pairs and palpi strongly and thickly spined on the sides of the tibiæ, protarsi, and tarsi; tibia of 3rd leg without trace of superior basal excavation; *claws* with a single or double large tooth.

Integument of *abdomen* stiff, leathery, and naked, thrown into numerous narrow folds forming shallow grooves and ridges, which, except on the ventral area behind the epigastric fold, run in a longitudinal direction; posterior end of abdomen truncate, and forming a perfectly circular, slightly hollowed area marked with radiating grooves and impressed in its lower half with three pairs of deep oval sigilla, which become smaller from above downwards; beneath the inferior pair there is a single median sigillum. Marginal festoons of this area, about 71 in number, transversely oblong and tufted with long hairs. Spinners set almost in a transverse line, the external pair widely separated at the base and obliquely converging posteriorly, their 1st and 2nd segments subequal.

This new genus and the two related Sonoran genera may be briefly diagnosed as follows:—

a. Eyes of the anterior line very widely separated, the medians about three diameters from the laterals; (tibia of 3rd leg excavated and clypeus very long) .... *Chorizops.*
b. Eyes of anterior line less widely separated; the anterior medians less than two diameters from the laterals.
  a[1]. Tibia of 3rd leg excavated above at the base, and clypeus short as in *Pachylomerus* (sec. Simon) .... *Cyclocosmia.*
  b[1]. Tibia of 3rd leg not excavated above at the base, and clypeus long as in *Bothriocyrtum* .... *Halonoproctus.*

Halonoproctus ricketti, sp. n. (Plate XXI. figs. 1–1 *d*.)

Colour: carapace, legs, and sternum mahogany-brown; abdomen deep purplish brown, blacker on the surface of the disk. *Carapace* almost as long as the patella, tibia, and protarsus of 1st leg, as patella, tibia, protarsus, and tarsus of 2nd, as patella, tibia, and tarsus of palp, very slightly longer than patella, tibia, protarsus, and tarsus of 3rd, and as long as patella, tibia, and protarsus of 4th leg; width of carapace equal to the length between the posterior border and the front edge of the ocular tubercle. *Legs*: 1st a little longer than 4th, 2nd and 3rd about equal and shorter than the palpus, which is shorter than the 1st leg by its tarsus. Palpus and 1st and 2nd pairs of legs normally spined; tibia and protarsus of 2nd armed externally with about 15 spines each, the tarsus with 6; patella and tibia of 3rd leg armed above and in front with small, close-set spines, which increase in number towards the distal end of the segments; protarsus with similar spines and some much larger ones intermixed, armed below with a pair of apical spines; 4th leg with patella and tibia thickly spined, the spines increasing in number on the proximal end of the patella and on the distal end of the tibia.

Measurements in millimetres.—Total length 28; length of carapace 11·5, of abdomen 15; diameter of disk 16·5; length of palp 19; 1st leg 21, 2nd leg 18, 3rd leg 18, 4th leg 21.

Hab. Kuatun, N.W. Fokien, China (*J. de La Touche & C. B. Rickett*).

The following is a list of the previously described species of the subfamily:—

Genus CHORIZOPS Ausserer.

CHORIZOPS LORICATUS C. Koch, Die Arach. ix. p. 99, fig. 752, 1842 (*Actinopus*); Ausserer, Verh. zool.-bot. Ges. Wien, xxi. p. 144 (1871); Simon, Hist. Nat. Araign. i. p. 89 (1892); id. Bull. Soc. Zool. Fr. 1897, p. 172.

Loc. Mexico, Vera Cruz.

Genus CYCLOCOSMIA Auss.

CYCLOCOSMIA TRUNCATA Hentz, Journ. Bost. Soc. Nat. Hist. iv. p. 55, pl. vii. fig. 1 (1843) (*Mygale*); Ausserer, Verh. zool.-bot. Ges. Wien, xxi. p. 145 (1871); Simon, Hist. Nat. Araign. i. p. 88 (1892) (*Cyclocosmia*).

Loc. Alabama.

CYCLOCOSMIA THEVENETI Simon, Act. Soc. L. Bord. xliv. p. 313 (1892).

Loc. California.

Subfamily CTENIZINÆ.

LATOUCHIA, gen. nov.

(? = *Acattyma* Simon, Hist. Nat. Araign. i. p. 96 (1892); nec L. Koch.)

Carapace typically ctenizoid, smooth, with head elevated, and fovea very strong and procurved, the impressions well marked especially the anterior pair, which are deep. *Ocular tubercle* close to edge of clypeus, high, the median eyes standing considerably above the level of the laterals, ocular area about twice as wide as long, parallel-sided; eyes of anterior line lightly procurved, the anterior edge of the medians on a level with the centres of the laterals, the eyes subequally spaced and subequal in size, the medians less than a diameter apart; posterior eyes on a level by their posterior ends, the laterals much larger, separated from the anterior laterals by a space which is distinctly less than the diameter of either.

Rastellum as in *Cyrtocarenum*, but the process bearing the teeth less prominent and the teeth numbering about 9. *Labium* wider than long, narrowed distally, unarmed. *Maxillæ* armed anteriorly at base with about 9–12 cusps. *Sternum* a little longer than wide; its sigilla fusing to form a shallow Λ-shaped groove in the middle. Posterior *spinners* very short, the 1st and 2nd segments much wider than long. Tibiæ, protarsi, and tarsi of *palpi* and anterior *legs* thickly banded laterally with short spines, but almost entirely without inferior spines; tibia of 4th not spined externally; claws with a large basal tooth and one or more smaller.

Type, *L. fossoria.*

Most nearly related to *Cyrtocarenum* of the Mediterranean basin, but differing in the more compact setting of its eyes, the high tubercle, unarmed labium, different development of sternal sigilla, and thicker spine-armature of palpi and anterior legs.

This new genus is in all probability identical with *Acattyma* of Simon, which is totally distinct from *Acattyma* of L. Koch. The latter, as Koch's diagnosis clearly shows, is closely related to *Brachybothrium*, and belongs to a different family from the species referred by Simon to the genus *Acattyma.*

The true *Acattyma* from Japan has the fovea not transverse but forming a longitudinal impression; the posterior spinners as long as the protarsus of the 4th leg, with the third segment equalling the length of the first and second taken together; the sternum with 3 marginal impressions on each side, the maxillæ untoothed and the mandibles "hoch emporgewölbt" at the base, and armed with rastellum—characters which show its affinity with the two North-American genera *Brachybothrium* and *Atypoides* (see L. Koch, Verh. z.-b. Wien, 1876, p. 760).

LATOUCHIA FOSSORIA, sp. n. (Plate XXI. figs. 2, 2 *a.*)

Colour: carapace and mandibles nearly black; legs and sternum deep blackish brown; abdomen blackish grey. *Carapace* as long as patella; tibia and protarsus of 1st leg almost as long as tibia, protarsus, and tarsus of 4th. 2nd *leg* with 1 median inferior apical spine; patella, tibia, protarsus, and tarsus of 3rd spined externally (in front) and internally, the internal spines on the patella reduced to 2 near the top of the segment, protarsus with 3 inferior spines whereof 2 are at the base; patella of 4th with a short band of spines in its basal half externally, its tibia armed with setiform spines below, its protarsus with a pair of inferior apical spines, as well as others.

Measurements in millimetres.—Total length 20; carapace 8; 1st leg 15, 4th leg 19.

Hab. China: Kuatun in N.W. Fokien (*J. de La Touche & C. B. Rickett*).

LATOUCHIA SWINHOEI, sp. n. (Plate XXI. figs. 3, 3 *a.*)

♂. Paler than the female of *L. fossoria*; carapace and legs reddish brown, femora of palp and of 1st and 2nd legs blacker.

Carapace coriaceous, lower than in the ♀ of *L. fossoria*, a shallow horseshoe-shaped depression behind the fovea and following its curvature. *Ocular tubercle* lower; anterior median eyes about a diameter apart, smaller than the laterals, their centres about on a level with the hinder edge of the laterals, hence the anterior line is very distinctly procurved.

Rastellum composed of about 5 strong teeth. *Maxillæ* unarmed. *Palpi* and legs bristly, the bristles on the upperside of the trochanters and coxæ spiniform. *Palpi* about one and a half times as long as the carapace, the femur strongly spined at the apex especially above; the rest of the segments unspined; the tibia more than twice as long as the patella, fusiform, narrowed apically; tarsus short and truncate, some of the bristles on its upperside short and clavate; bulb of palpal organ large, deeply cleft, the spine relatively short, slender, lightly curved, blunt-pointed. *Legs* 4, 1, 2, 3; 1st with femur above and at apex, patella externally, internally, and especially below, tibia externally and internally at the apex strongly spined; protarsus and tarsus practically unspined (protarsus of right leg nearly straight, with one basal and one apical spine, of left leg bowed and unspined); 2nd leg spined like the 1st, except that there are more spines on the protarsus and the anterior side of the tibia is spined throughout its length, and the posterior side most strongly spined at its base; 3rd leg strongly spined, especially on patella and tibia; 4th leg much more weakly spined than 3rd: tarsi of legs practically unspined, two or three spines only being on the tarsus of the 4th. *Claws* of legs with 4–5 teeth. *Abdomen* bristly above.

Measurements in millimetres.—Total length 12; carapace 7; palpus 10; 1st leg 20, 4th leg 23; patella and tibia of 1st and 4th about 8.

Hab. Great Loo-Choo (*P. A. Holst*).

Genus Nemesia Aud.

Nemesia sinensis, sp. n.

♀. *Colour*: carapace deep brown, scantily haired; legs yellowish brown; abdomen imperfect, but apparently testaceous and pigmented above much as in *N. cæmentaria*.

Carapace with cephalic region but little elevated; ocular area more than twice as wide as long; eyes of anterior line not very unequal in area, the laterals not exceeding the medians, strongly procurved, the anterior edge of the medians on a level with the posterior edge of the laterals. *Rastellum* consisting of about 12 strong teeth overhanging the base of the fang and extending up the inner edge of the mandible. *Maxillæ* armed with a single row of 6 cusps. *Palp*: tibia armed with 11 spines, 8 or 7 of which are arranged in pairs on its lower side, tarsus armed with 1 external and 1 internal spine (the latter sometimes absent) and two rows of spines near the middle line of the distal half; scopulate at sides. 1st *leg*: tibia with 4 external spines beneath and 1 apical internal, also 2 on the inner side, protarsus with 3 external, 2 internal beneath, and 1 on inner side, tarsus spined at apex beneath, both tarsi and protarsi scarcely scopulate in the middle; 2nd leg: tibia armed with 4 inferior external spines, 1 inferior apical and 2—3 internal, protarsus with 3 inferior external, 2—1 inferior internal, and 2 internal; tarsus spined at apex beneath; 3rd leg: tibia armed with 2 spines in front and 3 spiniform setæ below; protarsus with many strong spines, tarsus with a few apical spines; 4th leg with tibia scarcely spined, protarsus with a few setiform spines; tarsus also only armed beneath with setiform spines.

Measurements in millimetres.—Total length 15; carapace 6; 1st leg 12, 4th leg 16.

Hab. China; Da Lan San, 60 miles uphill from Ningpo (*P. W. Bassett-Smith, Surgeon R.N.*).

This species apparently falls into section D of the species of the genus as divided by Simon. It is remarkable for its low head, strongly procurved anterior line of eyes, and strongly spined legs.

The genus *Nemesia* has hitherto not been obtained outside the limits of the Mediterranean Region. Its occurrence in China, therefore, is peculiarly interesting.

Family Dipluridæ.

Genus Macrothele Ausserer.

Macrothele palpator, sp. n. (Plate XXI. fig. 4.)

♀. Uniformly coloured like *M. fuliginea*. *Eyes* not very different from those of *M. fuliginea*. *Carapace* a little longer than patella and tibia of 1st leg, equal to those of 4th and to protarsus and half the tarsus of the 4th. *Palp* with tarsus about as long as the patella and tibia, lightly expanded at the base, armed with 3 external, 1 inferior distal, and 3 or more internal and distal spines. *Legs* 4, 1, 2 and 3 in length: 1st with 3 inferior apical tibial spines, 4—4—3 inferior protarsal and about 7—7 lateral tarsal spines; 2nd leg spined much like the 1st; 3rd and 4th with tibiæ, protarsi, and tarsi more numerously and less regularly spined, and also with few spines on the patellæ.

♂. Smaller than ♀. *Carapace* jet-black, as long as patella and tibia of 1st leg. Tibia of 1st *leg* armed beneath with 3 long spines in addition to an apical pair; tibia of 2nd leg armed with 5 long spines below; protarsus of 2nd lightly bowed at base and only armed with about 4 inferior spines, protarsus of 1st armed with three rows of long strong spines. *Palp* with tibia armed above with a band of about 12 short spines, this segment long, lightly convex above, swollen below at the base; tarsus short, truncate, about one-fourth as long as the tibia; palpal organ enormously long, about as long as the patella and tibia of the palp and as the width of the carapace, the spine broad at the base, gradually narrowing and very fine and filiform at the apex, with a lightly sinuous curvature.

Measurements in millimetres.— ♀. Total length 18; carapace 8; 1st leg 21, 2nd leg 20, 3rd leg 20, 4th leg 25. ♂ (*type*). Total length 12; carapace 6; 1st leg 16, 2nd leg 16, 3rd leg 15, 4th leg 20.

Loc. China: Hong Kong (*J. C. Bowring*); Da Lan San, 60 miles uphill from Ningpo (*P. W. Bassett-Smith, Esq., Surgeon R.N.*; ♂ (type), ♀).

Distinguishable from the Javan *M. fuliginea* Simon (Ann. Soc. Ent. France, 1891, p. 306), which it resembles in colour, in having 3 rows of spines instead of 2 rows on the underside of the protarsi of 1st and 2nd legs, as well as in the greater length of the tarsus of the palp. The British Museum has specimens of *M. fuliginea* from Ijigombong in Java (*E. W. Andrews*) and from Singapore (*H. N. Ridley*).

Macrothele holsti, sp. n. (Plate XXI. fig. 5.)

♂. Coloured like the Burmese and Javan *M. maculata* Thorell (Ann. Mus. Genova, xxviii. p. 409, 1890) and the Penang *M. segmentata* Simon (Ann. Soc. Ent. Fr. lxi. p. 284); that is to say, with the abdomen ornamented above with about 5 pairs of oblique transverse pale bands and some pale spots on a darker ground. *Eyes* practically as in *M. fuliginea* and *M. palpator*. *Carapace* as long as patella and tibia of 1st leg, the fovea having the form rather of a median transverse pit than of a transverse sulcus. *Legs*: femur of 1st spined internally, patella with about 4 spines; tibia armed internally and below with about 28 strong spines arranged in irregular series, protarsus with 10 spines in two rows, tarsus with 5 small spines in two rows; tibia of 2nd leg with 2 internal and 5 inferior, of which 3 are apical, protarsus with 4—2 spines; tibia of 3rd and 4th with 2 apical spines below. *Palp* shorter than in *M. palpator*, the tibia about three times as long as the tarsus, armed above with two bands of spines and 1 long inferior external spine; palpal organ about as long as the tibia and half the width of the carapace, the spine with its basal third thick, its apical two-thirds filiform, lightly sinuous.

In two sub-adult females the tarsus of the palp is only as long as the tibia, and the tibiæ and protarsi of the anterior legs are spined as in *M. fuliginea*.

Measurements in millimetres.—♂. Total length 14; carapace 7; 1st leg 19, 4th leg 22.

Hab. Laki-ku-li, Central Formosa (*P. A. Holst*).

The males of the two species of *Macrothele* here described may be compared as follows:—

a. Palpal organ at least as long as tibia and patella of palp and as width of carapace; tibia of palp about four times as long as the tarsus, armed above with a single band of close-set spines; tibia of 1st leg armed with about 7 spines below and internally, patella and tibia scarcely spined; tibia of 2nd leg with 5 long and strong close-set spines, protarsus slightly curved at base; tibia of 3rd and 4th armed with many strong spines below ... *M. palpator.*

b. Palpal organ only as long as tibia of palp and as half the width of the carapace; tibia of palp with two bands of spines above, only about three times as long as the tarsus; tibia of 1st leg armed with about 28 spines, patella and femur spined internally; tibia of 2nd armed with scattered spines below; protarsus unmodified; tibia of 3rd and 4th with a pair of apical spines below .... *M. holsti.*

EXPLANATION OF PLATE XXI.

Fig. 1. *Halonoproctus ricketti* (p. 209). Lateral view.
1 *a*. „ „ Dorsal view of cephalothorax and abdomen.
1 *b*. „ „ Ventral view of ditto.
1 *c*. „ „ Posterior view of abdomen.
1 *d*. „ „ Eyes.
2. *Latouchia fossoria* (p. 211). Sternum.
2 *a*. „ „ Eyes.
3. „ *swinhoei* (p. 211). Palp of ♂.
3 *a*. „ „ Anterior view of tarsus and palpal organ.
4. *Macrothele palpator* (p. 213). Palp of ♂.
5. „ *holsti* (p. 214). Palp of ♂.

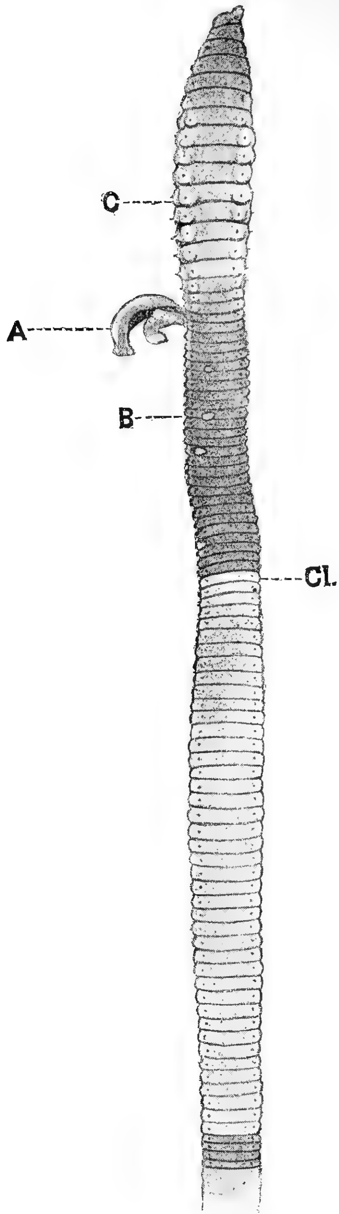
5. On the Clitellum and Spermatophores of an Annelid of the Genus *Alma*. By Frank E. Beddard, M.A., F.R.S.

[Received January 31, 1901.]

(Text-figures 59 & 60.)

Although the genus *Alma* is now fairly well known owing to the investigations of Levinsen (**1**), Michaelsen (**2**, **3**, **4**), and myself (**5**, **6**, **7**), no one has up to the present been able to detect the clitellum. That the spermatophores have not been found is less surprising, since these organs are known in but a small number of extra-European earthworms. I am now able, through the kindness of Mr. J. S. Budgett, F.Z.S., to fill in these two lacunæ in our knowledge of *Alma*. This gentleman has kindly placed in my hands a number of examples of a species of *Alma* which he collected during his recent expedition to the Gambia. They were gathered on McCarthy Island in that river, and consist of two fully mature specimens and of a few immature worms. The genus itself is purely African, and for the most part "Ethiopian" in range; the only species which reaches the Palæarctic portion of that continent is Levinsen's "*Siphonogaster ægyptius*," which appears to be identical with Grube's (**8**) *Alma nilotica*. It is, as I first pointed out, undoubtedly a member of the family Geoscolicidæ. It had been formerly regarded, though perhaps with some doubt, as an Eudrilid, to which latter family so many of the Ethiopian earthworms belong. My observations upon the clitellum confirm the justice of the former view, which is, indeed, definitely accepted by Dr. Michaelsen in his recently issued "Oligochæten" in the 'Tierreich' (**9**). He associates it with the genera *Criodrilus* and *Sparganophilus* in a subfamily Criodrilinæ, mainly distinguished from other Geoscolecids by the absence or rudimentary condition of the gizzard. In the generic definition of *Alma* occurs the sentence "Gürtel fehlt (?)," an almost necessary query in view of the fact that so many individuals of the genus had been submitted to careful examination, and that in not a single one was there any trace of this characteristic clitellum of the Oligochæta. It is possibly the case here, as in the aquatic lower Oligochæta, that the clitellum is only periodically developed, and that it is not so continuous a structure as appears

Text-fig. 59.



Anterior end of body of *Alma* sp. inc.

A, penis-like appendages; B, spermatophore; C, glandular thickenings round setæ; *Cl.*, commencement of clitellum.

to be usually the case with full-grown terrestrial forms. And in this connection it should be borne in mind that *Alma* is very largely an aquatic genus itself.

Clitellum.—The Geoscolicidæ agree with the Lumbricidæ, to which they are clearly very closely related, in the fact that the clitellum is often placed very far back in the body. Such a position is especially characteristic of the Madagascar genus *Kynotus*, in four species of which the clitellum commences at the xixth to the xxist segment. There is, however, no Geosolecid where the clitellum commences at a point farther back than the xxiind segment; *Glyphidrilus stuhlmanni* has a clitellum which commences at this segment. On the other hand, in the Lumbricidæ the clitellum is as a rule much farther back than in the Geoscolicidæ, commencing as a rule at a segment between xxii. and xxx. It is to this family that *Alma* shows the greatest likeness. In the specimen before me the clitellum (text-fig. 59, *Cl.*) is exceedingly plain on account of the white and opaque appearance of the integument; the individual segments which are comprised within the clitellum are, however, perfectly distinct, their lines of division not having been obliterated by the glandular modification of the skin. The clitellum does not commence or end at all sharply. The first segment which is fully modified is segment xlvii.; but two or three segments in front of this are slightly invaded by glandular tissue and in an irregular fashion. It is possible therefore that in a more fully mature example the clitellum would be found to have a greater extent than even the very large one which I record here. The last segment of the clitellum which is completely modified is segment lxxxii.; but here again two or three segments after this one are slightly modified. We may regard it as extending from xlv.–lxxxv. The clitellum, where fully developed, is continuous right round the body. This position of the clitellum is, however, much farther back than is the case with the large majority of the Lumbricidæ. There are, indeed, only four species where it commences at or just before the xlth segment. In *Allolobophora robusta* the clitellum extends from xl.–lxii.; in *A. molleri* from xlviii.–lix.; in *A. moebii* from lii.–lxii. *Lumbricus polyphemus* has a clitellum which reaches from xxxix.–xliv. It will be observed therefore that *Alma* is very exceptional in the backward position of this region of the integument, and that in extent coupled with position it is quite unique among earthworms.

Spermatophores.—The existence of these structures can be affirmed for the Lumbricidæ and for *Criodrilus* and *Polytoreutus* alone among the earthworms. As regards the former family, de Ribaucourt has recently added so much to our knowledge of those species among the genera *Lumbricus* and *Allolobophora* which possess spermatophores (**10**), that his conclusion that their existence will prove to be nearly if not quite universal for the family seems to be reasonable. The spermatophores of *Criodrilus* are much like those of the Lumbricidæ. Those of *Polytoreutus* on the other hand, described by myself, are of a different pattern, and on the whole more like those of the Tubificidæ, in which family these structures are very general. In the present species of *Alma* the spermatophores (text-fig. 59, B) are dotted about irregularly, but always in front of the clitellar segments. The largest number that I observed were possessed by the most fully mature individual, which had nine of these bodies. They are roundish in outline and very flattened; naturally they are firmly adherent to the integument. These two conditions must be very favourable to an earthworm having to force its way through the ground. It would be difficult to detach the spermatophores—more difficult one might imagine than in many Lumbricidæ, where the cases stand out far from the body. The spermatophores have a thin wall, and the contents are exceedingly striking on account of their chalk-white colour. On a microscopical examination, the contour of the spermatophores is seen to be not perfectly circular; the margins are crenated, the bulgings being due to the abundance of the sperm.

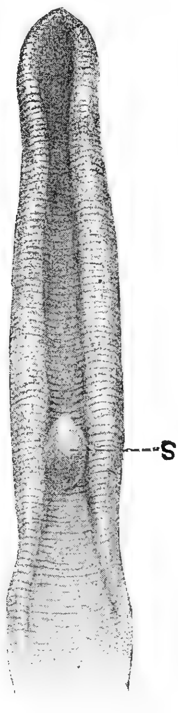
As it is a dangerous proceeding to argue from negative facts, I shall not do more than call attention to the fact that up to the present *Criodrilus*, justly placed by Michaelsen in the immediate neighbourhood of *Alma*, is the only Geoscolecid in which these structures have been hitherto made known. One matter, however, which may be emphasised is that, on the whole, the spermatophores of *Alma* resemble those of the Lumbricidæ; they are at least more like those of the Lumbricidæ than of other Oligochæta (save of course *Criodrilus*), though possessing distinctive features of their own. Now there has been, since recent discovery, little doubt that among the Lumbricidæ the spermatophores are a product of the tumid lips of the male pore. The suggestion was due to Rosa, who added that in earthworms which copulate in reversed positions the spermatophores are to be found behind the male pores. As a matter of fact this position is by no means constant; and in the species of *Alma* which I describe here they are both in front of and behind the male pores. As, however, *Alma* has no spermathecæ it is clear that the spermatophores cannot be a product of the spermathecæ as has been held; there are, however (see below), tubercula pubertatis which might by their presence confirm the theory of origin for the spermatophores propounded by Fraisse. The flatness and slightly protruding spermatophores of this species are in accord with the very slightly prominent male pores. It seems to be hardly a question now but that the spermatophores are formed by the glandular cells which accompany the external orifice of the sperm-duct.

Some other Anatomical Features.—I was myself disposed at one time to think that but one species of the genus *Alma* had been properly defined. I am now of the opinion of Michaelsen, expressed in his latest work (**9**), that four forms can be recognized. These species all come from different parts of Africa, with the exception of *A. emini* and *A. stuhlmanni*, which are associated together at Bukoba, Lake Victoria Nyanza. As the species which I describe here was obtained from a locality about fifteen hundred miles away from the locality which produced *A. millsoni*, there is a *prima facie* possibility of its being distinct from that form.

The general aspect is illustrated in the accompanying figure (text-fig. 59, A), and is like that of other species of *Alma*. The "penial processes" are not especially long, measuring as they do about 10 mm. as against a total body-length of 125 mm. These measurements are in all probability fairly accurate; for, though the worms were not in a very excellent state of preservation, they were, as it appeared to me, not unduly softened and presented no appearances of having been pulled out in the course of preparation or of subsequent handling. The square shape of the body both in front of the clitellum and posteriorly was quite well shown, a condition so characteristic of this genus, as of some others (e. g. *Allurus*, *Glyphidrilus*) which are at least sometimes aquatic in habit. To the corners of the quadrangular contour corresponded the pairs of setæ which in the present worm are not closely applied to each other. Throughout the body each seta is at some little distance from its fellow of the couple; and this arrangement persists unaltered to the end of the body, which is the case in *A. millsoni*, but not in any other of the remaining three species of the genus. In *A. millsoni*, however, the setæ are ornamented at the tip. In the present species I did detect a faint trace of ornamentation of the same nature as that of *A. millsoni*, where are denticulate ridges covering the free end of the setæ. The red colour of the setæ which I have referred to in *A. millsoni* was apparent at the imbedded end of the seta, where it is thick and squarely cut off. This end was quite red in several setæ which I noted, the red coloration was not always thus obvious.

The penial appendages of the present species differ at least from those of *A. millsoni* with which I have been able to compare them. They are more like those of *A. stuhlmanni*. In contrast to those of *A. millsoni*, the penes (as they may be termed in the absence of precise knowledge as to their functions and since they bear the male orifice) of the present species are not flattened and riband-like organs, but plumper and deeply excavated on the ventral surface; so deep is the excavation that the process, when viewed from below, is quite boat-like in shape. At the free extremity of the organ the depth is much greater than elsewhere; the part of the penis attached to the body (text-fig. 60), and for a little distance away from this as far as just before the first sucker, is not excavated, but quite flat though still fairly thick. This seems to show that the hollowing out of the organ is not a matter of unequal contraction, but is a real difference serving to differentiate the species at least from *A. millsoni*. Nothing of the kind is to be seen in Michaelsen's figures of *A. stuhlmanni* and of *A. emini*; but Levinsen figures the penes of *A. nilotica* as something like those of the present species. The attachment of the penes to the body-wall appears to present features of difference which may serve to assist in the discrimination of the species. In *A. millsoni*, as I have been able to assure myself by a re-examination of several specimens, the penes are attached to the ventral surface of both the xviiith and the xixth segments. In the present worm they are as clearly attached to the ventral surface of segments xviii., xix., and xx. This can be ascertained by the presence of lateral couples of setæ corresponding to the ventral area, which is devoid of setæ. There are three pairs on each side, the ventral setæ being missing or probably transferred to the penis, which is simply a pulled-out region of the ventral body-wall.

Text-fig. 60.



Penis-like appendage of *Alma* sp. inc.

S, sucker.

On the ventral surface of the penis are two suckers, which are quite conspicuous. The first is near to the base of the organ, the second at the opposite extremity at the bottom of the deep pit in which the penis ends. There were no suckers in intermediate positions such as are possessed by *A. millsoni*. In the arrangement of these suckers the present species seems to come near to

A. stuhlmanni. The whole organ is very vascular; there are a pair of strong longitudinally running blood-vessels whose cut ends in a specimen from which the two penes were removed were exceedingly obvious. Besides this there is a rich network of capillaries pervading the organ; and there are rich tufts of capillaries penetrating within the epidermis itself. There is thus quite a possibility of the organ serving, as was suggested by Levinsen, a respiratory function. The vascularity of the organ appeared to me to be more marked than in *A. millsoni*. In the latter species, it may be remarked, the penes are much thinner than in the present species. The penes bear setæ which are apparently limited in number to two pairs, as was occasionally found by Michaelsen in *A. stuhlmanni*. The setæ are rather slighter than those of the body generally and end in a fine point. They are nearly straight, and I could not detect any ornamentation. They are not unlike those of *A. stulmanni*.

The setæ of segments ix., x., xi., and some of the neighbouring segments to a less extent, are implanted in very conspicuous papillæ, which may possibly play the part of tubercula pubertatis. They are shown in the accompanying drawing (text-fig. 59, C).

I have given a somewhat full description of certain of the external characters of this species, in order to justify my conclusion that it probably belongs to Michaelsen's species *Alma stuhlmanni*. That a West and an East African form should prove to be identical is a little surprising; but less so when it is reflected that this genus *Alma* is at least largely aquatic. I can see at present no grounds for separating the two. The only point of difference which occurred to me is that in *A. stuhlmanni* the genital setæ are much smaller in proportion to the ordinary body-setæ than they are in the worms from McCarthy Island. Until the clitellum of the former is known, one cannot be quite certain. The internal anatomy could not be satisfactorily investigated owing to the condition of the specimens.

I have at least shown that the subject of the present communication cannot be the same as *Alma millsoni* from West Africa.

List of Memoirs referred to.

(1) Levinsen.—"Om to nye Regnormslægter fra Ægypten." Vidensk. Medd. Kjöbn. 1889, p. 31.

(2) Michaelsen.—"Beschreibung der von Herrn Dr. Fr. Stuhlmann am Victoria Nyanza gesammelten Terricolen." JB. Hamb. wiss. Anst. ix. 2, p. 8.

(3) Michaelsen.—"Zur Kenntnis der Oligochæten." Abhandl. Geb. Naturwiss. xiii. p. 7.

(4) Michaelsen.—Die Regenwürmer Ost-Afrikas, in Deutsch-Ost-Afrika, ix. 1896, p. 4.

(5) Beddard.—"On an Earthworm of the Genus *Siphonogaster* from West Africa." Proc. Zool. Soc. 1891, p. 48.

(6) Beddard.—"Two new Genera and some new Species of Earthworms." Quart. Journ. Micr. Sci. xxxiv. p. 271.
(7) Beddard.—A Monograph of the Oligochæta. Oxford, 1895.
(8) Grube.—Arch. f. Naturg. 1855, p. 129.
(9) Michaelsen.—Das Tierreich, 10th Lief., Oligochæten, 1900, p. 465.
(10) de Ribaucourt.—Etude sur la Faune Lombricide de la Suisse, 1896.

March 19, 1901.

Dr. Henry Woodward, F.R.S., Vice-President, in the Chair.

Mr. Sclater exhibited and made remarks on some specimens of Mammals from Uganda recently received from Sir Harry Johnston, K.C.B., who had written to call his special attention to these objects.

The principal specimen was a complete skin and skull of the Chimpanzee of Eastern Africa, concerning which Sir Harry had written to Mr. Sclater as follows:—

"Entebbe, Uganda,
Oct. 18, 1900.

"I have at last succeeded in getting a Chimpanzee from the Uganda Protectorate. I had long heard from the natives that this ape was found in Unyoro and Toru; but although I visited several forests in company with Doggett we never succeeded in getting specimens, though we occasionally thought we heard this animal's peculiar cries. At last, however, the natives succeeded in capturing one . . . a nearly full-grown female . . . which they sent on to me at Entebbe soon after my return here. The animal arrived alive. It was of immense strength and rather savage. After it had been taken out of its temporary cage and had been secured by means of thick wire collars and a heavy chain, it nevertheless managed to wrench itself free and escaped into a tree. There was no time for sentiment, and so I had the animal shot then and there. We have photographed it, and I am now sending you its skin and bones. The animal looks to me slightly different to the West Coast Chimpanzee, the difference being in the much reduced size of the canines (even though it be a female), the larger size of the middle incisors, and the length of the face. The colour of the bare skin of the face and nose when the animal was living was a dark purple-brown, which faded to a dirty yellow after death. It was certainly much darker-skinned when living than the average West Coast Chimpanzee.

"The locality where this animal was obtained is the central or eastern part of the Toru District, about 30 miles east of Ruwenzori, on the Durra River, a small stream which flows into the north end of Lake Ruisamba. Lake Ruisamba is connected with Lake Albert Edward. I have visited the locality where this Chimpanzee was subsequently captured, and thought I heard the Chimpanzee's cries. It is a dense bit of tropical forest, which, with a few breaks, extends from north to south down the Toru District. This forest is not directly connected either with Ruwenzori or with the Congo Forest. There are wide stretches of grass-covered country between them.

"The Chimpanzee is said by the natives to inhabit the now discontinuous patches of forest which extend from northern Unyoro through Toru into the northern part of Ankole. The Baganda say that at one time the Chimpanzee was found in Busoga and in other forested regions of Uganda, and they have a special name for the animal in their language. If this is true (and I see no reason to doubt it), it would bring the known range of this anthropoid ape a little nearer to the east."

Mr. Sclater remarked that the occurrence of a form of Chimpanzee in Africa as far west as the western shore of Lake Tanganyika had been known since the days of Livingstone, but that, so far as he was aware, this was the first example of the skin and skull that had reached this country.

Other specimens sent to Mr. Sclater by Sir Harry Johnston were flat native skins of the black-and-white *Colobus* which inhabits Ruwenzori, and flat native skins of two Antelopes, which probably belonged to undescribed species. One of the latter was stated by Sir Harry to belong to the genus *Cobus*, and to have been obtained in the Semliki valley north of Lake Albert Edward; the other was a *Cephalophus* of the group of *C. natalensis*, of which the exact locality was not stated.

Mr. Sclater laid on the table a small case of Lepidoptera collected in St. Lucia, West Indies, by Major A. H. Cowie, R.E., F.Z.S. As there appeared to be no published article on the Lepidoptera of this island, Mr. Sclater thought it worth while to record the names of the species, which had been kindly determined for him by Miss E. Sharpe. The following is a list of the species:—

(RHOPALOCERA.)

1. *Colænis delita* (Fabr.).
2. *Dione vanillæ* (Linn.).
3. *Dione juno* (Cram.).
4. *Pyrameis cardui* (Linn.).
5. *Junonia genoveva* (Cram.).
6. *Anartia iatrophæ* (Linn.).
7. *Marpesia peleus* (Sulz.).
8. *Cymatogramma dominicana* Godm. et Salv.
9. *Hypolimnas misippus* (Linn.).
10. *Aganisthos orion* (Fabr.).
11. *Terias venusta* Boisd.
12. *Pieris phileta* (Fabr.).
13. *Phœbis agrithe* Boisd.
14. *Callidryas drya* (Fabr.).
15. *Rhabdodryas trite* (Linn.).
16. *Aphrissa statira* (Cram.).
17. *Papilio xenodamas* Hübn.
18. *Papilio lycophron* Hübn.

(HETEROCERA.)

1. *Letis mycerina* Cram.
2. *Erebus ordoratus* Linn.

Mr. W. B. Tegetmeier, F.Z.S. (at the request of Mr. Rowland Ward, F.Z.S.), exhibited the mounted head and horns of a Sable Antelope (*Hippotragus niger*), the largest on record, the length of the horns on the outer curve being $50\frac{7}{8}$ inches, the girth at the base $9\frac{1}{2}$ inches, and the width between the tips $18\frac{1}{4}$ inches. They had been obtained by Mr. F. V. Worthington in Barotseland, South Africa.

A communication was read from Dr. G. Stewardson Brady, C.M.Z.S., which contained descriptions of a collection of Ostracoda belonging to the Zoological Museum of Copenhagen, most of the species represented in it being new to science. The collection was very varied in character, embracing examples of both marine and freshwater species from widely different localities. A new species belonging to the group *Halocypridæ*, from a North Atlantic Plankton collection, made by Dr. George Murray, F.R.S., was also described in this paper.

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

The following papers were read:—

1. On the Hymenoptera collected in New Britain by Dr. Arthur Willey. By P. Cameron[1].

[Received March 4, 1901.]

The Hymenoptera brought back from New Britain by Dr. Arthur Willey are, with the exception of the *Melipona*, all large or medium-sized species. Judging from them, I should say that the islands are likely to prove rich in species. The collection is not extensive enough to enable me to form a definite opinion on the geographical relationship of the Hymenopterous fauna of the island. If it were not for the presence of a species of *Thynnus*[2], a typical Australian form, I should have said that the affinities of these insects were certainly with the Oriental Zoological Region rather than with the Australian, and, in the main, this is probably the case.

In view of the somewhat fragmentary character of the collection, I have not thought it worth while to draw up, at present, a list of the previously recorded species of New Britain, but have enumerated all those represented in the collection submitted to me.

The specimens were mostly collected in the Gazelle Peninsula, which is the part now known, I believe, as New Pomerania. New Britain itself is now included in the Bismarck Archipelago by German geographers.

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

[2] *Thynnus serriger*, Sharp, Willey's 'Zoological Results,' part iv. p. 388.

TENTHREDINIDÆ.

SINOCLIA VIOLACEIPENNIS, sp. nov.

Cœrulea, nitida ; alis violaceis. ♀.
Long. 8 *mm.*

Antennæ of a darker blue than the body, thickly covered with short, stiff, black pubescence; the third joint is, if anything, longer than the fourth. Head smooth and shining; thickly covered with short black pubescence, which is longer and thicker on the face than on the vertex; the front is closely and minutely punctured; above it bears two oblique foveæ, the space between them being depressed; in the centre below is a smaller oval one. The sutures on the vertex are wide and deep; in the middle behind is a short deep furrow; bordering the inner side of the antennæ is a smooth curved furrow. Apex of the clypeus closely punctured. Mandibles at the base closely rugose; the apex broadly rufous. Thorax and abdomen smooth and shining; the mesonotum thickly covered with short black hair. Cenchri large, white. Wings fuscous-violaceous; the nervures and stigma black; the 2nd cubital cellule above is not quite half, below distinctly less than half, the length of the 3rd; the radial, the 2nd and 3rd transverse cubital, and the 2nd recurrent nervures at the top are largely bullated. Legs stout; the tibiæ and tarsi are thickly covered with short, stiff, black hair; the patellæ on the 4th joint are distinct; the calcaria short, curved; the claws distinctly bifid.

EVANIIDÆ.

MEGISCHUS VIOLACEIPENNIS, sp. nov.

Niger ; pedibus rufis ; coxis, trochanteribus, femoribus posticis basique tibiarum posticarum nigris ; alis fusco-violaceis, nervis nigris. ♀.
Long. 24 *mm.*

Antennæ black, slender. Front rugosely punctured above; the sides above stoutly obliquely, the lower part transversely striated, the ocellar region irregularly reticulated, the keels below them mostly curved; above the reticulated upper portion are four long curved keels, the vertex behind these is irregularly rugosely striated; the ocellar region is distinctly depressed; the three tubercles form a triangle. The base of the pronotum is smooth and shining; behind on the sides are two stout curved keels; the rest of the pronotum is opaque and irregularly transversely striated. The base of the mesonotum is smooth and shining; the rest of it bears mostly large and deep punctures, except on a space on either side of the centre; on the sides and base the punctures tend to become confluent. Scutellum somewhat triangular in shape, smooth, shining, and impunctate. Median segment closely, stoutly, irregularly punctured; behind the punctures run into reticulations. Propleuræ smooth and shining; the meso- opaque, irregularly punctured, and striated; the meta- rugosely punctured.

The four front legs are rufous, with the coxæ darker; the hinder black, except the apical two-thirds of the tibiæ and the tarsi, which are rufous at the base, blackish towards the apex; the hinder coxæ are, as usual, irregularly striated; the two teeth on the hinder femora are acute; the apical one is longer and narrower than the hinder. Wings fuscous-violaceous; the nervures and stigma are black. The petiole is longer than the rest of the abdomen united; it is opaque and is closely striated. The ovipositor is annulated with white and is not quite so long as the body. The recurrent nervure in the front wings is interstitial.

BRACONIDÆ.

BRACON DIORES, sp. nov.

Niger; ore, mandibulis, thorace pedibusque anterioribus rufis; alis nigro-violaceis. ♀.

Long. 8; *terebra* 1·5 *mm.*

Antennæ stouter than usual; thickly covered with short, stiff, black pubescence. Head black, smooth and shining; the inner orbits narrowly, the apex of the clypeus, the space between the eyes and the mandibles, and the mandibles at the base rufous; the apical half of the mandibles black. The frontal furrow is wide and deep; its sides oblique, and it becomes gradually narrowed towards the apex. Except above the antennæ, the head is thickly covered with long, soft, white hair; the face bears also longer fuscous hair; the base of the mandibles thickly covered with white pubescence. Thorax smooth and shining, almost bare. Abdomen smooth, bare, and shining; the apices of the segments are narrowly lined with white; the dorsal surface is devoid of transverse or oblique furrows. The four front legs are of a paler rufous colour than the thorax; the hinder are black, except the apices of femora, which are dull rufous; their tarsi on the under surface are thickly covered with rufous pubescence; the calcaria pale. Wings large, uniformly dark violaceous; the stigma and nervures are deep black.

CRATOBRACON, gen. nov.

Apex of scape of antennæ projecting into a short sharp tooth. Head cubital, largely developed behind the eyes; the occiput roundly incised in the middle, its margin placed very low down and margined. Eyes oval, widely distant from the base of the mandibles. Oral depression large. Mandibles becoming gradually narrowed towards the apex and without a subapical tooth. In front the head is transverse. Thorax more largely developed in front than usual, so that the fore wings are placed almost in the middle. Median segment largely hollowed in the middle above. Legs stout, of moderate length; the fore tarsi twice the length of their tibiæ. The 2nd and 3rd abscissæ of the radius are almost equal in length; the first is very short, not half the length of the third transverse cubital nervure; the transverse basal nervure is interstitial; the recurrent nervure is interstitial. Hind wings with one cubital cellule. Abdomen twice the length of the head and thorax united; the suturiform articulation is deep; it is the only transverse furrow, and there are no oblique ones. Hypopygium cultriform, large; the last segment is well developed above, being about two-thirds of the length of the penultimate.

The pterostigma is large; the radius issues from behind its middle; the sheaths of the ovipositor are slender and not pilose; the palpi are not densely pilose; the eyes on the inner side are margined; the antennal tubercles are distinct; the scape of the antennæ is not very stout; the 3rd joint is slightly longer than the 4th. The basal three segments of the abdomen are striated, the others smooth and shining; the penultimate segment is not quite so long as the preceding. Metathoracic spiracles large. Middle lobe of mesonotum distinctly separated.

The fact of there being only one—the suturiform—transverse furrow on the abdomen and no oblique ones separates this genus from *Iphiaulax*, *Odontoscapus*, *Chaolta*, and *Zaglyptogastra*, with which it appears to be most nearly allied otherwise.

Cratobracon ruficeps, sp. nov.

Niger; capite flavo-rufo; pro- mesothoraceque rufis; pedibus anticis, femoribus tibiisque intermediis rufis; alis nigro-violaceis, stigmate nervisque nigris. ♀.

Long. 16 ; *terebra* 24 *mm.*

Scape of antennæ rufous; the flagellum covered with a stiff black microscopic down. Head smooth and shining, pale rufous-yellow; the face below sparsely covered with pale hair; the mandibular teeth black. Thorax smooth and shining; the median segment covered with black hair; its apex in the middle is largely depressed, the depression is narrowed towards the base and apex. The anterior legs bear no black; the middle pair are black, with the femora and tibiæ rufous. The petiole is keeled down the middle; the lateral furrows are wide and deep and are obscurely, irregularly, transversely striated. The second segment has the central region irregularly rugose, the sides longitudinally striated; the central keel becomes weaker towards the apex; its dilated basal part is small and is minutely striated, on either side of it is a stout oblique keel; the transverse depression is stoutly striated; the third segment is closely longitudinally striated, the striæ are irregular and run into reticulations, the apex is smooth; the basal half of the 4th is coarsely aciculated; the basal three segments are for the greater part white.

Ichneumonidæ.

Ophionini.

Leptophion, gen. nov.

Disco-cubital nervure not broken with a stump of a vein; its middle broadly and roundly curved; the first abscissa of the radius thickened, the second roundly curved upwards; the transverse median nervure is received in front of and not far from the transverse basal; the 2nd recurrent nervure is received at a slightly greater distance than the length of the first transverse cubital, not at double, or more than double, the distance as in *Ophion*. In the hind wings the transverse median nervure is broken shortly below the middle. Median segment reticulated, except at the base, where there is a transverse keel; its base is widely and deeply depressed. Abdomen more than three times the length of the thorax.

This genus has greater affinity with *Enicospilus* than with *Ophion*. From the former it may be known by the absence of the horny points in the fore wings and by the transverse median nervure in hind wings not being broken far below the middle; from *Ophion* it may be separated by the disco-cubital nervure not having a stump of a nervure and broadly rounded, by the apical abscissa o the radius being broadly curved upwards, and by the swollen base of the radius.

LEPTOPHION LONGIVENTRIS, sp. nov.

Luteus; segmento mediali reticulato; alis hyalinis, nervis stigmateque nigris. ♀.

Long. 21 *mm.*

Antennæ dark luteous. Head pallid yellow; the face distinctly and closely punctured; on the top, in the middle below the antennæ, is a stout smooth keel or elongated tubercle. Clypeus roundly convex, smooth, and sparsely punctured. Mandibles broad, smooth; the apical teeth black and rounded at the apex, they are almost equal in length. The prothorax is paler, more yellowish in colour then the rest; the scutellum is minutely punctured; the lateral keels are prominent only at the base; the apex is finely shagreened, almost striated. The depression at the base of the median segment is wide and deep; in the middle there are some stout longitudinal striations; the central two form a V-shaped area; the space between this and the curved transverse keel is smooth; the rest of the segment is closely and coarsely reticulated, except the lower half of the metapleuræ. Pro- and mesopleuræ smooth and shining. Wings clear hyaline; the stigma and nervures black; the stigma is pale at the base; the basal abscissa of the radius is thickened; the transverse median nervure is almost interstitial. The tarsi are minutely and thickly spinose; the tibiæ are thickly covered with short pubescence. The abdomen is paler than the thorax; apical three segments are brownish black.

Mr. W. H. Ashmead (Proc. U.S. Nat. Museum, xxiii. p. 86) describes a genus *Pleuroneurophion* which has the radius swollen towards the base as it is in this genus and in *Enicospilus*; but it has a short nervure on the disco-cubital nervure and the transverse cubital nervure in hind wings is broken below the middle at the basal third, or at least far below the middle. The abdomen in our species is longer than usual compared with the length of the thor The eyes are very large and prominent. The subdiscoidal nervure is received higher up than usual, in the upper fourth of the nervure.

ENICOSPILUS NIGRINERVIS, sp. nov.

Luteus; flagello antennarum abdominisque apice late nigro-fuscis; alis hyalinis, nervis stigmateque nigris. ♀.

Long. 17–18 *mm.*

Scape of antennæ luteous; the rest of it blackish, lighter, more fuscous in colour towards the apex; it is longer than the body. Head pale yellow; the clypeus darker, more rufous in tint. Mandibles yellow, with black teeth. Thorax luteous, the pleuræ more yellowish, paler in tint. Scutellum strongly keeled laterally; its apical half is closely, irregularly, transversely striated, and is bordered behind by a distinct transverse keel which unites with the lateral ones. The base of the median segment behind the keel is smooth and is obscurely shagreened at the apex laterally; the rest of it is closely distinctly rugose, the rugosities in places forming almost reticulations. The lower half of the mesopleuræ is closely, longitudinally, irregularly striated; the lower part of the meta- irregularly, obliquely, and not very closely striated. Wings hyaline; the costa, nervures, and stigma black; the basal abscissa of the radius is thickened, becoming thinner on the apical third; the apical abscissa is also thickened; there is only one horny point; it is large, rounded on the lower side; the basal half above is straight and oblique, the apical half becomes gradually narrowed towards the apex. The abdomen is three times longer than the head and thorax united; the basal two segments are coloured like the thorax; the others are deep fuscous-black.

The apical abscissa of the radius is roundly and broadly curved upwards; the transverse median nervure is received distinctly in front of the transverse basal, and not behind it or interstitial as usual; the first abscissa of the radius has the basal two-thirds thickened; the middle third is curved upwards.

PIMPLINI.

RHYSSA FULVA, sp. nov.

Lutea; capite pleurisque flavis; flagello antennarum, mandibulis verticeque nigris; tarsis posticis fuscis; alis hyalinis, macula substigmatali fusca. ♂.

Long. 17 *mm.*

Scape of antennæ luteous, bare, smooth, and shining; the flagellum closely covered with stiff, short, blackish pubescence. Head pallid yellow; the vertex with a broad black stripe between the eyes, enclosing the ocelli. The face is punctured in the centre below the antennæ; the rest of it and the clypeus smooth and shining. The clypeus is distinctly separated from the face; the foveæ are large, deep, and are united by a narrow curved furrow; the apex of the clypeus is transverse and bears three short nipple-like teeth, the central is smaller than the lateral.

Mandibles black, brownish at the base: the apical tooth is triangular, blunt, and is clearly separated; there is a short triangular incision between it and the slightly oblique inner part. The eyes slightly converge above. The transverse striation on the mesonotum is coarse; the scutellum is transversely striated, the base not quite so strongly as the rest. The base of the median segment is obliquely depressed; its centre is broadly furrowed; the lower half of the metapleura is strongly punctured. Legs: the tarsi are closely spinose; the anterior are more than twice the length of the tibiæ, which are narrowed at the base; the hinder are bent distinctly there and dilated before the apex. The cloud in the wings extends from the costa to the middle of the transverse cubital nervure; it originates at the end of the stigma; the areolet is oblique, its pedicle is not quite so long as the basal fork of the nervure.

RHYSSA TRIDENTATA, sp. nov.

Nigra, late flavo-maculata; segmento mediali flavo; alis hyalinis, macula substigmatali nigro-cœrulea; pedibus rufis, tarsis fuscis. ♀.

Long. 18; *terebra* 23 *mm.*

Antennæ black; the scape and base of the flagellum rufous; there is a narrow white ring shortly beyond the middle of the flagellum. The face, the inner orbits to the lower ocellus, the outer orbits entirely, and the clypeus are pale yellow; the face below the antennæ is punctured and has a shallow longitudinal furrow there; over the clypeus is a distinct furrow ending on either side in a fovea; the apex of the clypeus is transverse and ends in three short blunt teeth. Mandibles black; the two apical teeth short, subequal. Occiput yellowish, suffused with rufous. Prothorax yellow, rufous on the lower side. Mesonotum black; the sides next the tegulæ rufous, in the centre are two yellow lines. Scutellum and scutellar keels yellow; the apex of the scutellum rufous and finely transversely striated; the scutellum distinctly punctured. Postscutellum smooth, yellow. The base of the median segment black, of its pleuræ dark rufous; the mesopleuræ yellowish below the fore wings, rufous yellow below the hinder wings and at the apex below. Metapleuræ closely punctured, most strongly on the lower half. Legs rufous; the anterior pallid yellowish in front, especially the tibiæ; all the tarsi are darker towards the apex, they are minutely spinose and are longer than usual, the basal joint of the anterior is as long as the tibiæ. Wings hyaline, except for the cloud, which extends from the costa to the end of the recurrent nervure, it becoming narrower as it does so, but not extending beyond its outer side; the stigma is fulvous; the costa and nervures black; the cloud has a distinct bluish tinge; the areolet is distinctly appendiculated and oblique; the pedicle is two-thirds of the length of the branches; the areolet is oblique, narrowed above, somewhat triangular in shape, and receives the recurrent nervure at the apex.

Abdomen rufous; the basal five segments black above, the sides of all the segments black at the base; the basal two segments have a large mark, narrowed towards the base, on their apices above; the 3rd, 4th, and 5th have yellowish marks on their sides, and the 6th and 7th indistinct ones.

The fore tarsi appear to be longer than usual compared to the tibiæ, and the areolet has the pedicle much longer.

Xanthopimpla insularis, sp. nov.

Lutea; facie, orbitis oculorum, pleuris coxisque flavis; alis hyalinis, apice fumatis. ♂.

Long. 14 *mm.*

Scape of antennæ yellow; the flagellum black, brownish at the base. Face closely and distinctly punctured and thickly covered with short pubescence. Clypeus smooth, its upper part convex; labrum triangular. Mandibles yellow, black at the apex. Thorax smooth and shining; the middle lobe of the mesonotum with a triangular band of punctures on the base. Scutellum smooth, the keels distinct on the sides and apex. On the base of the median segment are two curved keels, which form large areæ, wider than long, which are indistinctly joined to the apical transverse keel by two oblique ones; the outer side of the latter is straight and oblique and is united to the upper outer keel, which is more distinct than the inner one. The lower half of the mesopleuræ closely and distinctly punctured, the upper half has the middle depressed and less distinctly and more irregularly punctured. The metapleuræ behind the spiracles are minutely punctured. The areolet is shortly appendiculated above. The abdomen has the apices of the basal five segments yellowish; the petiole has on the basal half two curved stout keels; the oblique apical furrow is smooth, the furrows on the apices of the 2nd, 3rd, and 4th are striated, the oblique lateral ones on them are wide and smooth. The ventral surface is pallid yellow. The ocellar region is deep black; the tibiæ have no spines; the top of the scutellum is rounded and is clearly raised above and separated from the lateral keels; the raised apex of the petiole is depressed, the apex of the depression being narrowed; there is a short wide depression on the base of the second segment in the middle; the petiole is distinctly longer than the width of its apex and is as long as the second segment; the face is distinctly longer than broad; the tarsi bear short spines.

Comes near to *X. micholitzi*, Kreiger, from New Guinea. The metanotal areæ are somewhat similar to those of *X. octonotata*, as figured by Kreiger, Sitzung. d. naturf. Ges. Leipzig, 1898.

Cryptini.

Eurycryptus, gen. nov.

Head large, wider than the thorax. Eyes large, largely projecting beyond the temples, which are only slightly developed; on the inner side they are almost parallel and extend below the top of the clypeus; the malar space is small. Apex of clypeus transverse. Antennæ slightly thickened beyond the middle, where there is a large white ring. Areolet wide, the nervures almost parallel; the second transverse cubital is faint; the transverse median nervure is placed considerably behind the transverse basal. In the hind wings the transverse median nervure is broken near the middle. Parapsidal furrows narrow. Median segment smooth and bearing two transverse keels; its spiracles small, oval. Fore tibiæ narrowed at the base, shorter than the tarsi. Petiole rather broad; all the abdominal segments are banded with white; the last segment is entirely white. Ovipositor exserted. The last segment longer than the preceding, its upper third projects over the lower part.

A genus easily known by the large wide head, very little developed behind. The scutellum is roundly convex; the mesopleural furrow is wide; the oblique furrow on the metapleuræ is wide and crenulated; the radial cellule is long and lanceolate at the apex; there is no nervule on the disco-cubital nervure, nor on the recurrent nervure; the stigma is linear.

EURYCRYPTUS LATICEPS, sp. nov.

Niger, flavo-maculatus; alis hyalinis, stigmate nervisque nigris. ♀.

Long. 10; *terebra* 5 *mm.*

Antennæ with the 9th to 15th joints white; the tubercles white. The face and clypeus, the inner orbits—the lower white part obliquely narrowed,—the outer entirely, and the base of the mandibles white. The face is sparsely punctured, on it are two narrow furrows which end in the clypeal foveæ. Front and vertex smooth and shining; the lower ocelli are bordered by a furrow; there is an indistinct furrow down the middle of the front. Thorax shining, bare; a line on the pronotum, the apex of the middle lobe of the pronotum, the scutellum, the median segment behind the second transverse furrow, except for a conical black mark in the centre of the apex, the tubercles, a pyriform mark under the hind wings, and the greater part of the metapleuræ—the top and base are black—white. The mesopleural furrow is deep and crenulated, except at the apex; the base of the meta- and the apex of the mesopleuræ are foveated; the metapleuræ obscurely punctured; the apex is depressed, and has on the lower side four short stout keels. The front legs are white, with the tarsi black; the middle coxæ white, their trochanters black; the hinder coxæ black, broadly white behind; the trochanters are black; the rest of the four hinder legs are broken off. Wings clear hyaline; the nervures and stigma black. Abdomen black; the apices of the segments bordered with white, the last is entirely white; the 2nd and 3rd segments are closely and distinctly punctured; the 2nd segment at the base is raised, the raised part roundly narrowed towards the apex and bordered by a shallow depression.

XANTHOCRYPTUS, gen. nov.

Areolet minute, square; the second transverse cubital nervure faint; the transverse median nervure is placed distinctly behind the transverse basal; the stigma is linear. Apex of clypeus depressed obliquely, the middle with a short tubercle. Clypeus distinctly separated behind. Labrum large, its apex rounded. Temples not much developed behind: the occiput transverse, with the edges rounded. Eyes large, parallel, reaching to the middle of the clypeus. Mandibles short, stout, the upper tooth projecting. Parapsidal furrows distinct to shortly beyond the middle of the mesonotum. Scutellum convex, but not much raised. Base of the median segment smooth, the rest of it closely, stoutly, transversely striated; there are no teeth; the spiracles are oval. Petiole rather broad, the basal third only narrowed; the spiracles are placed almost in the middle, only a very little behind it. Abdomen smooth and shining; the last segment is largely developed above and below; ovipositor as long as the abdomen. Hinder legs long; the tarsi spinose; the fore tibiæ not much longer than the basal joint of the tarsi, they are distinctly narrowed at the base.

There is no little vein on the discoidal or recurrent nervures; the last joint of the tarsi is long, with its claw long, curved, and simple; on the front legs the basal joint of the tarsus is longer than all the others united; the antennæ are long and ringed with white; the occiput is not very sharply margined; in the hind wings the transverse median nervure issues from shortly below the middle. The hinder tibiæ are longer than the femora and the tarsi.

This genus may be referred to the *Mesostenini*, but it has hardly the *facies* of that group or of the *Cryptini*. The fore tibiæ remind one of the *Xoridini*, e. g. *Xylonomus*; but the totality of its characters agrees with the *Mesostenini*. The minute areolet, anterior tibiæ contracted at the base, transversely striated median segment, depressed apex of clypeus, and projecting labrum enable it to be easily recognized.

XANTHOCRYPTUS ROBUSTUS, sp. nov.

Luteus; facie orbitisque oculorum flavis; antennis nigris, albo annulatis; alis fulvo-hyalinis, nervis stigmateque nigris. ♀.

