

May 15, 1906.

Dr. J. ROSE BRADFORD, F.R.S., Vice-President,
in the Chair.

The Secretary read the following report on the additions that had been made to the Society's Menagerie during the month of April 1906 :—

The number of registered additions to the Society's Menagerie during the month of April was 171. Of these 71 were acquired by presentation and 6 by purchase, 80 were received on deposit, 4 in exchange, and 10 were born in the Gardens. The number of departures during the same period, by death and removals, was 150.

Among the additions special attention may be called to :—

A Samango Guenon (*Cercopithecus samango*) from South Africa, deposited on April 25th.

A Pallas's Cat (*Felis manul*) from Tibet, deposited on April 3rd, new to the collection.

Fourteen Desert Jerboa Rats (*Notomys cervinus*) from Australia, deposited on April 20, new to the collection.

A Canadian Porcupine (*Erethizon dorsatus*) from North America, presented by Mr. Munro Walker on April 11th.

Mr. F. E. Beddard, F.R.S., exhibited a nearly full-time fœtus of the Red-fronted Lemur (*Lemur rufifrons*), and called attention to the carpal vibrissæ, which were extremely conspicuous, though the rest of the ventral surface of the arm was devoid of hair.

Mr. Beddard also exhibited, on behalf of Dr. C. G. Seligmann, a cock of mixed breed which had been caponised for commercial purposes whilst young. The bird, which had been under observation for over a year, at no time showed any evidence of sexual attraction for or towards either sex. On dissection, there was no trace of testicular tissue. The head was hen-like, but the bird possessed well-marked and rather stout but short spurs, whilst the tail, which contained sickle-feathers, was "over-furnished."

Mr. R. I. Pocock, F.Z.S., Superintendent of the Gardens, exhibited and made remarks upon a specimen of a Leaf-insect (*Phyllium*) from the Seychelles, which had been brought to the Gardens by Mr. E. G. B. Meade-Waldo, F.Z.S.

Mr. Henry Munt, F.Z.S., exhibited, on behalf of Mr. Bussell, a skin of the Spotted-necked Otter (*Lutra maculicollis*) obtained at Fort Johnston, Uganda. The skull and carcass had been extracted through the mouth, thus leaving the skin intact.

The following papers were read :—

1. Zoological Results of the Third Tanganyika Expedition, conducted by Dr. W. A. Cunningham, 1904-1905. Report on the *Hydrachnida*. By J. N. HALBERT, Dublin Museum*.

[Received March 9, 1906.]

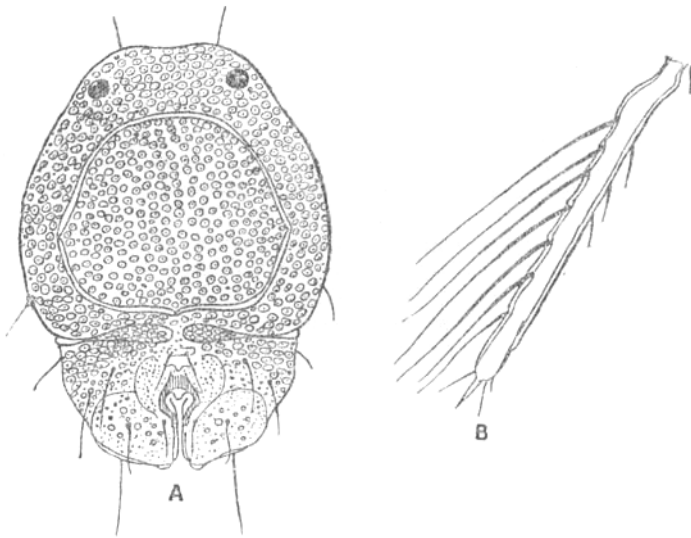
(Text-figure 94.)

The Water Mites collected by Dr. W. A. Cunningham were taken in Lake Nyasa and are referable to two species, which have been described by Dr. F. Koenike in his papers on the Hydrachnida of Madagascar and East Africa.

ENCENTRIDOPHORUS SPINIFER (Koen.).

Two of the three specimens of Hydrachnida collected at Nyasa are to be referred to this species. Dr. Koenike includes it in the

Text-fig. 94.



A. Dorsal view of *Arrhenurus plenipalpis*, Koen. (legs and palps not drawn).

B. End segment of fourth pair of legs of *Encentridophorus spinifer* (Koen.).

genus *Atax* (1); but Piersig makes a new genus *Encentridophorus* for its reception (2), chiefly on account of the peculiar spine which replaces the claws on the end segment of the fourth pair of legs

* Communicated by Dr. W. T. CALMAN, F.Z.S.