Long. 18 *mm.*

Antennæ not quite so long as the body; black, a short white ring before the middle of the flagellum, the scape yellow. Head smooth and shining, the vertex broadly black. Pro- and mesothorax smooth and shining, and tinged slightly with yellow. The lower half of the metapleuræ is closely and distinctly punctured, the upper stoutly obliquely striated. The apices of the four front tarsi and almost the whole of the hinder are black. The apical halves of the mandibles are black. The median segment behind the keel is closely transversely striated, the striæ extending to the metapleural keel; the lower part of the metapleuræ closely punctured. The hinder tarsi are for the greater part black.

CHRYSIDIDÆ.

STILBUM SPLENDIDUM Fab.

A species common in the Indian and Australian Regions.

CHRYSIS (HEXACHRYSIS) NOVO-BRITANNICA, sp. nov.

Viridis, aureo cæruleoque variegata; flagello antennarum nigris; alis fusco-violaceis. ♀.

Long. 10 *mm.*

Scape of antennæ brassy blue; the 2nd and 3rd joints metallic bright green, the remaining joints are black; the 1st joint is sparsely covered with white hair, the 2nd and 3rd with a pale down; the 3rd joint is twice the length of the 2nd, and about one-third longer than the 4th. The vertex is deeply and closely punctured; the ocellar region is broadly blue; the top of the front has a distinct margin; its middle is roundly incised; the sides roundly project; the central depression is smooth; the lateral projections bear some large, deep punctures; the front is covered thickly with long white hair. The lower outer orbits bear a stout keel between the centre and the eyes; the base of the mandibles punctured, but not strongly or closely. Thorax emerald-green largely mixed with blue; the pro- and metapleuræ are largely brassy. The thorax, including the scutellum, is closely, deeply, and uniformly punctured; the thorax is not clearly separated above; below there are two large, deep, smooth foveæ, somewhat oval in shape and separated by a narrow keel which does not reach the top; on either side of their basal half is a large, shallower oblique depression, which is rounded behind and transverse and oblique in front; in the middle of the central fovea are two stout curved keels. The upper half of the propleuræ is largely excavated, the lower bears two large foveæ. Mesopleuræ rugosely punctured, except on the lower part, which is depressed, smooth, and irregularly punctured round the edges; the upper part roundly projects in the middle. Metapleuræ for the greater part closely and minutely striated; the edges, except below, are deeply and largely irregularly punctured. Wings uniformly dark fuscous violaceous; the costa, stigma, and nervures deep black. The basal two segments of the abdomen are uniformly, but not very deeply punctured; the basal segment has a deep rounded depression in the centre above at the base; the 3rd segment is more closely punctured, especially towards the apex; the 6 teeth are not large or acute; the divisions are shallow and waved; the outer teeth are smaller, there are 7 foveæ on either side, the inner ones are broad; the dorsal surface is for the main part blue mixed with brassy tints; the ventral surface is green mixed with golden; the sides of the median segments project largely and are gradually narrowed towards the outer side.

Closely allied to the foregoing is the following from New Guinea:—

CHRYSIS (HEXACHRYSIS) DEMOCRATICUS, sp. nov.

Long. 12 *mm.* ♀.

The basal three joints of the antennæ are green, the rest black; the third is fully twice the length of the fourth. The upper part of the head is deeply, closely rugosely punctured; the centre is of a darker bluer tinge, the sides are more brassy; the lower edge is ⌒-shaped and deeply excavated in the centre below the keel; the raised sides have large deep foveæ. The front is much more golden in tint than the vertex; it is closely and minutely punctured with some minute striæ; the orbits are deeply, irregularly punctured. Thorax above strongly, closely, and uniformly punctured; the punctures on the post-scutellum are larger and deeper; its sides, above, project; the middle fovea is large, and wider than long; the lateral are smaller, shallower, oval, and are placed obliquely. The apex of the median segment has an almost perpendicular slope; the projecting sides are sharply pointed. The upper part of the propleuræ is coarsely punctured, the lower part of it is deeply excavated, above it is rounded; the base is straight, the lower part has a straight, oblique slope, the centre of the depression is closely, obliquely striated. The base of the mesopleuræ is golden, closely and minutely punctured, and is distinctly bordered on the outer side; the rest is coarsely and deeply punctured; the lower part projects; this lower part is separated from the upper by an oblique row of more elongated irregular punctures; the posterior lower part is finely and closely striated. Metapleuræ closely and minutely striated, they are golden in tint. The coxæ and femora are golden; the tibiæ are also tinged with golden; the tarsi are for the greater part black; the hair is thick and white. Wings fuscous-violaceous; the nervures are deep black, with a slight violaceous tinge. Abdomen green, blue in the centre; the sides largely tinged with golden; the basal two segments are uniformly punctured, but not very closely or deeply; the third is more closely and deeply punctured; the punctures become deeper and closer towards the apex; there are 6 teeth; the foveæ are deep and irregular; the ventral surface is largely brassy; the last is broadly black round the edges.

MUTILLIDÆ.

MUTILLA NOVO-BRITANNICA, sp. nov.

Nigra, dense albo pilosa, abdominis basi late rufa; alis violaceis, basi hyalinis. ♂.

Long. 12 *mm.*

Scape of antennæ closely punctured, sparsely covered with white stiff hair; the scape opaque, covered with a pale down. Head: the face thickly covered with long glistening white hair; the front and vertex closely and strongly punctured, and covered with white glistening hair; the antennal tubercles on the outer side are rounded, smooth, shining, and bare; the eye-incision is punctured. Mandibles black, with a dull rufous band before the middle; the base and lower side thickly covered with long white hair; the apical tooth is long and rounded at the apex. Thorax covered with white hair, except on the mesonotum, where it is shorter, stiffer, and black; the median segment is reticulated, more closely on the apical slope than on the base; the central area is long, contracted in the middle, and extends to the top of the apical slope. Legs thickly covered with stiff white hair; the calcaria and spines are pale. Wings dark violaceous; the base to the transverse basal nervure hyaline; the 2nd cubital cellule at the top and bottom is about one half the length of the 1st; the 1st recurrent nervure is received near the base of the apical third of the cellule. The base of the petiole is black; the rest of it, the 2nd segment, and the basal half of the 3rd are bright ferruginous; the ventral keel of the petiole has a slight, rounded curve, its base is more dilated than the apex; the keel on the epipygium becomes gradually dilated towards the apex, the space between it and the outer edge is punctured; the sides are smooth, shining, and impunctate; the pygidium is closely and rather strongly punctured, except in the middle, where it is smooth and shining; this smooth central part becomes gradually wider towards the apex, which is depressed.

Scoliidæ.

Discolia foveifrons, sp. nov.

Nigra, capite thoraceque nigro pilosis; alis fusco-violaceis. ♂ ♀. *Long.* 30 *mm.*

Head only slightly shining on the vertex, the rest of it opaque; behind it is thickly covered with longish black hair. The sides of the clypeus bear deep, distinctly separated punctures; its apex is depressed, smooth, closely punctured behind; the central part is opaque, somewhat bell-shaped, the narrow part being at the top, above the centre it is depressed. The space immediately between the antennæ is opaque and impunctate; above this, on either side, is a large and strongly punctured depression; the depressions are oblique and narrowest above. The vertex, in the centre and behind, bears scattered, deep punctures. The central part of the mesonotum is impunctate, as is also the apical in the middle; the sides and base bear scattered punctures. Scutellum and post-scutellum closely and uniformly punctured, except the apex of the former and the centre of the latter towards the apex. Median segment closely and strongly punctured; the longitudinal furrows are wide and deep. Pleuræ closely and distinctly punctured, except for a large irregular space in the centre of the pro- and mesopleuræ. The spines and hairs on the legs are black; the fore calcaria are dark rufous. The abdominal segments are sparsely, slightly, and irregularly punctured; the hypopygium is coarsely punctured, except at the apex. The wings are deep violaceous, very highly iridescent, and with greenish tints towards the apex.

The abdomen does not shine much and has hardly a trace of blue or violet tints.

DISCOLIA PULCHRIPENNIS, sp. nov.

Nigra ; alis violaceis, basi late flavo-hyalinis.

Long. ♂ 21–22 *mm.*, ♀ 25 *mm.*

Antennæ black; the scape covered with very long black hair; the flagellum opaque, covered with a pale microscopic down. Head rather narrow; except on the front it is thickly covered with long black hair. The vertex is not very shining and is sparsely punctured; the front below the ocelli is smooth and shining; the lower part obliquely projects, is closely and distinctly punctured and with a furrow down the centre; this oblique lower part is distinctly separated from the upper. Clypeus strongly punctured, except in the centre. Thorax thickly covered with black hair; it is closely and strongly punctured all over, except on the upper half of the mesopleuræ behind. Wings fuscous-violaceous; the base to shortly beyond the transverse basal nervure and the first radial cellule fulvous-yellowish. Abdomen black, distinctly violaceous on the back, closely punctured and thickly covered with black hair.

The ♀ has the mesonotum in the centre impunctate; its antennæ are fuscous beneath; the punctuation of the thorax is stronger, closer, and more uniform; the hypopygium is strongly punctured except at the apex: the wings are of a brighter violaceous tinge; the front is not excavated and there is a broad impunctate band below the ocelli; its fore spurs are rufous; the tarsal spines are of a brighter rufous colour.

POMPILIDÆ.

SALIUS INSULARIS, sp. nov.

Flavus ; abdomine nigro ; metanoto nigro, fulvo bimaculato ; alis flavis. ♀.

Long. 27 *mm.*

Antennæ reddish yellow, paler beneath and towards the apex. Head rufous, thickly covered with depressed golden pubescence; the eyes slightly converge above and are there separated by a little more than the length of the fourth antennal joint, which is not much longer than the scape and distinctly shorter than the third. The ocelli are almost in a triangle and are close together; the hinder are separated from the anterior by nearly the same distance they are from each other; from the eyes they are separated by a perceptibly greater distance than they are from each other. The apex of the clypeus is bluntly rounded; the mandibles have the teeth black; the apical one is bluntly rounded; the subapical is transverse at the apex, and is not separated behind. Pro- and mesothorax thickly covered with golden depressed pubescence, and more sparsely with fuscous hairs. The scutellum is not much raised above the mesonotum, and is rather flat; the post-scutellum is more prominent, and is obliquely sloped on the sides and apex; the part between it and the wings is black. Metanotum black, thickly covered with pale down and more sparsely with longish fuscous hair; the striation is as usual; in the middle are two large, somewhat oval fulvous marks, which, on the outer side of their apex, are prolonged to near the end of the segment. The mesosternum and the basal half of the mesopleuræ are black; the black on the latter is roundly incised on the apex above. Metapleuræ black, except on the apical third. Legs coloured like the antennæ; the tarsi have a yellowish, paler tint; the claws have one stout tooth at the base. Wings yellowish hyaline with a violaceous tinge; the space bounded by the tips of the 1st and 2nd transverse cubital nervures is almost equal in length to that bounded by the 2nd and 3rd; the apices of both wings are very narrowly bounded by a fuscous cloud. Abdomen entirely black; the ventral surface sparsely, the hypopygium and epipygium more thickly covered with long black hairs.

The 3rd transverse cubital nervure is roundly and broadly curved; the 2nd transverse cubital nervure is received at the apex of the basal third of the cellule; the 2nd recurrent nervure has the lower part straight and obliquely bent backwards; the 2nd submedian nervure in the fore wings is received distinctly behind the middle of the discoidal cellule; the 1st recurrent nervure is not quite interstitial, as it is in some of the species of the *Mygnimia* section, it being received shortly, but distinctly, behind the transverse cubital; the apical tooth of the mandibles is blunter, broader, and more rounded than in most of the species, than in, *e. g.*, *S. ceylonicus* and *S. flavus*; and the apex of the clypeus is more rounded, not so broadly transverse in the middle, than it is in the two species just mentioned; the sides of the pronotum do not bulge out roundly as in *S. flavus*; the metanotal tubercles are large and prominent, on the base they have a longer and more oblique slope than on the apex, where the slope is much more abrupt; the furrow on the mesopleuræ is straight and oblique and ends behind in a distinct fovea.

SALIUS BASIMACULA, sp. nov.

Flavus; abdomine nigro, petiolo late flavo balteato, femoribus posticis supra late nigro-lineatis; alis flavo-hyalinis. ♂.

Long. 17 *mm.*

Antennæ pale yellow; the third joint is shortly but distinctly longer than the fourth, which is not quite so long as the vertex between the eyes. The ocelli are in a triangle, the hinder are separated from each other by half the distance they are from the eyes, which converge only very slightly on the lower side. The vertex across the ocellar region is black, the black line enclosing all the ocelli. The whole head is covered with depressed golden pubescence, and more sparsely with long pale hairs; the apex of the clypeus is transverse, with the sides broadly rounded; the apical tooth of the mandibles is triangular, the subapical is short and blunt. Thorax thickly covered with depressed golden pubescence; the sternum, the base of the meso- and metapleuræ, the space between the scutellums and the wings, and the base of the median segment are black. The sides of the pronotum are broadly rounded behind; the post-scutellum is raised above the level of the scutellum, and is clearly separated from it by a wide, rounded depression; its top is smooth and shining. The metanotal tubercles are large, prominent, bluntly rounded above; the basal and apical slopes are about equal in length. The wings have a slight violaceous tinge; the first and second transverse cubital nervures above are separated by a slightly greater distance than the second is from the third; the third transverse cubital nervure has a rounded slope; the first recurrent nervure is distinctly separated from the transverse cubital; the second is received shortly behind the apex of the basal third of the cellule. Except for black marks on the four posterior coxæ behind and a broad black line on the hinder femora, the legs are coloured like the body; the single tooth on the claws is large, stout, and curved. Abdomen black, with a plumbeous hue; the petiole luteous, black at the base and apex; the penultimate ventral segment is thickly covered with long black hairs.

This species is only represented by males. It is certainly not the male of *S. insularis*, as apart from the marked difference in coloration, the two differ in important structural characters not of a sexual nature, *e. g.* in *S. basimacula* the post-scutellum is raised above the level of the scutellum, which is not the case with *insularis*.

Salius willeyi, sp. nov.

Luteus, abdomine nigro; alis violaceis; antennis nigris, basi luteis. ♂.

Long. 12 *mm.*

Antennæ black, the scape clear, the base of the flagellum dark luteous; the third joint is shortly, but distinctly, longer than the fourth. On the head the vertex, the occiput, and the front, except at the sides, are black. Eyes distinctly curved on the inner side; the ocelli form a triangle, the hinder are separated from each other by a distinctly less distance than they are from the eyes. Apex of clypeus broadly rounded. The apical tooth of the mandibles is large, triangular; the lower oblique, not projecting. Prothorax broadly rounded at the base. The thorax has the following parts black:—the mesonotum except in the middle behind, the space at the sides of the scutellums, the median segment broadly on the basal half, the apex slightly in the middle, the mesosternum, the lower half of the mesopleuræ at the base, and the metapleuræ except at the apex. Post-scutellum and scutellum roundly convex; the former is large and is on a level with the scutellum. The median segment is not transversely striated; the tubercles are large and rounded. Wings uniformly fuscous violaceous, strongly iridescent; the cubital cellules are equal in length above; the 1st recurrent nervure is received near the base of the apical fourth, the 2nd near the apex of the basal third. The hinder tibiæ are sparsely, the tarsi are more thickly spinose; claws bifid, the inner tooth stout. The apex of the abdomen is thickly covered with black hairs; the last segment is roundly and broadly incised below; above, the incision is not so wide, but is equally distinct.

It is not clear if this is a *Salius* or a *Pompilus*; there seems to be a transverse furrow on the second ventral segment. It is not unlike a *Pompilus* of the *peregrinus*-group.

SPHEGIDÆ.

SPHEX CONFRATER Kohl.

Sphex confrater Kohl, Ann. k.-k. Hofmus. Wien, v. pp. 414, 106.

Described from New Britain. A handsome species, easily known by its shining black abdomen, with the apical three segments bright red.

SPHEX UMBROSUS Christ.

A single male, which I am disposed to consider identical with this variable and widely spread species. The hair on the thorax is dense and pale golden.

SPHEX (ISODONTA) INSULARIS, sp. nov.

Niger, dense nigro-pilosus; mandibulis rufo-piceis; alis fusco-violaceis. ♂.

Long. 10 *mm.*

Antennæ black; the flagellum covered with a pale down; the 3rd joint is fully longer than the basal two joints united and distinctly longer than the 4th. The eyes distinctly converge at the top; the hinder ocelli are separated from each other by a distinctly less distance than they are from the eyes. The hair is long, black, and thick; the front and vertex are also covered with depressed silvery pubescence; the clypeus is keeled down the centre. Mandibles tridentate; the apical tooth is somewhat triangular, broad at the base, becoming narrowed towards the apex; the other two teeth are short, of equal size, and do not project much. The thorax is thickly covered with long black hair; the mesonotum is smooth and shining, as is also the scutellum; the post-scutellum is more opaque; neither is furrowed down the centre. Median segment opaque, minutely, obscurely transversely striated in the middle; it can hardly be said to be furrowed down the centre, but there is an obscure fovea on the apex of the basal part. Wings highly iridescent; dark fuscous-violaceous, the costa, stigma, and nervures black; the space bounded by the 3rd and 2nd transverse cubital nervures is one-third of the length of that bounded by the 2nd and 1st and not quite one-half more than that bounded by the 2nd and the 3rd recurrent nervures; the 1st recurrent nervure is received about the same distance from the 2nd transverse cubital nervure; the 3rd transverse cubital nervure is roundly curved on the lower side. Legs black, pruinose; the tibiæ and tarsi are sparsely spined. Abdomen black, shining; the petiole long, curved, clearly longer than the fore tibiæ, it is rather thickly covered with long black hair; the apical ventral segments are thickly covered with long black hair.

This species cannot well be confounded with the other New Britain *Isodonta* (*egens* Kohl), which is easily known from it by the difference in the colour of the body and wings, and by the very different form of the antennæ. (*Cf.* Kohl, Termész. Füzetek, xxi. 1898, p. 335, pl. xv. f. 23.)

VESPIDÆ.

VESPA AFFINIS Fab.

This is probably only a variety of *Vespa cincta* Fab. The New Britain queens do not differ materially from the normal forms; but the workers are much darker than usual, not only on the thorax but on the abdomen; the brownish colour is either very obscure, much darker than usual, or completely obliterated.

POLISTES MACULIPENNIS Sauss. (*stigma*).

The abdomen is richly coloured; the black is deeper and the yellow and rufous brighter than in most of the examples I have seen.

POLISTES ARTHURI, sp. nov.

Ferrugineus; scutello, mesopleuris metathoraceque nigris; pedibus rufis, coxis, femoribus tibiisque posticis nigris; alis fulvo-hyalinis, nervis stigmateque fulvis. ♀.

Long. 20–21 *mm.*

Antennæ rufous, covered with a pale microscopic down. On the head, the occiput, the vertex from shortly behind the ocelli to the end of the upper part of the eye-incision, the space between the antennæ and above the top of the clypeus are black. The part below the eyes of the clypeus is distinctly longer than the part above it; it becomes narrowed towards the apex, which is broadly rounded, not sharply pointed as with most of the species of the genus; it is fringed there with fulvous hair. The vertex is closely and rather strongly punctured; the clypeus bears scattered punctures. On the thorax the pronotum and the mesonotum are rufous; the edges of the latter, a line down the middle, and the apex broadly are black; it is covered with a white down; the pleuræ and scutellum are punctured, but not closely or deeply; the furrow on the median segment is wide and deep; the post-scutellum has a rather sharp oblique slope. Tegulæ black. Legs black; the four anterior tibiæ and tarsi are rufous, with the middle tarsi paler towards the apex; the hinder tarsi are pale yellow, except at the base, where they are more rufous in tint. The basal segment of the abdomen is entirely black; the 2nd and 3rd segments may be black at the base; below they may be entirely black.

The ♂ is coloured like the ♀; its fore legs may be entirely without black in front and the coxæ there pale yellow; the antennæ only differ from those of the ♀ in being thinner towards the apex: the clypeus is flat, with the sides slightly raised; the lateral suture at the top is not so widely oblique, the space between it and the eyes being much less; its apex in the middle broadly and roundly projects, and is clearly separated from the lateral portions, which are narrower than it: the epipygium is armed at the apex with two stout teeth; their basal slope is longer and more rounded than their apical, which is straight and only slightly oblique.

Comes nearest apparently to the Australian *P. lepidus* Fab., but, among other differences, that may be known from it by the clypeus ending in a sharp angle.

POLISTES LYCUS, sp. nov.

Flavus, abdominis basi nigro maculata; alis fulvo-hyalinis; nervis stigmateque fulvis. ♀.

Long. 20 *mm.*

Antennæ rufous, covered with a white pubescence. The ocellar region is deep black; the front ocellus is separated from the posterior pair by a distinctly greater distance than these are from each other. Clypeus smooth and sparsely covered with rufous hairs; it is longer than broad; above it is roundly and broadly incised downwards: the foveæ are not widely separated from the eyes; the keel issuing from them to the eyes is not widely separated from the eyes; the space bounded by them and the latter being narrow, distinctly longer than broad, and not forming a triangle as in *P. hebræus*. The part between the antennæ distinctly projects. Thorax smooth and shining and covered with a white microscopic down. The sides of the mesonotum at the tegulæ, its base more broadly, and an oblique line over the hinder coxæ are black. The suture on the mesopleuræ below the tegulæ is roundly curved on the lower part and bulges backwards below the middle; there is no suture running to the base. Legs coloured like the body. Wings hyaline, with a distinct fulvous tinge, which is deeper and more distinctly visible along the apical margin; the costa and stigma are fulvous, as are also the nervures. On the abdomen the bases of the basal three segments are black; the amount of the black colour probably varies.

This species looks at first sight like one of the pale yellow forms of *P. hebræus*, but it wants the black, or at least dark-coloured, waved lines found always on the abdomen of the latter. The two may be readily separated by the difference in the form of the clypeus: in *hebræus* its breadth in the middle is not perceptibly greater than its length; in the present species its length is distinctly greater than its greatest breadth; in *hebræus*, too, the suture at the top is much more oblique, so that its top is much more widely separated from the eyes.

POLISTES ASTEROPE, sp. nov.

Rufus, late pallide flavo maculatus; pedibus pallide rufis, basi late pallide flava; alis hyalinis, apice fere violaceis, nervis, costa stigmateque fuscis. ♀.

Long. 14 *mm.*

Antennæ rufous, covered with a white microscopic pile. Head pale yellow, rufous on the vertex; the vertex and the upper part of the front sparsely, but distinctly punctured; there is a distinct, rather wide furrow on the lower part of the front. Clypeus longer than wide; its apex roundly projects in the middle; the furrow on its top is broadly curved downwards in the middle; the lateral one is oblique and is angled in the middle where it unites in the fovea. Mandibles pallid yellow, rufous round the edges; the teeth are black. Occiput for the greater part black. Thorax pallid yellow; the upper part of the pronotum and the centre of the mesonotum rufous; the sides, the base and apex of the mesonotum are black; the inner side of the black lateral and apical parts are lined with pale yellow. Scutellums pale yellow; the post-scutellum is lined with black behind. The furrow on the median segment is black, wide and narrowed at the top. The upper part of the mesopleura at the apex, the lower two-thirds of the metapleuræ at the base, and a mark placed between the basal suture and the spiracles, and two irregular marks on the mesosternum, black. The nervures, costa, and stigma have a violaceous tinge; along the costa the colour is tinged with fulvous, along the radial cellule with violaceous. Abdomen rufo-fulvous; all the segments are pale yellow at their apices all round; the apex of the petiole is much more broadly marked with yellow.

RHYNCHIUM BRUNNEUM Fab.

One example. The black colour on the basal three segments extends to near the apex of the segments, which have only a narrow band of the rufous colour. The wings, if anything, are more richly coloured than usual.

ANTHOPHILA.

MELIPONA (TRIGONA).

A single species of this genus, which I have not been able to identify. In view of the present very unsatisfactory state of this genus, I have not ventured to describe it.

XYLOCOPA PERKINSI, sp. nov.

Long. 24 *mm.*

In Willey's 'Zoological Results' (p. 388), Dr. Sharp has written the following remarks:—"Mr. R. C. L. Perkins has (E. M. M., Feb. 1899, p. 38) called attention to the very extraordinary symbiosis of the female bees of the genus *Koptorthosoma* (*Xylocopa*) and certain Acarids; the bee being provided with a special chamber in the abdomen which is tenanted by the Acari. The males do not possess this structure. Mr. Perkins mentions the remarkable fact that in this species from New Britain the female is destitute of the special chamber, though it exists in the closely allied *K. æstuans.*"

The New Britain bee is closely allied to the last mentioned species, from which it differs in not having the whole of the upper part of the thorax covered with yellowish hair. The species may be a form of *X. provida* Smith, from Mysol aud Waigiou; but I cannot make out this with any degree of certainty, either from the original description (Journ. Linn. Soc. vii. p. 48) or from that given in his Monograph of *Xylocopa* in Trans. Ent. Soc. 1874, p. 274.

♀. Black; the hairs black, except on the thorax behind the tegulæ, where they are orange-yellow. The basal three joints of the antennæ are bare, smooth, and shining; the rest are opaque and thickly covered with a pale microscopic down; the 3rd joint is narrow and longer than the 4th and 5th united. The hair on the head (including the face) is long, dense, and deep black. The clypeus is closely and deeply punctured; its top, centre, and a curved line on the sides are smooth and shining; its apex is distinctly raised and separated. The mandibular teeth are bluntly rounded; the upper is rounded and not much shorter than the lower. The wings are fuscous black, with a dull greenish iridescence; the 2nd transverse cubital nervure has on the upper two-thirds a straight, oblique slope; the lower third is not, or only very slightly, oblique; the upper and lower halves of the 2nd recurrent nervures are oblique, straight, and form an angle at their junction and are not roundly curved as in *X. æstuans.*

Anthophora zonata Fab.

A common Oriental species.

Megachile megistia, sp. nov.

Nigra, dense nigro hirsuta; fronte, facie clypeoque longe albo-pilosis; alis nigro-violaceis. ♂.

Long. 13 *mm.*

Scape of antennæ almost bare; the flagellum covered with a pale microscopic down. Front and vertex closely and distinctly punctured and covered with black hair; the lower part of the front, the face, and clypeus thickly covered with long pale fulvous hair; the clypeus is rugosely punctured. The basal half of the mandibles closely punctured; there is a large, not very sharply pointed apical tooth, and a broad, bluntly pointed subapical one. Thorax closely and distinctly punctured and thickly covered with black hair; the pronotum and the parts above and below the tegulæ with longer white hair. The upper part of the median segment is opaque and shagreened; the lower irregularly punctured. Legs black, thickly covered with black hair; the base of the anterior with longer white hair; the anterior femora in front and the middle joints of the front tarsi are rufo-testaceous; the coxæ are not toothed. Abdomen black; the 4th and 5th segments edged towards the apex with rufous; the apex of the last segment has a wide rounded incision in the middle; the sides of the incision project into a blunt tooth; outside there are two shorter, blunter teeth; the central part is roundly raised and surrounded by a wide depression; the apical half in the centre is distinctly keeled. The ventral surface is more or less brownish; the epipygium is obliquely raised and obliquely narrowed towards the apex, which is acutely pointed. The wings are uniformly fuscous-violaceous, with black stigma and nervures.

Comes nearest to *M. alecto* Smith, from New Guinea: that species may easily be known from it by the central keel on the last segment of the abdomen extending backwards to the base of the segment, it being also much broader; the apex of the abdomen too is not toothed, only incised in the middle, and the apical tooth of the mandibles is much longer and stouter, and the apex of the clypeus and the space between the antennæ only are covered with pale hair.

MEGACHILE OTHONA, sp. nov.

Nigra; abdomine late rufo-vestito; pedibus anticis rufis; alis fusco-violaceis. ♂.

Long. 12 *mm.*

The lower part of the front, the face, and clypeus are thickly covered with pale fulvous hair; the front and vertex are strongly punctured. The mandibles are closely punctured, except at the apex; the apical tooth is sharply triangular; separated from this by a short space is a shorter triangular tooth, followed by a much larger, more projecting, rounded one. Thorax closely and distinctly punctured. Legs black; the anterior femora, tibiæ, and tarsi in front rufous; the femora are also rufous above and the tarsi dark testaceous; the tooth on the front coxæ is stout; the tarsi are thickly covered with pale hair. Wings fuscous-violaceous; the nervures and stigma deep black; the 2nd transverse cubital nervure has the lower part slightly oblique; the upper is sharply oblique, with the top on a different angle from the rest. Abdomen above densely covered with brick-red depressed pubescence, except on the basal and on the greater part of the 2nd, 3rd, and 4th segments; the apex in the middle has a shallow incision; the part behind this is depressed; the part on either side is irregularly, slightly toothed. The apical segment roundly, broadly projects in the centre above; below it is broadly curved inwardly.

This may be *M. placida* Smith, from Gilolo (Proc. Linn. Soc. 1861, p. 60), but as no mention is made of the form of the mandibles or of the anal segment, this is a mere guess.

Allied to this species is the following from New Guinea:—

MEGACHILE MALAYANA, sp. nov.

Nigra; capite thoraceque dense nigro-pilosis; abdominis dorso rufo-vestito; alis fusco-violaceis. ♂.

Long. 11–12 *mm.*

Antennæ black; the last joint straight and oblique on the lower side. Head black; closely and distinctly punctured; the apex of the clypeus and the part between the antennæ thickly covered with long white hair; the front bears also longish hair, and the vertex is covered wtih short pale hair. The base of the mandibles is closely and distinctly punctured; the apical tooth is long, becomes gradually narrower towards the apex which is rounded, it is widely grooved in the middle. Thorax closely and uniformly punctured; the pubescence is short, stiff, dense, and black above; on the sides it is longer and not quite so deeply black in colour. Legs black, the apical three joints of the fore tarsi brownish, and they are covered with pale hair; the hair on the middle pair is more rufous in tint; the posterior on the underside are thickly covered with stiff rufous pubescence. Wings uniformly fuscous-violaceous, the nervures black. The upper surface of the abdomen is covered, from the apex of the first segment, with depressed rufous pubescence; the ventral segments are fringed at the apex with pale fulvous hair. The apex of the last abdominal segment is entire; in the middle is a deep, somewhat triangular, depression. The apex of the clypeus is transverse, it is not furrowed in the middle.

Allied to *M. bicolor* Fabr.

CRICOSA EMARGINATA Lep.

This species is found in the Himalayas, China, India, and South Africa.

NOMIA FULVIVENTRIS, sp. nov.

Fulva; mesonoto, scutello abdominisque dorso late nigris; pedibus fulvis; tibiis posticis late nigris; alis hyalinis, costa stigmateque nigris, nervis fuscis. ♂.

Long. 10 *mm.*

Scape of antennæ and pedicle fulvous, sparsely covered with long pale fulvous hair; the scape densely covered with a pale down, which gives it a whitish look. The front, face, and clypeus densely covered with fulvous pubescence, smooth and shining; the clypeus is almost square, its apex is raised and transverse, in its centre is a narrow carina which does not reach to the apex. Mandibles pale fulvous, becoming gradually narrowed towards the apex, which is black. Thorax smooth and shining; on the mesonotum is an indistinct central line, and a larger one on either side. Scutellum large, slightly but distinctly depressed in the centre; the post-scutellum furrowed in the middle. The metanotal area is clearly defined behind by a stout, curved keel; the edge behind it is also raised; inside it is irregularly longitudinally striated, almost reticulated; the centre is distinctly furrowed; the lower half of the sides is bounded by a stout keel. Behind the middle of the mesopleuræ is a narrow, but distinct, oblique, slightly curved keel; the central furrow is wide but shallow and ends in a fovea in the middle. Wings almost hyaline; the costa and stigma are black.

Abdomen smooth; the basal two thirds of the basal segment, the greater part of the fifth, the apex and the ventral surface are reddish fulvous.

NOMIA (PARANOMIA) PULCHRIBALTEATA, sp. nov.

Nigra; capite, thorace pedibusque dense griseo-hirsutis; abdominis segmentis virido-marginatis; alis fere hyalinis, stigmate nervisque nigris; post-scutello spinis duabus armatis. ♂ *et* ♀.

Long. 8–9 *mm.*

♀. Scape of antennæ sparsely covered with pale hair. The vertex and the sides of the face are thickly covered with griseous pubescence; the pubescence on the other parts is much sparser. The lower part of the vertex, the face, and the clypeus have a distinct keel down the middle; the face is punctured, except in the centre; the clypeus is closely, irregularly, longitudinally striated; its sides and apex are bordered by distinct keels. The base of the mandibles in the centre is rugose, and bordered above and below with keels; the apex of the mandibles is oblique. Mesonotum and scutellum closely punctured; the scutellum is slightly depressed in the middle; the post-scutellum is armed with two spines, which are stout, straight on the inner side, rounded above on the outer. The basal area of the median segment is longitudinally striated; the striæ are more widely separated in the centre than at the sides. The legs are thickly covered with griseous pubescence; the calcaria are dark rufous; the scopa has white, mixed with longer, black hairs. Abdomen shining; the basal four segments banded with green, mixed with yellow on their apices; the basal band is narrower than the others; the segments are closely punctured except at the apex; the basal is covered with white, the apical segments with longer, black hair; the ventral segments are thickly covered with white hair. Median segment at apex closely punctured, except for a triangular smooth space at the top.

The ♂ is similarly coloured; the scutellum has the sides obliquely narrowed, and ends laterally in a short tooth; the scutellar spines are longer and narrower than in the ♀; the hinder femora are greatly swollen; on the basal part above are two curves, the basal being the shorter and straighter; the tibiæ are thickened, and broadly rounded on the outer side, the apex on the inner side is oblique; the greater part of the tibiæ behind, their apex, and the base of the tarsi are fulvous; the tarsal spines are rufous.

NOMIA METALLICA, sp. nov.

♂. *Long.* 7 *mm.*

A species easily known from *N. pulchribalteata* by its smaller size, by the head and thorax having brassy metallic tints, by the head in front not being keeled, and by the abdomen not being banded with greenish yellow.

Antennæ black; the flagellum brownish beneath. Head black, with distinct brassy tints; thickly covered with griseous pubescence; closely and distinctly punctured, except in the centre of the face above; the apex of the clypeus is broadly pallid yellow and is sparsely punctured and almost bare. Mesonotum and scutellum distinctly brassy, closely punctured; the scutellum is broadly depressed in the middle. Post-scutellum unarmed and thickly covered with white pubescence. Basal area of median segment bare, shining and irregularly reticulated. Wings clear hyaline; the stigma and nervures black. Legs black, thickly covered with white hair; the hinder femora are dilated, above they have a rounded curve from the base to the apex; the tibiæ are not much narrower than the femora and become gradually wider from the base to the apex, which is straight and oblique, their upper side is rounded, their lower straight; the calcaria and spines are pale. The abdomen at the base has bluish tints; the segments are ringed with white hair at the apices.

2. On *Lemur mongoz* and *Lemur rubriventer*. By C. I. Forsyth Major, F.Z.S.

[Received March 4, 1901.]

(Plate XXII.[1])

(Text-figures 61–70.)

It is well known to those who have approached the subject that we are not yet satisfactorily acquainted with the members of the genus *Lemur*, and that the synonymy of the species is therefore far from being settled.

The reasons for this state of things are also known, at least in great part. Some of the species vary considerably in the coloration of their skin. In others the male is different from the female in outer appearance. In others again two different species resemble each other in external characters. Quite a number of so-called species have been introduced without sufficient descriptions, and, the types being lost or uncertain, it is impossible exactly to know what their authors had in view.

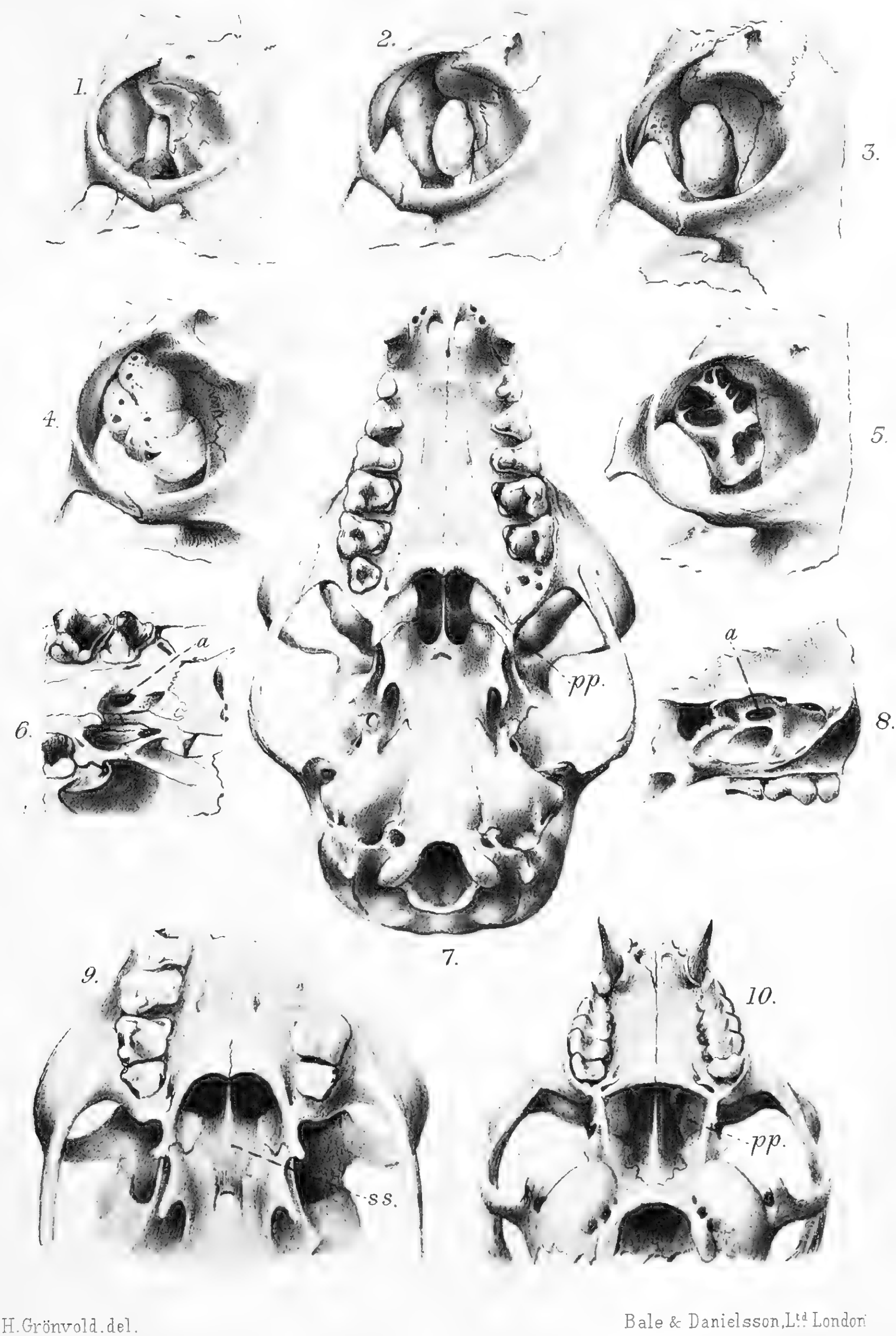
In menageries, different varieties of the same species, or two different species, have been again and again crossed together, and there is every likelihood that in more than one instance species have been founded upon hybrids.

With the exception of, perhaps, the Paris Museum, no collection contains sufficient materials for our present exigencies.

And, last not least, the species have without one single exception been based upon external characters, and the skull especially has been almost entirely overlooked.

Schlegel's excellent 'Monographie des Singes' of 1876, the fruit of researches extending over fifty years, is still the standard work from which we have to start when studying most of the

[1] For explanation of the Plate, see p. 268.



H. Grönvold. del.

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SKULLS OF LEMURS.

groups of the Primates. Although the author limited himself almost exclusively to outer characters, his practised eye very often, and, so far as the genus *Lemur* is concerned, as a rule, hit upon the truth. His shortcomings are due to the lack of sufficient collections, and the entire neglect of cranial characters, considered by him to be "un terrain glissant."

In the following paper I have done my best to contribute to a better knowledge of two species of the genus *Lemur*, with especial reference to some characteristic features of their skull. Incidentally have been pointed out the cranial characters of a third species, one which is almost always confused with *Lemur mongoz* L.

1. Lemur mongoz L.

The Mongooz, G. Edwards, Gleanings of Natural History, Ch. v. pl. 126, p. 12 (1758).

Lemur mongoz, Linn. S. N. (12) i. p. 44 (1766); A. Wagner in Schreber's Säugthiere, Suppl. i. pp. 267, 268 (1840) (exc. p. syn.); id. op. cit. Suppl. v. p. 144 (1855) (exc. p. syn.); H. Schlegel, Nederl. Tijdschr. Dierk. iii. p. 75 (1866); H. Schlegel et Pollen, Rech. Faune Madag. ii. p. 4 (1868); P. L. Sclater, Proc. Zool. Soc. Lond. 1871, p. 231 (exc. p. syn.); H. Schlegel, Mus. Hist. Nat. Pays-Bas, vii. p. 312 (1876); Jentink, Mus. Hist. Nat. Pays-Bas, ix. p. 62 (1887).

Lemur albimanus, E. Geoffr. S.-H., Tabl. des Quadr. p. 160 (1812); I. Geoffr. S.-H., Cat. méth. p. 72 (1851); A. Milne-Edwards et Oustalet, Nouv. Arch. Mus. d'Hist. Nat. (2) x. p. 282 (1888); A. Milne-Edwards et A. Grandidier, Hist. Nat. des Mammifères (Hist. . . . de Madagascar, éd. A. Grandidier), x. tome v. Atlas ii. pls. 156, 157, 162–164, 165, figs. 1, 2 (1890); L. v. Lorenz-Liburnau, Abh. Senckenb. naturf. Ges. xxi. iii. p. 450, pl. xxxiii. fig. 2 (1898).

Mongous d'Anjouan, F. Cuvier (E. Geoffr. S.-H. et F. Cuvier), Hist. Nat. des Mammifères, 87, sub "Le Mongous," pp. 2 & 3 (1819).

Lemur dubius, F. Cuvier, op. cit. 93 (1834).

Lemur anjuanensis, Peters, Reise nach Mossambique, Zool. i. p. 21 (1852); Günther, Ann. Mag. Nat. Hist. (5) iii. p. 215 (1879).

Prosimia albimana, J. E. Gray, Proc. Zool. Soc. London, 1863, p. 139.

Lemur cuvieri, Fitzinger, Sitzungsber. Akad. Wiss. Wien, lxii. i. p. 58 (1870).

Anticipating the result of the following detailed review, I may state at once briefly the history of the name "*Lemur mongoz.*"

Linnæus based his species upon the tolerably good figure and the good description of "*The Mongooz*" in G. Edwards's Gleanings. Schreber[1] and soon afterwards Gmelin[2] extended the name to

[1] Die Säugthiere, i. p. 137: "Der Mongus" (1774).

[2] Caroli a Linné, Systema Nat. xiii. ed. pp. 42, 43 (1788).

one or more other forms, quite certainly to one other species; and this has been going on to the present day[1], although A. Wagner, Schlegel, and P. L. Sclater had, in succession, arrived at the truth. Sclater, moreover, was the first to point out that, as in some other species of the genus, the sexes have a different coloration in the true *L. mongoz*.

To begin with the description of "The Mongooz" by G. Edwards.

"The Mongooz is less than a small cat. This was a female.—The head of this animal is shaped much like that of a fox, and is wholly covered with hair; the eyes are black, with orange-coloured irides, or circles round the eyes: the hair is black and joins between the eyes, tending downwards in a point toward the nose, which is also black; but there is a space between the eyes and nose purely white, which reaches under the eyes, on the sides of the head. The upper part of the head, neck, back, tail, and limbs is of a dark-brownish ash-colour, the hair being something woolly; the underside of the body is white . . . . ; all the paws are covered with short hair of a light ash-colour; the tail is long, the hair is pretty thick and soft, and appears to have a mixture of lighter and darker parts all over the body."

That E. Geoffroy Saint-Hilaire's *Lemur albimanus* is a synonym of *L. mongoz* was not recognized at the time, because the species was founded apparently upon a male specimen, as results from the description of the coloration[2].

Possibly for the same reason Fr. Cuvier's excellent description of the "*Mongous d'Anjouan*" has been generally overlooked:—

"J'ai eu en même temps deux mâles et deux femelles de *Mongous*, auxquels la description que je viens de donner convenait également sous tous les rapports. Mais j'ai possédé un mâle qui avait avec ces animaux la plus grande ressemblance, et qui en différait cependant par quelques points assez remarquables pour que je croie devoir le faire connaître ici.

"Ce Maki avait été emmené d'Anjouan . . . . Il était mâle et très-adulte, toutes les parties supérieures de son corps, et le sommet de la tête lui-même, étaient d'un gris jaunâtre, résultant de poils alternativement colorés sur leur longueur, de gris sale et de noir; ce gris était plus pur sur les jambes de devant, et sur les côtés

[1] *Cf.* e. g. A. Milne-Edwards and E. Oustalet, Nouv. Arch. Mus. d'Hist. Nat. (2) x. p. 22 (1888).—A. Grandidier et A. Milne-Edwards, Hist. Nat. des Mammifères (Hist. . . . de Madagascar, éd. A. Grandidier), v. Atlas ii. pls. 133–153 (1890).—F. A. Jentink, Mus. d'Hist. Nat des Pays-Bas, xi. Cat. Syst. des Mammifères, pp. 68–72 (1892).—H. O. Forbes, A Handbook to the Primates, i. pp. 71–73 (1894).—Trouessart, Catal. Mamm. tam viv. quam foss. i. p. 57 (1898–99).

[2] "Pelage gris-brun en dessus: poils d'un roux cannelle sur les côtés du cou: poitrine blanche: ventre roussâtre: mains blanches" (Geoffroy Saint-Hilaire, Tableau des Quadrumanes, Ann. Mus. d'Hist. Nat. xix. p. 160, 1812).—"Gris en dessus avec la gorge et la poitrine blanches, le ventre roussâtre; fraise d'un roux cannelle se prolongeant supérieurement assez pour entourer l'oreille. Ce dernier caractère distingue mieux l'espèce que la couleur des mains, qui sont blanchâtres ou d'un fauve sale" (I. Geoffroy Saint-Hilaire, Catalogue méthodique, p. 72, 1851).

du corps. La partie postérieure des cuisses de derrière était jaune, et ce caractère était remarquable. Le ventre était d'un jaune sâle, et le gris-blanc dominait à la poitrine, au-dessous du cou, et de la mâchoire inférieure, et au-dessus de la supérieure. Enfin il avait, comme le *Mongous*, de larges favoris à la base des mâchoires, mais au lieu d'être orangés, ils étaient d'un roux sale. La forme de sa tête différait aussi sensiblement de celle du *Mongous* mâle : le crâne était plus élevé, le museau moins allongé, et il y avait une dépression à la racine du nez plus forte encore que celle qui se voit dans nôtre tête de *Mongous* femelle ; enfin la partie antérieure du museau était blanche. Du reste, il ressemblait entièrement aux *Mongous*."[1]

A. Wagner in his turn gives a good description of the species ; from the following we are able to gather that his specimen was a female :—" Ein Halsband, das von den Ohren beginnt und um die Kehle herumzieht, der Unterhals, die Brust und ein schmaler Streif auf der Innenseite der Vorderglieder sind weiss ; der Bauch und die Innenseite der Schenkel ist licht röthlichgelb. Die Stirngegend bis ausserhalb und unterhalb der Augen herab ist am dunkelsten und bildet eine fast ganz schwarze Querbinde ; die Schnautze fällt mehr ins Weissliche, die Schnurren sind schwarz."[2] He also identifies Fr. Cuvier's Mongous d'Anjouan—to which Fitzinger subsequently gave the name of *L. cuvieri*—as belonging to *L. mongoz*, and likewise the *L. albimanus* of Geoffroy Saint-Hilaire[3]. It is very probable that, as Wagner and several of the following writers have maintained, the *L. nigrifrons* of E. Geoffroy Saint-Hilaire is likewise a synonym of *L. mongoz*.

In the fifth Supplement of Schreber's 'Säugthiere,' Wagner has unfortunately up to a certain extent again undone his previous good work. Cuvier's *Mongous d'Anjouan* is here[4] excluded from the synonymy of *L. mongoz* on the ground that it had red whiskers, which was not the case in Geoffroy's and Peters's specimens from Anjouan[5]. Wagner therefore now ranges it under *L. collaris*[6], as he does likewise with *L. albimanus*.

The fact is, that Peters's specimen was a female.

In his eight days' sojourn at Anjuan, one of the Comoros, Peters obtained a young male and an " older " female of " *Lemur anjuanensis*." The female is described as follows :—" Gesicht und Schnauze schwarz, Oberkopf, Nacken, Oberrücken, Schwanz und die Aussenseite der Vorderextremitäten grau, der übrige Theil des Rückens bis zur Schwanzbasis und die Hinterextremitäten graubraun, die Seiten des Gesichts bis zu den Ohren, die Kehle, Brust und die innere Seite der Vorderextremitäten bis zu den Pfoten weiss, der ganze Bauch bis zur Schwanzbasis rostbraun, die nackten

[1] Hist. Nat. Mammifères, 87, sub "Le Mongous," pp. 2 & 3 (1819).
[2] Schreber's Säugthiere, Suppl. i. p. 268,
[3] *Op. cit.* p. 269.
[4] Schreber's Säugthiere, Suppl. v. p. 145.
[5] Peters's specimen was a female ; see below.
[6] *Op. cit.* p. 145.

Theile des Gesichts und der Hände schwarz. Die Länge des Thiers von der Schnauzenspitze bis zur Schwanzbasis betrug im frischen Zustande 13 engl. Zoll . . . "[1]

H. Schlegel repeatedly asserted, between the years 1866–1876[2], that with the real *Lemur mongoz* of Linnæus, based on the "Mongooz" of G. Edwards, has been almost constantly confused a different species, for which he adopts the name *L. collaris* E. Geoffr. S.-H. He showed that, apart from *L. catta*, which stands aside from all the other species of the genus, these last may be divided into two groups—those with a black snout, and those in which "all the parts of the snout are covered with white hairs." To the latter group belong the *L. mongoz* L. and the *L. coronatus* Gray.

Thirty years ago[3], the Secretary of this Society "submitted as an hypothesis to be confirmed by subsequent investigation," that two kinds of Lemurs in the Society's Gardens, the "Yellow-cheeked" and the "Black-fronted," hitherto regarded as distinct species, were really male and female of the same species, to which the earliest name applicable appears to be the *L. mongoz* of Linnæus, founded on the "Mongooz" of Edwards, a female. The female specimens of the Gardens are said to be certainly the animal figured by F. Cuvier (Hist. Nat. des Mammifères) as "Le Maki à gorge blanche, femelle—*Lemur dubius*." Now, certainly not all the "Yellow-cheeked" Lemurs are the males of the species *L. mongoz*, nor are all the "Black-fronted" its females. But neither was this Sclater's view of the question, for he expressly states as his opinion that F. Cuvier's *L. nigrifrons* and Gray's *L. xanthomystax* are different.

In his 'Monographie des Singes,' Schlegel partly endorses Sclater's view, which on the whole was a confirmation of his own. He omits, however, from the synonymy of *L. mongoz* the *L. collaris* of E. Geoffroy S.-H., on the other hand adding to it *L. albimanus* of the same author.

From Schlegel we also obtain, for the first time, information about the exact locality where the species was found in Madagascar; most of the specimens in the Leyden Museum were obtained by the Dutch collector Van Dam near Bembatoka Bay, West Coast of Madagascar. The description of the skin is given as follows:—

"Teinte dominante d'un gris brunâtre, plus ou moins lavé de roussâtre et tiqueté de noir. Dessous blanchâtre, quelquefois roussâtre, ou même teint comme les parties supérieures. Teintes de la tête assez différentes dans les deux sexes: le mâle ayant les

[1] Reise nach Mossambique, Zool. i. p. 21 (1852).

[2] H. Schlegel, Contributions à la Faune de Madagascar et des Iles avoisinantes: Nederlandsch Tijdschrift voor de Dierkunde, iii. p. 75 (1866).—Schlegel et Pollen, Rech. sur la Faune de Madagascar et de ses dépendances. II. Mammifères et Oiseaux par H. Schlegel et François P. L. Pollen, p. 4 (1868).—H. Schlegel, Mus. d'Hist. Nat. des Pays-Bas, vii. Monogr. des Singes, p. 312 (1876).

[3] P. L. Sclater, "Notes on rare or little-known Animals," Proc. Zool. Soc. London, 1871 (p. 230).

favoris, un bandeau frontal ou même tout le front et le vertex d'un roux vif; tandis que la femelle offre des favoris blancs et un large bandeau noir sur le devant du front, sans nulle trace de roux. Ce bandeau noir est très caractéristique pour la femelle du Mongoz, et ne se retrouve pas non plus dans aucune autre espèce du genre." [1]

Four specimens of a Lemur collected by Mr. C. E. Bewsher in Anjuan and preserved in the British Museum have been described by Günther, likewise under the name *L. anjuanensis.* It is stated that Peters's description of the female "agrees entirely with a specimen of the same sex obtained by Mr. Bewsher." The three males are exactly alike; "the face before the eyes is white, the nose blackish, the forehead with mixed black and whitish hairs; the side of the throat below the eye, and the throat itself, bright brownish red; crown, back, outer side of the legs, and the greater part of the tail grey, with a not very perceptible rufous tinge on the rump; chest and abdomen greyish, with a rufous tinge; inner side of the legs with scarcely any white; hands and feet grey (in one specimen whitish); the terminal third or fourth of the tail blackish." [2]

It will have been observed that Peters states the snout of the female to be black. The female in the British Museum, said by Günther to agree with the one described by the former writer, has only the tip of the nose black. Peters may have used the term "Schnauze" in a loose sense, or he may have disregarded the whitish hairs covering the dark skin of the snout [3]. The agreement with the British Museum specimens from Anjuan is so perfect in all the other characters, that I have given Peters's specimen a place in the synonymy of *Lemur mongoz.*

A specimen in the British Museum (Z. D. No. 79.11.12.7), collected by Dr. (Sir John) Kirk in another of the Comores, Mohilla, agrees exactly in the characters of the skin with the male specimens from Anjuan. The cranial characters are those of the species under consideration (see below). This is the only record of a *Lemur* occurring in Mohilla Island.

In their "Etudes sur les Mammifères et les Oiseaux des Iles Comores" [4], A. Milne-Edwards and Oustalet state that the species of *Lemur*, common in the forests of the Island of Anjuan, at about 1000 metres, is the *Lemur albimanus* E. Geoffr. S.-H. They deny that this species has ever been found in Madagascar: "Le *Lemur albimanus* a été décrit par Geoffroy Saint-Hilaire d'après un exemplaire de la collection du Muséum rapporté par Péron et Lesueur, lors de l'expédition de la corvette *le Géographe*, en 1803, et indiqué comme recueilli à Madagascar. Or jamais, à notre

[1] *Op. cit.* p. 312. Schlegel adds: "M. Sclater a indiqué à l'inverse le sexe de ces deux individus." This applies, of course, only to the explanation of the figures in pl. xvi. of the P. Z. S. 1871.

[2] Ann. Mag. Nat. Hist. (5) iii. p. 215 (1879).

[3] *Cf.* plates 162–165 in Grandidier's Atlas.

[4] Nouv. Arch. Mus. d'Hist. Nat. (2) x. p. 222 (1888).

connaissance, cette espèce n'a été trouvée sur cette grande terre et il est probable que la provenance avait été donnée d'une manière approximative par Péron et Lesueur, ce qui n'étonne pas quand on sait combien, à cette époque, on attachait peu d'importance aux questions de Géographie zoologique." [1] From the description they give of this Lemur [2] it is quite evident that we have not only the same species as that described by Peters and by Günther, but also the one described by Sclater and by Schlegel; but both the last-named writers, and especially the latter's statement about the occurrence of the species on the West Coast of Madagascar, are overlooked.

In the same article [3], the two French zoologists mention a second species of *Lemur* from Anjuan, under the name of *L. mongoz* L. (=*L. nigrifrons* E. Geoffr. S.-H.), adding that the type of Geoffroy's *L. anjuanensis*, in the Paris Museum, is a synonym of the former. As Günther had already pointed out [4], E. Geoffroy's diagnosis of his *L. anjuanensis* [5] can be applied to more than one species. Schlegel made, with regard to the "Lémur de l'île d'Anjuan, Lemur anjuanensis," the vague statement that persons who have seen specimens pronounced them not to be different from the ordinary *L. collaris*; although he refers to Peters's description, he overlooks that the description of the female in the 'Reise nach Mossambique' corresponds exactly with his own description of the female from Bembatoka [6]. With regard to E. Geoffroy's *L. anjuanensis*, in the absence of a more accurate description, we must rely on Milne-Edwards's and Oustalet's assertion, that the type is distinct from the same author's *L. albimanus*. As a consequence, the name *L. anjuanensis* cannot stand for the Lemur described from Anjuan by Peters and by Günther, nor as a synonym of *L. mongoz* L.

Bearing in mind what Milne-Edwards, Grandidier's collaborator in the work on Madagascar, asserts about the patria of *L. albimanus* (see above), we must assume that the plates of "*Lemur albimanus*" in the 'Histoire de Madagascar,' issued two years later, in 1890 [7], were drawn after specimens from Anjuan. The

[1] *Op. cit.* p. 223.

[2] "Les mâles diffèrent beaucoup des femelles, ils ont tous une fraise jaune; les femelles ont la poitrine blanche, la teinte du corps varie plus ou moins du gris au roux, mais les caractères que nous venons d'indiquer sont constants et se remarquent même chez les jeunes sujets" (*op. cit.* p. 223).

[3] *Op. cit.* p. 222.

[4] *Op. cit.* p. 216.

[5] "Pelage roux-vif en dessus, gris-roux sur les membres: les parties antérieures du tronc cendrées" (Ann. du Mus. vol. xix. p. 161). I. Geoffroy S.-H.'s diagnosis is slightly more complete: "Gris en dessus et en dessous jusqu'aux épaules; roux en dessus et en dessous dans tout le reste du corps; queue et cuisse rougeâtres" (Cat. Méth. p. 73, 1851). Whatever the habitat of this type of *L. anjuanensis* may be, the above diagnoses, insufficient as they are, support Milne-Edwards's and Oustalet's view that this species is different from *L. albimanus*.

[6] *Op. cit.* p. 309.

[7] Pls. 156, 157, 162–164, 165, figs. 1 2.

sex has been wrongly indicated in the plates 156, 157, and 162, just as in Sclater's figures.

From the descriptions by Günther, Schlegel, Milne-Edwards and Oustalet, and from Grandidier's plates, we learn that, apart from the very characteristic coloration of the throat and front, different in both sexes, the colour of the skin varies to some extent, although on the whole the males are more reddish, the females more greyish.

Von Lorenz describes our species from specimens collected by Dr. Voeltzkow at Kandani and Antema, near Bembatoka Bay, the same district whence the Leyden specimens were obtained. Although the description is given under the heading "*L. albimanus*," the writer states expressly that he inclines to agree with Schlegel and Sclater in assuming that the appropriate name is *L. mongoz* L. Von Lorenz also records that, out of twenty individuals, two females approached to the colorotion of the males, and *vice versa* one male had a grey head[1].

I trust that by the foregoing quotations the synonymy of *L. mongoz* L., placed at the heading, has been justified, and that its outer characters have been abundantly pointed out.