(text-fig. 9 B), and the absence of a large chitinous disc-bearing plate on each side of the genital field. The genital discs are imbedded in the soft skin of the body.

The colouring of the Nyasa specimens is pale green with brownish blotches on the dorsal surface, the central caecal area is yellow, and the legs and palps green.

Localities. Zanzibar (*Stuhlmann*); Dromira Bay, Lake Nyasa, June 19, 1904, among algæ &c. (*Cunnington*).

ARRHENURUS PLENIPALPIS Koen.

A male *Arrhenurus* found in the same locality as the preceding species seems to be referable to *A. plenipalpis* Koen. On comparison, however, with the description and figures of this species some rather puzzling differences are apparent, notably the presence in the Nyasa specimen of a chitinous petiolus-like organ. This structure is situated in the middle line of the body and projects in the posterior indentation of the body appendage in the form of a short bluntly-pointed process (text-fig. 94 A). This, however, is a sexual characteristic, which in the *Micrurus* section of the genus may possibly be prominent only in some specimens or under certain conditions. The forked chitinous organ in the centre of the appendage, which Dr. Koenike calls the "Hautgebilde," seems to differ somewhat in outline, but I suspect that this may be due to the preservation of the specimens or to slight differences in the drawing. Otherwise the Nyasa mite agrees closely with the description of *A. plenipalpis* (3), and a full description of the Nyasa specimen is unnecessary. Although Dr. Koenike describes the present species in the letterpress of his paper (3) under the name of *A. plenipalpis*, and makes reference to plate xxi. figures 36-40, yet in the explanation of the plates these particular figures are referred to as representing a new species, *pertusus* (page 427). No explanation is given for this change of name. The species is included in Dr. Piersig's recent work on the Hydrachnida (4) as *A. plenipalpis*.

Localities. Madagascar; Nossi-Bé; German East Africa (*Quilimane*); Dromira Bay, Lake Nyasa (*Cunnington*).

Bibliography.

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2. PIERSIG, R.—"Bemerkungen zur Hydrachnidenkunde." Zool. Anz. 1897, xx. pp. 59-61.
3. KOENIKE, F.—"Hydrachniden: Fauna von Madagascar und Nossi-Bé." Abhand. Senckenb. Ges. 1898, xxi. pp. 297-435.
4. PIERSIG, R.—"Hydrachnidæ und Halacaridæ." Das Tierreich, 1901. 13. Lieferung.

2. On Mammals from Northern Australia presented to the National Museum by Sir Wm. Ingram, Bt., and the Hon. John Forrest. By OLDFIELD THOMAS, F.R.S., F.Z.S.*

[Received April 2, 1906.]

(Plate XXXVII.†)

The Northern Territory of South Australia has a Mammalian fauna of a very peculiar type, and one that is far from being worked out, in spite of the labours of Dr. Elsey, Mr. Gould's collectors, and others in early days, and of Dahl, Tunney, and others more recently. Similarly the centre of the continent is badly represented in the National Collection, although Prof. W. B. Spencer, of Melbourne, who first went there with the Horn Expedition, has laid the foundation of a proper knowledge of it.

Now, thanks to the liberality of Sir William Ingram, Bart., and of the Hon. John Forrest, of Brisbane, a zoological collector has been put to work at Alexandria, a station intermediate in position between the two areas above referred to, and therefore in a district possessing a very special interest to the student of Australian zoology.

Alexandria is situated about lat. 19° S., long. 137° E., about 200 miles inland from the S.W. coast of the Gulf of Carpentaria, and lies in an area draining inwards to the Polygonum swamp. The watershed-boundaries would, however, appear to be low, and unlikely to act as barriers to the dispersal of species, so that in this region the question of drainage is not likely to be of great zoological importance. Collections have also been made near Alroy, about 100 miles to the west of Alexandria. Perhaps later the exploration may be extended still further west to the ranges along the Trans-continental Telegraph-line.

Mr. W. Stalker, the collector employed, has naturally found immense difficulties in the way of collecting in this desert region, owing to the long-continued drought, no rains of any value having fallen for several years, and the fauna being therefore at its lowest ebb.

For this reason the collection of which I here give a list is a most creditable one for the time in which it was obtained, and as rain has since fallen in the district we may hope that Mr. Stalker will now be enabled to capture many further forms of interest that have hitherto escaped him.