It is a matter of considerable difficulty to find out the proper name for the one species with which the *Lemur mongoz* L. is generally confused. Schlegel adopted for it the name *Lemur collaris* Geoff., but the descriptions of the older writers are mostly insufficient, so that, if the types are not forthcoming, the matter will never be satisfactorily settled. All I wish to say for the present on this subject, with which I am not directly concerned here, is, that there exists in Madagascar and the Comoros a widespread species, varying considerably in the colour of its skin, but constant in some cranial features of easy observation, which last will be described farther on. To this species, besides the name *L. mongoz*, the following names have been applied at one time or other:—*Lemur albifrons*, *L. anjuanensis*, *L. bruneus*, *L. collaris*, *L. fulvus*, *L. mayottensis*, *L. nigrifrons*, *L. rufifrons*, *L. rufus*, *Prosimia melanocephala* and *Prosimia xanthomystax*. *L. fulvus* E. Geoffr. S.-H. has the priority, and I therefore adopt this name.

Cranial Characters.

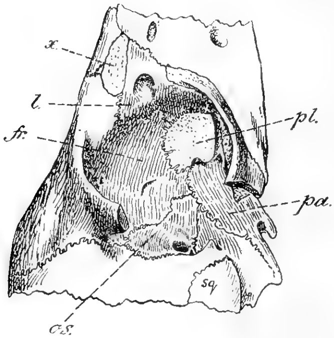
Lemur mongoz has the smallest skull of all the species of the genus, *L. coronatus* not excepted. Assuming that Edwards's specimen was adult, the dimension assigned to it, "less than a small cat," would be appropriate. As observed by F. Cuvier and von Lorenz, the facial cranium is short for a species of *Lemur*; it approaches in this character the *L. rubriventer*.

Von Lorenz has figured the skull in the side view, which he describes as follows: "Die Stirne ist infolge der stark entwickelten Sinus frontales weit vorgewölbt und von der Nasenwurzel

[1] Abh. Senckenb. naturf. Ges. xxi. iii. p. 450 (1898).

an ziemlich steil ansteigend, doch zeigen die verschiedenen Individuen eine sehr wechselnde Entwickelung der Stirnhöhlen; bei einigen beschränken sie sich mehr auf den vorderen Theil der Frontalia, bei anderen verursachen sie auch eine Vorwölbung der hinteren Partieen und der verticalen Fortsätze der Stirnbeine. Mit

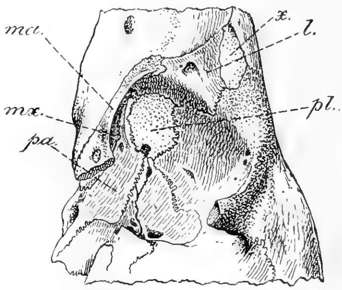
Text-fig. 61.



Right orbital region of *Lemur catta*, nat. size (Br. M. 59 *c*).

l.=lacrymal; *pl.*=planum; *fr.*=frontal; *pa.*=palatal; *os.*=orbito-sphenoid; *sq.*=squamosal; *x*=intercalar bone.

Text-fig. 62.



Left orbital region of the same specimen of *Lemur catta*, nat. size.

ma.=malar; *mx.*=maxillary.

dem Geschlechte stehen diese Unterschiede in keinerlei Zusammenhang "[1]. The specimens from Anjuan and Mohilla before us agree with the foregoing descriptions.

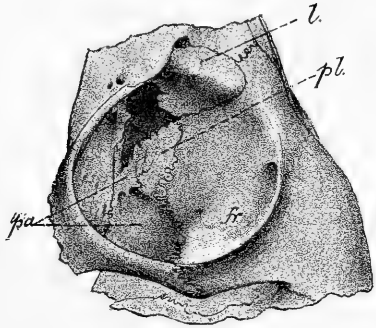
Still more characteristic for the present species are some peculiarities in the basis cranii, due also to pneumatic cavities.

The conditions of these pneumatic cavities, which give a

[1] *Op. cit.* p. 452, pl. xxxiii. fig. 2.

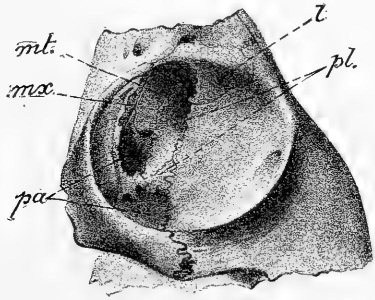
characteristic feature to the skull of *Lemur mongoz*, are so peculiar in this and the following species (*Lemur rubriventer*) that, in order to understand them, some general considerations must precede their description.

Text-fig. 63.



Left orbital region of *Lepidolemur mustelinus*, ½ nat. size.
(Letters as in text-fig. 61.)

Text-fig. 64.



Lepidolemur mustelinus.

Same specimen as fig. 63. The bones forming the roof of the sinus have been removed, in order to exhibit its floor.

mt.=basal plate of maxillo-turbinal; other letters as in text-fig. 61.

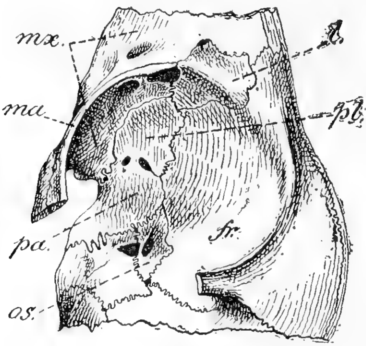
It has been stated that in the "Common Lemur"—whereby I take the genus *Lemur* to be implied—"the os planum of the ethmo-turbinal does not enter into the inner wall of the orbit, but is shut out from it by the maxilla, as in most inferior Mammals"[1].

At this Society's meeting on February 19th, I showed that in

[1] W. H. Flower, An Introduction to the Osteology of the Mammalia, 3rd ed., p. 166 (1885).

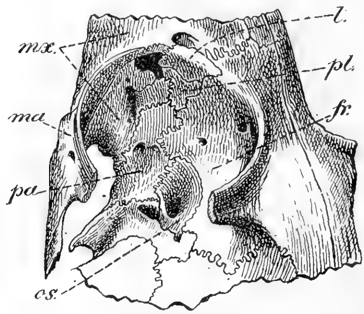
all the Oriental and Ethiopian Lemurs, as well as in the Malagasy *Microcebus*, an os planum is always very evident, so long as the sutures in the orbit remain distinct, adding that, with the exception of *Chiromys*, I had observed the os planum in all the Malagasy Lemurs in which sufficiently young stages could be examined. In the majority of the Malagasy Lemurs the frontal, and here and there to a slight extent the orbito-sphenoid—not the maxilla—overgrow the medial part of the planum. The

Text-fig. 65.



Left orbital region of *Lepidolemur mustelinus* (Br. M. 97.9.1.18), $\frac{3}{2}$ nat. size. *ma.*=malar; *mx.*=maxillary; other letters as in text-fig. 61.

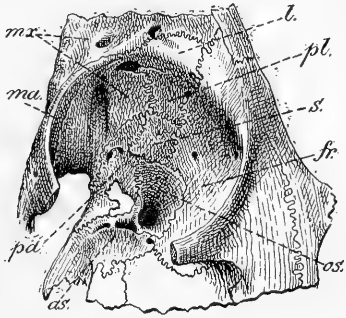
Text-fig. 66



Left orbital region of *Lepidolemur globiceps* Maj. (Br. M. 97.4.6.1), $\frac{3}{2}$ nat. size. *mx.*=maxillary; *ma.*=malar; other letters as in text-fig. 61.

lateral part has become united with the palatal at a very early stage; a remnant of the suture with the latter bone is seen in the adult at its antero-medial extremity; in exceptional cases, e. g. *Lemur catta* and young specimens of *Lepidolemur*, the planum remains completely (*pl.*, text-fig. 62, p. 256) or almost completely (*pl.*, text-fig. 63, p. 257) distinct from the palatal (text-figs. 61, 62). It always forms the roof of a pneumatic cavity, which often (*Lemur catta*, *Lemur macaco*, *Lemur varius*) is but an appendix of the maxillary sinus. The anterior portion of the palatal also participates, as a rule, in the formation of this

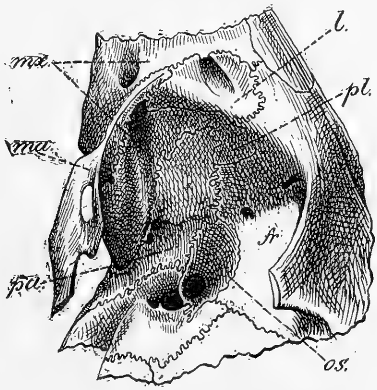
Text-fig. 67.



Left orbital region of *Lepidolemur grandidieri* (Br. M. 68.9.7.4), $\frac{3}{2}$ nat. size.

S.=intercalar bone; *as.*=alisphenoid; *mx.*=maxillary; *ma.*=malar; other letters as in text-fig. 61.

Text-fig. 68.



Reversed right orbital region of *Hapalolemur griseus* (Br. M. 67.9.1.12), $\frac{3}{2}$ nat. size.

mx.=maxillary; *ma.*=malar; other letters as in text-fig. 61.

pneumatic cavity, by forming its posterior *cul-de-sac* (text-figs. 63, 64, p. 257). But the early union of the palate-bone with the planum renders it very difficult to state for every genus and every species, where no young stages were available and no sections could be made of the skull, in what degree, if at all, the palatal partakes in the formation of the walls of the pneumatic cavity.

With regard to the Oriental and Ethiopian Lemurs, all of which, as stated, have a well-developed planum and in all of which the orbital process of the palatal is small, I submit, pending a more accurate investigation, that this process belongs to the palatal exclusively.

In the Malagasy Lemurs, in which part of the planum is shielded by the frontal, the anterior prolongation of the orbital process is large (*Microcebus* occupies an intermediate position between the Malagasy and non-Malagasy Lemurs) (text-figs. 65, 66, p. 258). For the reasons stated above, I have submitted, that in this group the larger portion of the orbital process is in reality a part of the planum, which, in union with a small portion of the palatal, helps to form the walls of a pneumatic cavity. There are cases, however—*Hapalolemur* and sometimes *Lepidolemur* (text-figs. 67, 68, p. 259)—in which occurs besides a separate bone, which, from its position, has the claim of being a small independent portion of the planum. So that in these exceptional cases the planum is represented by three distinct portions—one covered by the frontal, another contributing towards the formation of a sinus, and a third, which plays the usual part of a planum, but is greatly reduced in size. This last can scarcely be regarded as a stop-gap, an intercalar bone, for in the case of *Hapalolemur* at least it is already present in a new-born specimen.

In *Man*, the orbital process of the palatal is more or less hollow and completes, so to say, one of the ethmoidal cells, by closing it. In very exceptional cases (M. J. Weber) this cavity of the human palatal opens into the maxillary sinus.

The palatal of Man is, according to the general assumption, developed from a single osseous centre. But Cleland has drawn attention to the circumstance [1] that, not uncommonly in Man, the orbital process is unusually large, owing, he believes, to its having incorporated one of the three elements of the sphenoidal spongy bones (ossicula Bertini); for it has the same position which is occupied by that element when it appears in the orbit, and the enlarged orbital process replaces the element by contributing towards the formation of the lateral wall of the cavity (sinus sphenoidalis) which owes its origin to the spongy bones. In three young Orang skulls Cleland found that "the sphenoidal spongy bones take part in the formation of the orbit, while the palatal has no orbital plate" [2].

Henle holds that part of the processus orbitalis helps to close the sinus sphenoidalis when its wall is incomplete [3]. A similar view is advocated by Toldt [4], who says that when the spongy bones are rudimentary, the orbital process may contribute in a comparatively

[1] Phil. Trans. Roy. Soc. London, vol. 152, pp. 291, 292 (1862).

[2] *Op. cit.* p. 297.

[3] "Was von der Grundfläche des Proc. orbitalis hinter seiner Öffnung übrig bleibt, legt sich vor die laterale untere Ecke der vorderen Wand des Wespenbeinkörpers und trägt, wenn diese Wand unvollständig ist, zur Schliessung der Wespenbeinhöhle bei." (Handb. d. syst. Anat., 3rd ed., I. i. p. 190, 1871.)

[4] Lotos, Jahrb. f. Naturwiss., N.F. iii. & iv. p. 75 (1883).

large measure towards the formation of the wall of the sinus sphenoidalis; or else this function may be taken over by an *intercalar* bone making its appearance in the most posterior part of the medial orbital wall and articulating with the same bones as does the "third element" noticed by Cleland.

Gegenbaur states [1] that the *superficies sphenoidalis* of the orbital process, situated behind the latter's *superficies ethmoidalis*, articulates with the body of the sphenoid, from the cavity of which a hollow ("Buchtung") extends on to the sphenoidal surface, and he accordingly figures [2] a small cavity in this part of the orbital process, almost symmetrical with, but smaller than, the cavity of the ethmoidal surface.

There is therefore no perfect accord amongst the writers on this topic—Gegenbaur representing as the normal condition what by other anatomists is termed an occasional occurrence; and, like Henle before him, he does not speak of an articulation of the orbital process with the ossicula Bertini, but with the præsphenoid.

In Lemurs—*Lemur fulvus* ("*L. mongoz*," B.M. Z. D. No. 60 *b*), *Lepidolemur* (see text-figure 67, p. 259), *Avahis* (see *s.*, text-figure 27, above, p. 132)—I find sometimes present a separate bone, occupying exactly the position of Cleland's "third element" [3] and Toldt's "Schaltknochen." In one instance at least amongst Lemurs (see below under *Lemur rubriventer*), the anterior portion of the sphenoidal sinus is annexed in a later stage by a palatal sinus.

I am likewise inclined to assume that the small cavity in the human orbital palatal communicating with one of the ethmoidal cells is the remnant of the condition in Lemurs, where ethmoid and palatal concur in forming a cavity. From this it follows that the so-called "cellulæ ethmoidales" are not organites proper only to the ethmoid of Man, and hence are not without phylogenetical importance, as assumed by Seydel [4].

Proceeding now to an examination of the conditions in *Lemur mongoz*, I find that in all the skulls of this species which I had the opportunity to examine the *pars perpendicularis* and the orbital process of the palatal diverge considerably from behind forward, so as to enclose between them the posterior triangular portion of a spacious cavity. The divergence of the *pars perpendicularis* takes place by its advancing into the *cavum nasale* from behind forwards in a latero-medial direction, so that the two parts of either side converge slightly towards the middle line (Pl. XXII. fig. 10, *p.p.*); each of them terminates freely with a sharp vertical margin, which forms the posterior boundary of the large opening of the cavity into the cavum nasale. The divergence of the orbital process is produced by its being inflated in a lateral direction. The vaulted

[1] C. Gegenbaur, Lehrb. d. Anat. d. Menschen, 6te Aufl., i. p. 234 (1895).

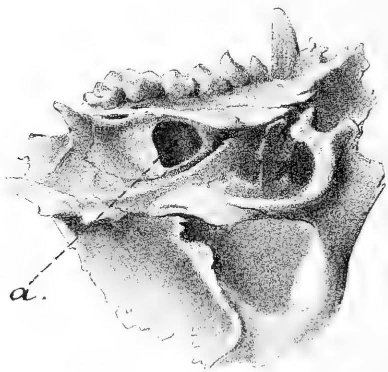
[2] *Op. cit.* p. 233, fig. 176 C.

[3] "Articulating behind with the sphenoid, in front with the ethmoid, inferiorly with the palatals, and sometimes [in Lemurs always—F. M.] above with the frontal."

[4] Morph. Jahrb. xvii. pp. 86, 89 (1891).

roof of the cavity has invaded the whole bottom of the orbit; bearing in mind what I stated in the above introductory remarks, it may be assumed that the planum, possibly some part of the sphenoid also, shares with the palatal the roofing of this cavity. The sutures having disappeared (text-fig. 69), I must leave this to future investigation.

Text-fig. 69.



Right palatal view of *Lemur mongoz*, showing the large opening (*a*) of the right-side sinus into the cavum nasale. Nat. size.

It has been stated above that the medial and lateral walls of the triangular posterior portion of the cavity are formed by parts of the palatal. The anterior portion is triangular also, but the apex is at its anterior end; the walls of this anterior portion are formed by parts of the ethmoid, the medial wall by the basal plate of the maxillo-turbinal, the posterior free margin of this plate, which is concave backward, forming the anterior boundary of the large opening of the cavity. This aperture (*a*, in text-fig. 69) therefore has somewhat the shape of a D, placed parallel to the long axis of the skull, the curved part anteriorly; the vertical part of the D is the posterior margin of the opening. The anterior and lateral walls of the cavity are apparently formed by the planum, the former of the two at the same time marking the boundary between this cavity and the true maxillary sinus, which in this species does not advance into the orbit; nor can I see any communication between the two cavities. The bottom of the cavity under consideration is formed by the bony palate, almost exclusively by the maxilla; the alveoli of the two anterior true molars protrude into it.

The characteristic features of this cavity, as compared with other species, are:—

(1) its large opening;

(2) its not being connected with the maxillary sinus (into the bottom of which always protrude the two posterior premolars); and

(3) the characteristic position of its postero-medial wall, as seen from behind, when the skull is held in a horizontal position, with the basis directed upwards (Pl. XXII. fig. 10).

There are other species of Lemurs (e. g., *Lemur macaco*, *Lemur nigerrimus*, *Lemur coronatus*) in which the pars verticalis of the palatal advances into the cavum nasale in a slightly oblique direction; but in none does it form a high vertical wall as in *Lemur mongoz*, which therefore is by this character alone at once to be distinguished from all the other species.

Lemur fulvus, generally confused with *Lemur mongoz*, is precisely the one which exhibits no trace of a similar wing-like structure, there being no pneumatic cavity intercalated between the posterior region of the orbit and of the cavum nasale respectively. An equally striking character of the skull of *Lemur fulvus* is the great vertical extension of the sphenoidal sinus (Pl. XXII. fig. 9, *ss*), which produces a considerable and sudden change of level between this part of the basis and the cavum nasale in advance of the sinus sphenoidalis, the former coming to be situated much higher [1].

2. Lemur rubriventer.

Lemur rubriventer, I. Geoffr. S.-H., C. R xxxi. p. 876 (1850); id. Cat. méth. p. 71 (1851); H. Schlegel, Nederl. Tijdschr. Dierk. iii. p. 75 (1866); id. Mus. Hist. Nat. Pays-Bas, vii. p. 311 (1876); Jentink, Mus. Hist. Nat. Pays-Bas, ix. pp. 61, 62 (1887) (exc. cran. nos. *o*, *p*, *s*); A. Milne-Edwards et A. Grandidier, Hist. Nat. des Mammifères (Hist.....de Madagascar, éd. A. Grandidier), x. tome v. Atlas ii. plates 168–170 (1890); Jentink, op cit. xi. pp. 72, 73 (1892) (exc. sp. *d*); Forsyth Major, Proc. Zool. Soc. Lond. 1899, p. 554.

Lemur flaviventer, I. Geoffr. S.-H., C. R. xxxi. p. 876 (1850); id. Cat. méth. p. 71 (1851); A. Milne-Edwards et A. Grandidier, op. cit. pl. 191 (cranium).

Prosimia rufipes, J. E. Gray, Ann. Mag. Nat. Hist. (4) vii. p. 339 (1871); id. Proc. Zool. Soc. Lond. 1872, p. 852, pl. 69 (nec Milne-Edwards, P. Z. S. 1893, p. 177).

At the Society's meeting of May 2, 1899 [2], I gave expression to some doubt against the correctness of the view brought forward by Milne-Edwards [3], that Gray's *Prosimia rufipes* is the female of Sclater's *Lemur nigerrimus*. My observations may be epitomized as follows:—

(1) Gray's species was based upon a male *and* a female specimen, both of them rufous.

(2) I myself have collected numerous specimens of both sexes

[1] This is seen also in Grandidier's plate 189. figs. 3, 6 ("*Lemur mongoz*") & pl. 193. figs. 3, 6 ("*Lemur albimanus*"). Von Lorenz had already rightly guessed that the latter plate does not represent the skull of *Lemur albimanus* (=*L. mongoz*, L.).

[2] Proc. Zool. Soc. Lond. 1899, pp. 553, 554.

[3] Proc. Zool. Soc. Lond. 1893, pp. 177, 178.

of the same as Gray's species, and have never met with a black male.

(3) According to Schlegel's view, Gray's *Prosimia rufipes* is a synonym of I. Geoffroy S.-H.'s *Lemur rubriventer* and *Lemur flaviventer*, the latter being the female, the former the male form. The difference in coloration between the sexes of *Lemur rubriventer*—which name antedates *Prosimia rufipes*—would therefore appear merely to consist in a lighter coloration of the underparts in the female.

This view I found to be supported by my own material also.

(4) In the specimens collected by myself, the iris is yellow and not greenish blue, as is the case, according to Milne-Edwards, with *Lemur nigerrimus*.

(5) The skull of one of the two types of *Prosimia rufipes* [1], which agrees perfectly with those collected by myself, is very different from the skull of *L. nigerrimus* figured in the 'Hist. Nat. de Madagascar.'

The conclusion was that Gray's *Prosimia rufipes*, which is I. Geoffroy's *Lemur rubriventer* and *L. flaviventer*, is a very different species from *Lemur nigerrimus*. Not having seen the types of *L. rubriventer* and *flaviventer*, nor any specimen of *L. nigerrimus*, I expressed myself in perhaps too cautious a manner, although at that time already the matter was settled in my opinion. Thereby I did not wish in the least to cast a doubt on Milne-Edwards's statement with regard to the colour of the female *Lemur nigerrimus*. His mistake is easily explained by the circumstance that in the description of the types of *Prosimia rufipes* none of the very characteristic features of the species are mentioned: the accompanying plates are inaccurate even with regard to the coloration.

I have, since the date of my first note, been able to examine (1) a couple of *Lemur rubriventer*, deposited some time ago in the Society's Gardens by the Hon. Walter Rothschild; (2) one of the types of Geoffroy's *Lemur flaviventer*, in the Leyden Museum, it was obtained in 1834 by Bernier and received in 1835 from the Paris Museum; (3) a skull of the adult male of *Lemur nigerrimus*, presented last year by Mr. Stanley Flower to the Natural History Museum.

From an inspection of the individuals living in the Gardens, any one may convince himself that the male of *Lemur rubriventer* is not black; and that the iris in both is yellow, and not greenish blue as in *Lemur nigerrimus* according to Milne-Edwards. A third point which needed explanation, is elucidated by them. In a recent book on Primates—in which, by the way, quite a number of original observations are embodied, although it does not pretend to be more than a compilation—the description of the male of *Lemur rubriventer* contains the following: "a ring round the eyes cobalt-blue" [2]. This peculiar statement is easily traceable back to

[1] The skull has not been taken out of the second mounted specimen.

[2] H. O. Forbes, A Handbook to the Primates, i. p. 76 (1894).

the coloured figure of the male of *Lemur rubriventer* in the Hist. Nat. de Madagascar[1]. Having known the *Lemur rubriventer* in life, without ever having seen this "cobalt-blue" ring in the male, I had already arrived at the conclusion that it was merely the outcome of the artist's highly coloured imagination. The specimens in the Gardens show that the region in question has in both sexes about the coloration of the lower figure in plate 169 of the quoted work, viz. dark grey with a bluish tinge.

The examination of one of the types of Geoffroy's *Lemur flaviventer* in the Leyden Museum showed that Schlegel was perfectly justified in considering this form to be the female of *Lemur rubriventer*. Apart from the slight variation in the coloration, the two agree absolutely in all other features, including the very characteristic conformation of the cranium.

The skull of a male *Lemur nigerrimus* presented by Mr. Stanley Flower[2] agrees in almost every particular with the one figured in Grandidier's work[3], and is therefore very distinct from the skull of *L. rubriventer*.

Lemur rubriventer has, in fact, very few of the characteristic features of the other species of the genus, but on the other hand some striking peculiarities of its own; and I perfectly remember how much I was puzzled when I first met with this species in the forests of Ivohimanitra. The head is roundish, the face being much less produced and the hinder portion broader than in all the other species. The ears are comparatively small, hairy and hidden, as it were, in the fur, as already perfectly characterized by Schlegel[4].

The skull is short and broad, and massive; the facial cranium remarkably short for a *Lemur*[5]. But the most peculiar feature in the skull of this species is a pneumatic cavity, developed in the palatal and which, with the increase in age of the animal, becomes so much enlarged that it pervades the whole of the bottom of the orbit, and, in the basis cranii, considerably narrows the posterior openings of the nares (Pl. XXII. fig. 7). In an advanced fœtus the *pars perpendicularis* of the palatal exhibits already, just above the posterior margin of the bony palate, the opening of a small recess, which extends in a supero-lateral direction; as a consequence, the palatal appears slightly inflated in the orbit. In the next stage available (Pl. XXII. fig. 6, a young individual), the opening of the incipient sinus is oval-shaped, its long axis parallel to the long axis of the cranium; it is situated almost entirely behind the bony palate, so that it is visible in the horizontal lower view of

[1] Pl. 167.

[2] Brit. Mus. Z. D. No. 0.8.6.21; from the Ghizeh Zool. Gardens. This specimen bred with a ♀ *L. macaco*, and the young is stated to have been like the mother.

[3] Pl. 188.

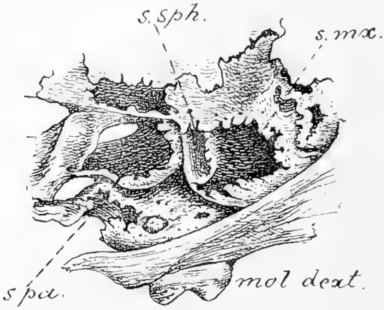
[4] "Oreilles passablement petites, fortement velues dans toute leur étendue et comme cachées dans le pelage de la tête." (Monogr. Singes, p. 311.)

[5] Grandidier's plate 191 ("*Lemur flaviventer*") conveys a good general idea of the skull of *Lemur rubriventer*.

the skull. In the orbit (Pl. XXII. fig. 1) the inflated part of the palatal appears situated medially from the orbital plate of the maxilla, and medially as well as posteriorly from the os planum; the latter helps to form the posterior prolongation of the maxillary sinus and covers besides the anterior prolongation of a sphenoidal sinus, laterally it is in its turn covered by the frontal.

In this stage the palatal pneumatic cavity rather resembles the swollen orbital maxillary plate above the germs of the molars of young individuals; so that, if it has ever been seen at all, it may have been mistaken for that part of the maxilla. As the figures (Pl. XXII. figs. 1, 2) show, both parts are lying side by side and are very distinct from each other. With the increase in age of the animal, the palatal pneumatic cavity continues to pervade the orbit in every direction, antero-posteriorly as well as laterally and medially (Pl. XXII. fig. 3). Anteriorly, the hinder portion of the maxillary sinus is the loser in the struggle, for it is gradually encroached upon and pushed forward by the palatal sinus; but I am not aware that a communication between the two cavities takes place. The palatal cavity becomes, however, enlarged at the cost of another sinus; in a youngish specimen ($m.3$ not yet in place) the following can be seen owing to its somewhat damaged condition (see text-fig. 70):—the before-mentioned sphenoidal

Text-fig. 70.



Lemur rubriventer.

Right orbital region. The bones forming the floor have been partially removed, in order to exhibit the disposition of the underlying sinuses. About $\frac{3}{2}$ nat. size.

s.sph.=sphenoidal sinus; *s.mx.*=maxillary sinus; *spa.*=palatal sinus.

sinus (*s.sph.*), which in the posterior part of the orbit runs parallel to the palatal cavity, medially from it, finally turns round in a lateral direction, ending in a *cul-de-sac* between the maxillary (*s.mx.*) and the palatal sinus (*s.pa.*), thus separating the two. As in later stages I have found no more trace of this *cul-de-sac*, its place being occupied by the palatal sinus (text-fig. 70), it is evident that it must have been absorbed by the latter.

Finally, the palatal sinus covers completely the orbital maxillary plate also, and constitutes for itself the whole inflated bottom of the orbit (Pl. XXII. fig. 4). As has already been mentioned, the sinus expands also on the basis cranii; the most posterior part of the palatal, the *processus pyramidalis*, becomes inflated, and the choanæ are considerably narrowed by the swollen *pars perpendicularis* (Pl. XXII. fig. 7, *pp*).

In very old specimens a partial absorption of the roof of this sinus takes place (Pl. XXII. fig. 5).

I have found this very curious palatal sinus in all the specimens of *Lemur rubriventer* examined, eight in the Zoological Department of the Natural History Museum, seventeen in the Leyden Museum, and six specimens forming the remainder of my collections made in Madagascar.

It is one of the characteristics of pneumatic cavities in Mammalia, that they often vary greatly within the same genus, so as to offer excellent specific characters for systematic purposes, when, as is the case in the present and in the before described species (*Lemur mongoz*), the change in the skull is such that it becomes apparent without any dissection being necessary. The skull of *Lemur rubriventer* can at once be recognized by the unique feature of its bulla-shaped palatal sinus.

As to its particular function, it certainly has not the one to supply space for the teeth. Conversely, a section of the maxillary sinus in this and other species shows that the latter apparently has amongst its functions to favour or protect the development of the two posterior premolars; and in the *L. mongoz* before described, the peculiar posterior sinus affords a similar protection to the two anterior true molars. But the palatal sinus of *L. rubriventer* certainly interferes with the development of the last true molar, for its floor grows over the corresponding part of the maxilla at the very time when the tooth is in the state of germ. The fact that *L. rubriventer* is the one species of the genus which has the smallest and most reduced *m.* 3 (see Pl. XXII, fig. 7) is a confirmation of the above.

The distribution of these pneumatic cavities over the whole of the family (Lemuridæ), and their various degree of development in different groups, gives a clue as to their principal function when they are greatly developed.

In those Lemurs which are characterized by their sluggish movements (*Loris*, *Nycticebus*, *Perodicticus*), the pneumatic cavities are small. In the nearly related Galagos, known for their agility, the sinuses around the cavum nasale are equally reduced; but the pneumatic cavities of the mastoid region evidently act as a compensation. In Malagasy Lemurs inflations of the mastoid region are an exceptional occurrence and, when present, never greatly developed, except in "*Chirogaleus trichotis*." The maximum of development of aerial sinuses, almost exclusively of those starting from the cavum nasale, occurs in the larger forms of Malagasy Lemurs, all of them excellent climbers and acrobats.

Of Tertiary Lemurs, *Microchœrus* (*Necrolemur*) agrees in this and other respects with the Galagos, *Adapis* with the Malagasy Lemurs.

EXPLANATION OF PLATE XXII.

(All figures are of the natural size.)

Figs. 1–5. *Lemur rubriventer* I. Geoffr. S.-H. Left orbit of young, adult, and old individuals.

Fig. 6. *Lemur rubriventer.* Lower view of part of the skull (region of the posterior nares), to show the position of the opening, *a*, of the palatal sinus.

7. *Lemur rubriventer.* Lower view of the skull. The opening of the choanæ is narrowed by part of the palatal sinus (*pp*).

8. *Lemur rubriventer.* View of part of the orbit. The bony roof of the palatal sinus has been removed in order to show the inner aspect of the floor. *a* = the aperture of the sinus leading into the nasal cavity (*cf.* fig. 6).

9. *Lemur fulvus* E. Geoffr. S.-H. (Br. M. 91.1.22.5). Part of lower view of the skull, to show the lower wall (*ss*) of the sphenoidal sinus.

10. *Lemur mongoz* L. (Br. M. 77.4.2.21). Part of lower view of the skull, to show the *pars perpendicularis* (*pp*) of the palatal.

3. Descriptions of new Freshwater Fishes discovered by Mr. F. W. Styan at Ningpo, China. By G. A. Boulenger, F.R.S.

[Received March 11, 1901.]

(Plates XXIII. & XXIV.[1])

Mr. F. W. Styan, F.Z.S., who has added so largely to our knowledge of the Fishes of the Yantse-kiang[2], has lately brought home a small collection made at Ningpo, which he has presented to the British Museum. Few freshwater Fishes have hitherto been collected in this district, a single species having been described from the collection of Abbé David[3], and a few from a series sent by the Chinese Government to the Berlin Fisheries Exhibition in 1883[4]. It is therefore not surprising to find representatives of some new species in the small series brought together by Mr. Styan. These belong to the family Cyprinidæ, so richly represented in the fresh waters of China.

Crossochilus styani, sp. nov. (Plate XXIII. fig. 1.)

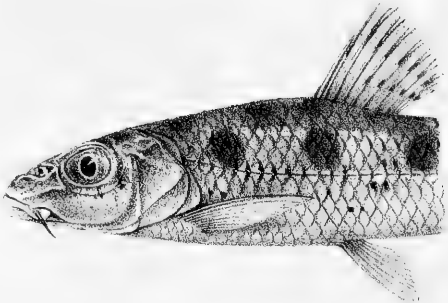
Depth of body $3\frac{1}{2}$ to $3\frac{3}{4}$ times in total length, length of head $4\frac{1}{4}$ to $4\frac{1}{3}$ times. Snout with strongly curved profile, projecting

[1] For explanation of the Plates, see p. 271.

[2] A. Günther, Third Contribution to our Knowledge of Reptiles and Fishes from the Upper Yangtse-Kiang. Ann. Mag. N. H. (6) iv. 1889, p. 218.

[3] H. E. Sauvage et Dabry de Thiersant, Notes sur les Poissons des Eaux douces de Chine. Ann. Sci. Nat. (6) i. 1874, art. 5.

[4] W. Peters, Uèber die . . . . . Fischsammlung aus Ningpo. Mon. Berl. Ac. 1880, p. 921.



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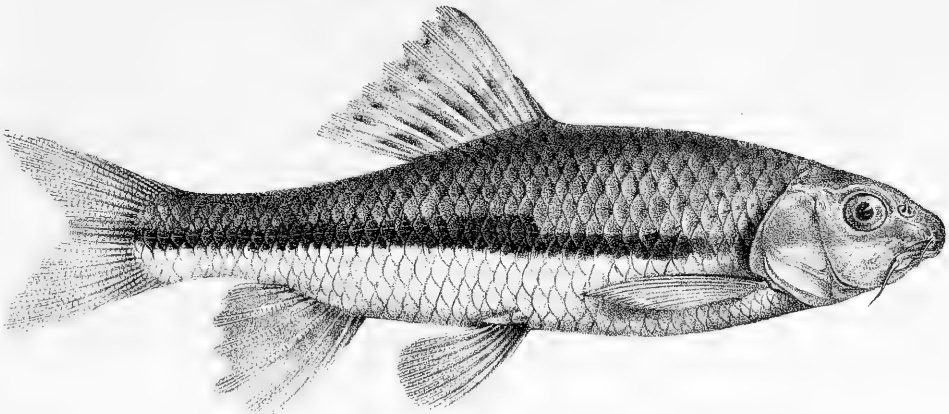

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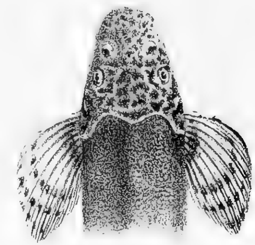


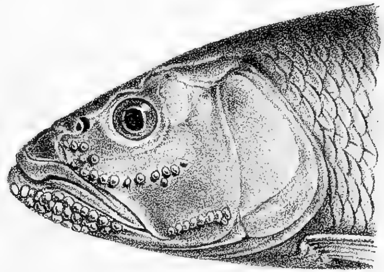
3a.

J. Green del. et lith.

Mintern Bros. imp.

1. CROSSOCHILUS STYANI. 2. GOBIO NUMMIFER. 3. HOMALOSOMA STENOSOMA.

1a.



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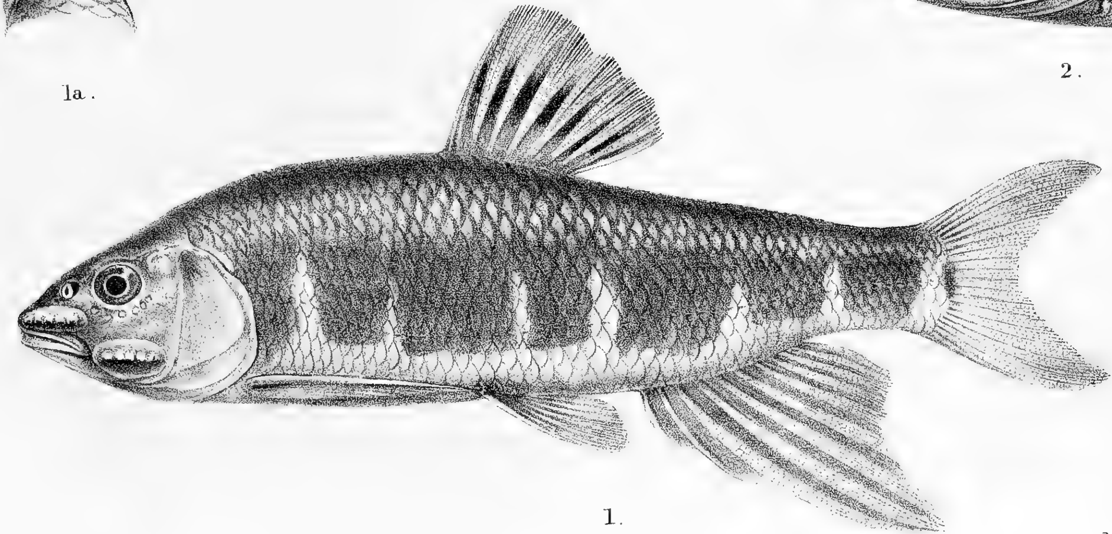


1.

J.Green del.et lith.

Mintern Bros. imp.

1. OPSARIICHTHYS ACANTHOGENYS. 2. O. PLATYPUS.

beyond the mouth; upper lip not fringed; two pairs of barbels, anterior $\frac{2}{3}$ or $\frac{3}{4}$ diameter of eye, posterior as long as or a little longer than eye; end and sides of snout pitted (scars of nuptial excrescences?); diameter of eye $1\frac{1}{3}$ to $1\frac{1}{2}$ times in length of snout, which equals interorbital width, and 4 to $4\frac{1}{2}$ times in length of head. 5 or 6 short gill-rakers on lower part of anterior arch. Dorsal III 8, equally distant from occiput and from base of caudal; longest rays about $\frac{3}{4}$ length of head. Anal III 5; rays as long as dorsals. Pectoral nearly as long as head, not reaching ventral; latter inserted below middle of dorsal. Caudal deeply forked. Caudal peduncle $1\frac{1}{2}$ to $1\frac{2}{3}$ as long as deep. Sq. $39\text{–}41\frac{6}{5}$; $3\frac{1}{2}$ series of scales between lateral line and ventral fin. Olive-brown above the lateral line, white beneath; a dark brown band above the pectoral, behind the gill-opening, and a dark brown stripe along the lateral line from the shoulder to the middle rays of the caudal fin; six rather indistinct dark bars across the back in the smallest specimen; some dark brown vertical streaks or mottlings between the rays of the dorsal fin; other fins immaculate.

Total length 135 millim.

Three specimens.

GOBIO NUMMIFER, sp. nov. (Plate XXIII. fig. 2.)

Very similar in general appearance to *Gobio fluviatilis.* Depth of body $4\frac{2}{3}$ times in total length, length of head $3\frac{3}{4}$ times. Eye in the middle of the head, its diameter equal to interorbital width and contained $3\frac{3}{4}$ times in length of head; mouth subinferior, extending to below nostrils; barbel $\frac{3}{4}$ length of eye; 4 bifid gill-rakers on lower part of anterior arch. Pharyngeal teeth as in *G. fluviatilis.* Dorsal III 7, equally distant from nostrils and from base of caudal; longest rays $\frac{3}{5}$ length of head. Anal III 6; longest rays $\frac{2}{3}$ length of head. Pectoral $\frac{2}{3}$ length of head, not reaching ventral. Latter below middle of dorsal. Caudal deeply notched. Caudal peduncle nearly twice as long as deep. Sq. $45\frac{6}{6}$; 4 series of scales between lateral line and ventral fin. Olive-brown above, whitish beneath; head speckled with blackish; small black spots and dots about the lateral line; a series of six round black spots along the body and tail, above the lateral line; dorsal and caudal dotted with blackish, other fins immaculate.

Total length 102 millim.

A single specimen.

OPSARIICHTHYS ACANTHOGENYS, sp. nov. (Plate XXIV. fig. 1.)

Depth of body $3\frac{1}{3}$ to 4 times in total length, length of head 4 times. Snout obtusely pointed, projecting slightly beyond the mouth, $1\frac{1}{2}$ to twice as long as the eye; latter $4\frac{1}{2}$ to 5 times in length of head, $1\frac{1}{2}$ to twice in interorbital width. A large, deciduous, horny excrescence, bearing a longitudinal series of 5 or 6 spines, on each side of the snout, and another on the lower part of the cheek, below the eye. Dorsal II 7, a little nearer the occiput than the root of the caudal; longest ray nearly $\frac{2}{3}$ length of head. Anal III 8–9, anterior soft rays more or less produced, longer than the head. Pectoral nearly as long as head, not quite reaching base of ventral. Caudal forked. Caudal peduncle $1\frac{1}{2}$ to $1\frac{3}{4}$ as long as deep. Sq. 49–51 $\frac{9-10}{5-6}$; 2 series of scales between lateral line and base of ventral. Brown on the back, greyish or plumbeous with irregular whitish vertical bars on the sides; belly white; large, purplish-black spots on the membrane between every two rays of the dorsal; other fins immaculate.

Total length 130 millim.

Several specimens.

The nuptial excrescences on the head in this species are quite unique. In describing specimens of *O. bidens*, Dr. Günther[1] observes :—"During the spawning-season the male develops brown horny tubercles on the snout and head; they are arranged in several rows on the mandible, and in a single row along the præopercular margin, below the eye, along the lower margin of the suborbital ring and on the intermaxillary. After the breeding-season the tubercles drop off, leaving a circular scar which after some time disappears entirely." This description applies very well to *O. platypus* Schleg., from Japan, Formosa, Hainan, of which examples measuring up to 160 millim. were obtained at Ningpo by Mr. Styan. A figure of the head of one of these specimens is here given (Pl. XXIV. fig. 2) for comparison with *O. acanthogenys*, in which a fusion of the tubercles has taken place, the enlarged bases forming a large plate which is only comparable to the nuptial horny plates on the breast of some South American Frogs of the genus *Leptodactylus*. The scar left by each of these plates is in the form of a series of large pits, corresponding to the number of cusps.

HOMALOSOMA STENOSOMA, sp. nov. (Plate XXIII. fig. 3.)

Body feebly depressed, its depth 6 times in total length, length of head $5\frac{1}{2}$ times. Snout much longer than postocular part of head, a little longer than broad, with rounded edge; diameter of eye 6 times in length of head, 3 times in interorbital width; upper lip not fringed; barbels short, simple, subequal. Dorsal with 9 rays (7 branched), originating a little in advance of ventral, equally distant from occiput and from root of caudal. Anal with 7 rays (5 branched). Pectoral as long as head, not reaching ventral. Caudal truncate. Caudal peduncle a little deeper than long. Scales extremely small; lat. l. 85. Brown above, white beneath; head vermiculate with blackish; some dark bars on the caudal peduncle; dorsal and caudal fins spotted with black.

Total length 105 millim.

A single specimen.

Fishes allied to the one here described have been figured by

[1] Ann. Mus. St. Pétersb. 1896, p. 216.

Dabry de Thiersant, Piscicult. et Pêche en Chine (1872), pl. xxxvii. figs. 9 & 10, under the name of *Gobius? Tsin-ting-yu* and *G.? Pa-chee-tsee-yu*, from Sze Chuen.

EXPLANATION OF THE PLATES.

Plate XXIII.

Fig. 1. *Crossochilus styani*, p. 268.
2. *Gobio nummifer* (p. 269), head and anterior part of body.
3. *Homalosoma stenosoma* (p. 270).
3 *a*. " " upper view of head and pectoral fins.

Plate XXIV.

Fig. 1. *Opsariichthys acanthogenys* (p. 269).
1 *a*. " " upper view of head.
2. " *platypus* (p. 270), side view of head.

4. A Note upon *Galago garnetti*. By Frank E. Beddard, M.A., F.R.S., Prosector and Vice-Secretary to the Society.

[Received March 5, 1901.]

(Text-figures 71–74.)

I believe that attention has not been directed to a curious point of likeness between the *hind* foot of the *Galago garnetti* and the *fore* foot of *Hapalemur griseus* which I propose to describe in the present note.

As is to be seen in the accompanying drawing (text-fig. 71, p. 272), there is upon the ankle of this Lemur close to the roots of the 2nd and the 5th digits a patch of spine-like structures which are exceedingly like those borne upon the wrist of the male *Hapalemur griseus* as figured by myself [1], Mr. Bland Sutton [2], and Prof. A. Milne-Edwards [3].

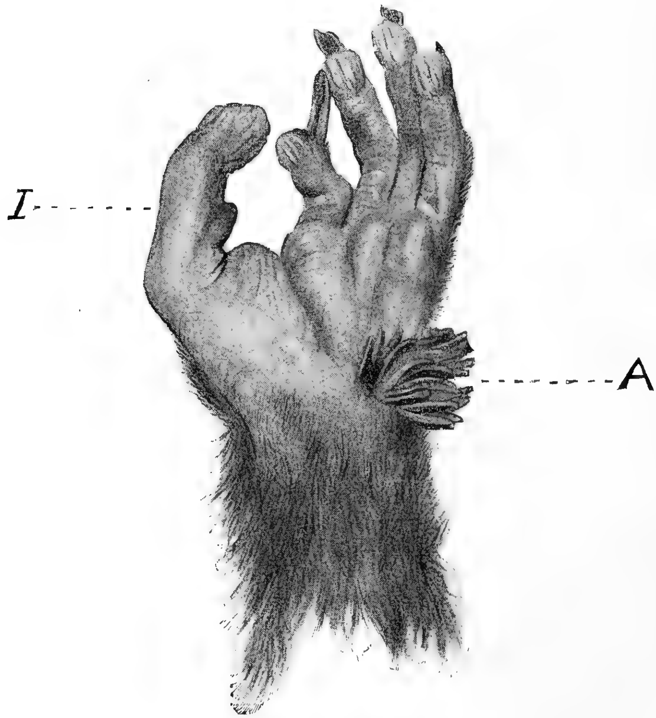
The spines form a dense tuft occupying an area of from 8–10 mm. square, and they lie beyond the line where the hairs of the arm cease. To the proximal (elbow) side of the large branch of spiny outgrowths there is a very much smaller one completely separated from it (text-fig. 72, p. 273) and consisting entirely of very small spiny outgrowths. As is correctly shown in Messrs. Murie and Mivart's paper upon the anatomy of the Lemuroidea, the hair upon the fourth foot (of *Galago crassicaudata*) [4] ends off in a V-shaped line, the arms of the V being directed towards the hand. This agrees with the condition which I have observed in *G. garnetti*, the chief difference being (apart of course from the spiny structures which it is the object of the present communication to describe) that the area of naked skin upon the ankle is more extensive.

[1] P. Z. S. 1884, p. 393, fig. 1. [2] P. Z. S. 1887, p. 369, fig. 1.
[3] Hist. Nat. Phys. et Pol. de Madagascar, Mamm. pl. 122 Z.
[4] Trans. Zool. Soc. vii. p. 11, woodcut, fig. 8.

The patch of spines lies behind the pad lettered 5 in the figure of Murie and Mivart.

The spines themselves are of a brown colour, paler therefore than the corresponding structures in *Hapalemur griseus.* The longest of them are quite 10 mm. in length; and this fact coupled with the relative smallness of the area which they cover renders them rather more conspicuous than in *Hapalemur.* On the other hand, they might be readily destroyed in the preparation of a skin, and thus have escaped notice at the hands of zoologists. Whether they are

Text-fig. 71.



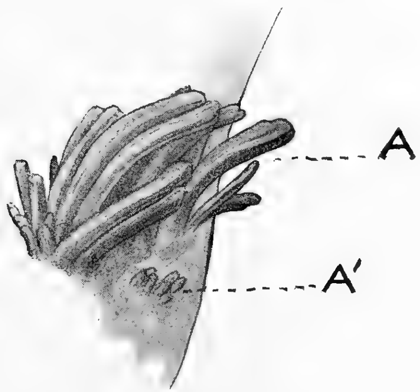
Galago garnetti.

Right hind foot:—I, hallux; A, patch of horny outgrowths.

present in other species of the genus as a general rule or not, I am unable to say; but I can at any rate assert that there is no such modification of the skin of the foot of *Galago maholi*, the only species which I am at the present moment able to examine in the flesh. The dried skin of *G. monteiri* shows no traces of these structures, but I do not regard that piece of evidence as so strong.

There can be no doubt that in *Hapalemur griseus* the corresponding structures are a permanent and apparently universal characteristic of the species, at least of the males of that species. It is quite likely therefore that these horny spinelets are equally characteristic of *Galago garnetti*, though unfortunately through an oversight I am not able to say anything about the sex of the individual examined by myself. Mr. Sutton held that in *Hapalemur* "the patch of spines was in reality formed by the hardened secretion of the gland underlying them." In this case the structure could have no possible relation to hair or spines, or to any mammalian integumental callosities; they would be rather comparable to the cuticular "hairs" and spines of Arthropods. One argument against Mr. Sutton's view appears to me to be this: the lumen of sebaceous and other integumental glands—indeed of all glandular structures—is either circular or oval; in any case without angles. Now the spinelets of this *Galago*, as may be readily noted in the more highly magnified drawing (text-fig. 72) which I exhibit, are distinctly quadrangular; and the same angular character was noticeable in the arm-spines of *Hapalemur*.

Text-fig. 72.

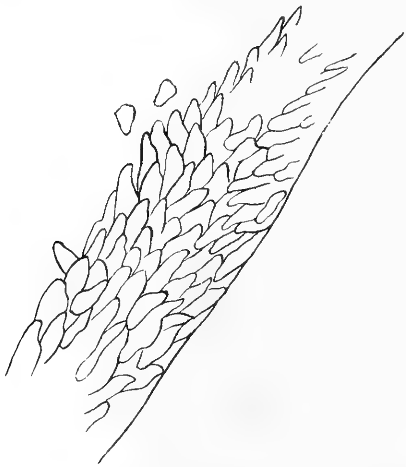


Galago garnetti.

Patch of horny outgrowths, more highly magnified.
A, the main patch; A′, a group of smaller outgrowths.

It is difficult to imagine that the squeezed-out secretion of a tubular gland would have an angular contour. The existence of a large gland in *Hapalemur* lying beneath (though as far as I can recollect not exactly corresponding to) the patch of spines lends of course some colour to the view of the glandular origin of the structure in question in that Lemur. After removal of the skin in *Galago garnetti*, no gland was to be observed beneath the patch of spines. I do not propose to assert the total absence of integumental glands in this region; but no large glandular body comparable to that of *Hapalemur griseus* was visible. To produce such large fibres as are those which constitute this peculiar organ in *Hapalemur griseus* and *Galago garnetti* would seem to need something larger than the normal glands of the integument, if we are to explain them as a glandular secretion. The spinelets are hard and horny, much of the consistence of nails. When softened a little with potash, they can be readily split longitudinally into fibres. When this is done, the spinelets appear to be made up of irregularly-shaped flakes (see text-fig. 73) which imbricate in a scaly fashion not at all unlike the outer coat of hairs. The individual flakes readily become detached when a fragment is teased with needles. They are rather angular and of different shapes, not at all

Text-fig. 73.



Galago garnetti.
One of the horny outgrowths, teased in glycerine to show cornified cells. Highly magnified.

unlike the scales of hair. Their general appearance will be gathered from an inspection of the accompanying drawing (text-fig. 73), which represents a fragment teased in glycerine after softening in potash. Treatment with acetic acid showed no traces of a nucleus in any of these flakes; but this negative result is not necessarily fatal to regarding them as cornified cells.

I made some transverse sections of this region of the integument (see text-fig. 74, p. 275) in order to see if there were any glands concealed in the thickness of the dermis which might be responsible for the formation of these spiny structures. There were a few sweat-glands, but so few that they were not an important feature of the sections. The sections showed the great contrast between the spine-covered area of the ankle and the hair-covered tracts which abut upon it and enable me, I think, to settle the nature of the spinelets. The hairy part of the skin has a very slight horny layer superficially;

this latter is easily recognized by its not staining with borax-carmine; it remains of a yellow colour. Imbedded in the dermis in this region are bundles of 5 or 6 hairs apiece, the exact number of which to each bundle I have not ascertained. The non-staining horny layer gets gradually thicker as the spine-covered area is approached, and at the same time the ridges upon the epidermis get more and more marked.

Text-fig. 74.

Galago garnetti.

Section through the skin of the forearm in the region of the horny outgrowth.

H, cornified epidermis, beneath which are seen nuclei of epidermic cells; S, one of the horny outgrowths. Highly magnified.

Ultimately the dense columns arise from the subjacent layer of non-staining horny epidermis which are the spiny structures themselves. It is impossible to detect any break between the spiny columns and the horny epidermis (text-fig. 74) of which they are extensions; nor are there any differences in minute structure that would justify the placing of the horny spines in any other category than as modified tracts of epidermis. The whole structure is an exaggeration of the pads of thickened epidermis upon the soles of the foot, and is in all probability comparable to such callosities as those found in the Equidæ. In any case I claim to have disposed of any theory that could account for these horny spines as the hardened secretion of a gland. They are plainly of a corn- or wart-like texture, though possibly to be looked upon as a pathological condition which has persisted and become normal.

A final point to which I would direct attention in this communication is the interesting correspondence shown between hand and foot. A structure peculiar to the *hand* of one Lemur is now known to characterize the *foot* of another species. There are among the Mammalia but few details of structure in which the hind limb does not, as it were, copy the fore limb. This correspondence is shown among the Lemurs in another curious point to which attention has of course been directed, since the facts are well enough known. It is not unusual in that group for the second digit in both manus and pes to be peculiar in some respect. This digit in the foot has a claw instead of a nail, while in the hand it is sometimes aborted altogether. The structure, however, with which I deal in the present paper is a positive and detailed point of likeness between hand and foot.

April 2, 1901.

Dr. A. Günther, F.R.S., Vice-President, in the Chair.

Prof. Bell exhibited two specimens of an Echinoderm, *Astrophyton clavatum*, the many-branched arms of which were closely entertwined, while the bursal slits (by which the genital products are evacuated) were turgid and widely open.

Recalling the observations of Prof. Ludwig on *Asterina* and of Dr. Jickeli on *Antedon*, Prof. Bell suggested that we had here a third example of sexual congress among Echinoderms. He further stated that he had called the attention of his valued correspondent, Mr. F. W. Townsend of Karachi, from whom the Trustees of the British Museum had received the specimens, to the difference in coloration between the two specimens, and had asked him to use his opportunities for discovering if the difference was constant and sexual. Since he had come into the room, Mr. Byrne had suggested to him that the entanglement of the arms might aid in the fertilization of the ova.

Mr. R. E. Holding exhibited and made remarks upon the horns of a Japanese Deer (*Cervus sika*), indicating arrest in the development of the left horn, apparently due to a cerebral tumour and adhesions in the right hemisphere of the cerebrum. A dissection showed an extensive inflammatory tumour on the right side, connected by a pedicle to the inner surface of the skull, perforating the bone by a circular opening, and causing thickening and breaking up of the horn-support.

Mr. Holding also exhibited the skull and horns of another Japanese Deer, showing a curious spur growing from the pedicle of the right horn, an uncommon position for a supernumerary horn; such horns, when they do occur, usually having their origin below the pedicle or above the burr.

Mr. G. P. Mudge gave an account of his researches on the Lingual Myology of Parrots, with a Classification of the Order based upon the structure of the Tongue. The ceratoglossus inferior exhibited structural modifications which could be grouped in nine stages, arranged in a graded series. In its most primitive form it consisted only of an anterior portion related to the basihyal; and in its most specialized condition of an additional posterior portion related to the hypobranchial, and connected with the anterior part by a strongly developed tendon. The primitive muscle possessed no tendon but a tendinous fascia. All stages in the development from the primitive to the specialized condition could be traced, in the form of a gradual posterior extension of the anterior primitive muscle along the hypobranchial and in the gradual thickening of a localized, elongated tract of the tendinous fascia, with its concurrent posterior extension along the developing posterior portion of the muscle. In *Brotogerys* and *Ptistes* the left- and right-hand muscles were not alike, and it was shown that the exceptional left-hand muscle of the latter Parrot could be directly derived from that of *Cacatua leadbeateri* by the completion of the incipient retrogression there indicated. In virtue of the structural features of this muscle, *Cacatua*, *Stringops*, *Ara*, *Calopsittacus*, and *Calyptorhynchus* were primitive, and the Lories were specialized; but some species of *Cacatua* and *Ara* were more advanced than others of the same genera.

The thyroglossus had arisen from the thyrohyoideus in three ways, each of which evolved along its own line through two stages: at the third stage all three ways converged, whence the further evolution of the muscle could be traced through three higher stages. The insertion and origin of the muscle in the highest stage was similar to that of its most primitive condition; but it was shown that there were reasons for regarding this apparently primitive condition as resulting from a secondary return to the original one.

The thyrohyoideus was shown to be much more extensive in its primitive condition than was now represented in the majority of Parrots. In respect of this, *Cacatua, Stringops, Calopsittacus, Calyptorhynchus, Microglossus, Eclectus*, and *Nestor* were primitive, since they possessed in the form of a thyrohyoideus accessorius evidence of the once more extensive nature of the muscle.

In *Stringops* the anterior mylohyoideus extended back to the posterior end of the inter-ramal space, though the middle portion of the muscle had undergone retrogression. In all other Parrots the muscle was confined to the anterior fifth of this space, but in many of them evidences of its once more posterior extension could be found.

In the majority of Parrots the posterior mylohyoideus consisted of an outer stylohyoideus and an inner serpihyoideus. Various degrees in the retrogression of the outer portion could be traced, up to *Pezoporus*, in which the left-hand one had disappeared and the right nearly so, and to the Lories, in which it had quite disappeared on both sides of the tongue.

The structural characters of the tongue suggested that Parrots might be arranged in three families—Loriidæ, Nestoridæ, and Psittacidæ.

The investigation covered the study of the tongues of fifty-three species, ranging over the whole Order, the Cyclopsittacidæ excepted.

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

The following papers were read:—

1. On the Larynx of certain Whales (*Cogia, Balænoptera,* and *Ziphius*). By W. B. Benham, D.Sc., M.A., F.Z.S., Professor of Biology in the University of Otago, New Zealand.

[Received February 27, 1901.]

(Plates XXV.–XXVIII.[1])

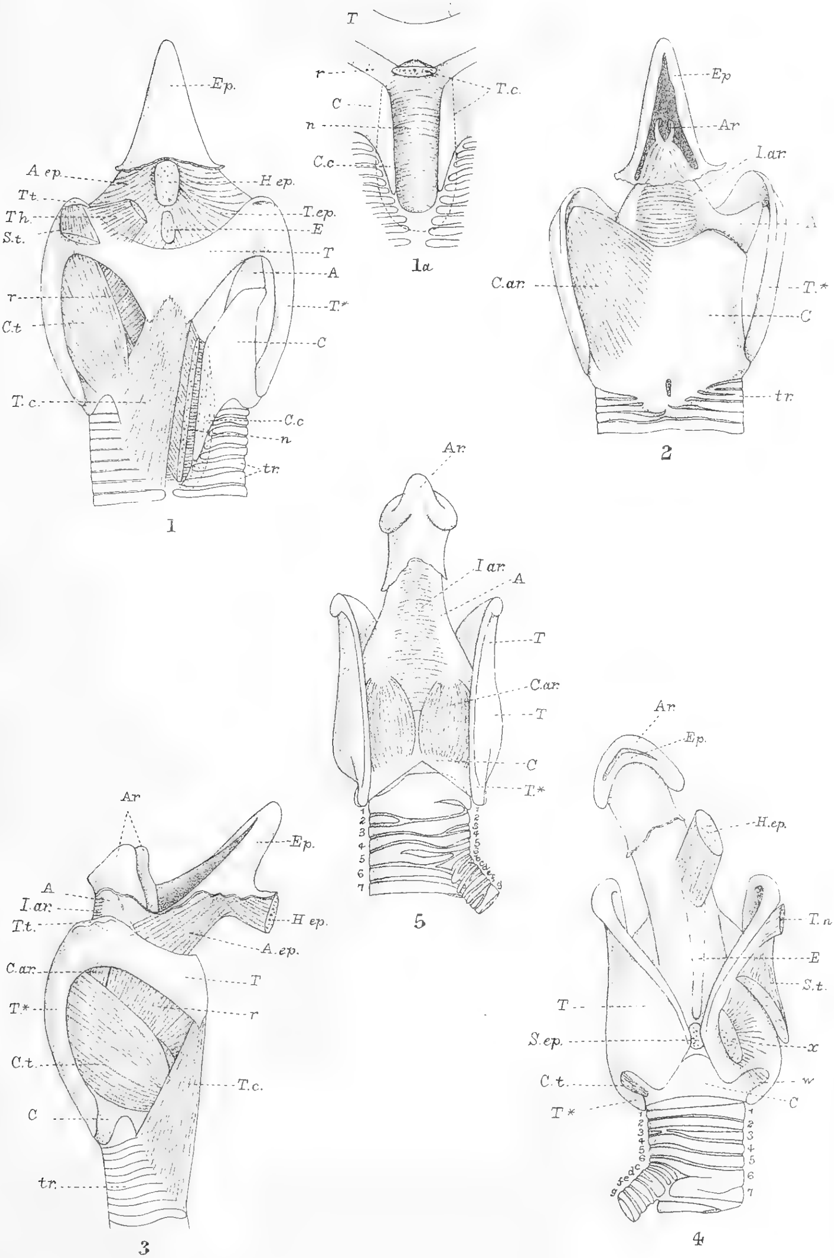
(Text-figure 75.)