The present collection contains examples of 16 species, of which five are new. The most interesting of these is the peculiar little flat-headed Marsupial mouse which I have named *Phascogale*

* [The complete accounts of the new species described in this communication appear here; the names and preliminary diagnoses of two of the species were published in the 'Abstract,' and these are distinguished by the names being underlined.—EDITOR.]

† For explanation of the Plate, see p. 543.



H. Goodchild. del. et lith.

Huth, imp.

1. MUS FORRESTI. 2. PHASCOGALE INGRAMI.

ingrami, after Sir William Ingram, though a new species of *Mus* (*M. forresti*) has such peculiarities of dentition that their study has resulted in a recent rearrangement of the murine genera of Australia.

1. *NYCTOPHILUS GEOFFROYI* Leach.

♂. Alexandria.

Forearm 35 mm.

2. *CHALINOLOBUS GOULDI* Gray.

♂. 122, 127. ♀. 125, 128. Bluff Hole, Alexandria, 21-24 May, 1905.

3. *SCOTEINUS GREYI* Gould.

Ten specimens. Alexandria.

4. *NYCTINOMUS PLICATUS COLONICUS*, subsp. n.

♂. Alexandria. B.M. No. 6.3.9.16. *Type*.

Similar in all essential particulars to the true Indian *plicatus*, but rather larger in body and limb dimensions, and markedly larger in the skull, the cranial crests, sagittal and lambdoid, very well developed.

Dimensions of the type, measured on the spirit-specimen:—

Forearm 50 mm.

Head and body 67 mm.; tail 42; ear 22; third finger, metacarpal 50, 1st phalanx 21, 2nd phalanx 22; lower leg 18.

Skull—greatest length to occipital crest 22; basal length 17.7; zygomatic breadth 13.5; mastoid breadth 12; palate length 8.7; front of upper canine to back of m^3 8; front of lower canine to back of m_3 9.

Hab. and *Type* as above.

A South-Australian specimen of *N. plicatus* received from Prof. Leche in 1890 also belongs to this larger race. On the other hand, examples from New Guinea and the Fiji Islands correspond in size with Javan and Indian specimens.

5. *CANIS DINGO* Blum.

Skin and two skulls. Alexandria.

6. *MUS VILLOSISSIMUS* Waite.

M. longipilis Gould *nec* Waterh.

♂. 86, 87, 89, 101, 106, 108, 139, 140, 142. ♀. 114, 137, 141, 143. Alexandria.

♂. 145, 186, 187. ♀. 147, 148, 184, 185. S.W. of Alroy.

This species is so common at the station as to be a serious pest.

The type locality of Gould's *M. longipilis* was the Victoria River, about 400 miles to the west of Alexandria, but in the same faunal area.

7. *MUS FORRESTI* Thos. (Plate XXXVII. fig. 1.)

Abstr. P. Z. S. No. 32, p. 6, May 22, 1906.

♀. 92, 101, 104, 117, 118, 119. Alexandria.

"Caught on dry grassy plain. Native name 'Keragenga.'

Mammæ 4."—*W. S.*

Size medium, intermediate between "rat" and "mouse." Fur of medium length; hairs of back 9–10 mm. long, fairly coarse, but not spinous. General colour above pale "drab-grey," paling to a creamy drab on the sides. Some specimens are, however, more buffy in tone. Under surface pure sharply defined white throughout, the hairs white to their bases. Ears rather short, their proectote pale brown, not darker than the general colour of the head; a tuft of creamy-drab hairs at their anterior base. Upper surface of hands and feet pure white. Tail well-haired, greyish white, little darker along the upper side.

Skull rather lightly built, with a slender muzzle. Interorbital region narrow, parallel-sided, its centre concave upwards, its edges rounded anteriorly, squared behind, but without ridges. Palatal foramina long, reaching backward to the anterior fourth of m^1 , unusually narrow, especially posteriorly, their edges rounded. Palate extending in middle line some way behind m^3 , the interpterygoid fossæ commencing further forward than the mesopterygoid one between them; the former very broad, the latter narrow. Bullæ comparatively little swollen.

Incisors slender, even in old specimens. Molars of rather unusual structure as compared with typical *Mus (rattus, &c.)*, but there is a great deal of variation among the Australian Muridæ in this respect, and the characters of *M. forresti* are led up to by other described species—e.g., *M. nanus* and *M. gouldii*. M^1 with a very strongly marked cingular ledge at its antero-internal corner, practically forming a small supplementary anterior lamina; the normal anterior and second laminae very strongly slanted backwards internally, their outer cusps hardly perceptible. M^2 with the large antero-internal cusp ("6" of Winge) about equal to the postero-external ("5"), the normal main lamina between them strongly tilted, as in m^1 , and with its inner and median cusps subequal, the outer practically absent; a minute antero-external supplementary cusp present. Lower teeth unusually brachyodont; m_1 and m_2 each with a small median supplementary cusp behind.