During the month of August, 1900, I had the opportunity of obtaining specimens of two species of Whales, both of which came ashore on the coast of Otago, near Dunedin, viz. a young new-born female Rorqual, *Balænoptera rostrata*, and an adult male *Cogia*, the small Cachalot (probably *C. breviceps*).

The young Rorqual was found on the beach just outside the Otago Harbour, and I received it at the Museum the day after it was thrown ashore; it was thus perfectly fresh and wholesome, and I was able to make a fairly complete dissection of it before its condition became unbearable. Since the soft anatomy of *Balænoptera* is pretty well known, thanks to the memoirs of Carte and Macalister, Delage, Turner, and others, I do not intend to give any account of it here. But on becoming possessed of some of the viscera of *Cogia*, about three weeks later, I was struck by the remarkable differences presented by the larynx in these two genera—a fact well known to students of the Cetacea.

The larynx of *Cogia* is, I believe, hitherto undescribed, for

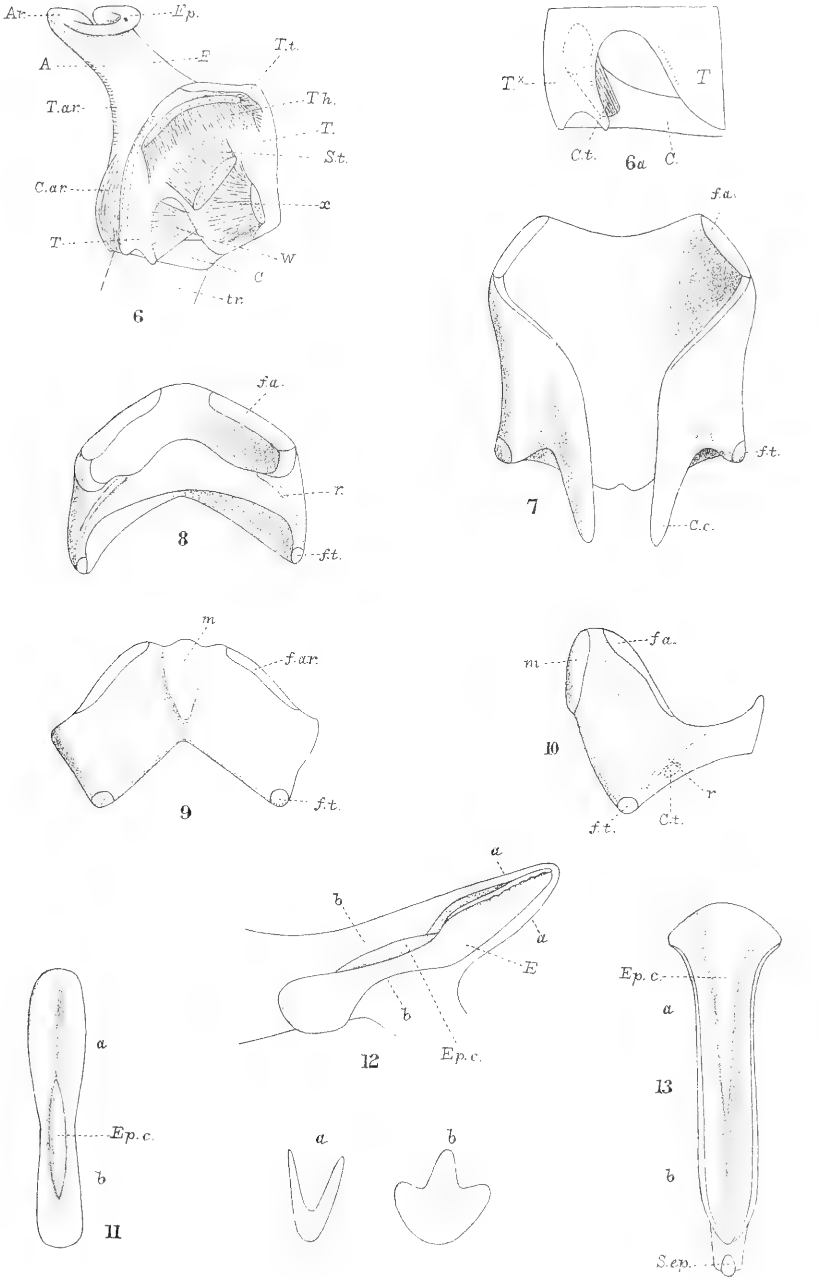
[1] For an explanation of the Plates, see p. 299.



M.P. Parker lith.

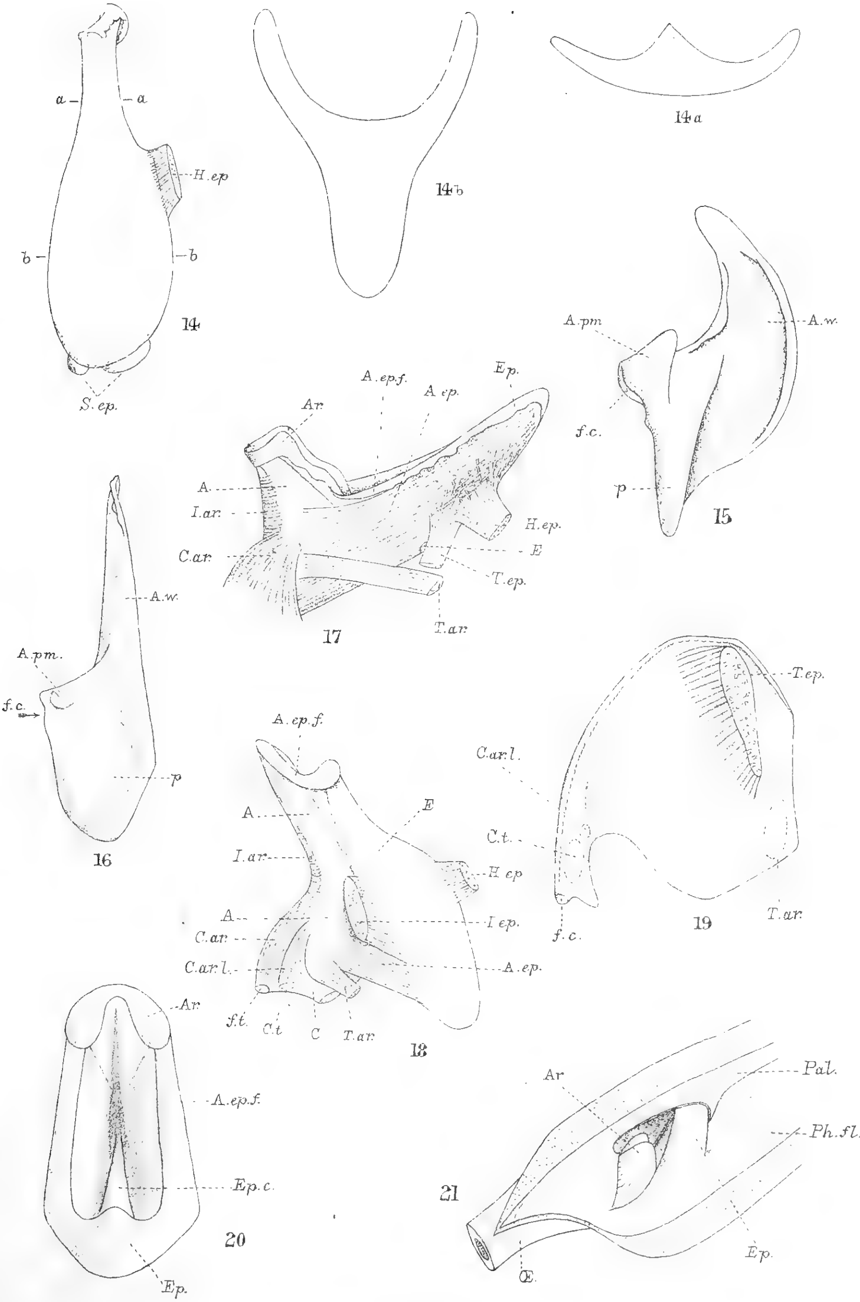
Parker & West imp.

LARYNX OF BALÆNOPTERA & COGIA.



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

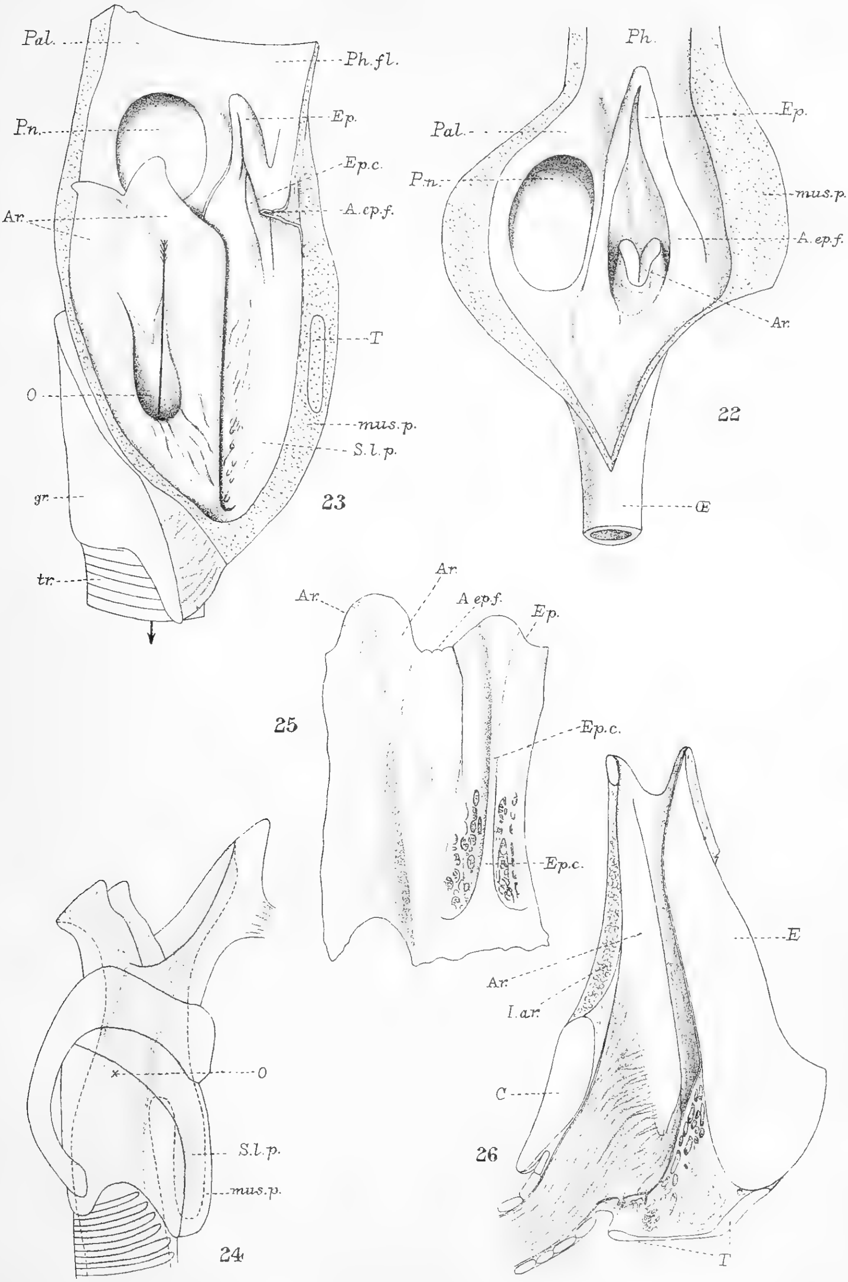
LARYNX OF BALÆNOPTERA & COGIA.



M.P. Parker lith.

Parker & West imp.

LARYNX OF BALÆNOPTERA & COGIA.



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

LARYNX OF BALÆNOPTERA, COGIA & ZIPHIUS.

Flower and Lydekker, in their text-book of "Mammals," state that very little is known of the soft parts of this small Cachalot, and it seems, therefore, worth while to figure, side by side, corresponding views of the larynx of *Cogia* and *Balænoptera*, in order to bring out more forcibly the differences in this organ between the Odontocete and the Mystacocete; for, although the text-books of earlier authors, such as Owen, Huxley, Stannius, and others, refer to the fact, yet in such modern works as Wiedersheim no mention is made of it, and it may be that other zoologists in the same case as myself will appreciate the differences when presented pictorially.

The young Rorqual was very evidently newly born; the navel had not healed up; the umbilical cord still remained attached to the inner surface of the abdominal wall; umbilical arteries and vein still existed, and had evidently only recently been ruptured.

I had a plaster cast made of half of the body of the animal, intending to place the skeleton therein, in the way that the late Prof. Flower had had carried out in the British Museum. I found, however, that the bones were but slightly ossified and were of no use for Museum purposes.

The animal measured 9 ft. 9½ inches in a straight line, from the tip of the snout to the bottom of the caudal notch (10 ft. 1 inch along the curve of the back). Its greatest diameter was 5 ft. 2½ inches, at a distance of 5 ft. 7 inches from the snout.

The specimen of *Cogia* only came into my possession a week after it had been washed ashore. When I arrived at Purakanui—about an hour's railway journey from Dunedin—I found that the original finder had cut the animal about considerably. The blubber from the back, including the dorsal fin, and the "spermaceti" from the head, had been carried away, as well as the lower jaw and the caudal fluke. The head had been very skilfully disarticulated from the atlas, but had not been removed. The body had been opened, and the viscera were lying about. The body and organs were much mixed up with sand that had been blown over them. However, I ultimately obtained the entire carcase, as well as most of the internal organs.

The specimen was a fully grown, and apparently adult, male; it measured 8 ft. 9 inches in a straight line from the tip of the snout to the notch in the fluke; of this the head occupied 16 inches, *i. e.* between one-sixth and one-seventh of total length. I did not make any attempt to measure the girth.

The pectoral fin was 14 inches long in a straight line, and 15 inches along the slightly-curved anterior margin; its posterior margin presented a rounded angle 4 inches from the base and 8 inches from the tip, the distal moiety of this side being concave.

The fin was 5 inches across at the base, 5½ inches at its widest.

The fluke, or tail-fin, was 27 inches from point to point; the median notch was 5½ inches deep, and this point was 10 inches from the plane of origin of the fluke from the tail, so that the total length of the fin was 15½ inches.

With regard to colour:—The dorsal surface of the body was black, the under surface of the fluke was also black; the belly dirty yellowish-white, but much discoloured; but how far the dark colour extended down the sides, and other details, I was unable to ascertain with sufficient accuracy to put on record.

The only detailed accounts of the external features of *Cogia* to which I have access are those by Owen (1865) and by Von Haast (1873).

Owen describes two specimens from Indian seas under the name of *Euphysetes simus*; the male measured 6 ft. 8 inches, and the female 6 feet only.

Von Haast's account of "*Euphysetes pottsii*" (according to Flower, these names are synonyms of *Cogia breviceps*) deals with a specimen thrown up on the New Zealand coast which measured 7 ft. 2 inches, its tail $16\frac{1}{2}$ inches, the pectoral fin 9 inches by $3\frac{3}{4}$ inches.

"The colour black, belly greyish white."

These specimens, then, are considerably smaller than my *Cogia*.

I hope to give, in a later contribution, some account of its viscera, but at present will confine my remarks to the larynx.

I. The Larynx of *Balænoptera rostrata*.

The only detailed account of this organ in the Rorqual that I have been able to consult is that by Drs. Carte and Macalister (1867), who in their very careful and interesting memoir on the anatomy of the Rorqual give a fairly good description of the external features, and of the muscles, both extrinsic and intrinsic; but the figures illustrating this account are small and poor, and no sufficient details are given as to the shape of the cartilages. In some respects I have to differ from these authors.

I have not been able to consult the original memoir of Dubois (1886), and only know the general conclusions to which he arrives from the abstract in the Zool. Jahresbericht, and this publication makes no reference to any account of the larynx in the abstracts of Delage's memoir (1885). It is likely, therefore, that I am repeating, to some degree, work that has already been carried out; but my apology lies in the isolation in which scientific men have to work in New Zealand.

It will be seen that in general, the larynx of *Balænoptera* agrees with that of *Balæna*, but in several details it differs therefrom.

The *aditus laryngis* is, in form, an isosceles triangle, with the apex directed anteriorly upwards; the sides are formed by the aryteno-epiglottid folds (*A.ep.f.*), which diverge posteriorly and embrace the arytenoid bodies, while they converge anteriorly and meet at the apex of the epiglottis. (Plate XXVIII. fig. 22.)

The epiglottis is a tongue-shaped or conical body arising from the floor of the pharynx and directed upwards and forwards. The tip of the epiglottis is, as the drawings show, a rounded point, and contrasts very strongly with that of the Odontocete. There is no special means for "locking" it into the narial canal, though its free end is inserted into the posterior nares, in the manner so well known for Cetacea and several other Mammals.

The epiglottis is 3 inches long in this young Rorqual: its postero-dorsal surface is grooved, the sides of the groove being thick and rounded near the apex, but becoming thinner as they pass into the aryteno-epiglottid folds. The groove is, near the end, narrow and almost slit-like, the lips being closely pressed together in a state of rest. Along the floor of this groove is a ridge, which commences about one inch from the tip of the epiglottis, and increasing in height as it passes backwards, is continued into the sublaryngeal pouch (see below) for a short distance and then gradually dies out.

The arytenoid bodies project upwards from the floor of the pharynx to a height of only $1\frac{1}{2}$ inches; they are sufficiently high just to enter the posterior nostril, though when food is passing along it appears as if, with the distension of the pharynx, the arytenoid bodies would not reach the nostril. (Plate XXVII. fig. 21.) But as Carte and Macalister show, the extensive muscles are so arranged as to pull the whole larynx upwards during the process of respiration. The two bodies are united posteriorly, and this point is somewhat recurved, but their anterior dorsal margins are free and enclose a deep groove—a groove that, becoming deeper, leads downwards into the laryngeal chamber, which is entered through a large oval aperture, the sides of which are supported by the posterior processes of the arytenoid cartilages. (Plate XXVIII. fig. 23.)

The epiglottidean furrow, on the other hand, leads downwards into the "sub-laryngeal pouch." This is a long tubular sac, ending blindly behind, provided with thick muscular walls, and lined with a smooth mucous membrane, which laterally is somewhat folded and trabeculate. This pouch lies on the ventral aspect of the larynx between the two cornua of the cricoid cartilage. (Plate XXV. fig. 1 *a*.)

The ventral wall of the pouch is formed by muscle, its dorsal wall by the arytenoids, between which the pouch communicates, by a wide aperture, with the laryngeal chamber.

The sub-laryngeal pouch is essentially a cæcal diverticulum of the ventral wall of the larynx, between the thyroid and cricoid cartilages. (Plate XXVIII. fig. 24.) It exists in *Balæna*, though the musculature there seems to be somewhat differently arranged according to the account given by Eschricht and Reinhardt. Whether it is homologous with the sacs present in several other mammals seems extremely doubtful. (See below.)

Carte and Macalister (p. 233) describe a "hood-like fold" of the mucous membrane of the floor of the pharynx just in front of the root of the epiglottis. This I have not seen. My figures (21–24) were drawn from the fresh animal, before I had looked up any literature on the subject; but I do not think I should have omitted to notice a fold—sufficiently large, according to these authors, to be drawn over the aditus laryngis—if it had existed.

The drawings given by these authors are small and indistinct, and from an inspection of them I was inclined to regard this "fold" as the epiglottis itself; but their account in the text is quite precise, and from the size of the "fold" in the adult it is remarkable that it does not exist in the young.

The *general form* of the larynx is shown in figs. 1, 2, 3, as seen in various aspects. It is of greater diameter from side to side than in the dorso-ventral direction, and the aryteno-epiglottid apparatus is relatively short, as compared with the long tube in the Odontocete.

The base of the larynx passes gradually into the trachea, the rings of which are incomplete on the ventral surface.

The windpipe is, of course, very short, and there is no "third bronchus" (nor is there in *Balæna*), such as will be seen in *Cogia*.

It will be convenient to describe the cartilages first, and then refer to the muscles connected with them.

The Cartilages.

In dealing with the topographical relations, the larynx is supposed to be still within the body of the animal, which is in its natural position, back upwards.

The *thyroid cartilage* consists of a distinct body and paired posterior cornua. The body is a transverse, narrow band, *i. e.*, it has a very short antero-posterior diameter; its anterior margin is concave, its posterior convex, but with a median V-shaped notch. At the extreme right and left extremities, where the body becomes continuous with the cornua, the anterior margin is thicker and more prominent than elsewhere; the ridge-like tubercle so formed probably represents an anterior cornu; just below it is inserted the sterno-thyroid muscle.

Opposite this ridge-like tubercle, the body of the thyroid curves abruptly backwards, and forms the conspicuous long posterior cornu on each side. This is a stout rod, curved as it passes backwards (*i. e.* posteriorly) with a rather strong convexity towards the dorsal surface; it is, of course, articulated at its hinder end with the cricoid cartilage.

Whereas the body of the thyroid is flat and band-like, the cornu, though of the same character at its origin, soon becomes a thick subcylindrical rod.

It is 4 inches long, measured from the anterior margin of the body to the posterior end of the cornu.

The body of the thyroid measures 5 inches from side to side; measured from the outer extremities its antero-posterior width (*i. e.* length) is about one inch, though this becomes greater towards the middle; the depth of the notch is $\frac{1}{2}$ inch; a line from the bottom of the notch to the anterior margin, on the median line, measures $\frac{7}{8}$ inch.

The *cricoid cartilage* differs from the form usual in mammals in that it is incomplete ventrally; it consists of a great dorsal plate, which curves round the sides and is produced backwards, towards the ventral face, into two "horns" or processes. (Plate XXVI. fig. 7.)

We may, therefore, distinguish a body and a pair of cornua. The body is nearly square; when seen from the dorsal surface, its anterior margin is nearly straight in the middle line, though the corners are obliquely truncated to bear the arytenoid cartilage; the posterior margin is produced backwards in the middle line, to form a somewhat rounded prominence, with which, in this young individual, 4 or 5 of the upper tracheal rings are continuous.

The dorsal surface is almost flat, slightly concave in the middle. As this broad plate of the cricoid curves round the side of the larynx its longitudinal diameter diminishes.

The anterior margin, beginning at the arytenoid facet, commences to slope gently backwards, and the inclination increases as the ventral surface is reached, till it makes an abrupt backwardly-directed curve near the middle line, giving rise to a rounded angle; the margin then continues nearly straight backwards to constitute the ventral or inner edge of the cornu of the cricoid.

The posterior margin, meanwhile, is inclined forwards from the mid-dorsal line towards the thyroid facet, but the inclination is slight; beyond this point it is continued forwards for a short distance and then curves backwards, forming a shallow lateral bag in the cricoid; their margin then passes nearly directly backwards to form the dorsal or outer edge of the cornu.

The cornu itself is not so definitely marked off from the cricoid as is the cornu of the thyroid from its body, it is rather the ventral posterior angle drawn out backwards to form on each side a short parallel bar for the support of the peculiar "sublaryngeal pouch" of the Mystacocete.

As to measurements, the cricoid is 3 inches long in the mid-dorsal line and 3 inches across, taken from the lower edges of the arytenoid facets, and the same between the thyroid facets, while the space between the two arytenoid facets is $1\frac{1}{2}$ inches. The lateral margin, as seen from the back, *i. e.* the distance from the outer edge of the arytenoid facet to beyond the thyroid facet, is 2 inches.

The ventral margin of the cricoid (or rather of its cornu) is 2 inches; the dorsal or outer edge of the cornu is $1\frac{1}{2}$ inches.

In the text-books, both of Owen and Huxley, the ventral incompleteness of the cricoid is mentioned.

Carte and Macalister give no clear figure of the cricoid, and do not represent the ventro-posterior cornua; but in the text this "tongue-shaped process" is described as reaching to the first ring of the trachea. In the present youthful specimen it extends backwards to the sixth ring.

The *arytenoid cartilage* consists of a somewhat conical "body" or processus muscularis, of a stout cylindro-conical posterior "process," and of a thin lamelliform, antero-ventrally placed "wing." (Pl. XXVII. fig. 15.)

Of these, the body and the "wing" are visible from without, after removal of the muscles, while the posterior "process" can only be seen by removal of the wall of the larynx.

The "body," or processus muscularis, of the arytenoid is somewhat conical, with an obtusely rounded apex directed forwards and outwards (Pl. XXV. fig. 2); the base—measuring $1\frac{1}{4}$ inches—is narrow and elongated transversely; it articulates with the cricoid in a typical fashion at the antero-lateral dorsal margin of the latter; its apex serves for the insertion of the crico-arytenoid muscles.

The anterior "wing-like" process (=supra-arytenoid of Thompson) rises from the body by a comparatively thick basal region, but this soon becomes a thin plate, which is somewhat crescentic in form—the form is, after all, best appreciated by a study of the figures. One horn of the crescent is directed forwards and dorsally, and the right and left "wings" approach one another at their extremities, supporting the "arytenoid bodies."

The posterior half of the crescent is continuous with the posterior process of the arytenoid: the convex margin of the "wing" is directed inwards, towards the cavity of the larynx; its extreme edge is reflected outwards, and the whole of the lower half of the wing is set at an angle with the plane of the posterior process, so that a "fossa" is enclosed by them.

In this fossa, to the external concave face of the arytenoid wing, are inserted the upper portions of the aryteno-epiglottidean muscles.

The third part of the arytenoid, the posterior "processus vocalis," arises from the body by a broad stout base; its long axis is directed backwards, parallel to its fellow, close to the dorsal wall of the larynx. In addition to serving for the insertion of the lower aryteno-epiglottidean muscles and the thyro-arytenoids, these two processes form the margins of the true entrance into the laryngeal sac.

The total length of the arytenoid is 4 inches, measured in a straight line from the anterior end of the "wing" to the posterior tip of the "process."

In the Greenland Right Whale the two processus vocales of the arytenoid cartilages are continuous at their distal ends, forming a posterior support for the laryngeal opening; this is not the case in the young Rorqual, though the ends were connected by dense connective tissue, and very probably this became replaced by cartilage in older animals.

The *epiglottid* cartilage is embedded in the aryteno-epiglottid and other muscles, so that only a small piece of it comes to the surface. On dissection, however, the cartilage is found to have the usual form (Pl. XXVI. figs. 11, 12), resembling a shoe-horn; it consists of an upper thin plate (a) with a wide shallow groove, and a lower thicker moiety (b) which is connected by fibrous tissue to the thyroid cartilage, and whose lower end is seen projecting through the muscles (Pl. XXV. fig. 1); the upper end is in this young Rorqual very thin, and the margin is reflected to support the overlying mucous membrane; the ridge supporting the "cushion" is of short extent and does not reach the upper end.

It measures $3\frac{1}{2}$ inches in length; $\frac{3}{4}$ inch deep at its base, which is $\frac{1}{2}$ *inch wide*, while the upper region is $\frac{3}{4}$ inch wide.

Before passing to a consideration of the muscles connected with the cartilages, reference may be made to the form of the laryngeal cartilages in *Balæna mysticetus*, which are fully and beautifully figured by Eschricht and Reinhardt (1866).

The form of the cartilages is very similar in the Right Whale to those of the Rorqual, though, as would be expected, the proportions of the various cartilages are slightly, but not markedly, different; the only important divergences are that the posterior processes of the right and left arytenoids are united behind the entrance to the larynx, and the smaller size of the epiglottid cartilage, while the body of the thyroid is of very much greater extent than in the Rorqual; nevertheless these two members of the Mystacocetes have a larynx formed on one plan, and this plan is very different from that of the Odontocetes.

The Musculature of the Larynx.

Drs. Carte and Macalister gave a detailed account of the various muscles of the larynx—both extrinsic and intrinsic—for *Balænoptera*, and I have made no attempt here to go over this ground. I shall content myself with referring to those only that are conspicuous in this whale, and those that are of interest in contrast with the larynx of *Cogia*. Carte and Macalister recognize 17 muscles, intrinsic muscles, in the larynx; most of these I have identified.

1. The *crico-thyroid* muscle (Pl. XXV. fig. 1, *C.t.*) is of considerable size; it arises from the hinder half of the latero-ventral face of the cricoid (body); the muscle-fibres pass forwards and outwards, diverging as they go, to be inserted on the inner surface of the posterior cornu of the thyroid.

2. The ventral surface of the larynx is occupied by a great bundle of muscle, longitudinally disposed in the middle line; on dissection it is found that this mass of muscle forms part of the wall of the sublaryngeal pouch, and can readily be separated into an external layer of longitudinal muscles and an inner sheet of circular fibres. Carte and Macalister describe and figure only the latter, and state that "the thick walls are almost entirely composed of circular fibres."

(*a*) The longitudinal muscles of this sublaryngeal sac take their origin in the body of the thyroid, to which they are attached in the sides of the V-shaped notch (Pl. XXV. fig. 1, *T.c.*) and on the inner face in the mid-line. From their point of origin the fibres spread out on both sides, forming two more or less distinctly separable sheets, a right and a left; these are inserted partly in the "cornu" of the cricoid, and partly in the five or six uppermost tracheal rings on each side.

This longitudinal muscle is, topographically, a "*thyro-cricoid.*"

(*b*) Below the "thyro-cricoid" is a thick layer of muscle ($\frac{3}{4}$ inch in thickness), dispersed transversely for the most part, but some fibres pass entirely round the sublaryngeal sac (Pl. XXV. fig. 1*a*, *n*). The transverse muscles are inserted at each end to the inner (*i. e.* dorsal) face of the cricoid cornu.

(*c*) This transverse, or inter-cricoid, muscle is not distinctly separated from a series of muscle-fibres (*r*) that also are related to the sublaryngeal sac. These fibres pass from the antero-ventral margin of the cricoid, obliquely forwards to their origin in the inner face of the body of the thyroid. The more ventral fibres of this muscle, becoming more and more oblique with regard to the sagittal plane, ultimately become transverse, and I was unable to separate this sheet from the "transverse muscles" just described, but they are quite distinct from the longitudinal thyro-cricoids.

This sheet of "accessory crico-thyroids" (*r*) forms the side-walls of the anterior part of the sublaryngeal pouch.

Murie (1871) has suggested that the muscular wall of this pouch is derived from the thyro-arytenoid muscle; in this he is supported by Dubois (1886), who sees also a representative of the lateral crico-arytenoid in part of the musculature. In this latter view I am inclined to concur, so far as my observations on *Balænoptera* go; for the sheet of muscle labelled "*r*" in the figures appeared to be quite continuous with that portion of the crico-arytenoid which passes round to the side of the cricoid, and it was only separable by careful dissection. Now this muscle (*r*) is continuous with "*n*," which forms the inner muscular coat of the sublaryngeal pouch, so that the representative of the "lateral crico-arytenoid" is here in the Mystacocetes of enormous size.

In discussing the myology of the human larynx, Kanthack (1892) has, by the use of microscopic sections, confirmed the view held by Disse and Fürbringer that the "lateral crico-arytenoid" is only part of—"a second head of"—the thyro-arytenoid, some of the descending fibres of which "blend with the lateral crico-arytenoid, and come into close connection with the crico-thyroid." I think my observations confirm this view.

3. The *thyro-epiglottidean* muscle (*T.ep.*) is also a conspicuous constituent in the ventral region of the larynx; it arises from the inner face of the lateral region of the body of the thyroid, and passes forwards into the mass of muscle that forms, with the cartilage, the "epiglottis." The fibres of this muscle are not distinctly marked off from that part of the aryteno-epiglottid muscle lying in front of the thyroid.

4. From the dorsal surface (Pl. XXV. fig. 2) two muscles are seen: the paired *crico-arytenoids* (*C.ar.*) and the *inter-arytenoid* (*I.ar.*).

The circo-arytenoid is a powerful muscle arising from the greater part of the dorsal and lateral face of the cricoid, the lateral portion being concealed below the crico-thyroid. The muscle passes forwards to be inserted in the apex of the processus muscularis of the arytenoid cartilage.

The lateral portion is not separable from the posterior portion (as Carte and Macalister and others have pointed out); there is no distinct lateral crico-arytenoid, it is one huge mass of muscle.

5. The *inter-arytenoid* muscle has the usual disposition, and, as already remarked, arises from the "wing" of the arytenoids.

6. The *thyro-arytenoid* muscle (Pl. XXVII. fig. 17, *T.ar.*) arises from the inner face of the body of the thyroid near the middle line—precisely as in the human subject—and is inserted into the ventral or inner surface of the body of the arytenoid, and partially to the upper part of the posterior process of the latter cartilage, above and external to the *aryteno-epiglottid* muscle.

7. The latter muscle (*A.ep.*)—which is much less streaked by blood-vessels—passes from the outer face of the wing of the arytenoid, and also from the posterior process of the same, to the epiglottid cartilage, which is embedded in muscle, and here the substance of the muscle is penetrated by fibres of the hyo-epiglottid and thyro-epiglottid.

This aryteno-epiglottid in reality consists of a supero-internal sheet attached to the arytenoid wing, and an infero-external sheet attached to the arytenoid process. These sheets are not well defined on their outer surface; but when the mucous membrane of the larynx is dissected away their demarcation is readily seen.

8. The *hyo-epiglottid* muscle (*H.ep.*), when it reaches the epiglottis, appears as a single muscle inserted in the antero-ventral face of the epiglottid cartilage; the fibres mingle with those of the previous muscles, some passing forwards, and some curve upwards round the side of the epiglottis.

As to the extrinsic muscles of the larynx, I will only refer to two, the *thyro-hyoid* and the *sterno-thyroid* (Pl. XXV. fig. 1, *T.h.*, *S.t.*).

The thyro-hyoid arises from the anterior region of the ventral surface of the thyroid cartilage, along nearly its whole width; it is triangular in outline, as the fibres converge forwards to be attached to the hyoid cartilage, near the middle line. This muscle is represented and described by Carte and Macalister, but the existence of the sterno-thyroid in *Balænoptera* is explicitly denied by them, though it appears to have been recognized by later authors. Certainly there is a muscle of considerable size attached to the ventral face of the thyroid near the lateral margin where the "cornu" arises, where fibres pass backwards as a broad sheet an inch and more across, which is directed downwards and backwards towards the sternum. Unfortunately I had cut through this muscle without noting carefully its relations, while tracing out the blood-vessels; but it is, I think, pretty evident, from the direction of its fibres, that it goes to the sternum.

II. The Larynx of *Cogia*.

From the few references to this small Cachalot that I have been able to discover, I gather that very little is known of its viscera. The larynx agrees on the whole with that of other Odontocetes hitherto described in detail, but in certain points—as, for instance, and in particular, in the duplicity of the thyroid cartilage—it appears to be unique amongst the Cetaceans, at least so far as is indicated in the small amount of literature available and references therein.

The specimen to which this larynx belonged had, as I have stated above, been cut open and injured in various ways before I was able to obtain possession of the carcase, and the larynx itself had been cut through and severed from the pharynx and from the hyoid bone, hence I am unable to give an account of the relations of the organ to the neighbouring parts; but, as these are well known for several other genera, this deficiency is of little importance.

The *general form* of the larynx is seen in the accompanying drawings (Pl. XXV. figs. 4, 5, Pl. XXVI. fig. 6). It has a greater diameter dorso-ventrally than laterally, which is the reverse of the condition in *Balænoptera* and in *Globiocephalus melas*, according to Murie (1867). Its dorso-ventral diameter (3 inches) is much greater than that of the trachea ($1\frac{3}{4}$ inches), so that the postero-ventral margin projects considerably and forms a veritable "pomum adami."

From the upper and anterior end of the larynx the conjoined arytenoids and epiglottid cartilages project as a distinct tube, and this characteristic Odontocete tube is directed upwards and forwards towards the dorsal surface; this makes a very distinct angle with the longitudinal axis of the laryngeal cavity, whereas in the Rorqual the arytenoids and the epiglottis diverge from one another, each forming an angle with the axis of the larynx, but in opposite directions.

The "aryteno-epiglottidean tube" projects upwards from the floor of the pharynx for about $1\frac{1}{2}$ inches. The upper end is thickened so as to be firmly clasped by the velum palati and retained within the narial canal; it had been cut away from its natural position, so that the relation of the end of the tube to the nares could not be ascertained, though there is no reason to believe it to be different from what has been described for other Odontocetes. The aditus laryngis (Pl. XXVII. fig. 20), when stretched to its fullest extent, is somewhat rectangular, with thickened, rounded margins; the lateral margin on each side is formed by the thick and fleshy "aryteno-epiglottid" fold, which reaches upwards to the apex of each of the cartilages concerned; the dorsal margin by the rounded edges of the two arytenoid bodies, which are continuous along their dorsal surfaces right to their tips, and are in strong contrast with those of *Balænoptera*, for in place of their lamelliform separable plates, we have in the Odontocete a thick, rounded or continuous fold. The ventral margin of the aperture is, of course, formed by the tip of the epiglottis, also thick and rounded.

This aperture is, then, perfectly well defined; it measures two inches by one inch, but it is rather wider at the ventral than at the dorsal (arytenoid) end. As seen from the side, this tube is somewhat peniform, the free end terminating in the thick lips just referred to, the arytenoids projecting beyond the epiglottis.

I have seen no trace or indication of a sublaryngeal pouch in *Cogia*, such as has been described by Murie (1871) for Risso's Grampus, by Watson and Young (1879) for *Beluga*, and by Sir Wm. Turner (1886) for *Mesoplodon*.

Murie writes (p. 127), near the base of the epiglottis there is "a median orifice leading into a moderate-sized pouch, which fills in great part the angle of junction between the enlarged epiglottis and the thyroid cartilage;" and Turner says (p. 165) that between the forks of the bifurcated epiglottis and the upper border of the thyroid cartilage there is a shallow mesial pouch, lined by mucous membrane, which freely communicates with the interior of the larynx.

With these statements before me I looked carefully for this pouch in *Cogia*, but it is absent. There is no space or "angle" between the epiglottis and the thyroid such as Murie describes, and there seems to be actually "no room" for any such pouch. At any rate, there is none, nor is there any glandular tissue to represent it, which Murie describes and figures (p. 128) in relation to the pouch.

In *Cogia* the lining membrane both of the arytenoids and of the epiglottis is smooth; the median ridge on the latter forms a slight depression on each side (which is precisely what occurs, too, in *Balænoptera*), and in the lower half of these lateral grooves the mucous membrane is pitted; these small pits and depressions are, however, present only on the sides, not in the middle line as Murie describes for Risso's Grampus. Nor does he mention any pouch in *Gl. melas* (1867), nor do I find one in *Ziphius* (see below).

The Cartilages.

The tracheal rings are here complete, and the upper ones present certain irregularities that will be better understood by reference to the figures than by a description.

About one inch below the larynx the trachea gives off on the right side a bronchus—the third bronchus—as in most other Odontocetes.

The *cartilages*, as will be seen by a glance at the figures, differ very considerably in form and proportions from the correspondiug parts in the Rorqual.

The *thyroid cartilage* (Pl. XXV. fig. 4, *T.*) is represented by *two separate pieces*, a right and a left, which meet ventrally. These two halves may be termed for convenience the thyroid plates or alæ. Each thyroid plate presents a "body" and cornu, and forms one side of the larynx, meeting its fellow at a distinct angle, and so forming a ridge.

The body is irregularly rectangular (Pl. XXVI. fig. 6), with a nearly straight but slightly curved ventral border having a thin edge, a curved anterior border presenting a recurved and thickened edge, which passes dorsally with the posterior cornu ; the posterior border of each ala is oblique but straight, while the dorsal border is curved, and passes forwards to join the root of the posterior cornu.

These various "borders" pass into one another at rounded angles, but the angle formed by the ventral and posterior borders is better marked than the rest, and it is at this angle that the two alæ—the right and left—approximate most closely; nevertheless they only just meet, and this when the apparatus is at rest. It is here that the lower end of the epiglottis rests, as will be seen later.

The posterior cornu of the thyroid is a short, flat, narrow plate, whose base passes quite imperceptibly into the dorso-anterior region of the body, but between the cornu and the dorsal border of the plate there is a well-marked "bay."

Each thyroid plate is nearly flat; it is only feebly convex in a dorso-ventral direction (a convexity which is slightly exaggerated in the figure of the ventral view); the edge is thin, except along the anterior border, which is thick and everted, and probably represents the "anterior cornu."

The measurements of this plate are as follows :—

> The ventral border is 3 inches, measured along the curve.
> The posterior border is $2\frac{1}{4}$ inches.
> The anterior border is $1\frac{1}{4}$ inches.
> The dorsal (behind the cornu) is 2 inches.
> The outer curve of the posterior cornu is $4\frac{1}{4}$ inches, while its inner (*i. e.* ventral) margin is about $1\frac{1}{2}$ inches, and its breadth $\frac{3}{4}$ inch.

In the Pilot Whale the figures and account given by Murie show a very different thyroid; the body, which is single, being transversely extended across the ventral surface of the larynx, while the posterior cornua are much longer, leaving a deep wide bay on each side between themselves and the body.

The *cricoid cartilage* (Pl. XXVI. figs. 8, 9, 10) is a complete ring, and, as usual, is of greater height (*i. e.* antero-posterior length) on its dorsal half than on its ventral.

The dorsal half of the ring is a broad thick band, deeply excavated on its hinder margin, while its anterior margin is irregularly convex; when viewed from this aspect, then, it has the appearance of an inverted V with a very open angle (about 90°) and thick limbs.

The median line of this dorsal face projects as a slight convex ridge, separating the right and left muscular fossæ from one another. The sloping sides bear on the upper margin the arytenoid cartilages, and below the articular facets the cricoid passes as a nearly horizontal band, much narrower than before, round the side and across the ventral surface to the other side. At the lower angle formed by the lateral and dorsal moieties is the facet for the thyroid cornu, and from here a slight ridge passes obliquely forwards and ventralwards to reach the anterior margin of the latero-ventral moiety of the cricoid; this is much thinner and of less diameter than the dorsal moiety.

The measurements of the cricoid are as follows:—

Length along the median dorsal ridge $1\frac{1}{4}$ inches.
Width of each limb of V $1\frac{1}{2}$ inches.
Separation of thyroid facets 2 inches.
Width of the latero-ventral moiety $\frac{1}{2}$ inch
(except in ventral mid-line, where it is $\frac{3}{4}$ inch).

In the Pilot Whale the cricoid has a much greater posterior (dorsal) surface, for according to Murie (1871) it is a "trifle longer than the body of the thyroid," while on the ventral surface it is produced into completely posterior cornua which embrace the trachea and "wellnigh meet in the mid-line."

In the Porpoise, too, the cartilage is incomplete ventrally (Owen).

The *arytenoid cartilage* (Pl. XXVII. fig. 16) is of considerable length, as in other Odontocetes, and though the same regions may be recognized as in the arytenoid of *Balænoptera*, these are less distinctly marked off from one another. But the descriptive terms used in that Whale are no longer appropriate here. In general form it closely resembles the corresponding cartilage in the Porpoise.

Each arytenoid is a long flat rod, oval in transverse section through the greater part of its extent, broader and thicker inferiorly, thin and flat superiorly. On the dorsal side is a distinct shoulder, at a point about two-thirds of its length from the summit; this makes nearly a right angle with the narrow (superior) moiety, and from this point, which projects about $\frac{1}{2}$ inch, the dorsal (or posterior) border slopes very gradually downwards; on this margin, just below the shoulder, is the articular facet from the cricoid.

The lower end of the cartilage is broad and rounded and very thick.

The upper moiety or supra-arytenoid (Thompson) becomes quite thin as the extremity is approached, and the plane of this narrow plate becomes twisted near the extremity, so as to take on a position finally which makes an angle with the plane of the broad face lower down. The margin of this upper extremity is recurved, and supports the mucous membrane that constitutes the arytenoid body, and the two cartilages touch one another here.

The external surface of the posterior moiety or "processus vocalis" is irregularly convex and serves for the attachment of muscles.

The region that represents the "processus muscularis" of *Balænoptera* is here a slight, nearly circular, convex prominence, not at all well marked. The internal face of the entire cartilage is smooth.

The length of the arytenoid is $5\frac{1}{2}$ inches; its greatest breadth is $1\frac{3}{4}$ inches; while its upper moiety is only five-eighths of an inch across.

The *epiglottid cartilage* (Pl. XXVI. fig. 13, Pl. XXVII. fig. 14) has the usual trough-like character; it is, in contrast with that of *Balænoptera*, very massive, being 6 inches in length, and its greatest breadth is $1\frac{3}{4}$ inches. Seen in side view, it is club-shaped in outline; the upper, narrower region being somewhat flattened from side to side, while the broader posterior region is much compressed; at the junction of these two regions the hyo-epiglottid muscle is inserted. This lower region is rounded posteriorly, where it abuts against the thyroid plates.

The lateral surfaces are here somewhat excavated, serving for the attachment of muscles. These surfaces meet in a relatively sharp ventral edge. The upper end of the cartilage becomes quite thin, and the extreme upper margin is recurved.

The posterior or internal surface is grooved; this groove at its commencement is shallow and wide, but further down becomes deeper and narrower. Rising from the floor of the groove in the upper half is a ridge, which fades away posteriorly; thus a transverse section near the upper region is **W**-shaped, while lower down it is **V**-shaped.

The broad base of the epiglottid cartilage is capped by two small cartilages: one is patelliform, measuring $\frac{3}{4} \times \frac{1}{2}$ inch, and is thrust between the two thyroid plates so as to be visible when the ventral margins of these are parted (Pl. XXV. fig. 4); the second is smaller, oval, and nodular in form, situated dorsal of the first; it measures three-eighths of an inch long, and is closely related to the ventral edge of the right thyroid plate, connected to it by fibrous tissue. It is situated at the origin of the thyro-arytenoid muscle of the right side, and rests against a small hard prominence on the inner surface of the ventral edge of the left thyroid plate. Each of these two subepiglottid cartilages is separated from the epiglottis by the thickened layer of fibrous tissue. It is possible that they represent the "lobulæ" of the 4th and 5th visceral arch, one of which persists in *Echidna*. I saw no representative of the process (marked *c* in Howes's figures) passing inwards from the base of the epiglottis towards the base of the arytenoid, to which it is connected by fibrous tissue.

Muscles of the Larynx.

The outer surface of each thyroid plate serves for the attachment of three muscles (Pl. XXVI. fig. 6).

1. The *thyro-hyoid* muscle (*T.h.*) is attached over the whole breadth of the anterior region of the plate, partly to the thickened edge,

but also to the outer surface. Only a short piece of the muscle remained in connection with the larynx, but the anterior direction of the fibres and the position of its attachment render it probable that it is the muscle of this name.

2. Just below this is the *sterno-thyroid* muscle (*S.t.*), the fibres of which pass obliquely backwards and downwards towards the position occupied by the sternum.

3. Separated from this muscle by a sheet of fibrous tissue is a third large muscle (x) whose identification is uncertain. The fibres are directed antero-ventrally, *i. e.* downwards and somewhat forwards, though the inclination is but slight, and they pass nearly directly ventralwards. This mass of muscle is attached over nearly the whole of the lower half of the thyroid plate between the "bay" and the ventral margin, which, however, it does not reach. As the larynx had been cut away from the neighbouring organs, and indeed cut across near the lower end, I am unable to identify the muscle: perhaps it is an accessory sterno-thyroid.

4. The dorsal edge of the posterior cornua and of the thyroid plates also serves for the attachment of muscles, probably the stylo-pharyngeal and the basio-thyro-hyoid (*cf.* Macalister, 1867).

5. *Crico-thyroid muscle.*—This is very small in *Cogia* and invisible from without, as it is entirely concealed, partly by the posterior cornu and partly by a fan-shaped tendon that passes from its ventral edge across the "bay" to the thyroid plate. But when this tendon is removed, a small muscle is exhibited (Pl. XXV. fig. 4, Pl. XXVI. fig. 6 *a*, *C.t.*). In its diminutive size it contrasts very notably with the homologous muscle in *Balænoptera*, and indicates a very feeble mobility of the thyroid cartilage upon the cricoid.

In some Odontocetes, e. g. *Globicephalus melas*, according to Murie (1867), this muscle is of "considerable size," while Macalister mentions that in *G. svineval* the crico-thyroid is attached "to the posterior edge of the thyroid cartilage," and makes no mention of its attachment to the cornu.

5. The *crico-arytenoid* muscle is here represented by a posterior and lateral division (the latter being absent in Mystacocetes).

The posterior muscle (Pl. XXV. fig. 5, *C.ar.*) is a large quadrate mass arising from the dorsal face of the cricoid and passing forwards to the arytenoid, to the "processus muscularis" to which it is attached. The lateral division (Pl. XXVII. fig. 18) arises from the side of the cricoid, ventral of the thyroid facet, and some of its fibres arise from the horn of the thyroid (as Murie states is also the case in *Globiocephalus*), and indicating the close relation of this muscle to the thyro-arytenoid.

6. The transverse *arytenoid* muscle is a thin sheet having the usual relations, and forming the dorsal wall of the "aryteno-epiglottidean tube."

7. The *aryteno-epiglottid* muscle (Pl. XXVII. fig. 18, *A.ep.*) is comparatively small, and connects the lower regions only of the two cartilages.

8. Above this is a much stouter muscle, the *thyro-epiglottid* (*T.ep.*), which arises from the inner surface of the thyroid near its ventral

margin, and after a very short course is inserted into the dorsal edge of the epiglottid cartilage at about the middle third of its extent (figs. 18, 19).

9. The *hyo-epiglottid* muscle has the usual relations.

10. The *thyro-arytenoid* is a small muscle arising from the inner surface of the thyroid plate (Pl. XXVII. figs. 18, 19, *T.ar.*) below the thyro-epiglottid, and is inserted in the outer surface of the enlarged base of the arytenoid cartilage, between the aryteno-epiglottid and the lateral crico-arytenoid muscles.

III. Note on the Larynx of *Ziphius*.

In 1887 a brief account of the external features and some parts of the skeleton and viscera of a species of *Ziphius* was presented to the Society by Professors Parker and Scott (Trans. Zool. Soc. xii. p. 241). In it the larynx is stated to agree with that of Cetacea in general, but no details or figures are given.

The late Prof. Parker had the larynx cut into two symmetrical halves, one half of which is amongst the many anatomical specimens accumulated by him in the laboratory of the Otago Museum, and it may be not without interest to add a brief account of it here. It presents features of greater resemblance to the Porpoise and Grampus than to *Cogia* (Pl. XXVIII. fig. 26).

The thyroid cartilage is continuous across the ventral surface, though this region is thinner than elsewhere. The body of the cartilage is otherwise like that of *Cogia*, but is stouter; the "bay" between the posterior cornu and the body is wider and deeper; the anterior cornu (which has been cut across) is more distinct.

The cricoid, on the other hand, is incomplete ventrally as in several other Odontocetes; its dorsal and lateral regions are much stouter than the corresponding regions in the cricoid of *Cogia*. The anterior border slopes backwards rather abruptly as it approaches the ventral surface and meets the posterior border, which is practically horizontal, in a blunt angle; this angle nearly meets its fellow below the thyroid.

The arytenoids appear to be closely similar to those of *Cogia*; there is no independent supra-arytenoid cartilage such as occurs in the Porpoise.

The epiglottis has relations to the thyroid intermediate between the conditions found in *Balænoptera* and *Cogia*, a condition in fact quite like that in the Porpoise. Its base rests against the upper margin of the thyroid, instead of pushing its way downwards between the two alæ of that cartilage. I see no subepiglottid cartilage.

The chief purpose for which I examined this larynx was with a view of ascertaining whether it presented any indications of the "median sac" described in some other Odontocetes, but there is no sign of this sac.

The ridge, a cushion of the epiglottis, is continued beyond the cartilage in the form of a high membranous fold or septum, subdividing this part of the laryngeal cavity into a deep right and left pouch—much deeper than in *Cogia*—the lining of which is much pitted; the pits lead into long tubular branching tubes, terminating blindly; they have not a muscular wall, nor is there any glandular tissue here (as in Risso's Grampus). These tubes are not seen well in the section, which involves the median septum, but the ends and sides of the tubes of the right (*i. e.* removed) pouch are seen adhering to this septum, and thus excluding the possibility of the existence of a median pouch.

The series of pits is continued to the commencement of the trachea, but naturally they become shorter as this is approached. These tubes lie between the cavity of the larynx and the thyroid cartilage, filling up the angle between the latter and the epiglottis, mingled with connective tissue and some blood-vessels. They are evidently of the same nature as the pits visible on a less extensive scale in *Balænoptera*, as well as in *Cogia* and other Odontocetes (*cf.* Murie's fig. of a longitudinal section of the larynx in Risso's Grampus (1871), p. 128). The lining of the back and sides of the larynx, and of so much of the trachea as is present in the preparation, is thrown into a series of parallel, equidistant, and well-defined ridges, which start—each by two or three "roots"—at the hinder margin of the arytenoid; these are not mere foldings of the mucous membrane due to shrinkage, but are extremely well-defined.

IV. General Remarks.

Two points of general interest are presented by the larynx of the Cetacea: firstly, the absence of vocal cords, and even of any rudiment of them; secondly, the peculiar modifications undergone by the arytenoid cartilage. As to the former, little more than the statement is necessary; possibly the disappearance (? primitive absence) of all rudiments is related to the second point.

It may be noted, however, that some authors have attempted to identify certain structures as being the rudiments of the cords; thus Murie (1871, p. 130) considers the "parallel folds" at the base of the epiglottis in Risso's Grampus, which form the margins of the entrance to a small sublaryngeal sac, as their representatives. These, however, pass from epiglottis to thyroid, instead of from arytenoid to thyroid, and more recent authorities, *e. g.* Dubois, deny the existence of vocal cords in the Cetacea.

As to the modifications of the "arytenoid cartilage," not only do we find it under two very different forms in the Mystacocetes on the one hand, and the Odontocetes on the other, but both these agree in the fact that this cartilage represents something more than the true arytenoid in Man and Dog.

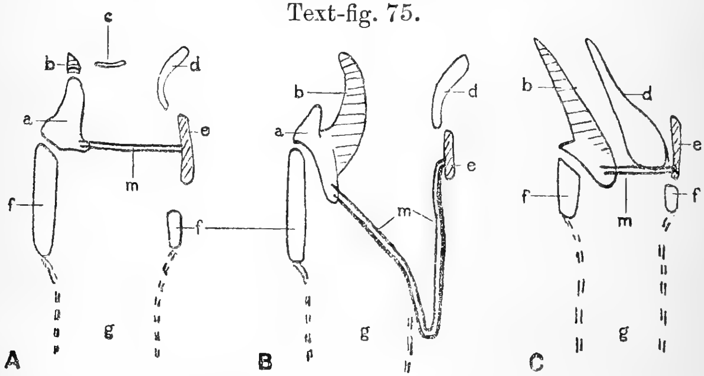
Howes (1879) pointed out that in the young Porpoise there are two cartilages closely united by connective-tissue, but distinctly separate; not only in the young, but in the adult, are these cartilages distinct. He gave reasons for believing that the upper of these cartilages—the supra-arytenoid, as D'Arcy Thompson named it later—represents, in all probability, the cartilage of Wrisberg of the Dog's larynx; in this view he was confirmed by Cleland (1884), who finds a similar condition in the Dolphin.

At a later date, D'Arcy Thompson (1890), as the outcome of an examination of the young of several species of Whales[1], put forward the view that part of this supra-arytenoid is also equivalent to the cartilage of Santorini. He, moreover, believes that the condition of the cartilage in the Cetacea is a primitive one.

Now, in the case of *Balænoptera*—where the condition of the "aditus laryngis" is less modified than in *Cogia*—the tips of the "wing" of the arytenoid cartilage enter the arytenoid body, very much as does the cartilage of Santorini in normal mammals; but the convex border, it seems to me, can scarcely be said to be "in the aryteno-epiglottidean folds" (see Pl. XXVII. fig. 17), in the manner in which the cartilage of Wrisberg should lie; and in my opinion the "supra-arytenoid" of the Mystacocete is not altogether and completely homologous with that of the Odontocete.

Thus in *Cogia* a considerable part of the inner (or ventral) margin of the "supra-arytenoid" may, perhaps, be regarded as supporting the arytenoid fold, which is extremely reduced in length, though from the examination of the adult of this form it

Text-fig. 75.



Diagrammatic longitudinal section through the larynx of *A.* Man; *B. Balænoptera*; *C. Cogia.* In each:—*a*, arytenoid; *b*, cartilage of Santorini; *c*, cartilage of Wrisberg; *d*, epiglottis; *e*, thyroid; *f*, cricoid; *g*, trachea; *m*, thyro-arytenoid muscle. Intended to illustrate the composite nature of the "arytenoid" in the Cetacea, and the disposition of the thryo-arytenoid muscle.

would not readily appear that this is the case. However, admitting, as I am quite willing to do, the truth of Thompson's views for the Odontocete, there is still, I think, a possibility that there is no cartilage of Wrisberg in the Mystacocete.

The lower portion of the "arytenoid" includes the *processus muscularis* and the *processus vocalis*; this region is the real "arytenoid." And the chief point of interest lies in the great development, in *Balænoptera*, of the *processus vocalis* (text-fig. 75) and the change in its direction. For in Man this process—supporting as it does the vocal cord and part of the thryo-arytenoid muscle—is horizontal, with respect to the longitudinal axis of the larynx, while in the Rorqual it passes almost vertically downwards,

[1] It does not appear, from the abstract of his paper given in the 'Zool Jahresbericht,' that Thompson examined any Mystacocete.

parallel to the long axis, and, as we have seen, forms the lateral margins of the entrance to the larynx, which, according to Dubois, corresponds to the "glottis"—the *rima glottidis* of human anatomy.

In the case of *Cogia* this process is less distinctly marked off from the rest.

Two further points of interest occur within the Cetacea, viz., the great ventral, sublaryngeal pouch in the Mystacocete, and the peculiar aryteno-epiglottid tube of the Odontocete.

I have already referred to the view that the sublaryngeal pouch of the Mystacocete is, in part at least, derived from the thryo-arytenoid muscle; the great downward "sagging," so to speak, of this muscle, so as to project between thryoid and cricoid cartilage, has led to the oblique and nearly vertical position of the "glottis"—the wide entrance to the laryngeal chamber.

This glottis is approached, in these Whales, by a comparatively wide, short canal, owing to the loose connection between the arytenoids and epiglottis.

But in the Odontocete these cartilages are very heavily built, especially at the lower ends; and that of the epiglottis projects much further into the larynx than in the other group, so that the entrance is reduced to a narrow cleft, and the glottis itself is greatly blocked up by the lower end of the epiglottis. Further, the glottis is not so definitely marked out as in the Mystacocete; it can be located only by the position of the thryo-arytenoid muscle.

One is tempted to see some interrelation between the "pouch" and the "tube"; to think that in some way the junction of the pouch of the Mystacocete is taken on by the glottideal tube and the elaborate "spiracular sacs" of the Odontocete. And this leads us to look for any homologue in the Odontocete of the sublaryngeal pouch of the Mystacocete.

The latter, as is known, is a median, ventral evagination of the muscular wall of the larynx, between the thryoid and cricoid cartilages; in position it is post-thryoideal.

But in the Odontocete, no outgrowth occurs in the same relative position. It is true that in various genera—e. g. *Mesoplodon*, *Beluga*, *Grampus*—a small median sac has been described by various authors; but this sac has glandular walls (a few muscles are mentioned by Murie), and at any rate occupies a different position, viz., between the base of the epiglottis and the upper (anterior) border of the thyroid cartilage. In fact, it is pre-thyroideal in position.

Nevertheless, Murie, Watson and Young, and Sir W. Turner, regard this sac as homologous with that of the Mystacocete, and Dubois agrees with them, and, further, includes in the homology small, *lateral*, glandular outgrowths which occur in some genera (no doubt the conditions represented by *Cogia*).

Now, *lateral* outgrowths in this position—at the sides of the base of the epiglottis and projecting, more or less, over the upper margin of the thyroid, either actually or morphologically—are known in a great variety of mammals. In some cases the two sacs or "ventricles of Morgagni" are near together and close to the epiglottis; in other cases, as in Man, they are more strictly lateral in position, lying in all cases between the "true" and "false" vocal cords, when both are present. In Man, each "ventricle" extends upwards, intervening between the aryteno-epiglottid and the thryo-epiglottid.

In some Monkeys, in addition to their lateral pouches, there is a smaller or larger (e. g. *Mycetes*) median pouch; but in all these cases, the pouch or pouches lie *above* the thyroid cartilage, either actually or morphologically.

Only in the Mystacocete [1], apparently, do we meet with a *post*-thyroideal pouch. It seems to me this must be distinct from the preceding. Naturally, I write with considerable hesitation in the face of the views of such well-known authorities on the Cetacea as those quoted above; but I cannot think that the median post-thyroideal sublaryngeal pouch of the Mystacocete is truly and genetically homologous with that of the Odontocete and other mammals—whether median or lateral—which is pre-thyroideal.

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[1] But, according to Owen (iii. p. 598), there is, both in *Ateles arachnoides* and in *Hapale rosalia*, a "small sacculus" which "projects from the crico-thyroid space."

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EXPLANATION OF THE PLATES.

The letters used have the following significance; in the case of muscles, the letters refer both to the muscles and their attachments.

A. Arytenoid cartilage.
a. Upper plate of epiglottis.
A.ep. Aryteno-epiglottid muscle.
A.ep.f. Aryteno-epiglottid fold.
A.pm. Processus muscularis, or base of arytenoid cartilage.
Ar. Arytenoid body.
A.w. Supra-arytenoid region of arytenoid cartilage.
b. Lower half of epiglottis.
C. Cricoid cartilage.
C.ar. (Posterior) crico-arytenoid muscle.
C.ar.l. Lateral crico-arytenoid muscle.
C.c. Ventro-posterior cornu of cricoid cartilage.
C.t. Crico-thyroid muscle.
E. Epiglottid cartilage.
Ep. Epiglottis.
Ep.c. Cushion or ridge of epiglottis or its cartilage.
f. Fossa; on external face of arytenoid cartilage.
f.a. Articular facet for arytenoid cartilage.
f.c. Articular facet for cricoid cartilage.
f.t. Articular facet for posterior cornu of thyroid cartilage.
gr. Groove in epiglottid cartilage.
H.ep. Hyo-epiglottid muscle.
I.ar. Inter-arytenoid muscle.
L. Cavity of larynx.
m. Median dorsal prominence of cricoid (*Cogia*).
mus.p. Muscular wall of sublaryngeal pouch.
n. Transverse and circular muscles of the sublaryngeal pouch.
O. Glottis: entrance to larynx from sublaryngeal pouch.
Œ. Œsophagus.
p. Processus vocalis of arytenoid cartilage.
Pal. Palate.
Ph. Pharynx.
Ph.fl. Floor of pharynx.
Ph.mus. Muscular wall of pharynx.
P.n. Posterior nares.
r. Accessory crico-thyroid muscle (*Balænoptera*).
r. Ridge on cricoid cartilage (*Cogia*).
S.ep. Subepiglottid cartilage.
S.l.p. Sublaryngeal pouch.
S.t. Sterno-thyroid muscle.
T. Thyroid cartilage.
*T**. Posterior cornu of thyroid cartilage.
T.ar. Thyro-arytenoid muscle.
T.c. Thyro-cricoid muscle in *Balænoptera*.
T.ep. Thyro-epiglottid muscle.
T.h. Thyro-hyoid muscle.
tr. Trachea, or tracheal rings.
T.t. Tubercle or ridge on the anterior margin (=anterior cornu) of thyroid.
W. Tendon, passing from body to posterior cornu of thyroid (in *Cogia*).
x. Muscle of uncertain homology.

Plate XXV.

Fig. 1. *Balænoptera.* Ventral view of entire larynx, as seen after the removal of the hyoid and the wall of the pharynx. Some of the muscles have been removed from the right side of the figure, so as to show the shape and relations of the cartilages.

The right longitudinal muscle (thyro-cricoid) of the sublaryngeal pouch has been cut away so as to exhibit the deeper circular muscles (*M.*).

Fig. 1 *a.* The median region of the above figure, after the removal of the whole of the thryo-cricoid muscle, showing now the outline of the sublaryngeal pouch. The area of attachment of the longitudinal muscle is indicated by the dotted lines.

Fig. 2. Dorsal view of the larynx of the same. Some of the muscles have been removed from the right side. Note the continuity of the upper tracheal rings with the cricoid cartilage.

Fig 3. View of the right side of the larynx of the same.

Fig. 4. *Cogia.* Ventral view of the larynx, the extrinsic muscles of the left side having been removed. The thyroid cartilage is seen to consist of separate right and left alæ or plates, which have been somewhat forced apart in order to show the subepiglottid cartilage.

On the left side, the tendon (*W.* on the right) had been cut away so that the small crico-thyroid muscle is partially exposed.

Fig. 5. Dorsal view of the larynx of the same.

PLATE XXVI.

Fig. 6. The larynx of *Cogia* from the right side.

Fig. 6 *a*. Aperture of the same, showing the small crico-thyroid muscle, the outline of which is dotted, where it is hidden by the thyroid cornu.

Fig. 7. *Balænoptera.* The cricoid cartilage from the ventral surface.

Fig. 8. *Cogia.* The cricoid cartilage (ventral view).

Fig. 9. The same, dorsal view.

Fig. 10. The same, side view. *r.* ridge, along which the lateral crico-arytenoid is inserted.

Fig. 11. *Balænoptera*: the epiglottid cartilage from within (*i. e.* dorsal surface). *a*, the upper and *b*, the lower region.

Fig. 12. The same, side view, *in situ* (*cf.* fig. 17): *a*, *b*, transverse sections of the epiglottid cartilage.

Fig. 13. *Cogia.* The epiglottis from the side.

PLATE XXVII.

Fig. 14. The epiglottis of *Cogia* from within: *a*, *b*, transverse sections at the levels similarly marked.

Fig. 15. *Balænoptera.* The right arytenoid cartilage from without.

Fig. 16. *Cogia.* The right arytenoid cartilage from without.

Fig. 17. *Balænoptera.* The aryteno-epiglottidean apparatus, seen after removal of the right half of the thyroid cartilage.

Fig. 18. *Cogia.* The aryteno-epiglottidean tube, from the right side, after removal of the right ala of the thyroid. The cricoid cartilage had been cut and the epiglottis has sunk downwards slightly.

Fig. 19. *Cogia.* The inner face of the left thyroid plate, showing muscle attachments.

Fig. 20. *Cogia.* The entrance to the larynx, at the apex of the aryteno-epiglottidean tube.

Fig. 21. *Balænoptera.* The right side of the pharynx has been cut through, and carefully lifted without disturbing the relations of the epiglottis and palate.

PLATE XXVIII.

Fig. 22. *Balænoptera.* The same as fig. 21, after the depression of the floor of the pharynx, so that the entrance to the larynx is displayed.

Fig. 23. *Balænoptera.* The sublaryngeal pouch has been opened by a longitudinal incision; the right arytenoid has been turned upwards so as to open out the groove between them and expose the glottis, the opening between the pouch and the larynx. This aperture (*O.*) is placed between the posterior processes of the arytenoid cartilages.

Fig. 24. *Balænoptera.* Outline of larynx, supposed to be transparent, so as to exhibit the extent and relations of the sublaryngeal pouch and the cavity of the larynx: the contained cavities are shaded.

Fig. 25. *Cogia.* View of the interior of the aryteno-epiglottid tube, as seen when it has been opened by an incision separating the right arytenoid from the epiglottid. It is seen that there is no median sac at the base of the epiglottis.

Fig. 26. *Ziphius*, sp. A median longitudinal section through the larynx. *t*, tubular outgrowths from the lateral pouches; *s*, membranous septum separating the right and left pouches.

2. On a Collection of Lizards 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.

[Received March 14, 1901.]

(Text-figure 76.)

I. *Native names of the Lizards.*

The small House-Geckos are known to the Malays as "chi-chak" ("chee-chak"). *Gecko verticillatus* is called "tokay." The different members of the genus *Varanus* are called "biawak" or "bewak" (biāwah"). *Liolepis bellii* is the "bewak pasir" (sand-lizard); *Gecko stentor* the owl lizard, "bewak pongo." *Draco* is often spoken of as "chichak terbang" or flying lizard, sometimes "bidadari" (fairy or celestial spirit), occasionally by way of a joke "bidandari" (bidan=midwife). The species of *Calotes* and *Gonodactylus* are called "sumpah-sumpah" in the south, farther north "pōkah." The Skinks are called "bengkarong" (or "mengkarong"), except *Lygosoma chalcides*, which is regarded as a snake and called "ular berkaki," the snake with feet, or "ular bengkarong," lizard-like snake. *Tachydromus sexlineatus*, on the other hand, is "bengkarong ular," the snake-like lizard.

II. *Distribution of the Lizards*[1].

The distribution of Lizards throughout the Peninsula is of course modified by the physical characters of the country. Thus along the east coast, where there are large tracts of barren sandy country, *Liolepis bellii* is exceedingly abundant and in such localities is the only reptile to be seen. This lizard is the only example from the Peninsula of the terrestrial group of Agamoids, so numerous in Australia and Africa, and it is interesting to find that it keeps to the driest and most exposed places to be found.

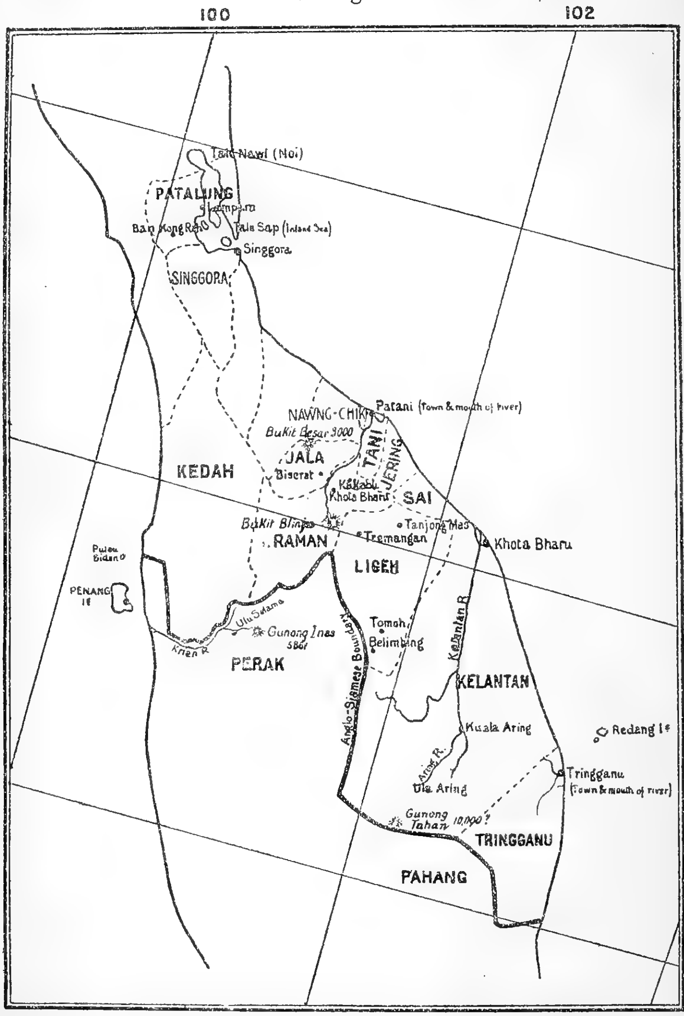
A number of species are only to be found in the cultivated lands lying alongside the rivers and spreading out over the plains. *Calotes cristatellus* is certain to be met with wherever there are groves of cocoanut, palms, or banana plants. The common species of *Varanus* too are abundant, sometimes they are to be seen right in the towns. I shot a specimen of *V. salvator* well over 5 feet in length at the back of our house in Tringganu, where it was feeding on a dead pig.

Draco volans is also found in cultivated lands; in the north *Gecko verticillatus*, which does not live in houses in the Peninsula, is sometimes to be met with under the bark of trees along with *Hemidactylus frenatus*. The most widely spread of all is perhaps *Mabuia multifasciata*, equally at home in the thickest forests and in towns within a few feet of high-water mark. The small house-haunting Geckos complete the Lizard-fauna of the cultivated

[1] The position of the localities in which specimens were collected is shown in the sketch-map, text-fig. 76, p. 302.

country. It will be noticed that all these species have a wide range in the Oriental region. On the other hand, the forest fauna consists for the most part of species with a limited range. The most characteristic genus of Lizards inhabiting this part of the

Text-fig. 76.



Map of part of the Malay Peninsula, to show the localities mentioned in the text.

world is certainly *Draco*, and the distribution of its various species is interesting as bearing on the general question of the distribution of the Malayan fauna. Mr. Boulenger (Cat. Liz. Brit. Mus. i. p. 253) divides the genus into two main groups—one with the nostrils directed laterally, the other with the nostrils directed vertically upwards. The former group has a wide range. On the mainland, *D. maculatus* ranges from Yunnan to Singapore; in Hainan it is replaced by the closely allied *D. whiteheadi*. Next come two species common to the Malay Peninsula and the three great Malay Islands, viz. *D. volans* and *D. fimbriatus*. *D. punctatus* is known from Borneo and the Peninsula, and there are three species confined to Borneo: these are *D. cornutus*, *D. rostratus*, and *D. cristatellus*. Eastwards, *D. lineatus* has been recorded from the Moluccas and doubtfully from Java. Four species are known to inhabit Celebes: one of these, *D. reticulatus*, occurs also in the Philippines, which have also six or seven 'precinctive' species. Lastly, *D. walkeri* and *D. timorensis* are found in Timor. On the other hand, the second group does not extend farther east than Java. It may conveniently be divided into two sub-groups: in one the gular pouch of the males is covered with very large scales, in the second the scales on the pouch are not enlarged.

The first sub-group contains four species, these are:—

D. blanfordi, from Tenasserim to Perak (Larut Hills).
D. tæniopterus, Tenasserim and Siam.
D. formosus, Perak and Penang.
D. obscurus, Borneo.

D. formosus is intermediate in structure between the first two species.

Of the second sub-group, *D. dussumieri* is found in India; all the others are from Borneo, but some range into Java, Sumatra, and the Malay Peninsula:—

Borneo.	Java.	Sumatra.	Peninsula.
D. maximus.			
D. affinis.			
D. quinquefasciatus.			*D. quinquefasciatus.*
D. micropterus.			
D. hæmatopogon.	*D. hæmatopogon.*	*D. hæmatopogon.*	
D. melanopogon.			*D. melanopogon.*

On the whole the Peninsula comes nearer to Borneo than do any of the other neighbouring countries; the other Agamoid lizards support this view strongly. The genus *Aphaniotis* is common to Borneo and the Peninsula, and not found in Java or Sumatra. The last-named island, on the other hand, has the precinctive genus *Phoxophrys*, and one species of the genus *Cophotis*, of which the other species is found in Ceylon, and belongs to a small group of three genera with processes on the snout otherwise peculiar to Ceylon. Java has the precinctive genus *Harpesaurus*, and is inhabited by *Lophurus amboinensis*, an eastern form belonging to that group of Agamoids furnished with femoral pores.

There remain for consideration three large genera widely distributed in the Oriental region. One of these, *Acanthosaura*, is entirely continental and reaches its southern limit in the Peninsula. The second, *Gonyocephalus*, is chiefly found in the archipelago, as far east as N. Guinea; this genus is represented in the

Peninsula. Lastly the genus *Calotes*, more widely spread than either of the preceding, is poorly represented in the south of the Peninsula by but one species *C. cristatellus*, but more abundantly both to the north and in the neighbouring islands.

It is worth remarking that I have never seen a really young specimen of any *Draco*; whilst young examples of *Aphaniotis fusca* and *Gonyocephalus borneensis* seem to be more frequently caught than adults.

III. *Systematic List of the Species, with Notes.*

Fam. Geckonidæ.

Gymnodactylus marmoratus (Kuhl).

Gymnodactylus marmoratus, Boulenger, Cat. Liz. i. p. 44; S. S. Flower, P. Z. S. 1899, p. 626.

I caught a young specimen of this lizard under a large stone in the Botanical Gardens at Penang, about 300 ft. above sea-level, a large one at the foot of Gunong Inas from under a boulder, and a young one at Kuala Aring in a dead bamboo.

Gymnodactylus peguensis Blgr.

Gymnodactylus peguensis, Boulenger, Ann. Mus. Genov. (2) xiii. p. 314, pl. vi. fig. 2.

One specimen, an adult male, was collected in Patalung by Mr. Annandale, who tells me that he saw another individual of the same species on a hill in Legeh.

This is certainly one of the most beautiful of lizards. The following is a brief description of our specimen:—Head ovoid, covered above with very small granules, largest on the snout. Forehead concave. Ear-opening small, oblique, and oval in shape. The back is covered with small granules; scattered amongst these are numerous small trihedral tubercles. The scales on the are very small, those of the belly considerably larger and somewhat imbricate. Eight pre-anal pores. Ground-colour a delicate brownish pink; on the dorsal surface are large patches of rich dark brown, darkest at the margins and unsymmetrically arranged. Tail with black rings.

Length of head	20 mm.
„ body	45 „
„ tail	60 „
„ fore limb	26 „
„ hind limb	32 „
Breadth of head	13 „

Gonatodes kendalli (Gray).

Gonatodes kendalli, Boulenger, Cat. Liz. i. p. 63; S. S. Flower, P. Z. S. 1896, p. 863; id. P. Z. S. 1899, p. 627.

One specimen from Bukit Timah, Singapore.

Gonatodes affinis (Stol.).

Gymnodactylus affinis, Boulenger, Cat. Liz. i. p. 42; S. S. Flower, P. Z. S. 1896, p. 862.

Gonatodes penangensis, S. S. Flower, P. Z. S. 1896, p. 863, pl. xliv. fig. 1.

Gonatodes affinis, id. P. Z. S. 1898, p. 455; id. P. Z. S. 1899, p. 627.

I found this species common on Gunong Inas between 3000 and 4000 ft., where it was the only lizard I came across except a *Draco* that I could not catch. I collected about half-a-dozen specimens amongst boulders on the course of a small stream, these were all of small size, and I saw several others none of which appeared to be larger than the individuals I caught. The measurements of one of these are:—

Breadth of head............	7 mm.
Length of head	11 ,,
,, body	30 ,,
,, tail	38 ,,
,, fore limb	14 ,,
,, hind limb	15 ,,

On the other hand, a specimen taken some two thousand feet lower down was approximately of the size of the specimen figured by Capt. Flower (*loc. cit.*) and by Stoliczka (Journ. As. Soc. Bengal, xxxix. 1870, pl. x. fig. 1), but two others from about the same level agreed in size with my smaller specimens. The measurements of the large specimen are:—

Breadth of head............	10·5 mm.
Length of head	16 ,,
,, body	42 ,,
,, tail	65 ,,
,, fore limb	22 ,,
,, hind limb	38 ,,

HEMIDACTYLUS FRENATUS (Schleg.).

Hemidactylus frenatus, Boulenger, Cat. Liz. i. p. 120; id. Faun. Brit. Ind., Rept. p. 85; S. S. Flower, P. Z. S. 1899, p. 629.

Khota Bharu, Kelantan. In houses.

Ulu Selama, Perak. Under the bark of dead trees.

HEMIDACTYLUS GARNOTI Dum. & Bibr.

Hemidactylus garnotii, Boulenger, Cat. Liz. i. p. 141; id. Faun. Brit. Ind., Rept. p. 94.

Two specimens were caught inside our house at Kuala Aring. This species has not, I believe, been recorded previously from the Peninsula.

HEMIDACTYLUS PLATYURUS (Schneid.).

Hemidactylus platyurus, Boulenger, Cat. Liz. i. p. 143; id. Faun. Brit. Ind., Rept. p. 95; S. S. Flower, P. Z. S. 1899, p. 629.

Very abundant in Khota Baru, Kelantan, Tringganu, Singapore, and at Bangkok.

Gehyra mutilata (Wiegm.).

Gehyra mutilata, Boulenger, Cat. Liz. i. p. 148; id. Faun. Brit. Ind., Rept. p. 96; S. S. Flower, P. Z. S. 1896, p. 866; id. P. Z. S. 1899, p. 630.

Khota Baru, Kelantan, inside houses. Singapore, in Botanical Gardens.

Gecko verticillatus (Laur.).

Gecko uerticillatus, Boulenger, Cat. Liz. i. p. 183; id. Faun. Brit. Ind., Rept. p. 102; S. S. Flower, P. Z. S. 1899, p. 631.

Common in Singgora and as far south as Patani, rare at Khota Baru, Kelantan, and apparently unknown farther south along the E. coast. The specimens recorded by Dr. Hanitsch from Singapore were, I am inclined to suppose, accidentally introduced. In the Peninsula this species does not inhabit houses. If, however, one is set at liberty in a house it will often remain about the place.

Gecko stentor (Cant.).

Gecko stentor, Boulenger, Cat. Liz. i. p. 184; id. Faun. Brit. Ind., Rept. p. 103; S. S. Flower, P. Z. S. 1899, p. 634.

This is essentially a forest-haunting species and its loud barking cry is not unfrequently to be heard in the up-country jungle, although the lizard is but seldom seen. I have heard its cry "tok-tok-tok" repeated six or seven times and ending in a harsh chuckle several times, but never saw the beast alive myself. Mr. Annandale obtained two specimens, both males, one at Biserat, the second at Kuala Aring. The former was mature and had 11 pre-anal pores, the latter, a younger specimen, had only 9. Its head too was much more flattened than that of the adult individual. It was caught in a dead bamboo.

Gecko monarchus (Schleg.).

Gecko monarchus, Boulenger, Cat. Liz. i. p. 187; id. Faun. Brit. Ind., Rept. p. 103; S. S. Flower, P. Z. S. 1899, p. 868.

Khota Bharu, Kelantan; Singapore.

Fam. Agamidæ.

Draco formosus Blgr.

Draco formosus, Boulenger, A. M. N. H. (7) vi. p. 190 (1900).

A Malay in Penang sold me a specimen of this lizard (♂), preserved in spirit along with a number of specimens of *D. volans*. He assured me that he had caught it on the island, but had never seen another like it.

Length of head	....	17 mm.
" body	....	84 "
" tail	....	160 "
" fore limb	....	37 "
" hind limb	......	50 "
Breadth of head	....	12 "

DRACO MELANOPOGON Blgr.

Draco melanopogon, Boulenger, Cat. Liz. iii. p. 492; Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 9; S. S. Flower, P. Z. S. 1899, p. 637.

This species is common in the forest of the Ulu Selama district up to about 1000 ft. above sea-level. I caught three specimens, two females and a male. One of the females contained three large eggs. At a height of some 3500 ft. above sea-level on Gunong Inas, I saw two or three Flying Lizards belonging to another, smaller species, but could not capture any.

DRACO VOLANS L.

Draco volans, Boulenger, Cat. Liz. i. p. 256; S. S. Flower, P. Z. S. 1896, p. 868; id. P. Z. S. 1899, p. 636.

This lizard is very generally distributed all over the low-lying country, and we obtained a considerable number of specimens at Kuala Aring, Tringganu, Penang, and elsewhere. Mr. Ridley tells me that the longest flight of one of these lizards he has measured was about twenty-five yards; in the course of this flight it descended from a height of fifteen yards to the ground. They appear to have some power of avoiding obstacles in their flight. Females of this species contained two eggs, or in one instance three.

APHANIOTIS FUSCA Peters.

Aphaniotis fusca, Boulenger, Cat. Liz. i. p. 274; S. S. Flower, P.Z. S. 1899, p. 637.

We collected three young specimens of this lizard on the E. side of the Peninsula, and one young and three adults (2 ♂, 1 ♀) at the foot of Gunong Inas in Perak. The adult male, which I caught myself, was hiding under a large dead palm-spathe; the other adults, a pair, were caught sitting on a branch of a fallen tree. They seem to be rather sluggish little creatures, but are very difficult to see on the ground on account of their coloration. The inside of the mouth in our adult specimens was of a curious blue colour.

GONYOCEPHALUS BORNEENSIS (Schleg.).

Gonyocephalus borneensis, Boulenger, Cat. Liz. i. p. 288; S. S. Flower, P. Z. S. 1899, p. 637.

A single young specimen from the foot of Gunong Inas.

CALOTES CRISTATELLUS (Kuhl).

Calotes cristatellus, Boulenger, Cat. Liz. i. p. 316; id. Faun. Brit. Ind., Rept. p. 134; S. S. Flower, P. Z. S. 1896, p. 871; id. P. Z. S. 1899, p. 639.

This species, exceedingly common in the south of the Peninsula, becomes rarer towards the north, where it is replaced by *C. versicolor*. We collected specimens at Biserat, in Singapore, Penang, and Perak. A pair from Biserat, apparently sexually mature, were exceedingly small. The measurements of the female of this pair are:—

Length of head	....	24·5 mm.
„ body	....	58 „
„ tail	....	230 „
„ fore limb	....	40 „
„ hind limb	......	75 „
Breadth of head	....	14 „

The female lays two spindle-shaped eggs, which are left uncovered in any shady place.

Calotes versicolor (Daud.).

Calotes versicolor, Boulenger, Cat. Liz. i. p. 321; id. Faun. Brit. Ind., Rept. p. 135, fig. p. 136; S. S. Flower, P. Z. S. 1876, p. 572.

Note by Mr. Annandale:—"The male of this species dances in a conspicuous position before the female, which remains concealed. He is then of a pale yellowish flesh-colour, with a conspicuous black smudge on each side of the gular pouch, which is much dilated. He stands with the fore part of the body raised on the fore legs, and bows his head slowly and repeatedly, opening and shutting his mouth continually; after a time he advances a few steps towards the female and repeats the performance. If disturbed the black marks disappear. The males fight very readily with one another, and change colour as they do so; the victor becomes of a warm reddish brown. This species is common as far south as Biserat, less so in Raman, and I did not meet with it at all farther south."

Calotes emma Gray.

Calotes emma, Boulenger, Cat. Liz. i. p. 324, pl. xxv. fig. 1; id. Faun. Brit. Ind., Rept. p. 137; S. S. Flower, P. Z. S. 1899, p. 641.

This species is fairly common at Patalung, but grows rarer towards the south, and probably does not range beyond Patani.

Liolepis bellii (Gray).

Liolepis bellii, Boulenger, Cat. Liz. i. p. 403.
Liolepis belliana, id. Faun. Brit. Ind., Rept. p. 156.
Liolepis bellii, S. S. Flower, P. Z. S. 1899, p. 642.

Mr. Annandale has given me the following notes concerning this species:—"The commonest species of lizard in the barren stretches of sand which are common in Lower Siam near the sea-coast, on the east side of the Peninsula. It is exceedingly active and very timid. Though its colour is brilliant, the green and grey 'eyes' which ornament its back, and the orange and purple stripes on its side, are not conspicuous amidst its natural surroundings: the former harmonizing with the shadows cast on the sand by the scanty vegetation which it supports; the latter are more or less concealed by the fold into which the skin that covers the ribs naturally falls. When the male, which is more brilliant than the female, is roughly handled, and is prevented from using its powerful jaws, it flattens its body in such a way that the stripes of colour on the sides become most conspicuous. The female is unable to do this with such effect, as her ribs seem to be less mobile. *Liolepis* lives in holes in the ground, which often go down vertically for two feet before there is a bend in their course. The Malays say that the holes are dug by the lizard with the aid of claws and snout, but *Liolepis* is so timid that I have never been able to watch one digging. A male and female were generally captured in each burrow, and the natives assured me that the lizard is strictly monogamous." A female I opened contained eight large eggs with leathery shells. In the stomach of another specimen I found remains of a large spider, several grasshoppers, and a quantity of vegetable food.

Malay name, "Bewak pasir" (sand-lizard).

Fam. VARANIDÆ.

Two large species belonging to this family are common in suitable localities all over the Peninsula. These are *Varanus salvator* and *V. nebulosus*. Mr. Annandale has given me the following note concerning these species:—"*V. salvator* is perhaps more aquatic than *V. nebulosus*, otherwise their habits appear to be identical and they are equally at home in water, on land, or amongst the branches of trees. They lay their eggs in hollow tree-trunks. When in the water they swim beneath the surface, their legs closely applied to their sides; the powerful tail functions both as a propeller and as a rudder. Their food is very varied. In the States of Patalung and Singgora, in which the Siamese practise a form of tree-burial, these great lizards are accused, and probably with justice, of devouring the corpses. I have disturbed a large monitor eating the body of one of its own kind which had evidently been dead for some days; another when chased dropped from its mouth a small flying-squirrel (*Sciuropterus*); a third, which I dissected, had swallowed a small tortoise the carapace of which had been broken into innumerable little fragments; the stomachs of several others contained nothing but dung-beetles, for which *Varani* may often be seen hunting, turning over the dung of elephants or buffaloes with its fore feet."

I have watched a small *V. salvator* eating a rat in the Botanical Gardens at Singapore. It shook the rat very violently, banging it against the walls of its cage and on the ground, then bit it all over, until presumably all the rat's bones were broken, then bolted it head first. They may sometimes lay their eggs in burrows. A specimen at Kuala Aring lived in a very long and deep burrow, so deep that we could not dig it out. In and near Tringganu they are especially plentiful near the burial grounds.

VARANUS SALVATOR Laur.

Varanus salvator, Boulenger, Cat. Liz. ii. p. 314; id. Faun.

Brit. Ind., Rept. p. 166, fig. p. 162; S. S. Flower, P. Z. S. 1899, p. 873.

Our largest specimen measured 6 ft. 6 in. in total length.

VARANUS NEBULOSUS Gray.

Varanus nebulosus, Boulenger, Cat. Liz. ii. p. 311; id. Faun. Brit. Ind., Rept. p. 165; S. S. Flower, P. Z. S. 1899, p. 643.

VARANUS RUDICOLLIS Gray.

Varanus rudicollis, Boulenger, Cat. Liz. ii. p. 313; S. S. Flower, P. Z. S. 1899, p. 643.

A specimen of this lizard was brought to me at the foot of Gunong Inas. It appears to be an inhabitant of forest country only.

Fam. LACERTIDÆ.

TACHYDROMUS SEXLINEATUS Daud.

Tachydromus sexlineatus, Boulenger, Cat. Liz. iii. p. 4; id. Faun. Brit. Ind., Rept. p. 169; S. S. Flower, P. Z. S. 1899, p. 644.

Mr. Annandale tells me that this lizard is common at Biserat, where it is called "Bengkarong Ular" or snake-lizard. It runs about on the top of the long buffalo-grass (lalang); apparently the great length of its body, produced chiefly by the remarkable extent of the tail, saves it from breaking the grass or falling through to the ground. When chased it seeks safety by diving, so to speak, down through the grass to the ground. This species has not, I believe, been recorded previously from the Peninsula, although known to occur in Borneo and Burmah.

Fam. SCINCIDÆ.

MABUIA MULTIFASCIATA (Kuhl).

Mabuia multifasciata, Boulenger, Cat. Liz. iii. p. 186; id. Faun. Brit. Ind., Rept. p. 191; S. S. Flower, P. Z. S. 1899, p. 645.

Abundant everywhere, both in the forests and in open country. I have seen one of these Skinks climbing high up on a large forest tree.

LYGOSOMA FLOWERI, sp. n. (sect. *Hinulia*, Gray).

Form moderately slender; limbs well developed, pentadactyle, rather long; adpressed hind limb just reaches axil. Ear-opening moderately large. No auricular lobes. Eye large, its diameter nearly equal to its distance from the end of the snout. Lower eyelid scaly. No supranasals, fronto-parietals distinct, fronto-nasal in contact with rostral; five supra-oculars, 32 scales round the body. Colour: upper surface brown, with a mid-dorsal row of irregular black spots extending to the base of the tail, which is mottled brown and white; the limbs brown and black; lower surfaces brown.

Two specimens from the foot of Gunong Inas: one, very young, I caught running on the trunk of a tree, the other, a female, on the ground; its dimensions are:—

Length of head	....	11 mm.
,, body	....	35 ,,
,, tail	....	75 ,,
,, fore limb	....	20 ,,
,, hind limb	....	20 ,,
Breadth of head	....	5 ,,

I have much pleasure in naming this species after Mr. Stanley Flower, to whose work on the Reptilian fauna of the Malay Peninsula I am much indebted.

LYGOSOMA CHALCIDES (Linn.).

Lygosoma chalcides, Boulenger, Cat. Liz. iii. p. 340; S. S. Flower, P. Z. S. 1899, p. 652.

Malay name, "Ular Berkaki" or legged snake.

Specimens were collected at Ban Kong Rah in Patalung and at Khota Bharu, Raman. The natives regard it as the young of *Typhlops* or *Cylindrophis*, and say that its legs gradually grow smaller and smaller until they finally disappear.

3. On the Pterylosis of the Giant Humming-bird (*Patagona gigas*). By Professor D'ARCY WENTWORTH THOMPSON, C.B., F.Z.S.

[Received April 2, 1901.]

(Text-figures 77–82.)

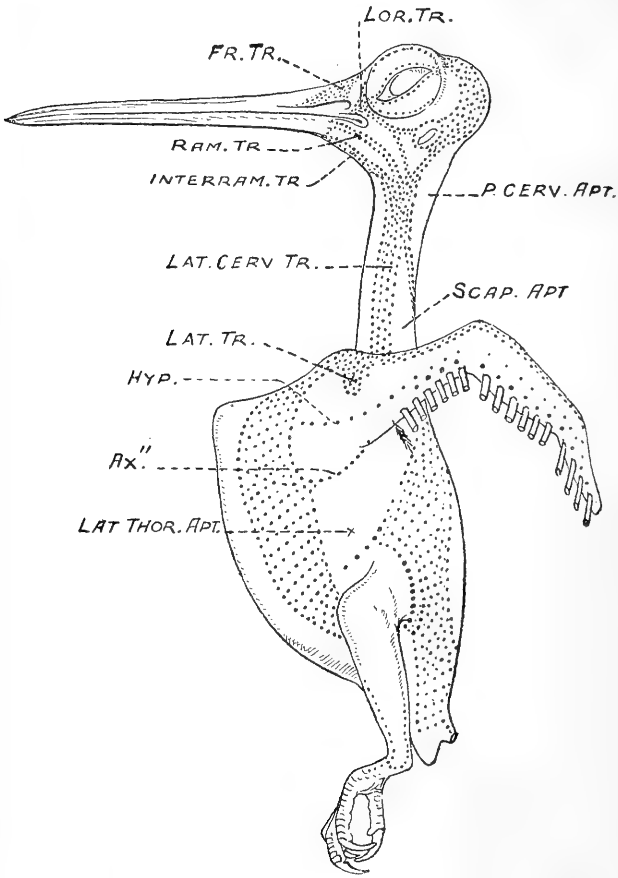
Our knowlege of the pterylosis of the Humming-birds is extremely scanty. It is based mainly on Nitzsch's very brief notes, supplemented by some observations of Dr. Shufeldt's. Nitzsch's very elementary figures are the only ones that I am acquainted with. The following account is based on the examination of a spirit-specimen of *Patagona* received lately by the Museum of University College, Dundee, from Mr. Alexander Rodger of the Perth Museum.

THE PTERYLOSIS OF THE HEAD.

The feathering of the head may be most simply described as starting backwards from the base of the bill in three lateral lines and a median ventral one. The three lateral lines start respectively (*a*) from the base of the upper mandible, above the nasal flap or cover; (*b*) from the neighbourhood of the nostril below the level of its cover; (*c*) from below the gape parallel to the line of the jaw.

The *upper lateral band* (*a*), corresponding to the *fronto-parietal area* of Pycraft, forms a closely feathered triangle (text-fig. 77, *fr.tr.*) over and behind the nasal valve, after which it narrows so as to leave a moderately wide space in front of and over the eye; then, the interspaces between its feathers becoming much wider, it runs in three somewhat widely separate feather-rows downwards outside the line of the hyoid cornua. It is separated from its fellow of the other side, firstly, by an elongated oval apterion (text-fig. 78, *fr.apt.*) extending as far back as the middle of the

Text-fig. 77.



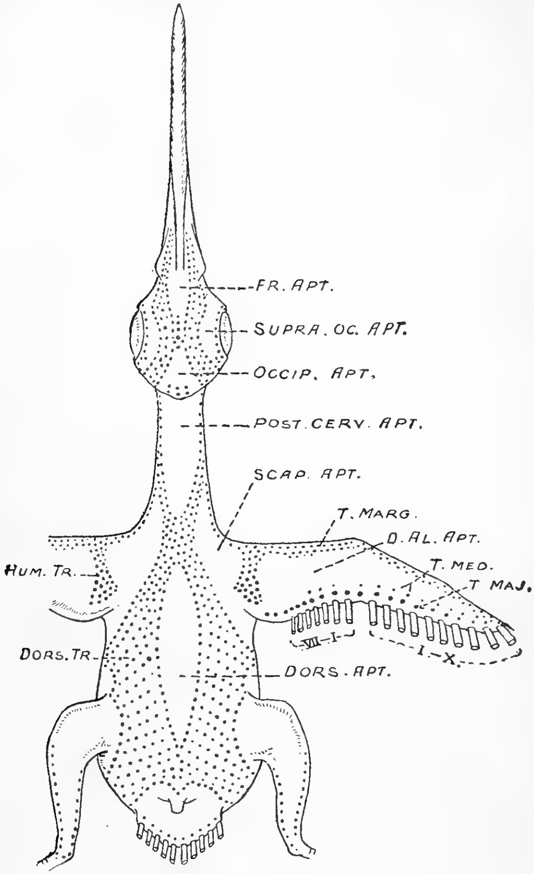
Pterylosis of *Patagona gigas*, side view, reduced.

fr.tr., frontal tract; *lor.tr.*, loral do.; *ram.tr.*, ramal do.; *lat.tr.*, lateral do.; *lat.cerv.tr.*, lateral cervical do.; *p.cerv.apt.*, posterior cervical apterion; *scap.apt.*, scapular do.; *lat.thor.apt.*, lateral thoracic do.; *hyp.*, hypopteron; *ax.''*, 'second row' of axillaries.

orbit and directly continuous with the posterior extension of the horny beak, and secondly by a small triangular space on the top of the head (text-fig. 78, *occip.apt.*), corresponding to the vertex of the triangle between the long hyoid cornua. Between these two interspaces, the bands come near together in the middle line, and the space between is here occupied by a longitudinal row of three or four feathers.

The *second lateral band* (*b*), beginning in the *loral area* (text-fig. 77, *lor.tr.*) behind the nostril, that is to say considerably

Text-fig. 78.



Pterylosis of *Patagona gigas*, dorsal view, reduced.

fr.apt., frontal apterion; *dors.apt.*, dorsal do.; *supra-oc.apt.*, supra-ocular do.; *D.al.apt.*, dorsal alar do. &c.; *t. marg.*, *med.*, *maj.*, marginal, median, and major coverts; *hum.tr.*, humeral tract; *dors.tr.*, dorsal do.

posterior to the commencement of the upper band, divides into three parts: firstly, a single row of feathers which courses over the top of the orbit and then divides into two rows, of which the outer stops short above the ear, while the other, running parallel and close to the band previously described, proceeds down the side of the neck; secondly, a little patch extending to the inner canthus of the eye, there becoming connected with a ring of tiny feathers that closely surrounds the eye very near the margin of the eyelid to the number of about 16 or 17 above and below, and finally continued backwards from the posterior canthus; thirdly, a well-defined band which forms firstly a well-defined row of feathers running backwards below the eye, secondly a band running downwards in front of the ear, and thirdly, between these two, a circlet of feathers surrounding the opening of the auditory meatus, from which it is separated by a wide interspace.

The *inferior lateral band* (*c*), or, again to use Pycraft's nomenclature, the *ramal area* (text-fig. 77, *ram.tr.*), starts from the apex of the lateral angle of the horny lower mandible and curves backwards and downwards until below and a little in front of the ear it becomes confluent with the adjacent tracts, and merges in the general feathering of the sides of the neck.

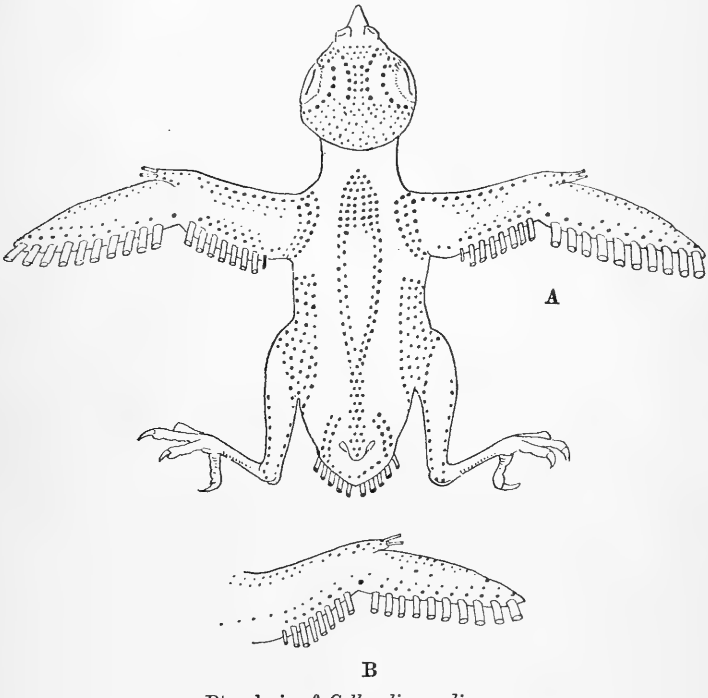
Separated in front by a considerable space from the last-mentioned band, the median ventral or *interramal tract* starts as a narrow triangle between the rami of the lower mandible, and very soon, about the level of the front of the eye, forks into two lateral branches which proceed downwards, merging with the lateral cervical tracts (text-fig. 77).

The arrangement of feathers on the head in *Patagona* is in striking contrast with the more uniform arrangement of ordinary Passerines. For purposes of comparison, I have examined a few birds only, especially *Collocalia* (as a type of the Swifts) and *Caprimulgus*; but bearing in mind the general scantiness of our knowledge, and also what we already know of the variability of the pterylosis within even limited groups, it is plain that we need countless additional observations before the comparative method shall be properly available.

In *Collocalia* (text-fig. 79) the top of the head is feathered without any median interruption from the beak to the nape of the neck, the feathers in front reaching to the border of the gape external to the nostrils. Laterally, a distinct crescentic apterion separates this feathered area, whose outer feathers are larger than those within, from a single row of outwardly directed feathers running above the eye and again separated from it by a considerable interspace. This row starts, very much as in the Humming-bird, from a loral patch which feathers the base of the bill between nostril and eye, and from which another row of feathers passes below the eye to stop short immediately behind it. Between these two rows is a row of eyelash-feathers on the lower lid only, continued into a little group behind the outer canthus. A third line of feathers starting from the same region becomes connected with the circlet of feathers around the wide auditory aperture. Below the gape, fringing its margin, a 'ramal' band of feathers is present separated by a narrow space from the broad feathered 'interramal' area which occupies the rest of the mandibular triangle.

To a certain extent there is a resemblance traceable between this pterylosis and that of *Patagona*. The converging lines of feathers that run backwards over the crown, the crescentic row of feathers over the eye, and the crescentic apteria, internal and external to this latter row, are features that the Swift possesses in common with the Humming-bird. But, on the other hand, the absence of the median frontal and occipital apteria, of the eyelashes of the upper lid, and in general the uniform feathering of the back of the head, all these are striking differences.

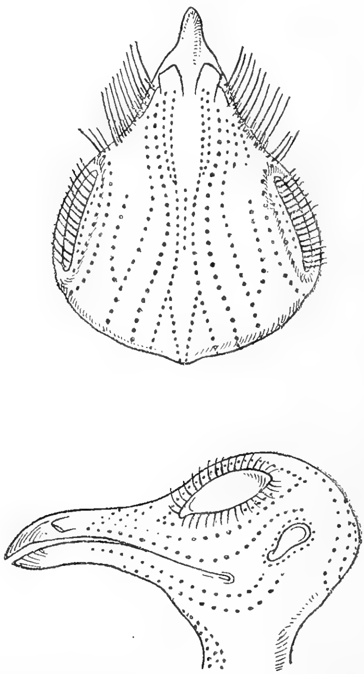
Text-fig. 79.



Pterylosis of *Collocalia spodiopyga*.
A, dorsal view; B, ventral view of wing.

In *Caprimulgus macrurus* (text-fig. 80, p. 316) the arrangement of the feathers on the head is as follows:—A double row of feathers starts on the dorsal side of each nostril and curves inwards to approximate to its fellow on a level with the anterior border of the eye, leaving a lanceolate space vacant between, much as in the Humming-bird. A few median feathers intervene between the two rows (each of which has become uniserial) on the top of the head, and behind these the two rows first fuse in the middle line, then diverge slightly (behind the level of the eye), and each afterwards bifurcates prior to running down over the occiput and nape. Two other rows immediately external to these on each side run backwards, diverging as they go, and combine with the former to form a complicated pattern on the back of the head and nape. The more external of these two sends forward in the posterior part of its course a branch communicating with a short longitudinal row of feathers dorsal to the eye: in the anterior part of its course it blends with a triangular patch of feathers, forming the 'loral area' dorsal to the line of vibrissæ that fringe the gape. Dorsal to the eye, and separated by a considerable interspace from the short row already mentioned, comes another more complete row, of somewhat stiff and prominent feathers, and external to it again the eyelid bears two incomplete rows of feathers on its dorsal surface, and

Text-fig. 80.



Pterylosis of head of *Caprimulgus macrurus*, from above and from the side.

then a fringe of stiff eyelash-feathers at its edge; these eyelash-feathers are continued round the edge of the lower lid also. The row of vibrissæ, of which 10 or 11 are conspicuously stiff, is continued backward into a row of softer feathers that run between the ear and the eye towards the general feathering of the back of the head. Immediately dorsal to them is another row of smaller feathers, which may, in like manner, be traced backwards along a similar course diverging somewhat from the former; and as they run below the eye they resemble, and at the anterior canthus they are not clearly disconnected from, the row of stiff and prominent feathers already described above the eye; the lower surface of the eyelid bears one row of feathers internal to them. The large auditory aperture, whose lower border is very distinctly produced and everted, is surrounded by a conspicuous fringe of feathers; this line of feathers around the ear is not distinctly connected with any of the other rows. On the outer side of the lower mandible, parallel with the vibrissæ, a double row of 'ramal' feathers runs backward towards the angle of the jaw; the outer row of this double series is in very close relation, if not in direct connection, with the feathers of the auditory ring. The interramal 'chin-feathers' are sparse and are separated from the mandibular or ramal area by a wide interval.

It will be found that this account is very similar to Mr. H. L. Clark's account of *Phalænoptilus nuttalli.* Bearing in mind the general features and minor difference in other genera of Caprimulgidæ, as described by Mr. Clark, I think we may say that there is a somewhat surprising resemblance between the pterylosis of the head in these forms and in our Humming-bird. The linear arrangement of the feathers is in a general way comparable; the median frontal apterion is well marked and the occipital one is indicated in the Goatsuckers; the main row of feathers over the eye is similar in both, and both have the complete circle of eye-lashes, though these differ in appearance, being complete small feathers in the Humming-bird, and not single stiff 'cilia' as in the Goatsucker. The connection between the auditory ring of feathers and those of the regions anterior to it is not very clear in either case, and would seem to be slightly different in the two according to my description and figures; the strong vibrissæ of the Goatsucker have no counterpart in the Humming-bird; but, apart from these differences, the resemblance between the two forms seems to me very noteworthy, and the more noteworthy and the more puzzling, in being apparently much greater than the resemblance of either form with the Swift.

The Pterylosis of the Wing.

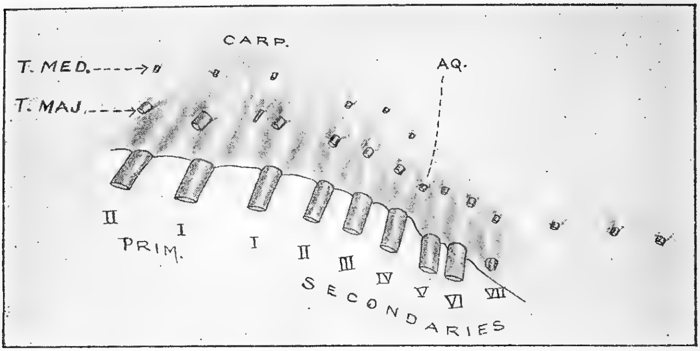
The Humming-birds are universally described as possessing ten primaries and six secondaries. As a matter of fact, *Patagona* possesses a distinct but minute seventh inner secondary.

The fourth primary from the end of the wing, that is to say the seventh reckoning from within outwards, is associated with the phalanx of the third digit (=ad-digital remex). Of coverts we find, both above and below, a row of major and of median coverts, the latter separated by a considerable interspace from the marginals.

On the dorsal surface of the wing (*cf.* text-fig. 78) major coverts are present in connection with each remex and overlap the bases of their corresponding remiges distalwards; their insertions, which at the base of the wing are distinctly on the proximal side of their corresponding remiges, shift outwards till at the farther end they are as distinctly distal.

An additional 'aquintocubital' covert (text-fig. 81) is intercalated between the fourth and fifth cubitals, and another intercalated feather is present at the carpal joint.

Text-fig. 81.



Part of the wing of *Patagona*, dorsal view.
aq., 'aquintocubital' feather; *t.med.*, *t.maj.*, median and major coverts; *carp.*, placed over an apparently intercalated covert at the wrist-joint.

All these belong clearly to a single row or series, and this series is further prolonged proximally beyond the corresponding row of remiges into a series of some five or six feathers that course dorsalwards along the humerus to merge with the humeral tract.

The median coverts are in each case placed a little in front of their corresponding majors. There are in the primary series ten, beginning with that in the interspace of the wrist. There are three only on the cubitus, corresponding to the second, third, and fourth secondaries, reckoning inwards.

The account here given is not entirely satisfactory to me, but I cannot from the examination of a single specimen arrive at greater certainty. My difficulty arises from the fact that I do not recognize a 'remicle,' and that I am not quite sure of the nature of the apparently intercalated 'carpal' covert. This latter, from its small size and from its position, one would naturally assume to be an intercalated or supernumerary one, especially as we shall see it to be still better shown in the Swift, and to be associated with a rudimentary remex in the Goatsucker. On the other hand, it lies directly opposite to a ventral covert which seems clearly associated with the first primary. The ventral major coverts, moreover, are all distinctly proximal to their corresponding primaries, while those of the dorsal side, unless we reckon the 'carpal' covert as the first of the primary series, are more and more distal to theirs. In the one case, the feather on the outer side of the tenth primary is to be interpreted as a remicle, in the other as the tenth major covert. I have merely described the feathers I have seen, and admit the possibility of a difference of interpretation.

On the ventral side of the wing (*cf.* text-fig. 77) the inferior major coverts are only present in correspondence with the ten primaries and the four first or outermost secondaries. Thus the whole series stops short precisely where the median coverts stopped short on the dorsal side of the wing.

The median coverts of the ventral side are present in number corresponding to all the remiges except the outermost, and are further continued downwards and forwards on the under surface of the wing towards the pectoral tract, to the number of four or five more, much in the same way as the dorsal major coverts were extended inwards to the humeral tract, and constituting the so-called axillaries or hypopteron (text-fig. 77, *hyp.*).

Between these two proximal extensions, that namely of the dorsal major coverts running to the humeral tract and that of the ventral median coverts running downwards towards the pectoral, we have a more conspicuous and more numerous row of about eight feathers running along the posterior border of the axilla and right down to the pectoral tract. They deserve the name axillaries more strictly than the former row, but for the purposes of this paper we may speak of them as the second row of axillaries (text-fig. 77, *ax''.*). It is impossible to say whether this row is in serial continuation of either the remiges or the ventral major coverts (that is to say, with either of the series lying between those with which the two other extensions are continuous), and as a matter of fact it seems to be separated by a gap from both of them.

This last series, together with the one above it, corresponds to the *parapteron* and pennæ humerales of Nitzsch, while the extension of the ventral coverts corresponds to the *hypopteron* or axillaries of Nitzsch and Wray. But, whereas the axillaries are commonly described as being extensions of the ventral minor coverts, they are here, at least, clearly an extension of the median coverts, and the pennæ humerales are as clearly an extension of the dorsal major coverts.

Between the median and the marginal coverts there is present on the ventral side a row of six or seven small minor coverts, which run, pointing strongly distalwards, from the level of the third primary towards the end of the wing.

The marginals themselves form several transverse rows of small closely-set feathers, having as usual no numerical relation longitudinally with the remiges or the other tectrices already described.

The marginal feathers encroach but a little way on the patagium, which is bare save for three or four rows of feathers on its anterior border.

There is a well-marked humeral tract nearly over the head of the humerus and extending backwards thence to the axilla. Anteriorly it unites with the marginals, and so comes into close relation, over the clavicle, with the forward continuation of the pectoral tract. It comes very near to the dorsal tract posteriorly, though it is difficult to say that it is connected with it;

in the main the two tracts are separated by a prolongation backward of the triangular apterion at the base of the neck.

The pollex is entirely concealed beneath the skin and bears no free alula, though a few somewhat larger feathers appearing among the marginals correspond to the position of the latter.

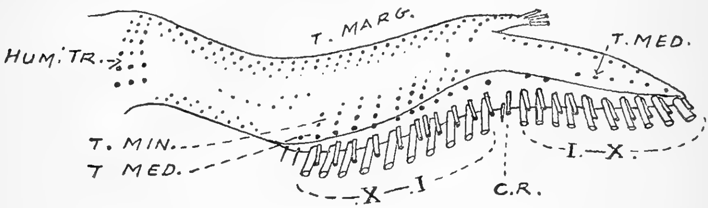
The whole wing is of a remarkably simple type. The small number of marginals, the scanty feathering of the patagium, and the absence of minor coverts on the whole dorsal and greater part of the ventral surface of the wing seem to me to leave the arrangement of the remaining rows unusually clear; and in particular, the relation of the upper and lower posterior extensions, parapteral and hypopteral, of the coverts to the rows of coverts themselves seems to be much more simple and definite than is usual.

The wing of *Collocalia* has ten primary feathers and seven well-developed secondaries, internal to which latter are two rudimentary ones. There is a greater covert to each of the primaries on the dorsal side and another on the ventral, of which, if my interpretation be correct (for it is in part subject to the same difficulty that I have discussed in describing *Patagona*), the ventrals are all proximal to, and the dorsals distal to, their corresponding primaries. There seem here to be clearly intercalated at the wrist a pair of dorsal and ventral carpal coverts. There is no aquincubital covert among the secondaries, at least in this particular Swift; there are seven major coverts on the ventral side, and on the dorsal side the series is further prolonged backwards to connect with the humeral tract. On the dorsal side of the wing there are median coverts present in connection with the seven outer primaries and all the secondaries, which latter are furnished also with a row of minor coverts. Median coverts are present on the ventral side in connection with all the primaries and secondaries, and are further continued backwards into a line of hypopteral feathers. On the ventral side of the manus is an incomplete row of minor coverts. The marginals are few, but the patagium bears on the dorsal surface more numerous feathers (in 3 or 4 rows) than in the Humming-bird.

The wing of *Caprimulgus macrurus* (text-fig. 82, p. 321) possesses ten primaries and ten conspicuous, together with one or two rudimentary, secondaries. There is a rudimentary remex at the carpal joint. The alula is of large size and bears three long feathers. On the dorsal side of the wing there is a major covert corresponding to each primary, to each secondary including the rudimentary carpal remex, and also a well-marked 'aquintocubital' feather. The six outer primaries (that is to say, numbers 5 to 10) possess each a well-formed median covert, and the first and second also each possess two coverts, the outer (or that corresponding to the median covert) being of large size, though not so big as the major one; besides these, the dorsal surface of the hand possesses no other coverts.

The secondaries all possess well-formed median as well as major coverts, including one for the aquintocubital feather; and these are succeeded by three rows of minor coverts, which rows become successively shorter, the outermost having only about five feathers. The median coverts each bear two tiny plumes at the base. There are several rows (about five) of marginal feathers which curve round on the shoulder to join the strong humeral patch. On the ventral side of the wing there is a complete series of major coverts, including an aquintocubital covert, and there is also an equally complete series of median coverts. There is one row of minor coverts together with a few others on the arm, not very regularly disposed.

Text-fig. 82.



Wing of *Caprimulgus macrurus*, dorsal view.

c.r., carpal remex, with its major covert.

The variations in the pterylosis of the wing are too numerous and too little known to justify us in drawing much from a close comparison of these types. They all three possess wings of comparatively simple structure, that of the Humming-bird being the most so, that of the Goatsucker the least. The wing of the Goatsucker is aquintocubital, with the apparently interstitial coverts present both above and below; in the Humming-bird we see one only on the dorsal side; in *Collocalia* there is no sign of either. The median coverts of the primaries on the dorsal side are interrupted alike in the Goatsucker and the Swift; in both of these birds, and especially the latter, the minor coverts of the cubitus and the patagial feathers are much more numerous than in the Humming-bird.

The Pterylosis of the rest of the Body.

In *Patagona* the general feathering of the back of the head, formed by the convergence of the bands above described, and supplemented by additional feathers on the occiput between the hyoid cornua, divides at the nape of the neck to run down on each side of a great posterior cervical apterion, fully an inch long, and occupying all the back of the neck nearly to the shoulders.

The middle of the back is occupied from the shoulders to a little way in front of the oil-gland by a somewhat broad, lanceolate, dorsal apterion. The rest of the back is covered by a broad dorsal feather-area, which in front divides into two very narrow feathered strips that border the posterior cervical apterion, and merge halfway up the neck with the lateral cervical feather-tracts.

The dorsal area descends in a triangular patch far on to the sides of the body midway between wing and leg; it covers the head of the femur and descends some little way behind that bone; it terminates posteriorly in a pointed extension on the base of the oil-gland, and a little way to the side of the latter it sends a little triangular patch some short way downwards behind the femur.

On either side of the breast-bone we have the broad median ventral apterion, which extends all the way from the anus to the region of the gape.

The lateral cervical feathers-tracts, on arriving at the level of the shoulders, communicate with the prepatagial marginal feathers of the wing and then pass on into the broad ventral or pectoral tracts. Between the prepatagial extension and the main pectoral tract there is a well-marked patch running backwards towards the hypopteron; this last is the "pteryla lateralis" of Nitzsch.