Dimensions of the type:—

Head and body 104 mm.; tail 72; hind foot 19; ear 15.

Skull—greatest length 25; basilar length 21; zygomatic breadth 13·5; nasals, length 8·5; interorbital breadth 3·6; palatilar length 13; diastema 7·6; palatal foramina 5·5 × 1·4; length of upper molar series 4·4.

Hab. Alexandria.

Type. Old female. B.M. No. 6.3.9.39. Original number 118. Collected 10 May, 1905.

This striking species may be readily distinguished from all others by its intermediate size, pale colour, pure white belly, peculiarly narrowed palatal foramina, and the unusual dental characters above described. *Mus fieldi* Waite, in other respects apparently near it, has a very much longer tail. I have named it in honour of the Hon. John Forrest, who has shared with Sir William Ingram the expense of supporting a collector at Alexandria station.

8. *MUS HERMANNSBURGENSIS* Waite.

♂. 126, 131. ♀. 124, 130. Bluff Hole, Alexandria, May 1905.

♂. 160, 161, 162, 163, 164, 165, 166, 169, 179, 182. ♀. 167, 168, 170, 180, 181, 183. 35 miles S.W. of Alroy, Alexandria. Alt. 800'.

"These Mice make large burrows in the hard stony ridges, piling up the excavated stones on the surface. The entrance is about 15 or 20 feet from the pile of stones, and is a small hole surrounded by a ring of stones."—*W. S.*

Many of the dental peculiarities of *M. forresti* are present in this species, notably the strong development of the antero-internal circular cusp of m^1 , and the slanting position of the inner part of the laminae of the same tooth. There is, however, an unusual amount of variability in the development of the different cusps, especially in the degree to which the outer cusp of the upper molars is separated from the main middle one. The palatal foramina are not specially narrowed behind.

No skins of this interesting species had been previously sent to Europe.

9. *NOTOMYS MITCHELLI* Og.

♂. 153, 154, 157, 158, 172, 177, 178. ♀. 149, 150, 151, 152, 156, 171, 173, 176; and one in spirit. S.W. of Alroy, Alexandria.

Mammæ 0—2=4.

The range of *N. mitchelli* seems to extend through the western part of New South Wales and Queensland. The British Museum contains examples collected by Sir Thomas Mitchell in Central New South Wales, while the type, now in the Sydney Museum, was obtained near the junction of the Murrumbidgee with the Murray.

My reasons for applying the name *Notomys* to the Jerboa-footed members of the *Conilurus* group have been explained elsewhere*.

All these specimens have an indication of a glandular organ on the throat, but whether it is such a "pouch" as that on which Mr. Waite founded the genus *Ascopharynx*, the condition of the specimen does not enable me to state.

* Ann. & Mag. N. H. (7) xvii. p. 81 (1906).

10. *MACROPUS RUFUS* Desm.

♀ (young). Alexandria.

11. *TRICHOSURUS VULPECULA ARNHEMENSIS* Coll.

♀. 123, 133. Alexandria.

12. *DASYURUS HALLUCATUS* Gould.

♀. 138. Alexandria, 800'.

"Trapped near water. Lives in lakes under and in rocks."—
W. S.

13. *PHASCOGALE MIMULUS*, sp. n.

♀. Skinned from spirit. Alexandria. (B.M. No. 6.3.9.75.)

A small species with a red patch behind each ear. No lower
secator*.

Size small, the general bulk far less than in *Ph. macdonnellensis*, with which alone comparison is needed. Fur short and fine; hairs of back only about 5 mm. in length, as compared with 8 mm. in the allied species. General colour above rather browner than "smoke-grey," rather greyer than "broccoli-brown," but some slight alteration may have occurred during the few months the specimen has been in spirit. Under surface dull cream-buff, probably whiter originally, the hairs dark slaty for three-fourths their length. Head clearer grey than back, a light line edging the eyes above and below. Ears of medium length, their fine hairs rufous brown. Behind each ear a large and prominent patch of light rufous hairs, contrasting strongly with the general colour. Upper surface of hands and feet dull whitish; soles with the main pads arranged as in *Ph. macdonnellensis*, but the general surface less granulated and the foot itself markedly narrower, measuring in the type only 3.4 mm. in breadth as compared with 5.2. Tail nearly the length of the head and body, slightly incrassated at base, thinly haired, not tufted or crested, dull rufous brown above, rather paler below.