The ventral feather-tracts are broad along the sides of the breast; posteriorly they are continued by a single line of feathers to join with a feather-tract behind the anus; anteriorly over the shoulder-joint they merge with the humeral tract and with the marginal or pre-patagial wing-coverts, and each then runs forward on the side of the neck, to be joined by the strip already mentioned from the dorsal tract, and so to form the lateral cervical areas.

We thus recognize the following apteria in *Patagona*:—

(1) An elongated apterion on the top of the head divisible into an anterior and posterior portion.

(2) A more or less crescentic supraocular apterion on each side of the top of the head.

(3 & 4) The apteria around eye and ear.

(5) A small apterion extending backwards from the angle of the mouth, very narrow when the mouth is closed, but stretching into a wide triangle when the mouth is open. It is possible that this is directly continuous with a little triangular apterion intercalated in the lateral feathering of the neck just below and behind the ear.

(6) The great posterior cervical apterion.

(7) The dorsal apterion.

(8) The lateral thoracic apteria, more or less subdivided by the downward extensions of the dorsal tract and also encroached on by certain feathers, to be subsequently described, in connection with the wing. This apterion is continuous with a large naked space on the underside of the wing, and with the bare space on the side of the femur.

(9) The great ventral apterion which runs all the way from the fore part of the neck to the anus.

(10) A triangular apterion, which we may call the scapular apterion, on each side of the neck, separated from the posterior cervical apterion by the narrow anterior prolongations of the dorsal tract, and separated by the humeral tract from

(11) the apterion on the dorsal surface of the wing.

In *Collocalia* the interramal area is continuous with a feathered area which occupies the front of the neck to the level of the shoulders, the feathers here pointing towards the middle line, where they are divided by a narrow median apterion. The dorsal tract has a small lanceolate median apterion, in front of which it runs more than halfway up the neck to form a median shoulder-patch of strong stiff feathers; it covers, much more closely than in the Humming-bird, the sides of the body, the outer surface of the thigh, and the rump, also the base of the oil-gland in its middle line, where, indeed, the feathers are very stiff and strong.

The pectoral tracts are widely separate in the middle line, and are further separated from the feathering of the neck, so that here the feathering of the head and neck is entirely cut off from that of the body. On each side of the breast is also a long narrow lateral apterion, which is only prevented from communicating with the apterion of the neck by a single row of feathers that run inwards from the humeral tract to the sides of the shoulder-patch.

On the leg we have no well-defined femoral tract, which may, however, be represented by a single row of about seven feathers, imperfectly differentiated from the dorsal tract. The outer and inner surfaces of the leg are bare, but on the tibia there is a band of feathers on the edge of the leg in front and behind, which two bands unite at the ankle and are continued down the front of the tarsus.

The tail consists of ten rectrices, each with a corresponding upper and lower covert, the lower row of coverts, however, containing two additional outer feathers on each side.

The anus is crowned with a circlet of long feathers. The oil-gland, as is well known, is unfeathered.

In *Caprimulgus* the feathering of the back of the head is continued into a narrow posterior cervical tract, three rows broad, without either the posterior cervical apterion of *Patagona* or the interruption seen in *Collocalia*. The posterior cervical tract, which is placed on a median fold of skin, as in Pycraft's description of the Owls, divides over the shoulders into two narrow bands which unite with similarly formed extensions of the dorsal tract to enclose a small diamond-shaped apterion and to form a dorsal saddle much less extensive than in the Humming-bird. There are well-marked femoral tracts, and scattered feathers between them and the dorsal tract. The inferior cervical tract divides near the middle of the neck, and gives off a branch to the prepatagial border of the wing and shoulders, as it merges into the pectoral (or ventral) tract on each side. The median branch between these two, broad and characteristic in the Owls, is not present.

The pectoral tracts are wide apart, and somewhat narrower, and they contract a little way in front of the posterior edge of the sternum into narrow bands that run backwards curving in towards the anus.

The pterylosis of the neck differs much, therefore, in the three birds described, the narrow posterior cervical tract and broad lateral apteria of *Caprimulgus* being very different from the characters of either of the other two. The median dorsal apterion is common to the three, and the general arrangement on the back is otherwise not so different as is that of the neck, or rather the difference is more one of degree; for the broad saddle of the Humming-bird includes the lumbar and femoral tracts of *Collocalia*, and the apterion between is in part occupied by scattered feathers in the Goatsucker.

As an instance of the great divergence of characters to be found in certain groups often more or less closely approximated to the Macrochires, under such names as *Picariæ* or *Coraciiformes*, we may take the Kingfisher, than which it would be scarcely possible to find a bird whose pterylosis, at least, is in more striking contrast with those above described. The nearly complete and close feathering of the head, the junction of the occipital feathers with those of the strong posterior cervical tract, the separation of the latter from the dorsal tract, the numerous secondaries, the close feathering of the patagium—all these and other differences contrive to form a strong and evident contrast.

On the balance of evidence, I am inclined to think that the facts of pterylosis, so far as they go, tend to justify the association of the Humming-birds with the Goatsuckers and Swifts, and, if anything, to bring them somewhat nearer to the former than the latter of the last two. But I am bound to confess that the evidence is confused and the judgment far from clear. There are many resemblances and many differences, and we are not yet in a position to decide what proportion of weight several characters deserve.

April 16, 1901.

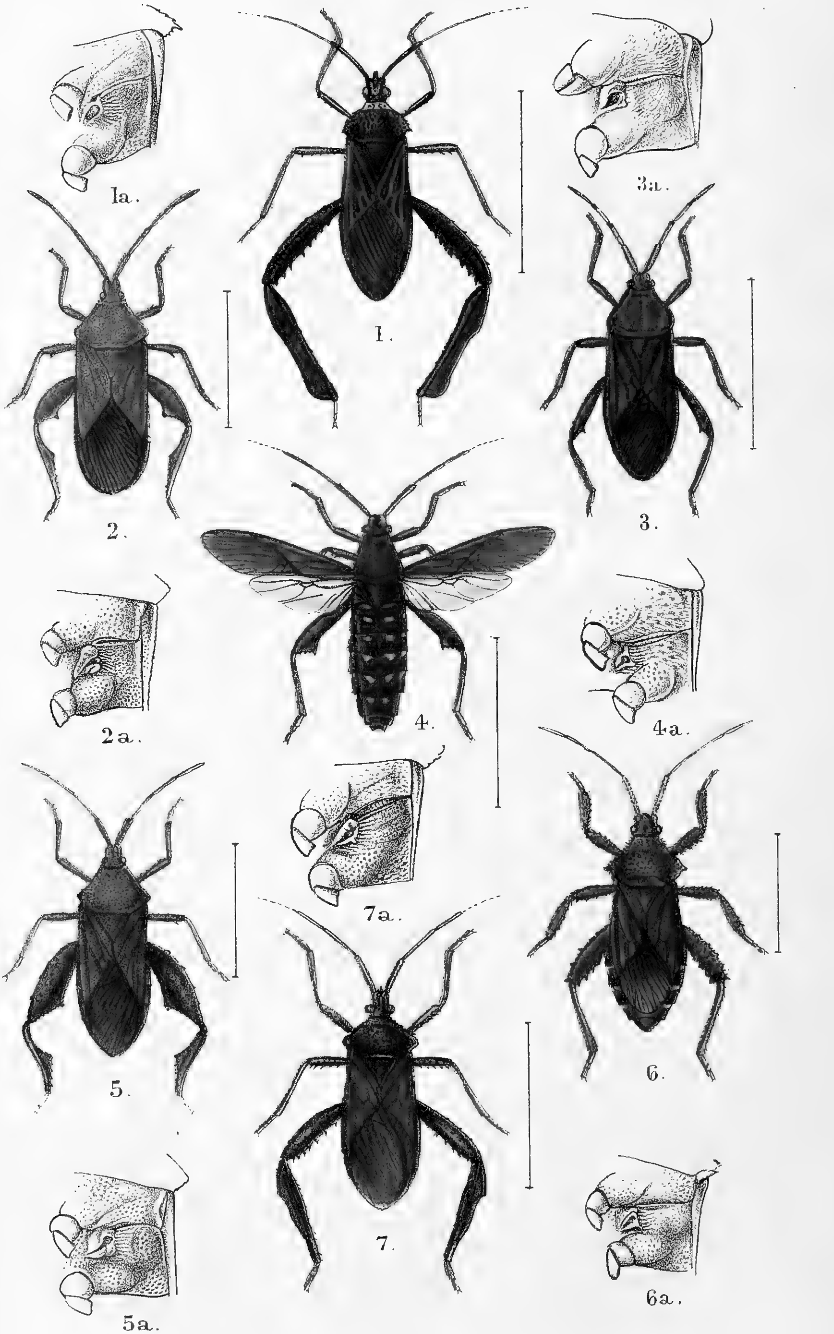
Howard Saunders, Esq., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March 1901:—

The total number of registered additions to the Society's Menagerie during the month of March was 106, of which 33 were made by presentation and 34 by purchase, 37 were received on deposit and 2 in exchange. The total number of departures during the same period, by death and removals, was 160.

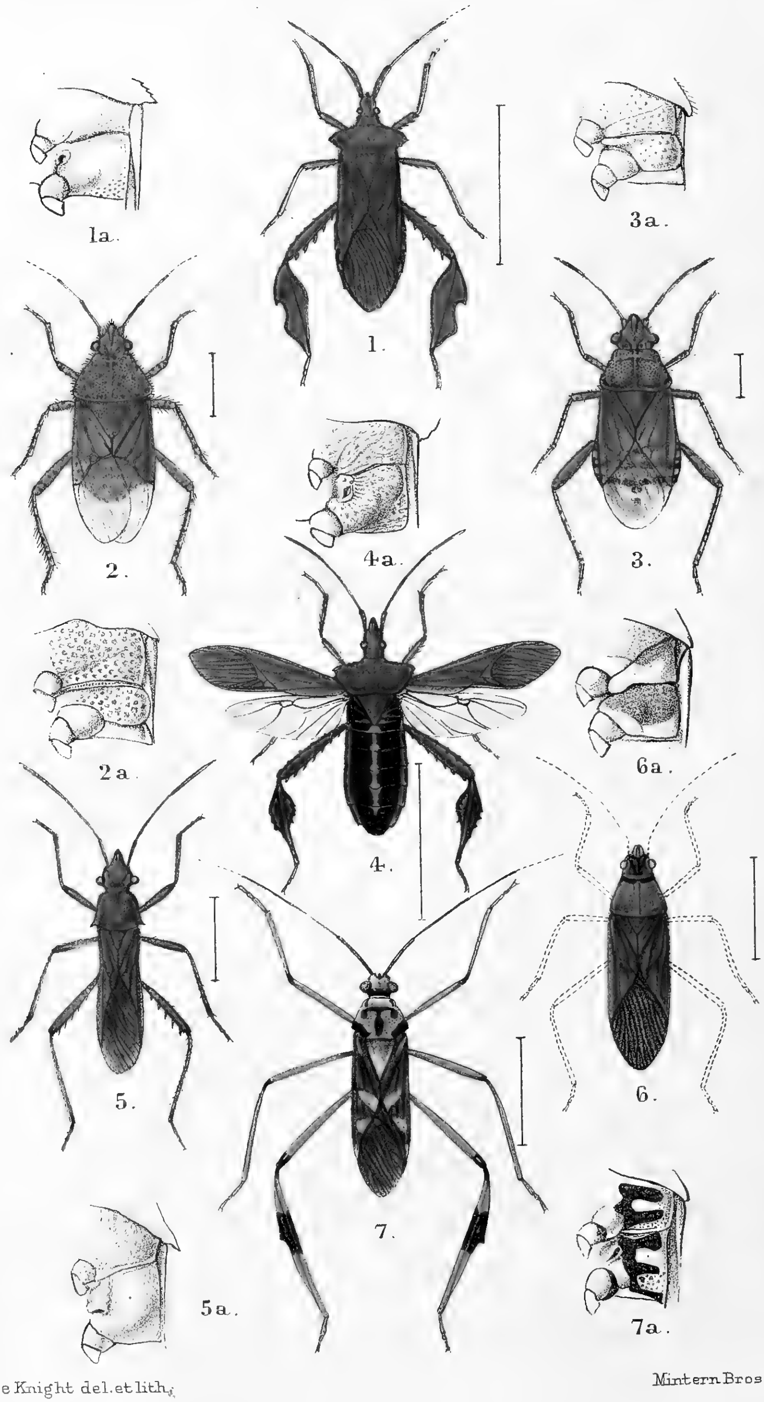
Amongst the additions special attention may be called to a male Tasmanian Wolf (*Thylacinus cynocephalus*), received in exchange on March 19th, this animal having now become extremely scarce and seldom seen in captivity.

I may also call attention to the Indian birds presented to us on March 8th by Mr. E. W. Harper, F.Z.S., of Calcutta, nearly all of which are new to the Society's series.



Horace Knight del. et lith. Mintern Bros. Chromo.

RHYNCHOTA OF THE FAMILY COREIDÆ.



Horace Knight del.et lith. Mintern Bros. Chromo.

RHYNCHOTA OF THE FAMILY COREIDÆ.

Mr. Sclater exhibited (on behalf of Mr. Phil Robinson) a copy of a copper-plate engraving made in 1771 by George Stubbs, Jr., from a painting by George Stubbs, Sr., which gave an excellent representation of a specimen of the Mountain Zebra (*Equus zebra*) and bore the following inscription:—

"The Sebra, or Wild Ass."

"Presented to Her Majesty in the Year 1762, by Sir Tho[s] Adams, Cap[t] of the Terpsicore Man of War, who brought it from the Cape of Good Hope."

"Printed for Carington Bowles, Map and Printseller, No. 69 in St. Pauls Church Yard, London, Published 3 Aug. 1771."

Mr. Sclater stated that he was informed by Mr. Tegetmeier that the original picture from which this engraving had been taken was now in the possession of Sir Walter B. Gilbey, Bart., F.Z.S., and bore the following inscription:—

"A Zebra, the first seen in England, and presented to the Princess Charlotte of Wales: painted from life, and exhibited at the Society of Artists, Spring Gardens, 1763. George Stubbs R.A."

A letter was read from Mr. L. A. Borradaile, F.Z.S., stating that the Crustacean described by him at the Meeting on November 20th, 1900 [1], as *Armadillidium pacificum* belonged to the genus *Cubaris*, and not to *Armadillidium*. In describing it the author had overlooked the presence of the minute exopodite of the uropod and had consequently regarded a linear inequality on the under surface of the outer flange of this limb as a joint. Had this been correct, the species would have been an interesting exception to the ordinary distribution of the genus *Armadillidium*, and in pointing out this supposed peculiarity the name *pacificum*, now inappropriate, had been given to it.

The following papers were read:—

1. Revision of the Rhynchota belonging to the Family *Coreidæ* in the Hope Collection at Oxford. By W. L. Distant.

[Received March 23, 1901.]

(Plates XXIX. & XXX.[2])

This communication concludes the revision of the Rhynchota briefly described by the late Prof. Westwood in the only two parts published of "A Catalogue of Hemiptera in the Collection of the Rev. F. W. Hope," which forms an integral portion of the well-known "Hope Collection" at Oxford. I have now, by the kind permission of Prof. Poulton, examined the *Coreidæ* which

[1] See P. Z. S. 1900, p. 796.
[2] For explanation of the Plates, see p. 335.

constitute the material described in the second part of that Catalogue; the revision of the Pentatomidæ treated in the first part, the Society has already done me the honour to publish in their 'Proceedings' (1900, p. 807). The introductory remarks there given are also applicable to this concluding instalment and need not be repeated.

Owing to the very attenuated descriptions given in these catalogues, considerable synonymy has been created by other workers, which under the circumstances may cause regret but no surprise.

Subfam. Mictinæ.

Melania, gen. nov.

♀. Body oblong, compressed. Head subquadrate, distinctly excavated between the apices of the lateral lobes; antennæ simple, third joint not dilated, first and fourth joints subequal in length; rostrum passing the anterior coxæ, third joint shortest; pronotum about as long as broad at base, lateral margins not denticulated, lateral angles not produced. Abdomen distinctly broader than corium, its lateral margins dentate, apical angles of second, third, fourth, fifth, and sixth abdominal segments distinctly spinous; abdomen beneath at junction of second and third abdominal segments armed with two long diverging spines. Posterior femora wide apart, regularly incrassated, about equally thick throughout, armed above and on sides with four series of spinous tubercles, and with a short but robust spine near apex beneath; posterior tibiæ dilated on each side, convexly outwardly, and angulately and truncately narrowed on inner margin at about one fourth from apex.

This genus is allied to *Pternistria*, *Cipia*, and *Odontoloba*, from all of which, apart from other characters, it may be separated by the dentate lateral margins of the abdomen and the spinous apical angles of the abdominal segments. The tuberculated posterior femora reflect a character in *Prionolomia*. In the female the posterior tibiæ are simple, the posterior femora less tuberculate than in the male, the abdomen unarmed, and the abdominal margins much less denticulate and spinous than in the other sex.

Melania gracilis. (Plate XXIX. fig. 4, ♀.)

♀. *Myctis gracilis* Westw. in Hope Cat. ii. p. 11 (1842).

♂. Dark castaneous, finely ochraceously pilose; connexivum piceous; eyes, abdominal spines, apex of scutellum, and subquadrate spots to connexivum pale ochraceous; antennæ, anterior and intermediate legs, and the posterior tarsi ochraceous. Abdomen above black, with two discal longitudinal series of ochraceous spots.

The antennæ have the first and fourth joints subequal in length, the second a little longer than the third, the first and fourth longest; the pronotum is granulate and coarsely punctate; the scutellum is irregularly transversely rugose, its apex levigate; the corium is thickly and finely punctate; the lateral areas of the pro- and mesosterna, the centre of the mesosternum and the disks of the metasternum, and first, second, and third abdominal segments are thickly ochraceously pilose, the sternum coarsely punctate, the abdomen finely tuberculate; other structural characters as detailed in generic diagnosis.

Long. ♂ 25 millim. Exp. pronot. angl. $6\frac{1}{2}$ millim. Max. abdom. lat. $8\frac{1}{2}$ millim.

Hab. Java (Hope Mus. Oxon. ♀); Singapore (Atkinson Coll. Brit. Mus. ♂).

In the female (figured) the body beneath is more uniformly greyish or ochraceously pilose than in the other sex.

MICTIS TENEBROSA.

Lygæus tenebrosus Fabr. Mant. ii. p. 288 (1787).
Myctis fasciatus Westw. in Hope Cat. ii. p. 11 (1842).

ANOPLOCNEMIS PHASIANUS.

Lygæus phasianus Fabr. Spec. ii. p. 361 (1781).
Myctis punctum Westw. in Hope Cat. ii. p. 10 (1842).
Myctis affinis Westw. loc. cit.
Myctis bicolor Westw. loc. cit.

ANOPLOCNEMIS VARICORNIS. (Plate XXIX. fig. 3.)

Myctis varicornis Westw. in Hope Cat. ii. p. 12 (1842).

ANOPLOCNEMIS FUSCUS.

Myctis fuscus Westw. in Hope Cat. ii. p. 13 (1842).
Myctis ventralis Westw. loc. cit.
Mictis similis Dall. List Hem. ii. p. 387. n. 4 (1852).

PACHYLIS LATICORNIS.

Lygæus laticornis Fabr. Ent. Syst. Suppl. p. 538. n. 15 (1798).
Pachylis grossus Westw. in Hope Cat. ii. p. 13 (1842).
Thasus grossus Stål, En. Hem. i. p. 133. n. 4 (1870); Leth. & Serv. Cat. Gén. Hém. t. ii. p. 14 (1894).

Westwood's type is a unique specimen, a dark variety, and in bad condition. Along with it were mixed up some specimens of *Thasus heteropus* Latr. var. This is the circumstance which probably misled Stål as to the genus (*supra*).

NEMATOPUS NERVOSUS.

Nematopus nervosus Lap. Ess. Hém. p. 30 (1832).
Nematopus ventralis Westw. in Hope Cat. ii. p. 14 (1842) (♀).
Nematopus punctiger Dall. List Hem. ii. p. 427. n. 13 (1852) (♀).

Stål (En. Hem. i. p. 142) rightly opined of the *N. ventralis* Westw., "an femina *N. nervosi* ?"; this is also the sex of *N. punctiger* Dall., and both agree with the female specimen of *N. nervosus* which I recorded from Panama (Biol. Centr.-Amer., Rhynch. i. p. 357).

Subfam. Amorbinæ.

Amorbus bispinus.

Physomerus bispinus Westw. in Hope Cat. ii. p. 9 (1842).

Amorbus rhombifer.

Physomerus rhombifer Westw. in Hope Cat. ii. p. 9 (1842).
Amorbus rhombeus Dall. (nec Westw.) List Hem. ii. p. 411. n. 7 (1852).

Amorbus rhombeus.

Physomerus rhombeus Westw. in Hope Cat. ii. p. 10 (1842).
Amorbus rhombifer Dall. (nec Westw.) List Hem. ii. p. 411. n. 8 (1852).

A. rhombifer and *A. rhombeus* are very closely allied and doubtfully distinct. Beyond a generally darker hue and greater incrassation of the posterior femora in the male of *A. rhombeus*, there is scarcely a character to separate the two forms.

Amorbus angustior. (Plate XXIX. fig. 2.)

Physomerus angustior Westw. in Hope Cat. ii. p. 9 (1842).

This species can be separated from *A. obscuricornis* Westw., to which it is closely allied, by the colour of the posterior tibiæ. Dr. Mayr (Reise Novara, Hem. pp. 86–7) separates the species by the colour of the antennæ, and by the presence or absence of a small black apical spot on the red upper surface of the abdomen. These characters are, however, both inconstant, and this distinctlion cannot be maintained. Westwood omitted to describe the colour of the posterior tibiæ in his *A. angustior*, but the unique type is now figured.

Amorbus subserratus. (Plate XXIX. fig. 5.)

Physomerus subserratus Westw.

The only really distinguishing feature of this species from the above is found in the character described by Westwood as "tibiisque pone angulum medium marginis interni 4-serratis."

Subfam. Daladerinæ.

Dalader rubiginosus.

Acanonicus rubiginosus Westw. in Hope Cat. ii. p. 8 (1842).
Dalader parvulus Dist. Ann. Mag. Nat. Hist. (6) xii. p. 122 (1893).

Subfam. Acanthocephalinæ.

Acanthocephala unicolor.

Metapodius unicolor Westw. in Hope Cat. ii. p. 15 (1842).
Metapodius distincta Walk. Cat. Het. iv. p. 50. n. 21 (1871).

Connexivum brownish ochraceous. A species allied to *A. granulosa* Dall.

ACANTHOCEPHALA FEMORATA.

Cimex femoratus Fabr. Syst. Ent. p. 708 (1775).
Metapodius bispinus Westw. in Hope Cat. ii. p. 15 (1842).

ACANTHOCEPHALA ÆQUALIS. (Plate XXIX. fig. 1.)

Metapodius equalis Westw. in Hope Cat. ii. p. 14 (1842).

Allied to *A. latipes* Dru., from which it differs by the more attenuated and less notched posterior tibiæ.

ACANTHOCEPHALA CONSOBRINA. (Plate XXIX. fig. 7.)

Metapodius consobrinus Westw. in Hope Cat. ii. p. 15 (1842).
Metapodius nigricans Westw. loc. cit.

Westwood's types are unlocalized; the British Museum also possesses two specimens of the species, but both without habitats.

ACANTHOCEPHALA APICALIS.

Metapodius apicalis Westw. in Hope Cat. ii. p. 15 (1842).

Form and size of *A. consobrina*, pronotal angles less produced, colour different, &c.

ACANTHOCEPHALA ANGUSTIPES.

Metapodius angustipes Westw. in Hope Cat. ii. p. 15 (1842).
Metapodius constrictus Walk. Cat. Het. iv. p. 47. n. 4 (1871).

Westwood's type is unlocalized; Walker's typical specimen is from Barbadoes; another specimen in the British Museum is from Cayenne. The Colombian specimen identified by Dallas (List Hem. ii. p. 430. n. 6, 1852) as *A. angustipes* is not Westwood's species.

EMPEDOCLES TENUICORNIS. (Plate XXX. fig. 1.)

Metapodius tenuicornis Westw. in Hope Cat. ii. p. 16 (1842).
Empedocles tenuicornis Stål, En. Hem. i. p. 152 (1870).

Both Westwood's type and Stål's representative are unlocalized, so that the habitat of this species is still to be discovered.

STENOSCELIDEA ALBOVARIA. (Plate XXX. fig. 7.)

Stenoscelidea albovaria Westw. in Hope Cat. ii. p. 18 (1842).

Subfam. HOMŒOCERINÆ.

HOMŒOCERUS BIGUTTATA.

Homœocerus 2-guttatus Westw. in Hope Cat. ii. p. 22 (1842).
Homœocerus sikkimensis Dist. Ent. Month. Mag. xxv. p. 231 (1889).

HOMŒOCERUS SERRIFER.

Coreus serrifer Westw. in Hope Cat. ii. p. 24 (1842).
Homœocerus parvulus Walk. Cat. Het. iv. p. 101. n. 32 (1871).
Homœocerus unipunctatus Dall. (nec Thunb.) List Hem. ii. p. 447. n. 11 (1852).

Subfam. CLORESMINÆ.

NOTOBITUS SEXGUTTATUS.

Nematopus 6-guttatus Westw. in Hope Cat. ii. p. 13 (1842).
Nematopus longipes Dall. List Hem. ii. p. 423. n. 2 (1852).

Subfam. COLPURINÆ.

COLPURA VARIPES.

Gonocerus varipes Westw. in Hope Cat. ii. p. 25 (1842).
Lybas annulipes Dall. List Hem. ii. p. 464. n. 2 (1852).

Subfam. ANISOSCELINÆ.

LEPTOGLOSSUS PHYLLOPUS.

Cimex phyllopus Linn. Syst. Nat. ed. XII., i., ii. p. 731 (1767).
Anisoscelis fraterna Westw. in Hope Cat. ii. p. 16 (1842).

LEPTOGLOSSUS FULVICORNIS. (Plate XXX. fig. 4.)

Anisoscelis fulvicornis Westw. in Hope Cat. ii. p. 17 (1842).

Subfam. PHYSOMERINÆ.

ACANTHOCORIS SCABRATOR.

Coreus scabrator Fabr. Syst. Rhyng. p. 195. 19 (1803).
Crinocerus fuscus Westw. (part.) in Hope Cat. ii. p. 21 (1842).

ACANTHOCORIS SCABER.

Cimex scaber Linn. Cent. Ins. rar. p. 17. 43 (1763).
Crinocerus fuscus Westw. (part.) in Hope Cat. ii. p. 21 (1842).

ACANTHOCORIS AFFINIS. (Plate XXIX. fig. 6.)

Crinocerus affinis Westw. in Hope Cat. ii. p. 21 (1842).

The female specimen is figured showing the rugosity of the posterior femora.

Subfam. GONOCERINÆ.

PLINACTHUS BASALIS.

Coreus basalis Westw. in Hope Cat. ii. p. 24 (1842).
Plinacthus peltastes Stål, Stett. ent. Zeit. xxii. p. 144. 1 (1861).

Subfam. PSEUDOPHLŒINÆ.

CERALEPTUS GRACILICORNIS.

Coreus gracilicornis Herr.-Schäff. cont. Panz. Deutschl. Ins. 135. 5, t. 182 (1835).
Arenocoris ? tibialis Westw. in Hope Cat. ii. p. 25 (1842).

CERALEPTUS ÆGYPTIUS.

Arenocoris ? ægyptius Westw. in Hope Cat. ii. p. 25 (1842).

Ceraleptus squalidus Costa, Cimic. regni Neap. Cent. 2 *a*, p. 12, pl. 4. f. 7 (1847).

Horv. (Rev. d'Ent. xvii. p. 278) considers the specific name *obtusus* Brull. (1838) as taking precedence; but I know neither the species nor the description.

Subfam. Leptocorisinæ.

Leptocorisa tipuloides.

Cimex tipuloides de Geer, Mém. iii. p. 354, pl. 35. f. 18 (1773).
Leptocorisa crudelis Westw. in Hope Cat. ii. p. 18 (1842).

Leptocorisa acuta.

Cimex acutus Thunb. Nat. Ins. Sp. ii. p. 34 (1783).
Leptocorisa bengalensis Westw. in Hope Cat. ii. p. 18 (1842).

Subfam. Alydinæ.

Hyalymenus dentatus.

Alydus dentatus Fabr. Syst. Rhyng. p. 249 (1803).
Alydus ichneumoniformis Westw. in Hope Cat. ii. p. 18 (1842).

Megalotomus rufipes.

Alydus rufipes Westw. in Hope Cat. ii. p. 19 (1842).
Alydus consobrinus Westw. loc. cit. p. 20.
Alydus pallescens Stål, Rio Jan. Hem. i. p. 34 (1860).
Alydus debilis Walk. Cat. Het. iv. p. 160. n. 12 (1871).

Megalotomus parvus. (Plate XXX. fig. 5.)

Alydus parvus Westw. in Hope Cat. ii. p. 19 (1842).

Alydus gracilipes Westw. in Hope Cat. ii. p. 20 (1842).

This species is represented only by the unique type, which is in far too mutilated a condition for generic allocation.

Head, pronotum, and prosternum pale castaneous; head beneath and base of prosternum black; a luteous fascia traversing each lateral area of head and prosternum; meso- and metasternum very pale ochraceous. Abdomen wanting.

Alydus simplex Westw. in Hope Cat. ii. p. 18 (1842).

The type and only specimen possesses neither head nor pronotum. Judging from the remaining portion of the body, it is almost certain that this is a synonym of *Megalotomus rufipes* Westw.?

Mirperus torridus.

Alydus torridus Westw. in Hope Cat. ii. p. 20 (1842).
Alydus albidens Westw. loc. cit.

It is very doubtful whether this species can be really separated from *M. jaculus* Thunb. Certainly not by locality, as specimens from both South and West Africa entirely agree. The structure of the first joint of the antennæ is distinctive in some specimens, but seems to fail when a larger number are examined: the coloration of the antennæ is an entirely variable character.

Riptortus abdominalis.

Alydus abdominalis Westw. in Hope Cat. ii. p. 19 (1842).
Alydus obscuricornis Dall. List Hem. ii. p. 475 (1852).

Hab. Australia: Port Essington (Brit. Mus.).

The types of Westwood's species are unlocalized. "Habitat in Brasilia?"

Subfam. Corizinæ.

Corizus robustus. (Plate XXX. fig. 2.)

Corizus robustus Westw. in Hope Cat. ii. p. 26 (1842).

Corizus vincentii. (Plate XXX. fig. 3.)

Corizus vincentii Westw. in Hope Cat. ii. p. 26 (1842).

Serinetha fraterna. (Plate XXX. fig. 6.)

Pyrrhotes fraterna Westw. in Hope Cat. ii. p. 26 (1842).

The unique type is without legs, antennæ, or habitat.

Serinetha griseiventris.

Pyrrhotes griseiventris Westw. in Hope Cat. ii. p. 26 (1842).
Serinetha chevreuxi Noualhier, Bull. Mus. d'Hist. Nat. Paris, 1898, p. 233.

Stål (Hem. Afr. ii. p. 114) describes this species, of which it is stated "Exemplum typicum Westwoodi haud examinavi," as having the "rostrum coxas posticas attingens." The rostrum, however, is much longer and generally reaches the third abdominal segment. This is the real distinguishing character which separates the species from *S. hæmatica* Germ.

Summarized Disposition of the Hopeian Genera and Species.

Coreidæ.

Genera remaining undisturbed.

Brachytes Westw. in Hope Cat. ii. p. 8 (1842).
Stenoscelidea Westw. loc. cit. p. 17.

Genus treated as synonymic.

Ceratopachys Westw. in Hope Cat. ii. p. 22 (1842) =*Homœocerus* Burm.

Species and Genera remaining undisturbed.

Menenotus unicolor Westw. in Hope Cat. ii. p. 8 (1842).
Brachytes bicolor Westw. loc. cit.
Myctis (*Mictis*) *longicornis* Westw. loc. cit. p. 11.

Nematopus fasciatus Westw. loc. cit. p. 14.
,, *obscurus* Westw. loc. cit.
Leptoscelis tricolor Westw. loc. cit. p. 17.
Stenoscelidea albo-varia Westw. loc. cit. p. 18.
Leptocorisa apicalis Westw. loc. cit.
Homœocerus angulatus Westw. loc. cit. p. 22.
,, *2-guttatus* Westw. loc. cit.
Corizus robustus Westw. loc. cit. p. 26.
,, *vincentii* Westw. loc. cit.

Species requiring Generic revision.

Spartocerus scutellatus Westw. in Hope Cat. i. p. 7 (1842)	belongs	to genus	*Eubule.*
Acanonicus planiventris Westw. loc. cit. p. 8	,,	,,	*Dalader.*
,, *rubiginosus* Westw. loc. cit.	,,	,,	,,
Physomerus angustior Westw. loc. cit. p. 9	,,	,,	*Amorbus.*
,, *subserratus* Westw. loc. cit.	,,	,,	,,
,, *obscuricornis* Westw. loc. cit.	,,	,,	,,
,, *bispinus* Westw. loc. cit.	,,	,,	,,
,, *rhombifer* Westw. loc. cit.	,,	,,	,,
,, *rhombeus* Westw. loc. cit. p. 10	,,	,,	,,
Myctis lobipes Westw. loc. cit. p. 11	,,	,,	*Petillia.*
,, *albiditarsis* Westw. loc. cit.	,,	,,	*Ochrochira.*
,, *gracilis* Westw. loc. cit.	,,	,,	*Melania*, g. n.
,, *granulipes* Westw. loc. cit.	,,	,,	*Elasmomia.*
,, *alatus* Westw. loc. cit. p. 12	,,	,,	*Holopterna.*
,, *scutellaris* Westw. loc. cit.	,,	,,	*Anoplocnemis.*
,, *varicornis* Westw. loc. cit.	,,	,,	,,
,, *fuscus* Westw. loc. cit. p. 13	,,	,,	,,
Nematopus dorsalis Westw. loc. cit.	,,	,,	*Notobitus.*
,, *6-guttatus* Westw. loc. cit.	,,	,,	,,
,, *marginalis* Westw. loc. cit. p. 14	,,	,,	,,
,, *nepalensis* Westw. loc. cit.	,,	,,	*Cloresmus.*
,, *javanicus* Westw. loc. cit.	,,	,,	,,
Metapodius æqualis Westw. loc. cit.	,,	,,	*Acanthocephala.*
,, *unicolor* Westw. loc. cit. p. 15	,,	,,	,,
,, *apicalis* Westw. loc. cit.	,,	,,	,,
,, *consobrinus* Westw. loc. cit.	,,	,,	,,
,, *angustipes* Westw. loc. cit.	,,	,,	,,
,, *tenuicornis* Westw. loc. cit. p. 16		,,	*Empedocles.*
Anisoscelis quadricollis Westw. loc. cit. p. 17		,,	*Leptoglossus.*
,, *fulvicornis* Westw. loc. cit.	,,	,,	,,
,, *fasciata* Westw. loc. cit.	,,	,,	,,
Alydus parvus Westw. loc. cit. p. 19	,,	,,	*Megalotomus.*
,, *rufipes* Westw. loc. cit.	,,	,,	,,
,, *abdominalis* Westw. loc. cit.	,,	,,	*Riptortus.*
,, *torridus* Westw. loc. cit. p. 20	,,	,,	*Mirperus.*
Hypselonotus centrolineatus Westw. loc. cit. p. 21		,,	*Cebrenis.*
Crinocerus affinis Westw. loc. cit.	,,	,,	*Acanthocoris.*
Chariesterus regalis Westw. loc. cit. p. 22	,,	,,	*Paryphes.*

Homœocerus diversicornis Westw. loc. cit.	belongs	to genus	*Savius.*
Coreus varicornis Westw. loc. cit.	,,	,,	*Anasa.*
,, *apicalis* Westw. loc. cit.	,,	,,	,,
,, *bipunctatus* Westw. loc. cit. p. 23	,,	,,	*Cletus.*
,, *rubidiventris* Westw. loc. cit.	,,	,,	,,
,, *punctulatus* Westw. loc. cit.	,,	,,	,,
,, *capensis* Westw. loc. cit.	,,	,,	,,
,, *basalis* Westw. loc. cit. p. 24	,,	,,	*Plinacthus.*
,, *serrifer* Westw. loc. cit.	,,	,,	*Homœocerus.*
,, *tenuicornis* Westw. loc. cit.	,,	,,	*Hydara.*
,, *scutellaris* Westw. loc. cit.	,,	,,	*Clavigralla.*
Gonocerus varipes Westw. loc. cit. p. 25	,,	,,	*Colpura.*
Arenocoris? ægyptius Westw. loc. cit.	,,	,,	*Ceraleptus.*
Pyrrhotes griseiventris Westw. loc. cit. p. 26	,,	,,	*Serinetha.*
,, *obscura* Westw. loc. cit.	,,	,,	*Jadera.*
,, *fraterna* Westw. loc. cit.	,,	,,	*Serinetha.*

Species treated as Synonymic.

Spartocerus bimaculatus Westw. in Hope [Cat. ii. p. 7 (1842).	= *Sephina erythromelæna* [White.
,, *lateritius* Westw. l. c.	= *Spartocera fusca* Thunb.
,, *affinis* Westw. l. c.	= ,, ,,
,, *subfulvus* Westw. l. c. p. 8	= ,, *cinnamomea* [Hahn.
Physomerus affinis Westw. l. c. p. 9	= *Amorbus rubiginosus* Guér.
Myctis punctum Westw. l. c. p. 10	= *Anoplocnemis phasianus* [Fabr.
,, *affinis* Westw. l. c.	= ,, ,,
,, *bicolor* Westw. l. c.	= ,, ,,
,, *fasciatus* Westw. l. c. p. 11	= *Mictis tenebrosus* Fabr.
,, *parallelus* Westw. l. c. p. 12	= *Anoplocnemis pectoralis* [Germ.
,, *apicalis* Westw. l. c.	= ,, *curvipes* Fabr.
,, *horrificus* Westw. l. c.	= ,, *pectoralis* Germ.
,, *religiosus* Westw. l. c.	= *Cossutia flaveola* Dru.
,, *annulicornis* Westw. l. c. p. 13	= *Anoplocnemis westwoodi* [Dist.
,, *ventralis* Westw. l. c.	= ,, *fuscus* Westw.
Pachylis grossus Westw. l. c.	= *Pachylis laticornis* Fabr.
Nematopus ventralis Westw. l. c. p. 14	= *Nematopus nervosus* Lap.
Metapodius bispinus Westw. l. c. p. 15	= *Acanthocephala femorata* [Fabr.
,, *obscurus* Westw. l. c.	= ,, ,,
,, *nigricans* Westw. l. c.	= ,, *consobrina* [Westw.
,, *gemmifer* Westw. l. c. p. 16	= *Petalops azureus* Burm.
Anisoscelis fraterna Westw. l. c.	= *Leptoglossus phyllopus* [Linn.
,, *indocta* Westw. l. c.	= ,, *stigma* Herbst.

Leptoscelis rubro-picta Westw. l. c. p. 17	= *Phthia lunata* Fabr., var.
Stenoscelidea bicoloripes Westw. l. c. [p. 18.	= *Placoscelis fusca* Spin.
Leptocorisa bengalensis Westw. l. c.	= *Leptocorisa acuta* Thunb.
,, *furcifera* Westw. l. c.	= ,, *filiformis* Fabr.
,, *crudelis* Westw. l. c.	= ,, *tipuloides* de Geer.
Alydus ichneumoniformis Westw. l. c.	= *Hyalymenus dentatus* Fabr.
,, *diversipes* Westw. l. c. p. 19	= ,, *tarsatus* Fabr.
,, *affinis* Westw. l. c.	= ,, ,,
,, *obscurus* Westw. l. c.	= ,, ,,
,, *consorbrinus* Westw. l. c. p. 20	= *Megalotomus rufipes* [Westw.
,, *ventralis* Westw. l. c.	= *Riptortus fuscus* Fabr.
,, *undulatus* Westw. l. c.	= *Camptotus lateralis* Germ.
,, *albidens* Westw. l. c.	= *Mirperus torridus* Westw.
Meropachus subluridus Westw. l. c. p. 21	= *Hirilcus gracilis* Burm.
,, *dorsiger* Westw. l. c.	= ,, *variolosus* Burm.
Hypselonotus bilineatus Westw. l. c.	= *Hypselonotus interruptus* [Hahn.
Crinocerus fuscus Westw. (part.) l. c.	= *Acanthocoris scabrator* [Fabr.
,, ,, ,, (part.) l. c.	= ,, *scaber* Linn.
Ceratopachys capensis Westw. l. c. p. 22	= *Homœocerus nigricornis* [Germ.
Coreus parvulus Westw. l. c. p. 23	= *Cletus capitulatus* H.-Schäff.
,, *immaculatus* Westw. l. c.	= *Cletus ochraceus* H.-Schäff.
,, *alternans* Westw. l. c. p. 24	= *Homœocerus pallens* Fabr.
Neides trispinosus Westw. l. c.	= *Jalysus spinosus* Say.
Gonocerus dorsiger Westw. l. c. p. 25	= *Catorhintha guttula* Fabr.
,, *angulatus* Westw. l. c.	= *Sethenira testacea* Spin.
Arenocoris ? tibialis Westw. l. c.	= *Ceraleptus gracilicornis* [H.-Schäff.
Pyrrhotes bicolor Westw. l. c. p. 26	= *Jadera sanguinolenta* Fabr.

Types mutilated and therefore of doubtful position.

Alydus simplex Westw. in Hope Cat. ii. p. 18 (1842).
,, *gracilipes* Westw. loc. cit. p. 20.

EXPLANATION OF THE PLATES.

Plate XXIX.

Fig. 1. *Acanthocephala æqualis*, p. 329.
2. *Amorbus angustior*, p. 328.
3. *Anoplocnemis varicornis*, p. 327.
4. *Melania gracilis*, p. 326.
5. *Amorbus subserratus*, p. 328.
6. *Acanthocoris affinis*, p. 330.
7. *Acanthocephala consobrina*, p. 329.

Plate XXX.

Fig. 1. *Empedocles tenuicornis*, p. 329.
2. *Corizus robustus*, p. 332.
3. —— *vincentii*, p. 332.
4. *Leptoglossus fulvicornis*, p. 330.
5. *Megalotomus parvus*, p. 331.
6. *Serinetha fraterna*, p. 332.
7. *Stenoscelidea albovaria*, p. 329.

2. On some Earthworms from British East Africa; and on the Spermatophores of *Polytoreutus* and *Stuhlmannia*. By Frank E. Beddard, M.A., F.R.S.

[Received April 1, 1901.]

(Text-figures 83–88.)

Contents.

(1) *On some Earthworms from Eastern Tropical Africa in the Collection of the British Museum.*

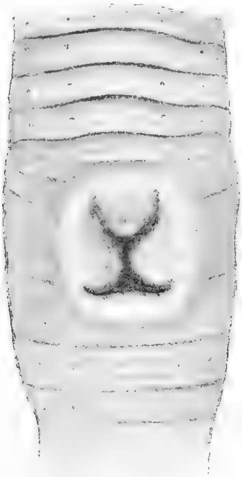
Mr. F. Jeffrey Bell has been so good as to forward to me for identification a number of earthworms which were collected by Mr. L. S. Hinde, C.M.Z.S., at Titui, in elevated country some 3000 or 4000 feet in altitude. The specimens were sent to Prof. Lankester at the Museum, and are of two, possibly three, species. The larger individuals, of which there are three specimens with the head end perfect, belong to the genus *Polytoreutus*, a genus that is, so far as we know at present, peculiar to East and Central Africa; the small worms are referable to the genus *Benhamia*.

Of the larger specimens two at least belong to an undescribed species of *Polytoreutus*; while the third, upon which I shall offer some necessarily brief observations, seems to me not to belong to that species, but to some other which may or may not be new. I shall call the new *Polytoreutus*.

Polytoreutus hindei, n. sp.

The larger of the two specimens, the only one which is absolutely complete, is also fortunately fully mature, with the clitellum developed—so far as I can judge—to its full extent. It measures 130 mm. in length and is a fairly stout worm, having a diameter of 5 mm. The external characteristics of this species enable it to be distinguished from any other species; it seems to bear the closest likeness to *Polytoreutus finni*, to which species its internal anatomy also affines it; but there is no possibility, I believe, of confounding the two species. The present form is, as has been said, a fairly large and stout worm. *Polytoreutus finni* is strikingly characterized by its length and slenderness. Nevertheless the appearance of the area which surrounds the generative pores has a certain likeness in the two species, both of which differ in this respect from other species of *Polytoreutus*. As will be seen from the accompanying drawing (text-fig. 83, p. 337), the ventral area of the seventeenth and eighteenth segments is occupied by an exceedingly prominent sucker-like structure ; this does not stray beyond the limits of the two segments mentioned. Its outline is that of a rounded square, and the walls which surround the central depression are well marked. In *Polytoreutus finni* each pore, both the male and the female, has a similar wall surrounding it. In the present species the two seem to have as it were fused together—a state of affairs which is not in the least due to a greater contraction of the worm, since the clitellar region was not at all contracted. The actual orifices within this area I could not detect, and did not wish to injure the specimen by an exploration. I imagine, however,

Text-fig. 83.



Clitellar region of *Polytoreutus hindei.* × 4.

that the male pore is on segment xvii., a very general position, and that the pore of the spermathecal sac is either on xviii. or just on the verge of xix., *i. e.* that it is placed intersegmentally between segments xviii./xix., also a very general position. This sucker is exceedingly conspicuous, and can be readily seen to bulge ventrally on a lateral view of the worm. It is important to notice that it appears to be fully matured before the clitellum. For in the second specimen, which is only a little more than half the size of that which I have made the type of the new species, there is no trace of a clitellum, but the generative area is quite as well developed. The *clitellum* of *Polytoreutus hindei* occupies segments xiii.–xviii. and is developed all round the body.

Behind the clitellum the next four segments, *i. e.* xix.–xxii., show a ventral thickening such as occurs in *Polytoreutus gregorianus* and

P. kilindinensis[1]. The appearance is very characteristic of those species, and, apparently, of those only. The grooves between the several segments are perfectly distinct. The appearance of this "Pubertätspolster" is indistinct in the figure (text-fig. 83). I could not find a similar structure in *Polytoreutus finni*, between which and *P. kilindinensis* the present species seems to stand.

The *setæ* have the usual arrangement which characterizes the genus, *i. e.* the two setæ of the ventral couples stand apart, while those of the lateral couples are closely paired.

As is the case with some but not all of the species of this genus, the *prostomium* does not in the least impinge upon the buccal segment, but is sharply marked off from it by a transverse groove; the prostomium is in fact what Michaelsen has called "prolobisch." There are of course no *dorsal pores.* The *nephridiopores* are in front of the lateral couples of setæ.

Such are the principal external characters of the present species, which are, I think, sufficient of themselves to establish its distinctness. In internal characters the members of this genus mainly differ in the form of the spermathecal sacs and of the spermiducal glands. The other viscera are not so variable, unless, indeed, the form of the sperm-sacs in different species is really distinctive of them and not merely due to varying stages of development. I am disposed to think, from my observations upon the present species, that the sperm-sacs do offer characters of some use in discriminating the species of *Polytoreutus* from each other.

In describing *Polytoreutus finni*[2] I drew attention to the extraordinary slenderness of the sperm-sacs, which extend like white threads, hardly, if at all, thicker than the sperm-ducts, for some distance backwards. Michaelsen has by a query suggested that this appearance may be due to immaturity—and a reasonable enough suggestion. And yet I am not altogether disposed to agree with him, since in *Polytoreutus hindei* I find precisely the same state of affairs. The two *sperm-sacs* are slender threads which reach back to about the level of the commencement of the spermiducal glands and are swollen here and there like a ganglionated nerve-cord. Now the present specimen is fully mature, as was that of *Polytoreutus finni*, upon which I founded that species. The probabilities appear to me to be in favour of considering the condition of the sperm-sacs as characteristic of the species and not to be due to immaturity. However, the question cannot be settled definitely at present. The sperm-duct is very noticeable in the dissection on account of this thickness, which is fully that of the duct leading from the spermathecal sac to the egg-sac. It has a swollen sac at its beginning, as in the other species of the genus.

The two *spermiducal glands* are white thick tubes of some length; they have not the extraordinary thinness and length that characterizes those organs in *Polytoreutus finni*. Each gland was somewhat bent like an elbow, a feature often shown by these glands in

[1] See Beddard, P. Z. S. 1901, vol. i. text-fig. 50, p. 188, and text-fig. 51, p. 190.

[2] "A Contribution to our Knowledge of the Oligochæta of Tropical Eastern Africa," Quart. Journ. Micr. Sci. xxxvi. p. 241.

Polytoreutus. The two glands open on to the exterior by a median bursa copulatrix of circular outline, which of course underlies the nerve-cord and the end of the spermathecal sac.

A more careful examination of the spermiducal glands shows that they can, like those of *Polytoreutus gregorianus* for example, be divided quite plainly into two regions. The "elbow," already mentioned, marks the boundary-line between these two regions. The proximal part of the gland, *i. e.* that which is nearest to the orifice into the bursa copulatrix, is perhaps one half of the length of the rest. It is oval in form and gradually tapers to a slender tube, which opens into the bursa copulatrix. At the very extremity of the latter, just before its orifice into the bursa, opens the sperm-duct, which is here as elsewhere covered with a thick layer of muscular fibres which dilate the duct to twice the diameter it would have were there no muscular coat, and, of course, thus accounts for its prominence in dissections. The distal part of the spermiducal gland has not the lateral diverticula that occur in *Polytoreutus cœruleus*, according to Michaelsen's figures and descriptions [1]; but it presents some hint of this in a series of irregularly disposed bulgings of the wall of the tube. The bursa copulatrix appears to have a circular contour; but when the upper part into which the spermiducal glands open is pushed aside it is seen to communicate with the exterior by a curved peduncle, so that on a lateral view it appears almost pear-shaped.

The *spermathecal sac* is like that of several species, including *P. kilindinensis* and *P. finni*, in that it has but two diverticula. The median part of the sac is very wide anteriorly and gradually shrinks in diameter until—where it traverses the bursa copulatrix—it is of quite small diameter; from the anterior end two relatively huge lateral sacs are given off, one on each side. These reach back to nearly the point of external opening of the sac. From the underside of each of these, quite hidden until the diverticulum is lifted up, arises the tube communicating with the egg-sac and the oviduct, the arrangement of which parts is as in other species of the genus, there being also a representative of what Michaelsen has termed the "Samenkämmerchen" in *Polytoreutus cœruleus*, &c.

This seminal chamber is a very extraordinary formation. In the specimen which I examined there was but one instead of the four figured in *Polytoreutus cœruleus* by Michaelsen. The single chamber was choked by a mass of ripe spermatozoa (as I interpret the structure in accord with Michaelsen), the tails of which depended into the lumen of the oviduct, while their heads were apparently fixed in the epithelium of the chamber; this recalls the case of the spermathecal diverticula of many Megascolicidæ, where, as I first showed [2], the spermatozoa are confined to the diverticula and are there attached to certain glandular cells.

[1] "Beschreibung der von Herrn Dr. Franz Stuhlmann im Mündungsgebiet des Sambesi gesammelten Terricolen," JB. Hamb. wiss. Anst. vii. pl. i. fig. 10, p. 24.

[2] "On the Specific Characters, &c. of certain New Zealand Earthworms," P. Z. S. 1885, p. 830.

The median part of the spermathecal sac is traversed by two longitudinal blood-vessels, of which one is the ventral blood-vessel and the other a special branch for this part of the body; the two give off branches laterally and have the relations of an artery and a vein.

The interior of the spermathecal sac was filled with a white mass friable, and when broken up of a "curdy" appearance. This when examined microscopically was seen to consist of a granular substance in which I could detect no structure and of multitudinous spermatophores (described below, p. 341).

The immature *Polytoreutus*, to which I have referred, is probably not an example of *P. hindei*. But I am unable to fix its specific identity further. I should have hardly thought it worth while to give any account of this worm were it not for the fact that a study of it enables me to point out that the female generative apparatus is not always developed before the male as I found to be the case in *P. kilindinensis* [1]. In the present specimen the male pore was conspicuous and upon the middle of segment xvii. One of the ventral pair of setæ has disappeared—naturally the innermost one on either side. On the boundary-line between segments xviii. and xix. was the smaller aperture of the spermathecal sac. The ventral pair of setæ were not modified in the neighbourhood of this pore. Internally I could find no trace of the spermathecal sacs. On the other hand, the sperm-sacs were fairly developed and were divisible, as is often the case in this genus, into a thin proximal region and a stout distal region. They originated in segment xii., and the thin part of the sacs did not widen out until the fourteenth segment. At the distal end the two sacs were fused together as in *P. gregorianus* [2]. The terminal apparatus of the male ducts was only represented by a bursa with muscular walls, and of a long and thin form, not a spherical pouch as in *Polytoreutus* generally. It suggested in fact the disconnected bursa of *Stuhlmannia*. If the shape was a transitory embryonic feature, it is of interest; but such a bursa may of course characterize the species.

(2) *On the Spermatophores of* Polytoreutus.

The spermatophores of this genus, the only genus of exotic earthworms save *Alma* [3] known to possess these structures, were discovered by myself in *P. magilensis* [4] and later in *P. violaceus* [5].

In the present species they appear to have a very different general appearance from those of the former species mentioned, but they

[1] "A Contribution to our Knowledge of the Oligochæta of Tropical Eastern Africa," Quart. Journ. Micr. Sci. (n.s.) xxxvi. p. 240.

[2] P. Z. S. 1901, vol. i. p. 193.

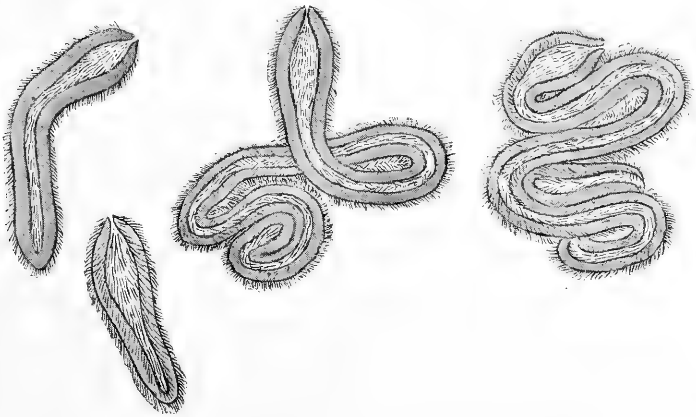
[3] See Beddard, "On the Clitellum and Spermatophores of an Annelid of the Genus *Alma*," P. Z. S. 1901, vol. i. p. 215.

[4] "Two new Genera and some new Species of Earthworms," Quart. Journ. Micr. Sci. (n.s.) xxxiv. p. 250.

[5] "A Contribution to our Knowledge of the Oligochæta of Tropical Eastern Africa," ib. xxxvi. p. 234.

resemble those of *P. violaceus*. The accompanying drawings (text-fig. 84) show their considerable variety of form, which is very striking when a portion of the contents of the spermathecal sac is teased out in glycerine. Claparède[1], as is well known, at first mistook the spermatophores of *Tubifex* for a parasitic organism which he termed *Pachydermon*, a mistake which was later rectified by himself and by Ray Lankester[2]. Had Claparède made his discovery upon the present species, the mistake would have been equally natural. For these remarkable spermatophores, when of large size, are invariably twisted and coiled, precisely like

Text-fig. 84.



Spermatophores of *Polytoreutus hindei*, greatly magnified.

a bunch of parasitic Nematoids, which animals do occur in the tissues of earthworms. The vermiform appearance of the spermatophores is shown in the drawing (text-fig. 84). There are, however, many of the spermatophores which are much smaller, and I have selected a series to illustrate the main varieties which I have observed. The small spermatophores may subsequently grow, though I have noticed no signs of immaturity about them or evidence of any kind that they do grow while within the spermathecal sac.

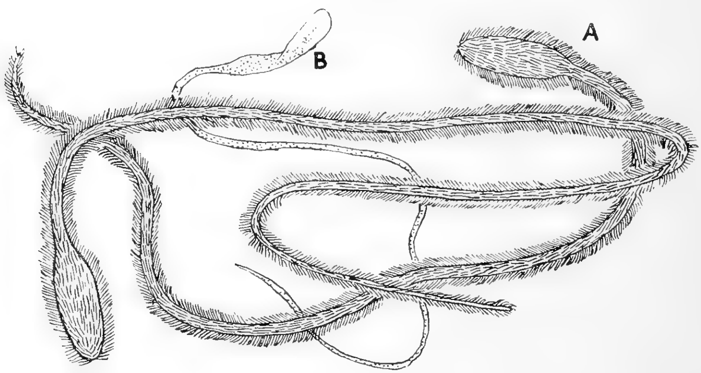
The complicated coils into which some of the spermatophores have thrown themselves seem to me to indicate the strong possibility that they are motile. There is no doubt whatever that the

1 "Études Anatomiques sur les Annélides, Turbellariés, Opalines et Grégarines observés dans les Hébrides," Mém. Soc. Phys. et Hist. Nat. Genève, xvi. 1861, p. 88.

2 "On the Structure and Origin of the Spermatophores or Sperm-ropes of *Tubifex*," Quart. Journ. Micr. Sci. xi. p. 189. For a fuller account of the literature of the spermatophores in the Tubificidæ, see Vejdovsky's 'System u. Morph. d. Oligochæten,' Prag, 1884, p. 151.

spermatophores of *Tubifex* and some of its allies are motile. Many observers have noted this fact. Thus one of the first, if not the first, to note the point, Jules d'Udekem [1], remarked that "ils font quelquefois plusieurs circonvolutions." Before him Budge [2] had described these structures in *Tubifex* or in *Limnodrilus*; and though stating that they bear "cilia" (which are of course the ends of the individual spermatozoa) did not comment upon their motility as a whole. Gegenbaur in his 'Grundzüge' records the movement of these spermatophores. Claparède [3] observed that "ils agitent leurs cils longs à la manière des Dicyema, mais ne changent que peu de place. Leur pouvoir de locomotion paraît assez limité." On the other hand, in *Psammoryctes umbellifer* (or *P. barbatus* as it apparently should be properly called) Lankester [4] noted a movement of great rapidity which resulted in the description of "a figure of eight passing and repassing on the same track." The enormous quantity of the spermatophores within the spermathecal sac is very noteworthy and a difficult fact to understand. It must be borne in mind, however, that *Polytoreutus* produces a considerable quantity of eggs, while the Tubificidæ, in whose spermathecæ there is but room for a few spermatophores, have large-yolked and few eggs.

Text-fig. 85.



Spermatophores of *Polytoreutus magilensis*, greatly magnified.
A, fully mature spermatophore; B, an empty case.

My original drawings of the spermatophores of *Polytoreutus magilensis* do not do entire justice to their remarkable form in that species, though the sketch given is quite an accurate representation of a spermatophere. I therefore exhibit some sketches (text-fig. 85) which will enable the spermatophores of the two species

[1] "Histoire naturelle du Tubifex des Ruisseaux," Mém. cour. et Mém. des Sav. étrang. Acad. Belg. xxvi. p. 26.
[2] "Ueber die Geschlechtsorgane von *Tubifex rivulorum*," Arch. f. Naturg. xvi. 1850, p. 7.
[3] *Loc. cit.* [4] *Loc. cit.*

to be compared together. Up to the present these and *P. violaceus* are the only three species of the genus in which they have been discovered. I have re-examined *P. gregorianus* and *P. finni* in the hope of finding spermatophores, but quite in vain. The matter would be of obvious interest, since it is clear from the drawings exhibited that the two species with which I am concerned in the present communication can be amply discriminated by their spermatophores alone. In *P. magilensis* they are all of the same form and vary only in their length, which is in some cases (see text-fig. 85, p. 342) considerably in excess of the length which I originally figured. The spermatophore is extremely thin in proportion to its length, and is expanded invariably at one end into a spoon-shaped head. It dies away at the other end to a fine point. The body throughout is closely beset with a fine covering of spermatozoa, and I cannot but doubt that these spermatophores also are mobile during life. But they were not twisted into the tight coils so characteristic of those of *P. hindei*. The relative sizes and the differences in structure can be gathered from the sketches (text-figs. 84 & 85).

In originally describing these spermatophores I commented upon their likeness to immature spermatophores in *Tubifex*, and thought that they might be in a state of immaturity. However, the occurrence of abundant spermatophores of precisely the same form in a second individual of the same species which I record here seems to me to do away with that possibility. Furthermore, there were no intermediate stages which would suggest a development of the theoretically immature spermatophores of *P. magilensis* into fully formed ones like those of *P. hindei* and *P. violaceus*. All the spermatophores—a very large number and, as I have already stated, from two individuals—were at precisely the same stage, which must be therefore, I should imagine, their definitive stage. Among the fully-formed spermatophores were a number (text-fig. 85, B) which had lost their contents, and were simply empty sacs, more or less hyaline in character, and preserving the exact form of the uninjured spermatophore. This material was not suggestive of the granular matter figured by Vejdovsky in the immature spermatophore of *Tubifex*, which he ascertained to proceed from the secretion of the cement-gland or at least from the atrium of that worm. It appears to me, in fact, that the spermatophores of *Polytoreutus magilensis* are really constructed on the same plan as those of the two other species of the genus in which they occur, but that the actual case of the spermatophore is much more slender and thus the spermatozoa project much further out. The result is an entirely different aspect, which is well shown in the drawings exhibited herewith. As to the spermatophores of *Polytoreutus violaceus* and *P. hindei*, their close likeness to those of the Tubificidæ other than *Bothrioneuron* is very striking, and applies to details of structure. Very often, though not in every case, the anterior end of the spermatophore, which is sometimes slightly swollen, was distinctly open, as shown in the drawings (text-fig. 84, p. 341). This peculiarity has been lately figured by Vejdovsky[1] in *Tubifex blanchardi*, a species of that genus discovered in Algeria. Among the exceedingly numerous spermatophores of *P. hindei* and *P. violaceus*, I did not discover any intermediate forms which were suggestive of immaturity. The shorter spermatophores I do not regard as immature, as they possess the same layers and are of equal thickness with the largest. I have been able to find no evidence at all of a conclusive nature as to the site of the formation of these spermatophores in the genus *Polytoreutus*, so remarkably like those of *Tubifex*, *Limnodrilus*, *Psammoryctes*, &c. Frequently the spermatophores could be observed imbedded among the tall columnar cells of the spermathecal sac, which has bowed right and left to make way for them. But in such cases there was no organic fusion between the cells and the spermatophores suggestive of their origin from these cells.

It is interesting to note that an earthworm has now been shown to possess spermatophores which agree in all essentials, and even further, with the spermatophores of the Tubificidæ. On the other hand, Stolc has shown in *Bothrioneuron vejdovskyanum*[2]—and I have been able to confirm his results in another species of that genus, *B. iris*[3]—that a Tubificid may possess spermatophores essentially like those of a Lumbricid. These two series of facts further break down—if any more destruction is necessary—the old division of the Oligochæta, devised by Claparède, into Limicolæ and Terricolæ. It is difficult, however, to understand why the form of the spermatophores should be so different in earthworms. It is true that many African forms—possibly including the species which is the subject of the present communication—are aquatic, unlike the majority of earthworms. But so are such genera as *Alma* and *Criodrilus*, which possess spermatophores of a different form. The difficulty would be got over were it certain that the spermatophores were invariably formed in the spermathecæ. But it appears on the whole that their elongated form and at least the central axis is a product of the spermiducal glands in *Tubifex*, and, according to Lankester, the bulk of the outer case is also a derivative of the epithelium of the atrium or of the cement-glands.

That they are moulded in the spermathecæ seems to be proved by Lankester's researches. There is, however, at present no evidence of a like formation for the spermatophores of *Polytoreutus*. They are, moreover, so totally different from the spermatophores of an allied genus of earthworms, *Stuhlmannia*, which I shall describe immediately and of which I shall indicate the probable origin, that the place of their formation seems hardly likely to be the same.

(3) *On the Spermatophores of* Stuhlmannia.

The site of the formation of the spermatophores in the Order

[1] "Note sur un Tubifex d'Algérie," Mém. Soc. Zool. France, 1891, p. 1.

[2] "Mongrafie Ceskych. Tubificidu," Abhandl. Böhm. Ges. vii.

[3] "On an Aquatic Annelid of the Genus *Bothrioneuron*, &c.," P. Z. S. 1901, vol. i. p. 81.

Oligochæta has been much debated, and is, perhaps, not yet settled in all cases. It seems clear, however, that in such Lumbricids as *Allolobophora constricta*[1], *Alma stuhlmanni*[2], and, among the aquatic forms, the Tubificid *Bothrioneuron*[3], the spermatophores must be formed by the glandular tissue which envelops the exit of the sperm-duct on to the body-wall, since not one of these forms possesses either spermathecæ or tubercula pubertatis, which have been set down by various authors as the seat of their manufacture. Even in those genera of Oligochæta which do possess either spermathecæ or tubercula pubertatis, or both, there is not always substantial evidence in favour of assigning to one or other of these two structures the duties of the production of spermatophores. Thus the comparatively narrow lumen of the terminal enlargement of the male efferent apparatus in *Tubifex*[4] and its allies seems better suited to mould the elongated spermatophores of these Annelids than are the comparatively capacious spermathecæ. So too with the genus *Polytoreutus*, which possesses spermatophores, as I have just pointed out, of pretty nearly the same characters as those of the Tubificidæ: its extensive spermiducal glands with their narrow lumen is, at least on *a priori* grounds, admirably suited for the formation of the spermatophores, while the enormously capacious spermathecal sacs are distinctly not.

Nevertheless there are facts which seem to show that the spermatophores of many Tubificidæ are—at any rate largely—produced by the activity of the epithelium lining the spermathecæ. Lankester pointed out that in *Tubifex rivulorum* there was frequently to be observed a ridge round the "head" of the spermatophore, the form of which corresponded exactly with the contour of the distal end of the spermathecæ where it debouches on to the exterior; spermatophores were even found at this spot fitting into the short diverticula on either side of the end of the spermatheca, which is of course strong evidence of their having been moulded *in situ*. The same author mentioned in support of his opinion the fact that in *Psammoryctes barbata*, where the end of the spermatheca has no such crumplings, the spermatophores have not the peculiar head of those of *Tubifex rivulorum*—a fact which subsequent investigations upon *Psammoryctes barbata* have fully borne out[5]. At the same time, not all the spermatophores of *T. rivulorum* have this peculiarity of form; and it is remarkable that in the Algerian *Tubifex blanchardi*, whose spermathecæ are stated by Vejdovsky[6]

[1] "Sull' Assenza dei Receptacula Seminis in alcuni Lumbricidi," Boll. Mus. Zool. Torino, iv. No. 71, Nov. 1889.

[2] P. Z. S. 1901, vol. i. p. 217.

[3] "Monografie Ceskych. Tubificidu," Abhandl. Böhm. Gesells. vii. 1888; Beddard, P. Z. S. 1901, vol. i. p. 81.

[4] "On the Structure and Origin of the Spermatophores or Sperm-ropes of two Species of *Tubifex*," Quart. Journ. Micr. Sci. xi. p. 180.

[5] Vejdovsky, "Ueber *Psammoryctes umbellifer* (*Tubifex umbellifer* E. R. Lank.) und ihm verwändte Gattungen," Zeitschr. wiss. Zool. xxvii. p. 137; Stolc, *loc. cit.* pl. iii. fig. 14.

[6] "Note sur un Tubifex d'Algérie," Mém. Soc. Zool. France, iv. p. 1.

to be like those of *T. rivulorum* (though he enters into no detail in the matter), spermatophores with sharply marked-off heads are not figured, the utmost being an oval swelling at that end of the spermatophore. The one positive fact, however, seems to be of more value than these negative discoveries. Prof. Lankester does not assert that the spermatophores are actually formed in the spermathecæ; he is of opinion that while the epithelium of those pouches "furnishes a secretion which occupies part of its cavity and in all probability also assists as a cementing material in the formation of the sperm-ropes," it is probable "that the bulk of the cementing material is introduced into them with the spermatozoa from the male organs of another worm." It is mainly the moulding and hardening which, according to Lankester, is accomplished in the spermatheca. On the other hand, Vejdovsky[1] leans towards the view that the axial core of the spermatophore is the result of the activity of the spermiducal glands in the Tubificidæ, while the transparent sheath is a product of the epithelium of the spermathecæ—a view mainly based upon the fact that immature spermatophores without the outer sheath are found in the spermathecæ, and that a secretion enveloping and binding together the individual spermatozoa has been detected in the spermiducal glands. Vejdovsky would thus divide the labour of producing the spermatophores between the terminal portion of the male efferent apparatus and the spermathecæ; but would assign the most characteristic and important part of the spermatophore to the activity of the spermathecal epithelium.

I do not venture to dispute this view, as I have no new facts to urge either in its favour or against it; but I may point out that any actual secretion of the case of the spermatophore by the spermathecal epithelium has not been described. It is true that Nasse[2] has stated that during the epoch of sexual maturity the epithelium of the spermathecæ undergoes a change and partly breaks down into or secretes a fluid substance, which he compares in its nature to the spermatophore-case. On the other hand, the spermathecæ of many earthworms show the same features at the time of ripeness, and in them there is no question, apparently, that the spermatophores are *not* formed in the spermathecæ. Vejdovsky considers this as "höchst wahrscheinlich"; but adds that the spermatophores of *Limnodrilus hoffmeisteri* and of *L. claparedianus* might settle the question, as their spermathecæ possess glandular cells which are coloured with a granular pigment. The spermatophore of the latter species has been since described by Stolc; but it is not apparent from his figures that there is any pigment in the hyaline sheath of the structure. Neither does Vejdovsky again allude to the matter in his later account of the spermatophores of *Tubifex blanchardi*. In the meantime therefore the actual source of the materials employed in the manufacture of the spermatophores in those worms cannot be entirely traced.

[1] System u. Morph. d. Oligochæten, Prag, 1884, p. 153.
[2] Beiträge zur Anatomie der Tubificiden, Inaug.-Diss., Bonn, 1882.

The case is, I believe, different with the spermatophores of an earthworm which it is the object of the present paper to describe. The species upon which my observations were made is of the genus *Stuhlmannia*, an East-African Eudrilid whose general anatomy was detailed some years since by Michaelsen. I am in possession of a quantity of examples of that worm which are in an excellent state of preservation for microscopical work. This Annelid, like other Eudrilidæ, has no true spermathecæ like those of the majority of earthworms, unless, indeed, the actual external orifice of the pouches and the epithelium which passes from the epidermis of the body-wall for a short way into the interior be regarded as the equivalent of the spermathecæ; it has capacious sacs which are probably (in other forms of Eudrilidæ certainly) formed by the peritoneal epithelium, and whose cavities therefore are cœlomic. They are lined throughout by an epithelium of tall columnar cells, whose characters I shall attend to in detail immediately. In the spermathecæ are frequently to be found masses of spermatozoa which are not compacted together by any cementing material apparent on staining, but which seem to be perfectly free and floating spermatozoa. This was the case with some examples which I studied. In two or three were these masses of spermatozoa compacted into spermatophores, which are always contained in the median sac[1].

The spermatophores of *Stuhlmannia* differ from those of any other Oligochæta whose spermatophores are known. Their characters are somewhat intermediate between the two types which these organs present in the Order. It will be recollected that in the Lumbricidæ, in *Criodrilus*, and in *Alma* the spermatophores are chitinous cases open at one end, but quite impervious elsewhere, of not very elongated form, which are found attached to the body-wall of individuals belonging to these genera in the vicinity of the generative pores. To this type belong also the spermatophores of one genus of Tubificidæ, *Bothrioneuron*, which has essentially similar spermatophores, and which, in accordance with their structural resemblance to those of the Lumbricidæ and the other genera mentioned, are attached to the body superficially. On the other hand, in the Tubificidæ (*Tubifex*, *Limnodrilus*, *Psammoryctes*, *Clitellio*), and in the genus *Polytoreutus* among the Eudrilidæ, the spermatophores are elongated structures, with often an aperture at one end, and always with the ends of the spermatozoa projecting through their chitinous (?) walls. These spermatozoa are capable of individual movement, which results in a movement as a whole of the spermatophore. They are invariably found in the spermathecæ. Of the first kind of spermatophores, it is certain now that they are formed by the epithelium surrounding the terminal male efferent apparatus. The second kind of spermatophores seem to be, in the case of the Tubificidæ at least, moulded in the spermathecæ, though the precise nature of their origin is

[1] See below (p. 351) for a description and figures of these sacs.

not completely ascertained; in *Polytoreutus* there are no facts which prove one or the other origin for these structures. The spermatophores of *Stuhlmannia* are very large; the largest which I measured was fully 3 mm. in length, and it must be noted that the diameter of the worm in which it occurred was only 2 mm. The spermatophore, therefore, has to lie longitudinally in the spermathecal sac.

Text-fig. 86.

Spermatophore of *Stuhlmannia*, greatly magnified.

The form of the spermatophore is illustrated in the drawing (text-fig. 86). It is not by any means unlike a cestoid worm, for which, indeed, for a moment I mistook it. The strongly pronounced "head" and the bag-like body widening irregularly is very like the immature stage of those parasitic worms. The shape is not, however, suggestive of that of any other spermatophore with which I am acquainted, either at first hand or by descriptions. It has the length of the longest spermatophores of *Polytoreutus*, but the wideness and bulk generally of the spermatophores in the

Lumbricidæ. The head-end is in several respects reminiscent of the corresponding region of the spermatophore of *Tubifex rivulorum.* There is a terminal beak, which is followed by a thick collar, after which the—at this part narrow—spermatophore gradually widens out into the bag-like posterior region. The spermatophores are so bulky that there is only room for two in the large spermathecal sac; at least I have not seen more than two, though the sac might accommodate perhaps three with some little difficulty. In every case the mouth of the spermathecal sac was plugged with one spermatophore, while another lay further up the sac and not in contact with the first spermatophore. Lankester, as I have already mentioned, found in *Tubifex rivulorum* that the head of the spermatophore was moulded by the terminal part of the spermatheca; he proved this not merely by the correspondence in form, but by the actual occurrence of a spermatophore with the projections of the head fitting into the lateral depressions of the spermatheca. I find precisely the same thing in these spermatophores of *Stuhlmannia.* The wing-like processes of the head fit into concavities and on to convexities on the walls of the spermathecal sac with great accuracy, while the beak-like anterior termination of the spermatophore corresponds to the narrow terminal duct of the sperm-receptacle. There can be, therefore, in my opinion, but little doubt that this part of the spermatophore at least is moulded by the form of the spermathecal sac. The rest of the spermatophore also shows evidence of being moulded by the spermathecal sac. The sac is narrower at first and then widens out. In the same way the spermatophore is narrower at first and afterwards becomes broader. Its diameter is throughout not far short of the sac in which it lies.

The only alternative locality for the formation of the spermatophore in *Stuhlmannia* is the spermiducal gland, or possibly the unpaired muscular sac which opens on to the exterior in relation to the spermiducal glands. But the lumen of neither of these organs has anything like the requisite breadth for the inclusion of the fully formed spermatophore, which cannot therefore, so far as I can see, be possibly moulded in its entirety anywhere save in the spermathecal sac. This, however, is not tantamount to saying that the spermatophore is altogether formed in the spermathecal sac. But before discussing the actual place of its origin, the rest of its structure must be dealt with. The walls of the spermatophore are much thicker at the collar region than elsewhere: in front of the collar the thin and narrow beak has thin walls, and is widely open at the end. This, it must be remembered, is the end which is turned towards, and indeed is not far from, the external orifice of the spermathecal sac. In examining closely with a high power the end of the spermatophore, I observed a stream of spermatozoa which had evidently issued from the open mouth. Why this apparent waste takes place I do not know, but that it must under normal circumstances take place is clear from the width of the mouth, which is not narrow enough to keep the active spermatozoa safe inside. In having this open end the spermatophore of *Stuhlmannia* agrees with the spermatophores of all (?) other Oligochæta. The walls of the spermatophore behind the thickenings at the neck are thin; their constitution suggests that they are not hardened in the specimens which I have examined. The walls are of a granular appearance, being compacted entirely of smaller and larger, more or less obvious, granules, some of which are more, and others hardly at all, stained by borax-carmine. The spermatozoa within the spermatophore closely fill the case, and for the far greater part, if not entirely, lie with their long axes parallel to the long axis of the sac. At the head-end, but after the beak-like process in which the spermatophore terminates in front, there are a quantity of greenish-black granules imbedded in the walls of the spermathecal sac. I have always seen these pigmented granules in the spermatophores, and with equal constancy at the head part and nowhere else. The point is of some little importance, as will be seen presently. Although the interior of the spermathecal sac is densely packed with spermatozoa, they do not protrude anywhere through its walls. In this characteristic the spermatophore of *Stuhlmannia* is more like those of the Lumbricidæ than those of the Tubificidæ, or its near ally *Polytoreutus*. Its soft and collapsible looking walls are, however, different from the hard chitinous cases of the spermatophores of *Lumbricus*, *Criodrilus*, *Alma*, and *Bothrioneuron*. It may, however, on looking back at its various characters, be regarded as intermediate in form and structure between the two types of spermatophores which I have briefly detailed above.

The question now arises,—Is the wall of the spermatophore formed out of materials provided by the spermathecal sac or does this material, as it does at least to some extent in *Tubifex* and its allies, reach the interior of the spermathecal from some other source, such as the spermiducal glands? It seems to me that the evidence, as I read it, points to a double origin for the material of the walls of the spermatophores. I have already briefly called attention to the granular and apparently soft walls of the spermatophore. An examination with high powers of the microscope shows that among the irregular granules of which the wall is mainly composed behind the neck are bodies which seem to be of the nature of nuclei. I cannot in fact distinguish them from the nuclei of the elongated and irregularly shaped cells of the lining membrane of the spermathecal sac. The size, general shape, and reaction to the staining reagent were identical in both cases, while the cells of the inside of the spermathecal sac were evidently undergoing some breaking up. I may remark at this point, that some observations of Dr. Michaelsen support this interpretation of the characters of the wall of the spermatophore.

Dr. Michaelsen[1] noticed constantly in the spermathecal sac of

[1] "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar und dem gegenüberliegenden Festlande gesammelten Terricolen," JB. Hamb. wiss. Anst. ix. p. 27.

this worm a peculiar compact body, "whose structure I was unfortunately unable, on account of the unfavourable preservation of the material, to understand. The whole interior of this body appeared to be formed of a structureless granular mass. An outer . . . . layer encloses this mass. This *outer layer seemed to me to possess a cellular structure*"[1]. Michaelsen then suggested the possibility that this body was an embryo—a by no means unnatural suggestion in view of its size and appearance in a badly preserved specimen. I emphasize, however, the remark that the outer layer appeared to be of a cellular nature; as this opinion was no doubt founded upon the observation of the deeply staining bodies, which, I think, must be the nuclei of the cells lining the spermatheca. I am far from asserting, however, that the outer case of the spermatophore is a layer of living cells. This may be so; but in the meantime I should regard it rather as produced by the broken down débris of the cells of the spermatheca, including liberated nuclei, all of which will possibly lose their characters as the spermatophore gets riper. The facts, however, so far do not permit, as I think, of a decisive statement of opinion. So far, then, the case of the spermatophore appears to be a product of the spermathecal sac where it is found. At the head-end of the spermatophore the case is filled with the dark granules already mentioned, which are particularly thickly clustered along the narrow beak. The cells of the spermathecal sac contain no granules of this character. They are like those of the chloragogen cells; but in this particular worm I noticed no chloragogen cells which might serve to explain the origin of the granules. The only place where there were cells filled with such granules were the innermost layer of cells of the spermiducal gland.

The evidence seems to me therefore to be strongly in favour of the view that the wall of the spermatophore in the head-region is derived from materials existing in the spermiducal glands. The final plug of granular matter must therefore be added after the spermatozoa have been injected into the spermathecal sac from the male orifice. There is a remarkable analogy here with the (or *a*) supposed use of the prostatic fluids in mammals. It has been held that it serves as a plug to retain the sperm in the female organs, and it may apparently harden into a definite plug useful for that purpose. The use of spermatophores of the type described here may be largely to prevent the sperm from wandering and from finding its way out of the receptacle intended for its storage. But it must be remembered that we are at present in absolute ignorance of the way in which fertilization is effected in these Annelids.

(4) *On the Ovaries, Oviducts, and Sperm-ducts of* Stuhlmannia.

Although the main features in the structure of this Eudrilid genus have been amply elucidated by the careful observations of

[1] The italics are mine.

Michaelsen [1], which I am able to confirm, there remain one or two points, in addition to the structure of the spermatophores, which he has not treated of so exhaustively. It is to these that I desire to call attention in the present communication.

I have pointed out myself that there is often in the species *S. variabilis* [2], to which my present observations appear to apply, a curious asymmetry of the reproductive organs resulting in the entire disappearance of one of the two receptacula ovorum. The same asymmetry in examples which I have examined by microscopical sections has involved the ovary, there being in at least one specimen but a single ovary which corresponds to the receptaculum ovorum, both being those of the left side. The ovary itself I have succeeded in finding.

Michaelsen's description does not exactly apply to these gonads in the worms which I have examined. His account of the matter, translated, is as follows:—"From the bottom of the sacs [which enwrap the intestine] stretch out small lobulated cell-masses into the lumen of the tubes. These cell-masses stain in picrocarmine with more intensity than the epithelium cells of the walls [of the tube], and can only be regarded as ovaries. This interpretation is supported, apart from their appearance, by their position. The wide atrium extends beyond the level of its external opening forwards, and the point of origin of the two sacs lies anteriorly in the thirteenth segment; thus the cell-masses contained in it lie in the position where the ovaries are normally found among earthworms." There is no suggestion that Michaelsen's second species of *Stuhlmannia*, viz. *S. gracilis*, differs from the type species in this point.

Now I find that the single ovary—I found but one, as already stated—is contained in a special forward diverticulum of the terminal atrium of the female spermathecal system, which is in connexion with the two sacs which surround the gut, but is quite distinct from them as a special outgrowth of the complex system of sacs which constitutes in this worm the spermathecal sac. This small forward diverticulum nearly, but not quite, touches the septum dividing the two segments xii./xiii. At the very end the walls of the sac are slightly imperfect so that the tissue of the base of the ovary is there free; it is not, however, in contact with the septum. The appearances suggest that the ovary has been, so to speak, forcibly torn away from the septal wall by the growth of the sac which has surrounded it. It is important to notice the distinctness of the ovarian sac from the rest of the spermathecal apparatus, since in *Eudrilus* and in other forms a longish duct intervenes between the sac which contains the ovary and the external orifice of the spermathecal sac. The ovarian

[1] "Beschreibung der von Herrn Dr. Fr. Stuhlmann auf Sansibar und dem gegenüberliegenden Festlande gesammelten Terricolen," JB. Hamb. wiss. Anst. ix.; and "Die Regenwürmer Ost-Afrikas," in Deutsch-Ost-Afrika, iv. p. 23.

[2] A Monograph of the Oligochæta, Oxford, 1895. It must remain for the present uncertain whether this species is really *S. variabilis*.

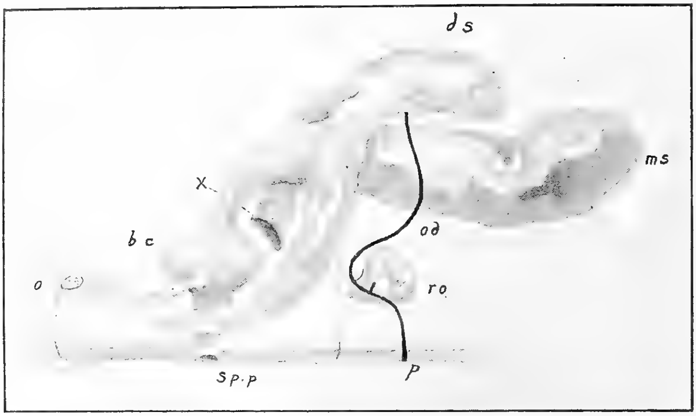
tissue was not much in amount, and I detected no ripe ova therein; but there were cells far on the way to become ova. This gonad, in fact, as always, contrasts with the testes, where the germinal cells are loosened and float into the sperm-sacs before undergoing much development. I direct attention to the diagrammatic sketch (text-fig. 87, p. 354) of the complicated female reproductive system of this Annelid, which has not been figured. It will be noted that the cells from the ovary of the thirteenth segment have to travel an exceedingly devious course to reach the receptaculum ovorum, where, according to current views, they complete their development. The passage would have to be through the terminal atrium to one of the circumœsophageal spermathecal sacs, and then through one of the two ducts only leading thence to the receptaculum ovorum by way of the oviducal funnel.

The alternative view is to suppose the transport of the ovarian cells at a period before the spermathecal sacs are established. But it is not easy to suppose that in such an immature condition the reproductive products would be sufficiently ripe; and if they were, why should so much be left behind? I am disposed to resume an hypothesis which I advanced some years ago [1], and which was stoutly combated by Dr. Horst [2], but is accepted by Dr. Eisen [3], viz., that the contents of the receptaculum ovorum are an ovary, a second ovary belonging to the fourteenth segment which has become evolved in the septal sac which is the receptaculum. At the time that Dr. Horst wrote, the existence of two pairs of ovaries and ducts in the embryo *Octochætus* [4] was not known, nor the double oviducts of *Lumbriculus*. These and a few other examples show that there is no *a priori* objection to two pairs of ovaries in an Oligochæte. It is permissible to attempt to show a *prima facie* case for the enquiry; but I hope to bring forward actual facts in support of the contention. Two ovaries might exist without the presence of two pairs of oviducts; but it is not necessary to weaken the position by allowing only a single oviduct which alone exists in *Eudrilus*. *Stuhlmannia* seems to me to have the requisite two pairs of oviducts. The receptaculum ovorum has no communication with the body-cavity or with the outside world except through the oviducal funnel; this is much plicated, and enters nearly every one, if not all, of the chambers into which the receptaculum is divided. Immediately after the funnel narrows into the oviduct it divides into two branches, neither of which is appreciably thicker than the other. I can find no "Eitrichterblase," as Michaelsen terms it. As is shown in the accompanying figure (text-fig. 87, p. 354), one branch runs to the body-wall and opens upon the exterior in the xivth segment in the usual way that the oviducts of earthworms open. The other branch has a rather longer course, and, passing fairly straight,

[1] P. Z. S. 1887, p. 376.
[2] Mém. Soc. Zool. France, 1890.
[3] Proc. Calif. Acad. Sci. ii. No. 2, 1900.
[4] Beddard, Quart. Journ. Micr. Sci. xxxiii.

without windings, opens into the spermathecal sac above the alimentary canal, just at the point where the two sacs surrounding the gut coalesce. The mode of its opening is, however, important for description. The duct, I may say in the first place, has a minute structure which is very similar to that of the part of the oviduct which runs from the funnel to the exterior. It is ciliated

Text-fig. 87.



Semidiagrammatic representation of the female generative system of *Stuhlmannia*. × 6.

bc, bursa copulatrix; *ds*, dorsal prolongation of spermathecal sac; *ms*, median region of the same; *o*, ovary; *od*, oviduct; *p*, oviducal pore; *sp.p*, spermathecal pore; ×, cut end of spermathecal sac.

for a short way below, but higher up appears to lose its cilia. It is lined, however, with cubical cells, and has a thickish muscular wall. The sac into which it opens is of a very different nature: the cells which line it are tall and glandular-looking; it is thus easy to demarcate the orifice of the tube where it opens into the sac. At this point the lower epithelium of the duct is spread out for a short distance round its actual orifice in a fashion quite reminiscent of the funnel of some of the lower Oligochæta; more than this, the cells were ciliated in this region.

As to the ciliation as a criterion of the oviducal nature of the duct, it is apparently not necessary to insist upon it. Eisen distinctly states that the oviduct, the undoubted oviduct of *Eudrilus*, is not ciliated; and Horst did not find cilia everywhere. Now it must be borne in mind that the sacs of the spermathecal apparatus belong to the xiiith segment. Their enormous development causes a growth backwards; but nevertheless the orifice of the mouth of the tube must be placed in the xiiith segment. I cannot in fact explain the structure of this part of the egg-conducting apparatus except on the view that we must look upon the tubes illustrated in the figure as two oviducts with two funnels, each of which funnels will then correspond to one of the two ovaries. The tube which opens into the sac is clearly continuous at the other end with the oviduct which leads to the exterior. It is as clearly not a diverticulum of the spermathecal sac, so different is the histological structure of the two. The only view that I can take of it is to put it down as a second oviduct which unites with the other, as the two sperm-ducts unite on their way to the exterior; the inappropriate position of the two funnels, which seems to militate against such a view, may be fairly explained by the growth of the enormous spermathecal-sac system.

I would further point out that the funnels of the oviducts which open into the receptaculum ovorum look backward; they are absolutely turned round, and the tube leading to the exterior starts from the front of the funnel and not from behind it, as is normal in Oligochæta. The same is the case with the presumed funnel of segment xiii., corresponding to the only funnel of segment xiv. The fact that the second (presumed) funnel of segment xiii. looks forward may be perhaps put down to the disappearance of the ovaries and of the receptacula seminis of that side of the body, a fact which has already been referred to. It has retained or reverted to what is presumably the ancestral condition. On the opposite side of the body to that which I have just described, there is no receptaculum ovorum and apparently no ovary; but of this latter fact I cannot be so certain as I am about the former, of which, indeed, there is not the slightest doubt. It became a matter of interest therefore to ascertain what were the conditions of the oviduct. At its orifice into the spermathecal sac above there was no difference whatever. The tube, expanding into what I consider to be a funnel anteriorly, left the sac as a tube in which I did not detect cilia until it arrived at the level of the missing receptaculum. At this point—where I could not find the least vestige of a receptaculum—the tube passed without any change of calibre into the ciliated region, which I traced, not absolutely, but very nearly, to the exterior. The two tubes made one continuous tube with the same low columnar epithelium and thick muscular walls, and without any more vestige of a second funnel than there was of a receptaculum. Both of the two structures have absolutely vanished. We have thus on the left side of the body a single tube of quite different histological structure to, but leading from, the cœlomic pouch, which constitutes the spermatheca of this worm, to the exterior.

This arrangement of the oviduct is not, however, peculiar to *Stuhlmannia*. In *Lybiodrilus* the oviduct divides before the tube ends in its funnels. One branch opens by the usual funnel into the receptaculum, the other into the spermathecal sac. Neither funnel is large, and I could not see any ciliation in either. I find that my account of *Hyperiodrilus* and *Heliodrilus* [1] is not quite accurate as regards the relations of the oviducal funnels.

[1] "On the Structure of two new Genera of Earthworms, &c.," Quart. Journ. Micr. Sci. xxxii. p. 235.

In both genera the oviduct gives off a branch before it ends in the funnel lying inside the receptaculum ovorum which opens into the spermathecal-sac system near to the position occupied by the ovary of its side. The two funnels are, as in *Lybiodrilus*, not very different in size, a feature in which they both contrast with *Stuhlmannia*, where the funnel opening into the receptaculum is enormous and explores every nook and corner of that sac. In *Alvania*[1] I find, on a reconsideration of my preparations, an identical arrangement. I may mention, with regard to this latter genus, that the cæcum of the oviduct, which I described as being visible in sections, is not an abnormality, as I thought at first, after ascertaining its presence, that it might be. For it also exists in *Hyperiodrilus* and *Heliodrilus*—a further reason, I must admit, for uniting these three genera, as has been done by Michaelsen. The same condition appears to exist in other Eudrilidæ, as I judge from certain figures. Thus I am disposed to believe that the tube lettered "*os*," in Rosa's figure[2] of the female organs of *Paradrilus rosæ*, is the oviducal tube opening into the cœlomic sac of the spermathecal system. Possibly also the tube lettered "*sg*" by Michaelsen[3], in his sketch of the genitalia of *Unyoria papillata*, is of the same nature. In his original description of *Stuhlmannia*, Michaelsen notes the opening of the oviducts into the spermathecal sac. He does not, however, state explicitly that there are two funnels, only referring to the fact that the oviduct is provided laterally with a receptaculum. In his later and more detailed account of the species, Michaelsen speaks of a funnel situated in the "ovarialblase." The latter paper deals in an appendix with the comparative anatomy of the "Teleudrilinen," a group afterwards abandoned by the author, which contained only those forms with unpaired generative orifices. In that review of the anatomical characters the author mentions in an isolated sentence that "Bei Platydrilus kommuniziert die Samentasche durch je einen Kanal mit den beidern Eileitern." In other cases he speaks of the "Eitrichterblase," by which term the somewhat swollen muscular coat at the junction of the two branches of the oviducts and the tubes themselves are described. The term tends rather to imply a distinct structure, and does not appear to me on this account to be quite appropriate.

I hope that the diagram (text-fig. 87, p. 354) given with this description may render the relations of the oviduct to the cœlomic spermathecal clear in *Stuhlmannia* and some of its allies.

It will be obvious from the foregoing that, whatever view be taken of the homologies of the parts concerned, many, if not all, of the more complex forms of Eudrilidæ undoubtedly possess two oviducal funnels.

[1] "Two new Genera and some new Species of Earthworms" Quart. Journ. Micr. Sci. xxxiv. p. 271.

[2] "Die exotischen Terricolen des k.-k. naturhistorischen Hofmuseums," Ann. k.-k. nat. Hofm. 1891, pl. xiv, fig. 13.

[3] "Die Regenwürmer Ost-Afrikas," in Deutsch-Ost-Afrika, iv. pl. ii. fig. 24.

In many earthworms, for example in *Sparganophilus* [1], the oviducal funnel opens partly into the xiiith segment, but the greater part opens into the egg-sac behind. It might be held that the Eudrilidæ present us with a simple exaggeration of this state of affairs. The separation between the two parts of the oviducal funnel is more emphasized, and at last results in its complete division into two funnels.

On the other hand, as Dr. Benham has pointed out, the actual change which seems to be more possible is that the funnel entirely loses its orifice into the xiiith segment, and comes to open entirely into the egg-sac; this at least is what occurs in *Eudrilus*. It must be borne in mind that in that genus, which is in some respects the most specialized of the Eudrilidæ, the spermathecal system is constructed on lines rather different from those upon which the spermathecal system of other genera of the family are built. Now it has been shown that a large part at least of the complicated series of sacs which constitute the spermathecal system originate from the septa of which they are outgrowths, like the egg-sacs or the sperm-sac. It seems therefore at least a possible view that the lateral sacs of *Stuhlmannia* which encircle the gut are to be compared to the egg-sacs of the xivth segment; that, in fact, they are an anterior pair of egg-sacs belonging to the xiiith segment. To these the second pair of funnels belong. In *Eudrilus*, where there are no such lateral sacs, there are no oviducal funnels in the xiiith segment. Just as in *Stuhlmannia*, where on one side of the body the egg-sacs of the xivth segment are wanting, there is a corresponding absence of the funnels of that segment.

Before leaving this matter I would direct attention again to the remarkable asymmetry—which I found so frequently that I am disposed to regard it as normal—of the female reproductive apparatus in this species. I may compare with this an apparently similar, and also apparently quite normal, atrophy of one oviduct and the absence of its external orifice in *Typhoeus nicholsoni*, a species recently described by myself [2], and the asymmetry of the pores in *Polytoreutus gregorianus*. Asymmetry, of at all a constant character, is so rare in Annelids, that it is legitimate to emphasize these two cases.

The sperm-ducts of the genus *Stuhlmannia* show a peculiarity which has not been apparently mentioned. It was first pointed out by Rosa [3] in the case of the genus *Teleudrilus* that the funnels of the sperm-ducts, instead of opening in the normal way opposite to the testes in the xth and xith segments, bent round and opened into the xith and xiith segments. I found subsequently the same arrangement in *Hyperiodrilus*. I had thought, however, that this peculiarity was confined to the Eudriline division of the Eudri-

[1] Benham, "A new English Genus of Aquatic Oligochæta, &c.," Quart. Journ. Micr. Sci. xxxiv. p. 155.

[2] P. Z. S. 1901, vol. i. p. 195.

[3] "Lombrichi dello Scioa," Ann. Mus. Civ. Genova (2), vi. p. 574.

lidæ. In any case I have ascertained that in several genera of the Pareudriline division the arrangement of the funnels with reference to the testes is carried out on the normal Oligochætous plan. However, in *Stuhlmannia*, with which I deal here, the funnels bend round and open into a funnel which faces the hinder end of the body precisely as they do in *Teleudrilus* and *Hyperiodrilus*. Moreover, a slight swelling of the sperm-duct just after it escapes from the funnel suggests a rudiment of the large chamber into which the sperm-duct of such genera as *Eudrilus*, *Teleudrilus*, and *Hyperiodrilus* expands in the same region. This fact brings closer together the two divisions of the Eudrilidæ. It may be also pointed out that in being thus turned round the sperm-duct funnels correspond more accurately with the oviducal funnels than they do in some worms.

(5) *Contributions to our Knowledge of the Genus* Gordiodrilus.

This genus was founded ten years ago by myself [1], and five species of it were described, to which a sixth from East Africa was subsequently added [2]. Since that period the genus has not received attention at the hands of any naturalist, though the genus as such has been universally accepted. In the present communication I have some further facts to add to what is known about *Gordiodrilus*, and the material upon which these observations were made necessitates the creation of one new species. This material was collected in the neighbourhood of Lagos on the west coast of Africa by the late Mr. Alvan Millson. I have examined three examples of *Gordiodrilus*, which seem to be referable to two distinct species. A fourth worm, though, so far as could be judged, clearly a member of the same genus, was not sufficiently mature to be placed with certainty in its proper species. Indeed none of the species appeared to be quite fully mature. The nearest approach to complete sexual maturity was shown by the one individual which I consider to represent a new species, for which I propose the name of

GORDIODRILUS PAPILLATUS, n. sp.

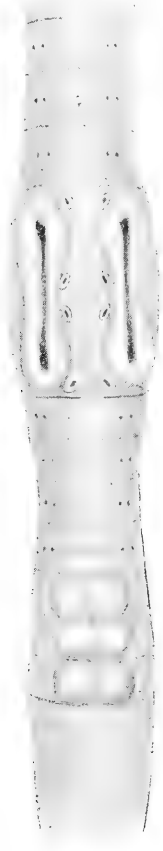
Of this distinctly new form of *Gordiodrilus* (text-fig. 88, p. 359) I have had, as already stated, but a single example, nearly if not fully mature. It is a long slender worm like all the members of the genus, and its marked tenuity is more suggestive of *Gordiodrilus tenuis* than of any other species. It has, moreover, as will be seen in the sequel, other points of likeness to that, the most anomalous species of the genus. The transparency of the body-walls is apparent even in the spirit-preserved individual, and the sperm-sacs show through the delicate body-wall quite plainly. This is also a feature of *G. tenuis*.

[1] "On a new Genus of Oligochæta comprising five new Species belonging to the Family Ocnerodrilidæ," Ann. Mag. Nat. Hist. (6) x. p. 74.

[2] F. E. Beddard, "A Contribution to our Knowledge of the Oligochæta of tropical Eastern Africa," Quart. Journ. Micr. Sci. (n. s.) xxxvi. p. 252.

The length of the single specimen was 63 mm. and the diameter varied from 1·50 mm. to 2·75 mm. The latter, the greatest diameter, was taken across the swollen areas on the generative segments, to which reference will be made immediately.

Text-fig. 88.



Ventral aspect of clitellar and neighbouring segments of *Gordiodrilus papillatus*. × 6.

The *prostomium* was a little difficult to study accurately. It appears, however, to be like that of other species of the genus and to be what Michaelsen[1] has termed "zygolobisch," *i. e.* the

[1] "Oligochæta" in 'Das Tierreich,' 1900.

prostomium is not cut off from the peristomial segment by any furrow.

The *setæ* present on the whole the characters of those of *Gordiodrilus tenuis* in that there is a difference in size between the ventral and the lateral pairs. The ventral pairs are much more marked than the lateral, especially in a few segments just anterior to those which bear the male generative orifices. In this situation they appear to the naked eye as strongish hooks. Five segments or so showed these particularly strong setæ. But an examination of the very last segments of the body showed a similar difference in size, only that here the difference was not so pronounced. The condition of the setæ of the present species is in some respects intermediate between that which characterizes *Gordiodrilus tenuis* and *G. robustus*. In the latter species the ventral setæ of a few segments in front of the male genital pores are markedly larger than the rest. In *G. tenuis*, on the other hand, the whole series of ventral setæ are much larger than the lateral, and their increased size can, as has been pointed out, be readily felt when the worm is handled. As in some other species of *Gordiodrilus*, the ventral setæ of the generative segments are partly absent.

The *clitellum* is a little difficult to map on a naked-eye inspection of the worm. Segments xviii.–xxii. appeared to be those occupied by this modified region of the integument.[1]

The genital region of this species shows several characters which enable the species to be differentiated from all its allies. As will be seen by the accompanying figure (text-fig. 88, p. 359), the segments which carry the male pores are somewhat swollen when compared with those that immediately precede and succeed. On these two segments, which are the xviiith and the xixth, a somewhat figure-of-8-shaped tumid area extends from end to end on each side; this is traversed by a longitudinal groove; the whole area of each side measures 3·25 mm. and the groove about 1·8 mm. The swollen structure would seem to be capable of performing the function of a sucker. But in addition to it there are four pairs of *genital papillæ*, the presence of which has suggested the name of the species, and which serve at once to differentiate *Gordiodrilus papillatus* from any of the other species of the genus which have been hitherto described. These papillæ are arranged in pairs following each other. The first pair are in front of the anterior end of the figure of 8. The last pair occupy a corresponding position behind this figure of 8, and in the middle are the two remaining pairs, closer together than either of them is to the first or to the last pair of papillæ. The groove which traverses the swollen sucker-like structure widens at both the anterior and at the posterior end, and at these points open the spermiducal glands. After an interval of four segments there are three segments, each

[1] I am indebted for the sketch from which the above drawing was made to Miss Fedarb.

of which bears a median squarish papilla, which are shown in the figure already referred to. The segments which bear these are xxiv., xxv., xxvi. When the worm is viewed laterally these papillæ are seen to project markedly. Otherwise they are not very conspicuous by reason of colour or texture.

As in other species of *Gordiodrilus*, there is a single *calciferous gland* in segment ix. There are two pairs of *hearts* in segments x., xi. The *gizzard* appears to be entirely absent, as is generally the case in the species of the genus. The *septa* dividing segments v./x. are thickened, the last septum not to so great an extent as are those which precede it.

Male Organs of Generation.—This species of *Gordiodrilus*, like the majority of its congeners, has two pairs of *testes*, which occupy the usual segments and the usual position in those segments. They are attached, that is to say, to the anterior septum of segments x., xi. There is nothing noteworthy about the structure of these gonads.

The *sperm-sacs* are rather unusual in number and position. In most of the species of this genus sperm-sacs are present, and it may be that the differences recorded in the number of pairs and the segments which they occupy will prove to be distinctive as marks of specific difference. In *Gordiodrilus papillatus* there were three pairs of sperm-sacs lying in segments ix., x., xi. These sacs showed the racemose character so often exhibited by these sacs. In addition to the three sperm-sacs, which had thin but perfectly recognizable walls, a mass of loose sperm fills up the ventral part of segments x., xi., which lodge the funnels of the sperm-ducts. It does not appear that these masses of sperm had any walls of their own, so that they cannot be regarded as sperm-reservoirs; they are merely, as has been stated, masses of sperm for which presumably no room could be found in the sperm-sacs, as the latter were completely filled with the usual masses of developing spermatozoa.

The *sperm-ducts* commence by large funnels in segments x., xi. They lie, as is always the case, opposite to the corresponding testes. They are much folded, and have not the simple cup-shaped character that sometimes distinguishes the funnels of the lower earthworms. From each funnel arises a sperm-duct, and the two ducts of each side are perfectly independent for the greater part of their course. They lie above the muscular layers of the body-wall. A segment or two in front of their opening into the terminal muscular bulbus, to be described immediately, the two ducts of each side unite, so that there is but a single orifice into the muscular bulbus.

The glands and other structures associated with the external orifice of the sperm-ducts help by their structure to bridge over the not very wide gap that separates the two African genera *Gordiodrilus* and *Nannodrilus*[1]. The latter genus, originally described

[1] "On two new Genera comprising three new Species of Earthworms," P. Z. S. 1894, p. 388.

by myself, is distinguished from *Gordiodrilus* by the fact that the sperm-ducts open by a single orifice on each side of the body into a terminal muscular sac; into this also opens one of the two or three pairs of spermiducal glands. In the first described species of *Nannodrilus* the spermiducal glands are but two pairs, of which the posterior opens into the muscular bulbus on the xviiith segment. In Dr. Michaelsen's subsequently described species *N. staudei*[1] there is in addition a third pair of spermiducal glands which open behind the muscular bulbus; so *N. africanus* can be derived from that species by a suppression of the last pair of spermiducal glands. In *Gordiodrilus*, on the other hand, the sperm-ducts open directly on to the exterior, and not through any terminal muscular bulbus; that at least is the structure of those species which have been investigated up to the present time. The new form described in the present communication is, however, different. There are as usual two pairs of spermiducal glands which open, the one pair behind the other, on to segments xix. and xx. On to segment xix./xx., just at the boundary-line and between the two pairs of spermiducal glands, open the sperm-ducts. These ducts, instead of simply burrowing their way through the integument, open first of all into a largish spherical muscular bulbus like that of *Nannodrilus*, which is not provided with an appended spermiducal gland. This species is thus intermediate between *Nannodrilus staudei* and the genus *Gordiodrilus* as hitherto defined. The middle pair of spermiducal glands may be supposed to have disappeared. *Pygmæodrilus* is a still further reduction of the same structural plan. There is but one pair of spermiducal glands, and the end of the vas deferens is involved in a muscular sheath, which may be looked upon—as Michaelsen has suggested—as the last remnant of such a muscular terminal sac as is possessed by *Nannodrilus* or *Gordiodrilus papillatus*. Coming now to the details of structure of these various glands, the spermiducal glands themselves are long and extend through four or five segments in front of their point of opening. It does not seem to be important in which direction the glands lie, but in the present species they are coiled and lie in front of the pores. The glands themselves are, as in other species of the genus, lined with a single glandular layer of cells. The terminal part which perforates the body-wall is short and of less calibre than the glandular part. It is lined by smaller and non-glandular cells; the muscular layer enveloping it is thin. At the actual orifice one of the two ventral setæ has disappeared; one, however, is clearly present, so that in this matter *Gordiodrilus papillatus* seems to differ from at any rate some of the other species of the genus, in which the ventral *pair* of setæ, and not merely *one* of the two setæ, has disappeared.

Female Organs of Generation.—The *ovaries* and *oviducts* furnish

[1] "Neue und wenig bekannte afrikanische Terricolen," JB. Hamb. wiss. Anst. xiv.

no material for comment. They are quite normal in position and structure.

The *spermathecæ* are rather peculiar. There are two pairs, which lie in segments viii., ix. Each consists of an oval sac with a simple lining of cells and a very thin muscular wall; this communicates with the exterior by an extremely long slender duct, which is much longer than the pouch itself, and is so thin as to hardly exceed the dimensions of the sperm-duct. There is no trace of a diverticulum. On the left-hand side of segment viii. there were, in the single example of the species which I have had for investigation, two spermathecæ, each with its separate long duct. The two pouches appeared to communicate. It is clear that the spermathecæ of the present species closely resemble those of *G. tenuis* in the length of their ducts.

It is plain that the species described in the present communication not only, as already pointed out, bridges over the not very wide gap which has hitherto separated the two genera *Gordiodrilus* and *Nannodrilus*, but that it also connects the somewhat extreme *Gordiodrilus tenuis* with the more "normal" species of the genus. The peculiarities of *G. tenuis* would seem almost to necessitate its inclusion in a separate genus. The existence of only a single pair of testes and of sperm-ducts and the backward position of the male orifices, together with the curious form of the spermathecæ, are three points which might be regarded as collectively entitling to generic separation. *Gordiodrilus papillatus*, however, while agreeing with *G. tenuis* in the form of the spermathecæ, in the large size of the ventral setæ, and approaching it in the position of the male genital orifices, has the normal pair of testes in each of segments x. and xi. The clitellum, too, is like that of other species, and is not so prolonged as is the clitellum of *G. tenuis*. The setæ, moreover, do not show throughout the body such a marked discrepancy of size as is exhibited by the species *G. tenuis*.

I shall conclude with a brief definition of

Gordiodrilus papillatus, n. sp.

Length 63 mm. Setæ of ventral pairs larger. Male pores on xix., xx., and xix./xx. Gizzard absent. Four pairs of genital papillæ on xix., xx., and three median papillæ on xxiv., xxv., xxvi. Testes two pairs. Sperm-ducts open into a muscular bursa. Spermathecæ, two pairs without diverticula and with enormously long and slender duct.

Hab. Lagos.

Gordiodrilus robustus.

G. robustus, F. E. Beddard, Ann. Nat. Hist. (6) x. p. 82; id. Mon. Olig. 1895, p. 508.

G. robustus, Michaelsen, Oligochæta, Das Tierreich, Lief. x. 1900, p. 374.

Two examples of this species allow of certain additions to the earlier account of this species, and of a few corrections in matters of detail. The larger of two examples examined measured 72 mm. by a greatest diameter of 2 mm. The worm is thus quite as slender as *Gordiodrilus elegans*, and the more robust form of the original specimens is perhaps merely a matter of greater contraction.

The openings of the two pairs of spermiducal glands is, as correctly stated in the original description of this worm, upon segments [1] xvii. and xviii. As to internal characters, it has been noted that this is the only species of *Gordiodrilus* which possesses a gizzard. The structure of this part of the alimentary canal shows some further peculiarities which have not yet been referred to. The gizzard in segment viii. has quite stout muscular walls, but the lining of cuticle is not strongly developed as is the case with earthworms where the gizzard is a prominent structure. Moreover, the gizzard by no means occupies the whole of the viiith segment; the last one-fourth or thereabouts is occupied by a portion of œsophagus, which differs from other parts of that tube in that the muscular layer is rather thick, about as thick as the epithelium lining it. There is thus evidence that the gizzard of this species is in a state of degeneration. In segment vii. there is a similar thickening of the muscular walls of the œsophagus, the layers being again about as thick as is the epithelium beneath them. Here, therefore, is another, and a rudimentary, gizzard to be taken account of. The species seems to be descended from some form in which there were two gizzards in vii. and viii., and while one of them has nearly disappeared the other is commencing to undergo reduction. These facts further emphasize the bond of union between the genus *Gordiodrilus* and its ally *Nannodrilus*, though in a different way from the likenesses shown between *Gordiodrilus papillatus* and *Nannodrilus*. The genus *Nannodrilus* has two gizzards, which lie in the two consecutive segments vii. and viii. The facts, however, must apparently be interpreted on the assumption that from *Nannodrilus* arose two separate lines of descent, one represented by *Gordiodrilus robustus*, from which again *G. dominicensis* can be derived as well as perhaps *G. ditheca*. The second line gave rise to *G. papillatus* in the first place, from which may have arisen *G. tenuis* on the one hand and *G. elegans* on the other. The relations of *G. zanzibaricus* [2] are not so plain as the others appear to me at present to be.

[1] It is necessary to emphasize this fact since some error has crept into my original paper upon this genus in respect to the positions of the spermiducal gland-pores. I find on re-examination of my preparations that in *G. elegans* the pores are correctly stated (upon pp. 84 and 90) to be upon segments xviii., xix., and incorrectly stated (upon p. 95) to be upon segments xvii., xviii. On the other hand, in *G. dominicensis* the same pores are, as in *G. robustus*, upon xvii., xviii., as correctly stated on the table on p. 95 of my memoir; they are incorrectly stated upon pp. 91 & 94 to be upon xviii., xix.

[2] As a small matter it may be well to note that "*Gordiodrilus matthewsi*," spoken of on p. 453 of the Mon. Olig., is not, as Michaelsen has suggested, a *lapsus pennæ* for *G. robustus* but for *G. zanzibaricus*.

In the original account of *G. robustus* the position of the first nephridium was not fixed. The first pair seem to be in segment v. The segments in front of this are so filled up by the pharynx and associated glands that there would appear to be hardly room for a pair of nephridia. The median calciferous gland of this species was single, not paired as seems to be sometimes the case in the species.

The spermathecæ have an extraordinarily long duct, the length of which in relation to the pouch is inadequately represented in the figure illustrating it in the original memoir. It is no thicker than the sperm-duct and runs a straight course to its orifice.

3. Some Notes upon the Anatomy and Systematic Position of the Ciconiine Genus *Anastomus*. By Frank E. Beddard, M.A., F.R.S., Prosector and Vice-Secretary of the Society.

[Received April 3, 1901.]

(Text-figures 89–91.)

Two out of the three examples of *Anastomus oscitans* acquired by the Society on Jan. 4th having died, I am able to contribute to our knowledge of the structure of the Order Herodiones by an account of certain points in the anatomy of this genus. So far as I am aware, *Anastomus* is one of the few genera of Storks which has not been dissected; and, as the genera of this order show some differences of structure, it is important to ascertain how *Anastomus* stands in relation to its allies. The chief sources of information as to the structure of the viscera and musculature of the Ciconiidæ are those stated below [1].

These various memoirs and books contain information upon nearly all the genera of Storks; the only prominent genus which has not been treated of is that which forms the subject of the present communication. There has not been, so far as I am aware, any doubt as to the truly Stork-like characteristics of *Anastomus*.

[1] Garrod, "On the Carotid Arteries of Birds," P. Z. S. 1873, p. 457; id., "On certain Muscles of the Thigh of Birds, &c.," *ibid.* 1873, p. 626; id., "On the Form of the Trachea in certain Species of Storks and Spoonbills," *ibid.* 1875, p. 297; id., "Note on an Anatomical Peculiarity in certain Storks," *ibid.* 1877, p. 711; id., "On the Trachea of *Tantalus loculator*, &c.," *ibid.* 1878, p. 625.

Weldon, "On the Anatomy of *Phœnicopterus* and its Allies," P. Z. S. 1883, p. 638.

Fürbringer, Untersuchungen über Morphologie und Systematik der Vögel, Amsterdam, 1888, *passim.*

Beddard, "A Contribution to the Anatomy of *Scopus umbretta*," P. Z. S. 1884, p. 543; id., "On certain Points in the Visceral Anatomy of *Balæniceps rex*," *ibid.* 1888, p. 284; id., "Notes on . . . the Syrinx in certain Storks," *ibid.* 1886, p. 321; id., "A Note upon *Dissura episcopus*, with Remarks upon the Classification of the Herodiones," *ibid.* 1896, p. 231; id., The Structure and Classification of Birds, London, 1898.

Gadow, "Aves" in Bronn's 'Klassen und Ordnungen des Thier-Reichs,' It has, however, been placed in a subfamily—and even in a family!—by itself, contrasting with the remaining genera, *Ciconia*, *Mycteria*, *Xenorhynchus*, &c. I find no sanction for this separation of *Anastomus* after an examination of its structure, unless, indeed, the peculiar formation of the quadrate bone, to which I shall refer later, is considered to necessitate so wide a divorce from other typical Storks. The viscera, muscles, and the skeleton in general, conform to the Ciconiine plan in every particular. And for my part I am disposed to regard *Xenorhynchus, Dissura* (*episcopus*), and *Abdimia* as more anomalous Storks than is *Anastomus*. The peculiar fringing of the bill in *Anastomus lamelligerus* is perhaps responsible for this separation of the genus from its allies. But lamellæ of a similar character are found in *Phœnicopterus*, which is in my opinion to be clearly regarded as a Stork. Moreover, they do not exist at all in the species which forms the subject of the present communication. The muscle-formula of the thigh is the typically Ciconiine one; no muscles are missing as is the case with *Abdimia*, *Xenorhynchus* (in part), on the one hand, or in *Leptoptilus* on the other; while the syrinx, so characteristic an organ in the Stork tribe, though peculiar in some respects—as I shall explain immediately—is constructed upon the Ciconiine plan, and does not diverge towards the Ardeine syrinx, as do those of *Scopus*, *Balæniceps*, and—to a less extent—*Xenorhynchus*, *Abdimia*, and *Dissura*. The skeleton, moreover, with the exception of the quadrate, is quite that of a Stork in every respect, though naturally details permit of a definition of this genus *Anastomus*.

Anastomus differs from some Storks in possessing no aftershaft. The rectrices, in the present specimen, although several are missing, appear to have been 12. The oil-gland is of course tufted.

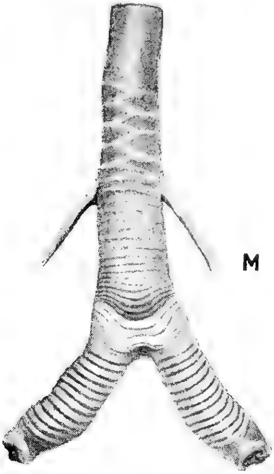
The *alimentary viscera* appear to be quite Stork-like. The two lobes of the liver are subequal as usual. The small intestine is particularly long; it measured 7 feet 8 inches, the large intestine being only 3 inches and the cæca mere "nipples." As a rule the intestinal canal in Storks appears to be shorter.

The *windpipe* (text-figs. 89, 90, p. 367) is also quite Stork-like. The last 13 tracheal rings in front of the pessulus are short and delicate, and form as in other Storks a definite area of the trachea. The pessulus itself is ossified; with it are fused four rings as on the ventral side, but only two on the dorsal. There is no trace whatsoever of a membrana tympaniformis. The bronchial rings are thus complete, and beginning with the last, which is connected with the syringeal box (on the ventral side), are partly ossified.

As regards the muscular anatomy, I have paid special attention to those muscles which differ among the Herodiones.

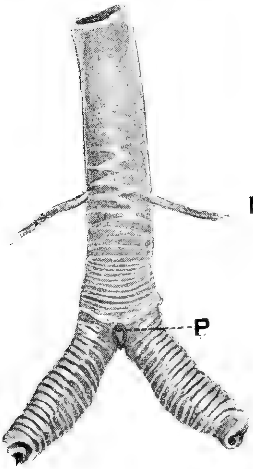
Tensores patagii.—The tensor brevis is quite Stork-like in the arrangement of its tendons. The tendon is flat and broad with a thickened anterior part; the contrast between this and the rest of the tendon dies away as the tendon approaches its insertion. It bifurcates, as usual, into a double tendon a little before insertion.

Text-fig. 89.



Syrinx of *Anastomus oscitans*, front view. × 1.
M, Extrinsic muscle.

Text-fig. 90.



Syrinx of *Anastomus oscitans*, back view. × 1.
M, extrinsic muscle P, pessulus.

There are two recurrent tendinous slips to the tensor patagii longus tendon. One of these, the thinner and broader, arises from the anterior tendon of the brevis; the other, which runs almost parallel with it, arises close to the insertion of the tensor brevis, but distinctly from an extensor tendon of the forearm. In *Ciconia nigra*[1], *Mycteria americana*[2], and *Tantalus leucocephalus* there is only a single recurrent slip, which, however, in *Ciconia*, branches into a double insertion. There is, as is the case with other Storks, no biceps slip.

The two *latissimi dorsi* are fairly equal in size; the anterior has a completely fleshy insertion; the posterior division is flat and strap-like, as is the anterior, but ends abruptly in two tendons of comparatively insignificant dimensions. One of these, the stronger, is inserted on to the humerus, headwards of but beside the tendon of the anconeus. The other is inserted on to the tendinous belly of the same muscle. This appears to be the usual insertion in Storks and in the Flamingo, but not in *Scopus*.

The *deltoides major* has the long second tendinous head from the scapula that is common if not universal in Storks. The main scapular head is, however, fleshy. The scapular tendon arises from the dorsal side of the scapula, and if the origin of the anconeus from the ventral border of the scapula were continued forwards it would meet that head.

The *anconeus longus* has two plainly separate heads of origin which are both tendinous. One has been just referred to. The other is thicker and arises from the scapula nearer to the coracoid. A broad and thin tendon attaches this muscle to the humerus in the ordinary way.

The *serratus superficialis posterior* is wide and thin, and largely tendinous; it is attached to the posterior two-thirds of the scapula. It arises from the uncinate process of rib 1 to that of rib 3.

The *serratus superficialis anterior* is a thick fleshy muscle attached to the scapula near to the coracoid end; it arises from the first complete rib, and a considerable gap is left between its insertion and that of the superficialis posterior. It may be noted that the muscle arises only from its rib, and not also from a cervical rib as in some other Storks.

The *pars metapatagialis* is strong.

The *serratus profundus* (*levator scapulæ* of Weldon) consists of only two slips, neither of which are of large size. They arise respectively from the last cervical and the first dorsal rib.

The *biceps* is two-headed as in other Storks.

The *expansor secundariorum* is present and attached to the margin of the *teres*.

The thigh-muscles of *Anastomus* are quite typically Stork-like, the formula being AXY+, the complete one for a Stork[3]. The

[1] Fürbringer, Unters. Morph. Syst. Vögel, pl. xx. fig. 7.
[2] Forbes MS.
[3] There is a feeble accessory femoro-caudal in *Xenorhynchus australis*.

ambiens is rather small, as in *Xenorhynchus australis* (it is of course absent in *X. senegalensis*), but plainly obvious.

The *semitendinosus* is smaller than the semimembranosus. It ends in the septum between itself and its accessory and in a thin tendon which joins the broad flat tendon of the semimembranosus.

The *femoro-caudal* is of fair size and has a fleshy insertion; there were no traces of its accessory.

The *gluteus maximus* is mainly tendinous; its origin hardly, if at all, extends behind the acetabulum. I find *four* other *glutæi*[1], of which *tertius* and *quartus* are inserted so near together as to appear at first sight but a single muscle. A little care, however, shows them to be distinct.

The two *adductors* are separated at their insertion, one being attached as usual with the femoral head of the accessory semi-tendinosus.

There is only one *peroneus*, the *p. brevis* being absent.

The *gastrocnemius* has three heads and is joined by the accessory semi-tendinosus.

The deep flexor tendons have the Ciconiine arrangement, a strong vinculum joining the flexor hallucis to the flexor communis just before the trifurcation of the latter.

Skull.—Judging from the measurements giving by Dr. Blanford[2], the skull of my example of *Anastomus oscitans* is about two-thirds of the size to which it would ultimately have grown. It therefore shows certain but not very numerous signs of immaturity[3]. I have been able, however, through the kindness of Mr. Gerrard, to compare it with the skull of an older example of *Anastomus lamelligerus*. The principal specific difference which I observed was the greater length of the beak-region of the skull in *A. lamelligerus* as compared with other Storks. *Anastomus* shows some peculiarities of skull-structure.

I could find no trace of a vomer in either specimen, a bone which, though small, is usually recognizable in Storks.

The pterygoids are unusually short and very broadly expanded where they come into relation with the palatines. This character of the skull of *Anastomus* is shown in the accompanying drawing (text-fig. 91, p. 370). The most salient difference, however, observable in this aspect of the skull is the form of the quadrate, that is of its articular surface for the attachment of the lower jaw. It will be noted that in *Anastomus* the quadrate has two facets—one longer saddle-shaped facet at right angles to the longitudinal axis of the skull; the other shorter at the jugal end of the under surface of the bone, much shorter than the first and more or less at right angles to it. The articular surface of the quadrate is therefore very narrow, and in this contrasts with the genera *Ciconia*, *Tantalus*, *Xenorhynchus*, and *Dissura*. In all these genera the lower articular surface of the quadrate is very broad, and the two main facets are

[1] Weldon only found three in the Storks dissected by himself.
[2] The Fauna of British India, Birds, vol. ii. p. 378.
[3] It is, for instance "schizognathous."

roughly of equal dimensions and parallel to each other, the posterior facet curving forwards in a hook-like fashion at the jugal side of the bone. It is this curved and forwardly directed portion of the facet which alone represents the second smaller facet of the quadrate of *Anastomus*. This peculiarity of *Anastomus* does not, I may remark, link it to the Herons; but, though there are detailed differences, the quadrate of *Platalea* has a small corresponding articular surface.

Text-fig. 91.

A, skull of *Anastomus oscitans*, ventral aspect, × 1. B, quadrate and adjoining bones of *Ciconia nigra*.

a, *b*, facets on quadrate.

When the skull is viewed laterally, the angle which the facial portion makes with the cranial is very noticeable and not Stork-like. This feature coupled with the curved lower jaw is not unsuggestive of the Flamingo. It may be noted that the post-frontal process and the process of the squamosal are far from each other as in most Storks: in *Xenorhynchus* these two processes join.

In other respects the skull of *Anastomus oscitans* appears to me to be quite Stork-like.

Vertebræ.—There are 17 cervical vertebræ as against 18 in *Xenorhynchus* and *Tantalus*. All Storks that I have examined, except *Anastomus* and *Dissura*, possess a catapophysial canal occupying a varying number of vertebræ. In not having this canal *Anastomus* agrees with *Phœnicopterus* among possible allies.

Ribs.—There are 5 fully developed pairs of ribs, which reach the sternum, and of which the first four are provided with uncinate processes. The origins of the last two are overlapped to the pelvis. In front of the series of complete ribs are two rudimentary ribs, of which the first pair are as usual exceedingly small. The vertebra in front of that which bears the latter has very delicate and thus rib-like transverse processes; but they are firmly ankylosed to the vertebra. On the left-hand side of the body a minute fragment represents a posterior pair of ribs.

The rib-formula of *Anastomus* may be thus stated and compared with some other Storks:—

Anastomus: $r+r'+5+r$.

Xenorhynchus australis: $r+r'+R+4$.

" *senegalensis*: $r+r'+R+4+r'$.

Tantalus leucocephalus: $r+r'+5$.

Dissura maguari has five complete ribs.

The *coracoids* of *Anastomus* just overlap at their insertion on to the sternum. Storks differ in this feature; while *Tantalus* agrees with *Anastomus*, the coracoids of *Xenorhynchus* and *Dissura* do not even meet.

A final point in the osteology of *Anastomus* to which I desire to direct attention is the proportion of the metatarsals, which are not identical in all these long-legged birds. In the subject of the present communication the second and third metatarsals are nearly of the same length, the middle one being slightly longer as well as slightly thicker.

In *Tantalus* the middle metacarpal is very decidedly the longer, and the fourth is even slightly longer than the second.

Ardea has a foot which has diverged in the opposite direction. The second metatarsal is distinctly the longest, and the fourth is much shorter than the third.

Phœnicopterus agrees with *Tantalus* in the excess of the middle metatarsal, but the fourth is the shortest.

4. On the Identity and Distribution of the Mother-of-Pearl Oysters; with a Revision of the Subgenus *Margaritifera*. By H. Lyster Jameson, B.A., Ph.D.

[Received April 2, 1901.]

(Text-figures 92–95.)

Acting upon a suggestion made to me by Professor E. Ray Lankester, I have recently been engaged in rearranging the collection of *Margaritiferæ* in the British Museum of Natural History, and in revising and extending the series illustrating the commercial forms. The nomenclature of these forms has hitherto been in a chaotic state, and it has occurred to me that this revision of the genus may be worth publication if only to prevent further confusion of the common commercial forms by zoological and economic writers.

The subgenus *Margaritifera* (P. Browne = *Meleagrina* Lamarck) is one of the three groups into which the genus *Pteria* (Scopoli = *Avicula* Olivi) has been divided.

It is distinguished from *Pteria* s. s. mainly by the small size or complete absence of the posterior auricle or hinge-continuation, and by the fact that the longest dorso-ventral axis of the valves is approximately at right angles to the hinge-line.

In *Pteria* s. s. and *Electroma* Stoliczka (type *E. smaragdina*, Reeve), on the other hand, the shell is oblique, *i. e.* the long axis of the valves is directed obliquely backwards.

Electroma is distinguished from *Pteria* s. s. by the shortness of its hinge and the absence of the posterior auricle.

Such species as *Margaritifera vulgaris* and *M. panasesæ*, together with certain *Pteriæ* and *Electromæ*, tend in many ways to bridge over the gaps between these three subgenera.

Genus Pteria Scopoli, 1777, p. 397: type *Mytilus hirundo* Linn. =*Avicula* Olivi, 1792, p. 125.

Subgenus Margaritifera P. Browne, 1756, p. 412. (Non binom.: type *M. radiata* Leach; Jamaica.)

=*Margaritifera* Humphrey, 1797 (ex parte), p. 44: type *M. fimbriata* (not descr.) (?=*M. radiata* Leach); W. Indies. *Apud* Da Costa, 1776.

=*Margaritophora* Megerle von Mühlfeld, 1811, p. 66: type *M. communis* =*M. margaritifera* Linnæus.

=*Meleagrina* Lamarck, 1812, p. 104; 1819, p. 150: type *M. margaritifera* Linnæus.

=*Margarita* Leach, 1814, vol. i. p. 107: type *M. sinensis* Leach =*M. margaritifera* Linnæus; China.

=*Perlamater* Schumacher, 1817, p. 107: type *P. vulgaris* Schumacher.

The species of *Margaritifera* are difficult to separate from one another by hard-and-fast lines, owing to the absence of well-marked diagnostic characters, and to the extraordinary amount of geographical and casual variation.

Probably the anatomical characters will, when known, be found to be the best guides to the limits and affinities of some of the species.

It is possible to divide the known species and forms into two groups—the first of which has no traces of hinge-teeth, the second possessing a pair of minute tubercles anterior to the ligament, and a small lamina in each valve representing a lateral tooth. The latter group may be split up into three sections, according to the form of the shell.

DIVISION 1. *Hinge without teeth.*

Species 1. MARGARITIFERA MARGARITIFERA.
Type in Mus. Linn. Soc. Lond.

Mytilus margaritiferus, Linnæus, 1760.

Margarita sinensis, Leach, 1814, vol. i. p. 180, pl. 48; China.

Margaritiphora mazatlanica, Hanley, 1855, p. 388, pl. 24. fig. 40; Mazatlan, California (var. dist.). (Not *Avicula fimbriata* Dunker, 1852; for *M. mazatlanica* Hanley, Carpenter, 1857, p. 550; Mazatlan.)

Avicula cumingii, Reeve, 1857, sp. 6; Lord Hood Island (var. dist.).

Avicula barbata, Reeve, 1857, sp. 9; Panama = var. *mazatlanica* (Hanley).

This species is distinguished from *M. maxima*, the only other known member of this division, by its greater convexity and the shortness of its hinge, and by its colour and markings.

In typical examples the hinge-margin measures but little more than half the length of the nacreous surface of the valve, from the anterior to the posterior margin.

The "rostrum" or anterior angle of the hinge, dorsal to the byssal notch, is more distinctly marked off from the shell than in *M. maxima*, and the posterior end of the hinge usually meets the posterior margin so as to form an obtuse angle (except in var. *persica* and var. *mazatlanica*). There is no sinus in the posterior margin.

The anterior margin, ventral to the byssal notch, projects further forward than in *M. maxima*, so that a line perpendicular to the hinge at its anterior end would cut off a considerable area of the nacre anteriorly ($\frac{1}{5}$ total antero-post. measurement).

The lappet-like processes of the lip are more numerous, more crowded together, narrower, and relatively longer than in *M. maxima*.

The greatest antero-posterior measurement of the nacre, parallel to the hinge, is about halfway between the hinge and the ventral margin, giving the shell a fairly circular outline.

The colour and markings of the exterior, though extremely variable, generally suffice to distinguish this species. The ground-colour is pale yellowish brown, green, olive, reddish grey, dark brown or black. It is characteristically marked with about 10–18 radial rows of white or yellow spots, running from the umbo to the margin, which may be so large as to fuse and form radiating bands, or may be completely suppressed.

The interior of the lip approximates to the ground-colour of the shell, and shows indistinct lighter markings corresponding to the distal ends of the radial rows of spots.

The nacre is highly iridescent, often somewhat steely in lustre, with a marginal band of dark metallic green, bronze, or brassy yellow iridescence.

Average specimens measure 10–18 cm. in diameter, but larger dimensions are at times acquired, especially by Polynesian examples, which sometimes almost rival *M. maxima* in size and weight.

Variation in this widely distributed species is so great that the above specific characters will by no means be found to cover every specimen. I find it necessary to break it up into several geographical races, which, although they intergrade, differ markedly from one another.

Var. a. *M. margaritifera* (? *typica*).

The original locality of Linnæus's type specimens in the Linnean Society's collection is not known. Linnæus gives "*in utriusque indiæ oceano*" as the distribution of his *Mytilus margaritiferus*. One of his specimens, a right valve, is obviously East Indian, probably from the Malay Archipelago, as it agrees in all respects with the "Black-edged Banda" shell of the trade. The other is apparently a Red Sea example, as it is quite indistinguishable from trade samples from that locality. Linnæus's description in the Mus. Reg. Ulr. is more applicable to the former than the latter specimen; so I feel inclined for the present to regard the Black-edged Banda shell as representing the type of Linnæus's species, and to group the geographical varieties round it.

Australian and New Guinea shells do not show sufficient differences to warrant me in separating them from the type by a distinct name, although their racial characters are enough to cause them to be distinguished in the Mother-of-Pearl markets.

Australian, New Guinea, and Malayan examples are characterized by dark greenish or brownish ground-colour, with well-defined radial rows of white spots which do not as a rule fuse to form regular striæ. The margin of the nacre is usually dark green, bronze, or smoky, but not so marked as in Polynesian examples.

The form of the shell is usually that described for the species generally.

Geographical Distribution. Australia, all along N. coast (Australian Black-lip); E. coast as far south as Moreton Bay (specimens from Moreton Bay, Mus. Cuming, B.M.), W. coast to about 29° S., Coasts of New Guinea and the adjacent Islands ("New Guinea Black-lip"), New Britain, the Solomon Islands, &c., and probably every suitable locality in the Western Pacific.

The Fiji shell of the trade, from Fiji, is also nearest to the Australian and New Guinea varieties. I have not seen a sufficiently large series of examples from Rotuma and the Line Islands to be able to say if shells from these localities are distinct varieties. I am inclined to think that, like the Fiji shell, they will prove to be nearest to the Australian form, but leading towards var. *cumingii* Reeve. The Black-edged Banda shell of the trade, to which form I believe Linnæus's type belongs, occurs throughout the Malay Archipelago. It is more smoky and less lustrous than the Australian shell, but the differences are slight. China (*M. sinensis* Leach, ? var. dist.); Andaman Islands (sp. in B. Museum approximating to var. *zanzibarensis*); Ceylon (occasionally found in Gulf of Manaar and Palk Straits); Maldive Islands (Mr. Stanley Gardiner informs me that it is fished by natives in Addu Atoll and occurs elsewhere throughout the archipelago).

Var. b. *M. margaritifera zanzibarensis*, n. var.

Type B.M. No. 1901.2.28.30; Zanzibar, A. van Noorden, Esq.

"Zanzibar shell" and "Madagascar shell" of the trade.

Ground-colour reddish grey, rufous tints prevailing. Radial rows of spots cloudy reddish yellow, rather indistinct. Margin of the nacre copper-coloured; the cupreous tint often pervading the nacre throughout. Form and size as in *M. m. typica.*

Geographical Distribution. Zanzibar, Madagascar and E. coast of tropical Africa; Amirante Islands (B.M.); Bazaruto Is. (B.M.); Mauritius (B.M.); Rodriguez (B.M., approaching to var. *erythrœensis*); Seychelles (B.M., pres. Sir A. Gordon; too young to refer definitely to any variety).

Var. c. *M. margaritifera persica*, n. var.

Type B.M. No. 1901.2.28.23; Persian Gulf, pres. A. van Noorden, Esq.

The "Bombay shell" of the trade; so called because largely shipped *via* Bombay from Persian Gulf.

The posterior margin of the nacre forms a right angle with the hinge, as in *M. maxima.* Colour greyish or greenish brown, lighter than in *typica*, with radial bands of yellowish white. Inside of lip light brown; margin of nacre brassy yellow or golden. The nacre lacks the somewhat steely sheen characteristic of the species, being whiter, often with a slight roseate tint, and approaching in lustre to that of *Margaritifera maxima.* Size as in *M. m. typica.*

Geographical Distribution. Persian Gulf, largely fished in the neighbourhood of the Island of Bahrein. There is an example in the British Museum from Adam Bank, near Gettar, Persian Gulf.

Var. d. *M. margaritifera erythrœensis*, n. var.

Type B.M. No. 1901.2.28.24; Red Sea, pres. A. van Noorden, Esq. Savigny, 1811, pl. 11. fig. 7.

The "Egyptian shell" of the trade.

Approximating to var. *persica* in form and colour, but less extreme. Posterior angle, formed by the meeting of the hinge and posterior margin of nacre, slightly obtuse, intermediate between that of *M. m. typica* and var. *persica*. Colour slightly darker than in var. *persica*. White radii very distinct. Inside of lip olive-green or brown. Nacre as in var. *persica* but less silvery. Size as in *typica*.

Hab. Red Sea. A specimen in the Museum from Aden, presented by Major Yerbury.

[Mother-of-Pearl dealers recognize three classes of Egyptian shells, differing slightly in colour and lustre, viz., Jiddah (darkest), Massowah (medium), and Aden (lightest). The last most closely resembles var. *persica*.]

Var. e. *M. margaritifera cumingi.*

Avicula cumingii, Reeve, 1857, sp. 6 (Lord Hood Island).

Type B.M.

The Black-edged shell of Eastern Polynesia, known in the trade as "Tahiti," "Gambier," "Auckland," &c. shell.

Form as in *M. m. typica*, but attaining greater dimensions; at times as much as 24–30 cm. in diameter, and often weighing six to eight pounds per pair of valves.

Colour deep glossy black, with, at most, very obscure traces of the radial rows of spots. The latter are often quite suppressed. Nacre steely in lustre, with a very broad margin of dark metallic green, this border being wider and darker than in *M. m. typica*. The "Tahiti," "Gambier," and "Auckland" shells of the trade are distinguished by slight differences in form, but in colour they all conform to *M. cumingii* of Reeve.

Geographical Distribution. Tahiti; Gambier Arch.; Lord Hood Isl.; Penrhyn Group, and Eastern Polynesia generally. I am not aware where the "Auckland" shells of the London markets are fished. Their name is probably due to their being shipped *per* Auckland from some Polynesian locality.

Var. f. *M. margaritifera mazatlanica.*

Margaritiphora mazatlanica, Hanley, 1855, p. 388, pl. 24. fig. 40 (Mazatlan, California).

Avicula barbata, Reeve, 1857, sp. 9 (Panama). Type B.M.

"Panama shell" of the trade.

This shell at first sight suggests a dwarfed and very convex example of *M. maxima* rather than a geographical race of *M. margaritifera*. It seems, however, to intergrade with the latter.

The distinctive characters of this variety are its great convexity and its aberrant shape and colour.

The posterior angle is acute, or, more rarely, a right angle; and the posterior margin of the nacre slopes forward from the hinge, much as in *M. maxima*, so that a perpendicular to the hinge, at its posterior end, would fall entirely posterior to the border of the nacre. The anterior margin, ventral to the byssal cleft, projects farther forward than in any other variety, so that a perpendicular to the hinge from its anterior end would cut off about $\frac{1}{3}$ of the valve.

Colour greyish yellow or light brown, often resembling that of *M. maxima*. Radial rows of spots very indistinct and approximating to ground-colour of shell. Inner surface of lip yellowish brown. Nacre silvery white, with a narrow golden or brassy margin.

Specimens from the Sandwich Islands and Mazatlan, and occasional Panama examples, together with exceptional individuals of *M. m. typica*, link this form to Linnæus's species.

Hanley's name *M. mazatlanica* takes precedence of Reeve's *M. barbata* for this variety. It has been referred to *Avicula fimbriata* Dunker (1852) by Carpenter (1857); but the species figured by Dunker (1872), pl. 3. figs. 2 & 6, as his *Avicula* (*Meleagrina*) *fimbriata*, 1852, is certainly distinct from the "Panama shell" of the trade, and probably represents a Central-American form allied to *M. vulgaris* or *M. sugillata*.

Geographical Distribution. Panama; Gulf of California; Mazatlan; Vancouver.

Specimens from the Sandwich Islands in the British Museum are intermediate between this variety and the type.

It is interesting to note that the oceanic variety (*cumingi*) is the darkest, the Australian and Malay shells are intermediate, and the lightest colours are assumed by shells living on the shores of the great Continents (vars. *zanzibarensis*, *persica*, *erythrœensis*, and *mazatlanica*). The most extreme of these, i. e. *persica* and *mazatlanica*, agree in having the posterior angle of the hinge right or acute.

Species 2. MARGARITIFERA MAXIMA, n. sp.

Type B.M. No. 1901.2.28.1; Basilaki (Moresby Island), British New Guinea, pres. H. Lyster Jameson.

Concha margaritifera (ex parte), Lister, 1685, fig. 222; 1696, pl. 9 (præ-Linnean).

Malacca pearl oyster, Home, 1828, vol. vi. pl. 49.

Meleagrina margaritifera (Linnæus), Kent, 1893, chap. 5, pl. xxxviii.

The large white Mother-of-Pearl shell of Australian, Papuan, and Malayan waters, "Silver-lip," "Gold-lip," &c.

It is a singular fact that the largest and most valuable species of Mother-of-Pearl Oyster has passed, hitherto, without a name; having been, no doubt, included by most writers under Linnæus's species.

Saville Kent, who was the first to point out clearly the distinctions between this shell and the "Black-lip," concluded that the more valuable species was the type of Linnæus's description, and recognized the Black-lip as *Avicula cumingii* Reeve. Pace (1898) suggested that the Black-lip was the species originally described by Linnæus as *Mytilus margaritiferus*; and by reference to the descriptions in the tenth edition of the *Systema* and in the *Mus. Reg. Ulr.*, as well as to the type specimens in the Linnean Society's collection, I found that this surmise, made before Mr. Pace's return to England, was correct. I suggest the name *maxima* for this species, as it reaches larger dimensions than the other members of the genus.

The shell is flatter than in *M. margaritifera* and of a different shape; the hinge being relatively much longer, $\frac{7}{8}$ of the total antero-posterior measurement of the nacre as a rule. The posterior margin of the nacre makes with the hinge an acute angle (in old shells a right angle); and a perpendicular to the hinge from its posterior end would pass outside the nacre altogether, or coincide for half the depth of the shell with its posterior margin. In typical examples of *M. margaritifera* (but not in vars. *persica* and *mazatlanica*) such a perpendicular would cut off a small area of the nacre posteriorly.

The anterior margin of the nacre, ventral to the byssal cleft, does not project so far forward as in *M. margaritifera*.

The byssal cleft in the right valve is less pronounced than in the preceding species, and becomes almost obliterated with age, as the byssus is lost when the shell reaches a diameter of 15–20 cm.

The young shell is flat, thin, and plate-like; with age it becomes massive, and may measure nearly a foot in diameter, and weigh 10 or more lbs. per pair.

The lappet-like processes of the lip differ in form from those of *M. margaritifera*, being broad at the base and gradually narrowing to the rounded apex, while in the latter species they are more oblong and parallel-sided. They are thinner and more fragile and transparent in *M. maxima* than in *M. margaritifera*.

Colour pale yellowish brown to deep ochre, with traces of radial markings of dark brown, green, or red in the umbonal area. The marginal region of the shell, together with the lappet-like prolongations, is marked by a series of characteristic dark and light circumferential lines, about 1–3 mm. apart, which I have never seen in *M. margaritifera*. The white spots of the preceding species are quite absent; when there are traces of radial markings they are *darker* than the ground-colour. The inner surface of the lip is light golden brown or amber-coloured and almost transparent. The nacre is silvery white, lustrous, with or without a golden margin.

As the geographical range of this species is much more restricted than that of the preceding, it does not so readily split up into well-marked geographical varieties, although at least seven local types are recognized in the Trade. "Port Darwin," "West Australian," and "Queensland" shells have a light yellowish exterior, and their nacre has a very white and silvery lustre, margin of nacre white or golden; New Guinea shells are darker than Queensland, usually with a golden margin; while the three Malayan varieties "Manilla" (Sulu Seas and Philippines), "Mergui," and "Macassar" are usually coloured deep yellow-ochre or brown, with a broad golden border to the nacre, and abundance of "fire," *i. e.* many-coloured iridescence.

Geographical Distribution. All along N. coast of Australia; E. coast as far south as Townsville (but not in quantities anywhere south of Cooktown); W. coast as far as 20° south in payable quantities, and sparingly as far south as 25° (for above details as to southern limits I am indebted to Mr. E. Munro of Thursday Island). In suitable localities off the coasts of New Guinea and the surrounding islands, the D'Entrecasteaux, the Louisiades, New Britain, and the Solomon Islands. It is found in many localities throughout the Malay Archipelago; the Aru Islands, coasts of Borneo, Sulu Seas, Philippines, Macassar, Mergui, &c. In the Indian Ocean proper it is unknown, and I cannot find any authentic record of its range extending far into the Pacific.

[My friend Mr. S. Pace has drawn my attention to the presence of hinge-teeth as an *occasional* character in the young of this species. A slight thickening of the hinge posterior to the ligament, in grown examples, may well be a trace of the obliterated lateral.]

Division 2. *Hinge with one or two minute tubercular teeth anterior to ligament; and a small elongated lateral tooth, running from the hinge, posterior to ligament, for a short distance on the surface of the nacre.*

Section a. *Shell massive, contorted, irregular in outline. Anterior margin with a very broad notch, ventral to rostrum; posterior margin entire or slightly sinuate, posterior process of hinge absent. Teeth feebly represented in the young shell, lost with age.*

Species 3. Margaritifera capensis.

Avicula (Meleagrina) margaritifera, L., var., Dunker, 1872, p. 58, tab. 20. figs. 1 & 2; Algoa Bay.

Avicula (Meleagrina) capensis, Sowerby, 1889, p. 158, pl. iii. fig. 10; S. Africa.

Specimens in the British Museum from Bazaruto Isl., E. Africa (*J. H. Ponsonby, Esq.*), and Port Elizabeth (*J. H. Ponsonby, Esq.*).

I can find no evidence of this species having ever found its way into the London Mother-of-Pearl markets. The thick massive shell should be of service for the manufacture of some of the articles for which *M. maxima* is used, but the dull, somewhat porcellaneous lustre of the nacre would naturally detract greatly from its value.

Section b. *Teeth very rudimentary. Shell flat as in* M. margaritifera. *Posterior marginal notch absent or slightly developed. Rostrum not sharply marked off from the inner surface of the valve. Longest dorso-ventral axis perpendicular to the hinge-line.*

Species 4. MARGARITIFERA SUGILLATA.

Avicula sugillata, Reeve, 1857, no. 27; Cape Hillsborough. Type B.M.

Avicula fimbriata, Reeve (nec Dunker), 1857, no. 25; N.W. Australia (*nom. præocc.*). Type B.M.

Avicula (Meleagrina) reeviana, Dunker, 1872, p. 45, tab. 15. fig. 1 (after Reeve), for *A. fimbriata,* Reeve.

Avicula irradians, Reeve, 1857, sp. 35; Australia. Type B.M.

The types of Reeve's three species are all very young shells. There are a few older examples in the Museum, acquired since the date of Reeve's monograph. I also possess a series of this shell, which I collected in Torres Straits. The complete intergradation between Reeve's three species makes it quite impossible to regard them as distinct.

I regard *M. sugillata* as the Torres Straits representative of the "Sharks Bay shell" of the London markets. The latter I am describing under a distinct name, as a well-marked geographical race, even if not actually specifically distinct.

The form of the adult *M. sugillata* is very variable, approximating to that of the Sharks Bay shell, but as a rule more convex, and with a shorter hinge relatively to the size of the valves. The colour is a dirty greyish yellow, with four or five brownish radial bands, which may be indistinct and imperfect, or may fuse to give the shell a uniform dark colour.

The lappet-like processes of the lip are large (especially in young examples), delicate, and characteristically "crimped" so as to be more or less ω-shaped in section, a feature easily discernible in Reeve's figures. The lappets are so thin as to be usually broken off except just at the lip; but here they are generally crowded together in grown shells, giving the lip a curious thickened appearance, which I have elsewhere seen only in specimens of *M. margaritifera* grown in unsuitable, silt-laden water.

The inside of the lip is dirty yellow, with cloudy brown markings, corresponding to the dark radial bands. These markings show a strong tendency to fuse and form a dark zone on the inner edge of the lip, next to the nacre. The nacre is white, with yellowish or greenish tints, but somewhat lacking in lustre.

Cape Hillsborough, N.W. Australia (*Reeve*). Port Essington and Torres Straits (spp. in Museum). Prince of Wales Island and Thursday Island, Torres Straits (*H. Lyster Jameson*).

This species, although closely resembling the Sharks Bay shell, has not yet found its way into the markets.

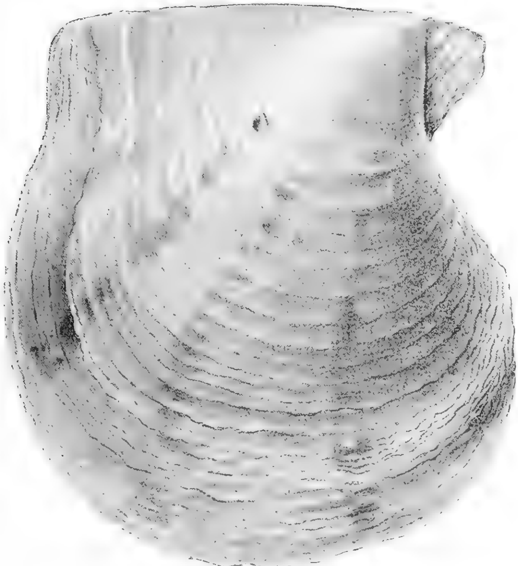
Species 5. MARGARITIFERA CARCHARIARUM, n. sp. (Text-fig. 92.)

Type B.M. 1901.2.28.48; Sharks Bay, pres. A. van Noorden, Esq.

"Sharks Bay shell" of Mother-of-Pearl markets.

Shell flat as in *M. margaritifera*, in outline suggesting a small example of *M. maxima*, but differing in the relatively greater size of the rostrum and the more vertical posterior margin of the nacre. Anterior teeth very abortive, in grown examples only represented by a slight unevenness on the inner surface of the hinge. Lateral teeth represented by a tiny lamina or elongated

Text-fig. 92.



Margaritifera carchariarum, nat. size.

facet just posterior to the ligament. The posterior angle of the nacre, where its margin meets the hinge-line, is a right angle. There is no marked sinus in the hinder margin, but a slight notch. The hinge is nearly as long as the antero-posterior measurement of the nacre, the ratio of measurements being the following:—

Hinge : length (ant.-post.) of nacre : depth (dors.-vent.) of nacre : : 60 : 70 : 75. Average specimens measure about 8–10 cm. in diameter. The hinge is relatively longer than in *M. sugillata*. In the latter species the anterior margin of the nacre, ventral to the byssal notch, projects considerably forwards.

The lappet-like lip processes are crimped as in *M. sugillata*.

Colour pale greyish or greenish yellow, almost white, with traces of four or five brown or green radial bands, which are never very distinct.

The inside of the lip is pale yellow, sometimes with brown markings. These, however, are less distinct than in *M. sugillata*, and rarely if ever fuse to form the dark marginal zone characteristic of that species.

The nacre is more leaden in lustre than in *M. margaritifera*, but slightly brighter than in *M. sugillata*. It has a distinct yellowish-green tint. The paler colour, absence of dark zone on inside of lip, and different shape serve to distinguish this species from the preceding.

A better acquaintance with the geographical variation of *M. sugillata* may lead to *M. carchariarum* being regarded merely as a variety of Reeve's species. Even as such, its characters are sufficiently distinct to entitle it to recognition as a variety as marked as any of those into which I have divided *M. margaritifera*.

The name *carchariarum* suggested itself to me as the most convenient way of associating the species with its chief locality, Sharks Bay, W.A.

Geographical Distribution. Sharks Bay, Western Australia (fished in quantities for the London markets). Sharks Bay, Derby, and Kimberley (spp. sent to Mr. Martin F. Woodward by Mr. B. H. Woodward, Curator, Perth Museum, W.A.).

This shell is of small and fluctuating value as Mother-of-Pearl, and yields a certain quantity of pearls in Western Australia, mostly of inferior quality. At present it realizes from 10*s.* to 20*s.* per cwt. in the London market, chiefly for the manufacture of small buttons.

Species 6. MARGARITIFERA NATALENSIS, n. sp. (Text-fig. 93, p. 383.)

Type B.M. 1901.5.29.1; Umkomaas, near Durban, Natal. Coll. J. H. Ponsonby, Esq.

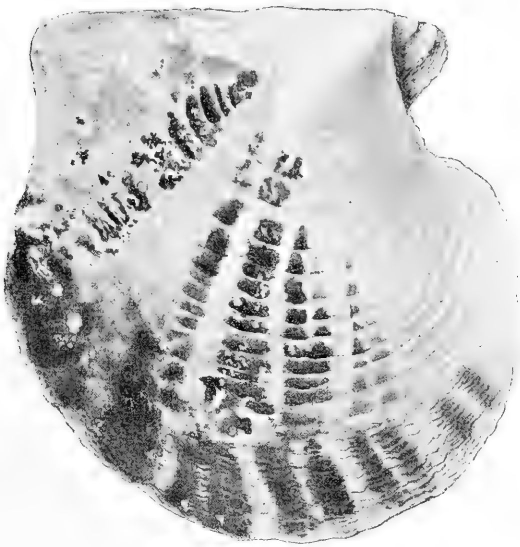
Form as in *M. carchariarum*, to which it is closely allied.

Posterior margin of shell without, or with very faint, sinus. Valves relatively flat. The hinge is as long as the antero-posterior measurement of the nacre. The postero-ventral angle of the nacre is somewhat truncated, the margin of the nacre turning sharply forward about halfway between the hinge and the ventral border. The posterior angle of the hinge is a right angle. Unfortunately, the lip-processes are not well preserved, but they appear to be smaller and less foliaceous than in *M. sugillata* and *M. carchariarum*. The ground-colour is pale greenish yellow, as in the two preceding species: but the radial markings are very much darker: they consist of four or five broad bands of a dark purple-brown colour, almost black.

The interior of the lip is whitish, the dark radii showing up as broad, sometimes confluent, black blotches. The nacre is as in *M. carchariarum*.

From hinge to ventral margin this shell measures 70 mm., do. to margin of nacre 57 mm. Total antero-posterior measurement of shell 70 mm.; do. nacre 55 mm.; do. hinge 55 mm.

Text-fig. 93.



Margaritifera natalensis, nat. size.

Loc. Umkomaas, near Durban, 3 specimens.

A specimen from Durban, J. H. Ponsonby, 96.9.25.8, though differing slightly in form from these examples, is probably the same species.

Species 7. MARGARITIFERA FLEXUOSA.

Avicula flexuosa, Reeve, 1857, sp. 4.
Cape Hillsborough, Australia. Type in Brit. Mus.

The following unlocalized species seem to be closely allied to the *M. sugillata* group.

Species 8. MARGARITIFERA CITRINA.

Avicula citrina, Dunker, 1852, p. 68; loc. incogn.
Avicula (Meleagrina) citrina, Dunker, 1872, p. 14, tab. 3. fig. 4.

Species 9. MARGARITIFERA ATROPURPUREA.

Avicula atropurpurea, Dunker, 1852, p. 76; loc. incogn.

Avicula (Meleagrina) atropurpurea, Dunker, 1872, p. 14, tab. 3. fig. 3.

Species 10. MARGARITIFERA ANOMIOIDES.

Avicula anomioides, Reeve, 1857, sp. 26; loc. incogn. Type in Brit. Mus.

= *M. vulgaris*, fide Cooke, 1886.

A young shell, apparently distinct. Young shells from Bazaruto Island (Ponsonby Coll. Brit. Mus.) resemble this form. Dunker suggests that this species and also *M. crocata* Swainson may be his *M. citrina*.

Species 11. MARGARITIFERA SCHEEPMAKERI.

Avicula (Meleagrina) scheepmakeri, Dunker, 1872, p. 6, tab. 1. fig. 1; loc. incogn; probably = *M. sugillata*, Reeve.

Species 12. MARGARITIFERA TRISTIS.

Avicula (Meleagrina) tristis, Dunker, 1872, p. 44, tab. 14. fig. 3; loc. incogn.

Section **c**. *Teeth much more strongly developed than in* Section **b**. *Shell somewhat oblique; longest dorso-ventral axis directed slightly backward; very convex, inequivalve, with well-marked posterior process of the hinge and distinct sinus in posterior margin.*

In this section, which comprises the shells known as "*Lingah*" in the trade, there is a general approach towards the typical *Pteria* s. s. form, in the sharp separation of the hinge from the valves by anterior and posterior marginal notches, in the convexity and slight obliquity of the shell, and the well-marked anterior and lateral teeth.

Species 13. MARGARITIFERA VULGARIS.

Perlamater vulgaris, Schumacher, 1817, p. 108, pl. xx. fig. 8; no loc.

Chemnitz, 1785, tab. 80. fig. 717 (referred to by Schumacher as a second figure of his *P. vulgaris*).

Avicula fucata, Gould, 1850, p. 309; 1852, p. 441, pl. 39. fig. 551; New Zealand.

Avicula fucata, Reeve, 1857, sp. 74; Japan. Type in B.M.

Avicula occa, Reeve, 1857, sp. 24; Red Sea. Type in B.M.

Avicula aerata, Reeve, 1857, sp. 32; Australia. Type in B.M.

Avicula perviridis, Reeve, 1857, sp. 20; Australia. Type in B.M.

Avicula (Meleagrina) varia, Dunker, 1872, p. 17, tab. 4. fig. 6; Red Sea.

Avicula (Meleagrina) badia, Dunker, 1852, p. 79; 1872, p. 12, tab. 2. fig. 7; no loc.

Savigny, 1811, pl. 11. figs. 8 & 9.

As Schumacher's figure, and the one by Chemnitz to which he refers, are evidently typical Eastern Lingah shells (from convexity, posterior "auricle" of hinge-line, sharp separation of the inner surface of the rostrum from the general surface of the nacre by a well-defined ridge, and distinct anterior and lateral teeth in Schumacher's figure), the name *vulgaris* must replace the more familiar *fucata* (Gould) for this species.

This shell is extremely variable, and young examples have been described as distinct species over and over again, while, until comparatively recently, the grown shell has been confused by many writers with *M. margaritifera.*

It is highly probable that some of the described forms which I am still treating as separate species will, on better acquaintance, prove to be merely geographical races of *M. vulgaris* Schumacher.

Geographical Distribution and Variation:—

Ceylon and Southern India. The Ceylon Pearl-Oyster is the best known local form of this species. It frequents the Gulf of Manaar, Palk Straits, and the Southern coasts of India. It differs from most other local races in its lighter colour, and the whitish or pink ground-colour of the interior of the lip.

Maldive Islands. Mr. J. Stanley Gardiner, on his recent visit to the Maldives, found this species fairly plentiful there, but not in extensive beds. Unlike *M. margaritifera*, this shell is not fished by the natives of the Maldives.

Mr. Gardiner's specimens closely resembled those from Ceylon, and were at once referred by Captain Donnan to the same species.

Persian Gulf. The Lingah shell of the Persian Gulf belongs to this species. It is distinguishable from the Ceylon form by its darker colour, the exterior being usually more purple and the radial markings almost black. The interior of the lip is dark red. The shell attains somewhat larger dimensions than in Ceylon waters. It is shipped in quantities to the London markets, but is of small and fluctuating value, owing to large supply and limited demand.

Red Sea. Throughout the Red Sea this shell is common, but is fished almost exclusively for pearls. There are a number of specimens from the Red Sea in the British Museum, but with one exception (Aden, Major Yerbury) they are very young. The Aden specimen is very like a Ceylon shell.

[*Mediterranean.* Since the opening of the Suez Canal this species has wandered into the Mediterranean. There are typical examples from Alexandria (W. B. Tegetmeier) and Malta (Col. Feilden) in the British Museum. An account of this interesting immigration has been published by Vassel, 1896.]

East Africa. Specimens from Mauritius (B.M.; Mus. Cuming), S. Africa (B.M.; J. H. Ponsonby Coll.), Bazaruto Isl. (do.), and

Durban (do.), although differing slightly from normal Lingahs in form and markings, are probably merely a local race of this very variable species. I do not feel disposed to describe them even as a geographical variety on the small amount of material available.

Malay Peninsula and Archipelago. Specimens from Malacca and Singapore in the Brit. Mus. are hardly different from Ceylon examples. I have found typical examples associated with the young of *M. margaritifera* in a trade sample from Flores.

Australian Waters. The "Australian Lingah" shell of the London markets, most of which comes, I believe, from West Australia, and the "Bastard Shell" of Torres Straits (Pace, 1898) are referable to this species. There are immature examples of *M. vulgaris* from various localities on the North coast of Australia in the British Museum. Two specimens from Sydney, presented by the Earl of Derby, are the most southerly record. On the West coast it occurs as far south as Sharks Bay (Saville Kent). Australian Lingahs closely resemble those from the Persian Gulf in colour.

New Guinea. The Pearl Shell of the Trobriand Islands, which is fished almost exclusively for its pearls, belongs to this species. The fishing is carried on entirely by the natives, in 0–2 fms., and the live shells are purchased in bulk by the traders. They yield quantities of pearls, mostly of inferior value. The shell has been exported and sold as Lingah in small quantities. The external colour of the Trobriand shell is as in the Persian Gulf form, but the nacre is more smoky and leaden in lustre. I have occasionally found isolated examples in other localities in Eastern New Guinea.

New Zealand. Gould (*M. fucata*).

Japan. Reeve (*M. fucata*) (locality doubtful).

Species 14. MARGARITIFERA MARTENSI.

Avicula (Meleagrina) martensii, Dunker, 1872, pp. 66 & 79, tab. 23. figs. 2 & 3 (nom. "*japonica*" p. 66), "Mare Japonica."

? *Avicula pica* (Gould), Lischke, 1869, i. pp. 161–2, iii. p. 112; Japan.

The Pearl-Oyster of Japan. The "Japan Lingah Shell" of the London markets.

In the absence of actual connecting forms I am treating this species as distinct. I anticipate, however, that a better knowledge of the Lingahs will prove it to be simply a local form of the preceding species, from which it differs mainly in its smaller size and in the predominance of brown and white in the external colouring. The interior of the lip is marbled with yellow-ochre and chocolate-brown, instead of pink and purple-red as in typical specimens of *M. vulgaris*. The form, texture, iridescence, and plan of marking are as in *M. vulgaris*.

Species 15. MARGARITIFERA NEBULOSA.

Avicula nebulosa, Conrad, 1837, p. 246.

Avicula pallida, Conrad, 1837, p. 246.

Avicula nebulosa, Conrad, Reeve, 1857, sp. 33, figs. 33, 34; Sandwich Islands. Type B.M.

Avicula (*Meleagrina*) *lichtensteinii*, Dunker, 1852, p. 77; 1872, p. 10, tab. 2. fig. 3; Sandwich Islands.

=*M. vulgaris* (Schumacher), fide Cooke, 1886.

If this shell is specifically distinct, which can only be proved by comparison of a larger series than that available in the British Museum, it is very closely allied to *M. vulgaris*. I fully expect that it will turn out to be merely a local form of Schumacher's species. Some of the specimens in the British Museum show a tendency to the predominance of orange ground-colour with black markings. Such a coloration is not unknown in examples of *M. vulgaris*. The largest examples in the Museum, about the size of five-year old Ceylon shells, are practically indistinguishable from specimens from the Gulf of Manaar.

Distribution. Oman, Sandwich Islands (B.M., collect. Nuttall); Sandwich Islands (Mus. Cuming).

The "Nuttall" specimens are probably the types or cotypes of Conrad's two species.

Species 16. MARGARITIFERA FIMBRIATA.

Avicula fimbriata, Dunker, 1852, p. 79; "Central America."

Avicula (*Meleagrina*) *fimbriata*, Dunker, 1872, p. 13, tab. 3. figs. 2 & 6.

This shell has been confused by Carpenter (1857) with *M. margaritifera* var. *mazatlanica*, on the strength of Dunker's description in 1850. Dunker's figures (1872) represent a species that is certainly not *M. margaritifera*, but probably a Central American representative of the Lingah shells. Dunker does not inform us whether it occurs on the Atlantic or Pacific side of the Continent.

Species 17. MARGARITIFERA LENTIGINOSA.

Avicula lentiginosa, Reeve, 1857, sp. 13; Moluccas. Type in B.M.

(=*M. vulgaris*, fide Cooke, 1886.)

The "White Banda" shell of the trade.

At present, unfortunately, the White Banda shell is not to be procured in the London markets. The couple of specimens that I have seen in City warehouses closely resemble Reeve's type of this species. They differ mainly from *M. vulgaris* in being larger, somewhat flatter, and of a greyish external colour. The White Banda shell is said to be fished in deep water, associated with the Macassar shell (*M. maxima*).

Species 18. MARGARITIFERA PRÆTEXTA.

Avicula prætexta, Reeve, 1857, sp. 15; Island of Corregidor, Philippines. Type in B.M.

(?=*M. lentiginosa*.)

Species 19. MARGARITIFERA IMBRICATA.

Avicula imbricata, Reeve, 1857, sp. 11; Philippines. Type in B.M. (= *M. vulgaris*, fide Cooke, 1886.)

Avicula muricata, Reeve, 1857, sp. 12; Philippines. Type in B.M. (= *M. vulgaris*, fide Cooke, 1886.)

Types, figures, and descriptions quite inseparable. Both species may well be the young of the White Banda.

Species 20. MARGARITIFERA CHEMNITZII.

Avicula chemnitzii, Philippi, 1849, p. 19; China Sea.

Chemnitz, 1785, vol. viii. tab. 80. fig. 720; Tranquebar (ref. Philippi): ? = *M. vulgaris*.

Avicula (Meleagrina) chemnitzii, Philippi, Dunker, 1872, p. 15, pl. 3. fig. 5; China Sea.

Dunker suggests that *M. lentiginosa* (Reeve) = *M. chemnitzii* (Philippi).

Species 21. (Unlocalized.)

MARGARITIFERA CETRA.

Avicula cetra, Reeve, 1857, no. 28; no loc. Type in B.M.

Species 22. MARGARITIFERA PITCAIRNENSIS, n. sp.

For *Avicula pica*, Gould, Reeve, 1857, sp. 71; Pitcairn Island. Type in B.M.

(Not *Avicula pica*, Gould, 1852, p. 443, pl. 39. fig. 549.)

Type sp. Mus. Cuming, B.M.

I cannot agree that Reeve's *Avicula pica* Gould, from Pitcairn Island, is the same species as that figured and described by Gould from Samoa. Reeve's type specimen is a dwarfed thick-shelled example of a mollusc that normally resembles *M. vulgaris* very closely. The Mus. Cuming specimens, from among which my type is selected, and which are probably paratypes of Reeve's species, are very like some specimens of Australian and New Guinea Lingahs. In the absence of evidences of intergradation, I am treating this Pitcairn shell as distinct from the latter. If further material is procured, it may be found to be a local race of *M. vulgaris*.

Size and form as in *M. vulgaris*, but with the processes of the lip-margin thicker and more rounded, resembling those of *M. lurida* Gould and *M. panasesæ* n. sp., rather than those of the Lingah shells. The transverse dark and light marks on these processes, so characteristic of *M. vulgaris*, are absent. The ground-colour of the shell is white, with a number of radial bands of dark red or purple-brown, which, as in *M. vulgaris*, are quite different in their number and relations in different individuals. Interior of the lip white, with red or purple blotches. Nacre lustrous, slightly golden in tint. The characters of the lip-processes and the prevailing white ground-colour distinguish this shell from typical *M. vulgaris*. The white ground-colour occurs occasionally in the Trobriand Island *M. vulgaris* and in Lingahs from other localities.

Species 23. MARGARITIFERA RADIATA.

Avicula radiata, Leach, 1814, vol. i. pl. 43, p. 98; ? West Indies.

Avicula squamulosa, Lamarck, 1836, tab. 7, p. 100; Brazil.

Avicula squamulosa, Lamarck, d'Orbigny, 1847, tom. 5, p. 658, no. 761; Rio de Janeiro, coasts of Brazil, Antilles (Cuba, Martinique, Guadeloupe, and Santa Lucia).

Avicula flabellum, Reeve, 1857, sp. 7; hab. Venezuela. Type in B.M.

Avicula (Meleagrina) flabellum, Reeve, Dunker, 1872, p. 20, tab. 6. fig. 1; hab. Porto Cabello, Venezuela.

Avicula alaperdicis, Reeve, 1857, sp. 10; Antilles. (Type apparently not extant in British Museum.)

Avicula assula, Reeve, 1857, sp. 40; Antilles. (Type apparently not extant in British Museum.)

[Probably also the following species of Dunker:—

Avicula (Meleagrina) echinus, Dkr. 1872, p. 40, tab. 13. fig. 2; Havana.

,, ,, *horrida*, Dkr. 1872, p. 11, tab. 2. fig. 4, tab. 15. fig. 2; Venezuela and Antilles.

,, ,, *longisquamosa*, Dkr. 1872, p. 12, tab. 2. fig. 6; Porto Cabello, Venezuela.

,, ,, *olivacea*, Dkr. 1872, p. 17, tab. 4. fig. 5; Antilles.

,, ,, *tamsiana*, Dkr. 1852, p. 78; 1872, p. 15, tab. 4. figs. 1 & 2; Porto Cabello, Venezuela.]

The West Indian Pearl-Oyster.

This species has been treated to a number of synonyms, mostly based upon characters of a nature quite valueless for systematic purposes. Lamarck and d'Orbigny both emphasize the great variability of colour in this shell. It remains yet to be proved that there is more than one species of *Margaritifera* in the West Indies and on the Atlantic Coasts of Tropical America.

The West Indian Pearl-Oyster yields pearls in many localities, but is practically valueless as Mother-of-Pearl. Conchologically, it seems to be closely allied to the Lingah shells, but the posterior process of the hinge is smaller, and the form often more nearly approaches to that of the subgenus *Electroma*.

Species 24. MARGARITIFERA LURIDA.

Avicula lurida, Gould, 1850, p. 310; 1852, p. 440, pl. 39 fig. 550; Fiji Islands.

Specimens in the British Museum, coll. J. Brenchley, Esq., from Tongatabu, Friendly Islands, are quite in agreement with Gould's figure and description of *Avicula lurida*. At first sight this species suggests a small convex example of *M. margaritifera*, but the presence of hinge-teeth and of a sinus in the posterior margin proves this resemblance to be purely superficial.

It seems to be most nearly related to *M. vulgaris*, but the hinge is shorter and the posterior "auricle" less pronounced.

The lappet-like processes of the lip are short, strong, and rounded.

External colouring greyish or greenish brown with dark radial markings. The inside of the lip is coloured much as in *M. margaritifera*. The general plan of marking is very much the same as in *M. vulgaris*, but there is an entire absence of the reddish tints so characteristic of that species.

Species 25. MARGARITIFERA PERNOIDES.

Avicula pernoides, Reeve, 1857, sp. 34; no loc. Type in B.M.

Species 26. MARGARITIFERA PANASESÆ, n. sp. (Text-fig. 94.)

? *Avicula maculata*, Gould, 1850, p. 309; Tutilla, Samoa (præocc.).

Avicula pica, Gould, 1852 (for *A. maculata*, Gould), p. 443, pl. 39. fig. 549 (præocc. Philippi, 1849, p. 21).

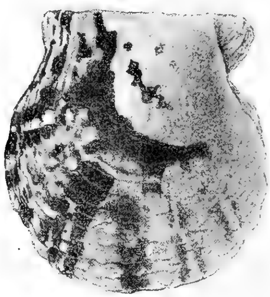
Not *Avicula pica*, Gould, Reeve, 1857, sp. 71.

Type B. M. No. 1901.3.25.2, Conflict Atoll, British New Guinea; coll. H. Lyster Jameson.

(Panasesa, native name of chief island of Conflict Atoll; also used collectively to denote the entire Atoll.)

Without an opportunity of examining Gould's type, it is impossible to say what shell he had before him. His figure and description strongly suggest the present species.

Text-fig. 94.



Margaritifera panasesæ, nat. size.

Shell somewhat convex, inequivalve, slightly oblique; rostrum distinctly marked off from surface of nacre internally by a sharp ridge. Form as in *M. vulgaris*, but with less pronounced posterior auricle. Teeth as in *M. vulgaris*. Lip-processes shorter, more rounded, and relatively thicker, with no trace of the dark and light circumferential or transverse markings so typical of the lip-processes of *M. vulgaris.* Ground-colour white, with 6 to 10 green, brown, or black radii, which are very variable, in some cases being almost entirely suppressed, in others being confluent, so that the shell is of a uniform dark colour. Interior of the lip white, with black or dark purple blotches, corresponding to the radial bands. Nacre lustrous, tinted with brassy yellow, with a steely sheen, transparent, showing the blotchy external markings distinctly through its substance, as depicted in Gould's figure.

Length of hinge 28 mm.; total antero-posterior measurement of shell 37 mm., do. of nacre 28 mm., total dors.-ventr. measurement of shell 37 mm., do. nacre only 28 mm. The greatest antero-posterior measurement of shell is in the ventral third.

Distribution. Conflict Group, British New Guinea, on dead coral-reef flats (*H. L. J.*). Other localities in New Guinea waters: Moresby Island, Samarai, Bonvouloir Group, &c. (*H. L. J.*); Badu (Mulgrave Island), Torres Straits, in rock-pools (*H. L. J.*).

"Australia"; Keeling Island: Fiji; Lord Howe Island (*J. Brazier, Esq.*); Samoa (*Rev. S. J. Whitmee*); Loo Choo Isls. (*H. Seebohm, Esq.*): in British Museum.

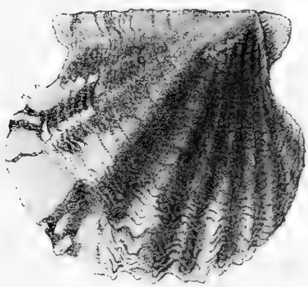
? Distinct, S. Africa, Ponsonby coll., B.M.

Species 27. MARGARITIFERA MAURITII, n. sp. (Text-fig. 95.)

Type B.M. No. 1885.9.19.14. Attached to pumice-stone found floating off Mauritius (*Robillard*).

Shell oblique, inequivalve, left valve very convex, right valve comparatively flat. Posterior margin very distinctly sinuated, as in *M. vulgaris.* Lappet-like lip-processes resembling those of

Text-fig. 95.



Margaritifera mauritii, nat. size.

M. pitcairnensis, *M. lurida*, and *M. panasesæ*, strong and finger-like, without transverse markings. Teeth as in *M. vulgaris.* Coloration unusually rich compared with the rather washy external markings of most species; very variable, from dark reddish brown to golden yellow and pale grey, with six to eight white or dark radii of very inconstant form. The radius from the umbo to postero-ventral angle of shell is usually more distinct than the others and often different in colour. No two of the ten examples in the Museum are similarly coloured, all colours—black, brown, purple, red, pink, white, and yellow—being represented in all possible combinations.

The interior of the lip is white with scattered red blotches, or golden yellow with dark brown markings, or cream-coloured with pale brown markings, or black with irregular white markings.

The nacre has the yellowish-green tint characteristic of *M. panasesæ*.

Measurements. Hinge 30 mm.; greatest antero-post. measurement 40; do. nacre 30 mm. Greatest dorso-ventr. measurement 35 mm.; do. nacre 25 mm. Greatest antero-posterior measurement is very nearly on the ventral margin in some specimens.

The shell shows a strong tendency for the postero-ventral angle to be drawn out somewhat, as in *Pteria* s. s. or *Electroma*. This character, coupled with great obliquity and convexity, extraordinarily rich coloration, and unusual length of the ventral margin, should suffice to distinguish this somewhat aberrant species.

Geographical Distribution. 10 specimens in B. M., 1885.9.19, nos. 13–22; found attached to pumice-stone floating off Mauritius (*Robillard*).

Species of uncertain position.

Species 28. Margaritifera nigra.

Avicula nigra, Gould, 1850, p. 309. Singapore.
Avicula nigra, Gould, 1852, pp. 438–9, pl. 40. fig. 554.

Species 29. Margaritifera vidua.

Avicula vidua, Gould, 1850, p. 309. Fiji.
Avicula vidua, Gould, 1852, p. 439, pl. 39. fig. 553.

Species 30. Margaritifera glabra.

Avicula glabra, Gould, 1850, p. 310. New Zealand.
Avicula glabra, Gould, 1852, pp. 442–3, pl. 39. fig. 552.

Species 31. Margaritifera placunoides.

Avicula placunoides, Reeve, 1857, sp. 68. Australia. Type in B.M.

Species 32. Margaritifera tegulata.

Avicula tegulata, Reeve, 1857, sp. 17. Moreton Bay, Queensland. Type in B.M.

Species 33. Margaritifera lacunata.

Avicula lacunata, Reeve, 1857, sp. 29. New Holland. Type in B.M.

Species 34. MARGARITIFERA REENTSII.

Avicula (Meleagrina) reentsii, Dunker, 1872, p. 9, tab. 2. figs. 1 & 2. Red Sea.

The following species, from Reeve's and Dunker's Monographs, are founded upon unlocalized material. Most of the shells figured, and such of Reeve's types as are preserved, are too young to be identfied with safety. They probably all belong to the Lingah division, and are, I believe, in most cases the young of *M. vulgaris* and *M. radiata*.

Species of this kind, based upon unlocalized immature and scanty material, can have no scientific value, and only a historic interest.

M. crocata (Swainson), Dunker, 1872, p. 16.
M. radula (Reeve), 1857, sp. 23. Type in B.M.
M. irrasa (Reeve), 1857, sp. 30. Type not extant.
M. chamoides (Reeve), 1857, sp. 41. Type in B.M.
M. hystrix (Reeve), 1857, sp. 18. Type in B.M.
M. pallida (Dunker), 1872, p. 46, tab. 15. fig. 4.
M. grisea ,, ,, p. 11, tab. 2. fig. 5.
M. prasina ,, ,, p. 52, tab. 18. fig. 2.
M. concinna ,, ,, p. 53, tab. 18. fig. 4.
M. bicolor ,, ,, p. 70, tab. 24. fig. 7.
M. fluctuosa ,, ,, p. 71, tab. 25. fig. 2.

[*Avicula (Meleagrina) magellanica* Stempell, 1899 ("Die Muscheln der Sammlung Plate," Fauna Chiliensis, Bd. 2, erstes Heft, S. 230, Taf. 12. figg. 13–15), strongly suggests the genus *Philippiella* (Pfeffer, 1886). Specimens in the B.M. from Punta Arenas, 9–10 fms., Dr. Coppinger, 79.10.15.—79 and 80 appear to me to be quite in agreement with Stempell's description and figure. The fact that the British Museum specimens were taken in the same locality and depth as Stempell's confirms my opinion that they are identical. I can see no grounds for placing them in the genus *Pteria*.]

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

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

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FOR

SCIENTIFIC BUSINESS.

(AT 3 HANOVER SQUARE, W.)

Session 1900–1901.

1900.

Tuesday,	November	20	Tuesday,	December	4 and 18

1901.

Tuesday,	January	15	Tuesday,	April ..	2 and 16
,,	February	5 and 19	,,	May	7 ,, 21
,,	March ..	5 ,, 19	,,	June	4 ,, 18

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