Skull considerably smaller than that of *Ph. macdonnellensis*, but of the same general proportions. Nasals rather shorter and broader. Bullæ conspicuously smaller.

Teeth as in the allied species, with the remarkable exception that the last premolariform tooth, the "secator" (p^4 of the Catalogue of Marsupials), while similarly absent in the lower jaw, is in the upper well developed, two-rooted, barely smaller than the tooth in front of it, and slightly larger than p^1 . In *Ph. macdonnellensis* this tooth is minute and single-rooted above in the usual correlation to its total absence below.

* The secator is the changing premolar, " p^4 " of the Catalogue of Marsupials, but probably more correctly homologised with the tritus, or p^3 of other mammals: cf. Ann. & Mag. N. H. (7) xvi. p. 425 (footnote) (1905). In that footnote the words "or more probably mp^3 " should be deleted.

Dimensions of the type, measured in spirit:—

Head and body 76 mm.; tail 74; hind foot 13.5; ear 16.

Skull—greatest length 24.7; basal length 22; zygomatic breadth 14.6; nasals 9; interorbital breadth 5.3; height of crown above basion 5.6; palate length 13; breadth at outer corners of penultimate molar 8.8; antero-posterior length of bullæ 5.8 (6.8 in *Ph. macdonnellensis*); combined length of three anterior molariform teeth 5.2.

Hab. and *Type* as above.

This species shows affinity to the Central-Australian *Ph. macdonnellensis* by its absent lower secator and its rufous ear-patches, but is distinguished by its smaller size, shorter fur, greyer colour, smaller bullæ, and by the increased development of its upper secator, a development quite anomalous in the case of a species without a lower one. In *Ph. macdonnellensis* Prof. W. B. Spencer records that in every one of 13 specimens examined this tooth is either absent or very minute, so that the presence of a well-developed double-rooted upper secator clearly indicates specific distinction.

14. PHASCOGALE INGRAMI Thos. (Plate XXXVII. fig. 2.)

Abstr. P. Z. S. No. 32, p. 6, May 22, 1906.

♂. 110, 111. ♀. 109, 113. Buchanan, Alexandria, 600'.

♂. 120. Bluff Hole, Alexandria, 600'.

A remarkably small species, with minute teeth and flattened skull.

Size very small, slightly smaller even than in *Ph. minutissima*. Fur soft, close, and fine; hairs of back about 4 mm. in length. General colour above not unlike that of the paler wild-living forms of *Mus musculus*, something between Ridgway's "wood-brown" and "broccoli-brown," the hairs slaty grey with pale tips. A younger specimen is clearer grey, without the drabby tone. Under surface paler, with a yellowish tinge, not sharply defined, the hairs slaty at base except on the chin. Crown like back. Cheeks and chin whitish. A whitish-buffy line just over each eye. Ears of medium length, their fine hairs buffy whitish. Upper surface of hands and feet whitish. Tail of medium length, uniformly short-haired, about as in *Mus musculus*, not pencilled, pale brownish white, scarcely lighter below.

Skull remarkable for its extraordinary flattening, a flattening only equalled in 4 other mammals*, three being bats, the height in profile view from the base of the skull in front of the bullæ to the crown only 3.3 mm., as compared with 4.7 mm. in a skull, otherwise little larger, of *Ph. minutissima*. Zygomata evenly convex outwards. Nasals well expanded in their posterior half. Interorbital region flat, its edges without ridges. Occipital crests almost obsolete. Anterior palatine foramina reaching to the level

* *Graphiurus platyops*, *Tylonycteris pachypus*, *Mimetillus moloneyi*, and *Platymops macmillani*.

of the front of the canines. Posterior palate practically without vacuities. Anterior portion of bullæ considerably larger than posterior.

Teeth with the same relative proportions to each other as in *Ph. minutissima*, but conspicuously smaller throughout, both absolutely and in proportion to the size of the skull. Upper secutor (last premolar, the "p¹" of the Catalogue of Marsupials) about twice the size of the subequal anterior and median premolars. Lower secutor about half the size of the anterior premolar, which is in turn about half the size of the median one.

Dimensions of the type, measured in the flesh:—

Head and body 80 mm.; tail 60; hind foot 10; ear 9.

Skull—greatest median length 18; basal length 17; zygomatic breadth 9·7; nasals 6·6 × 3; interorbital breadth 3·8; breadth of brain-case 8·5; palate length 8·7; length of upper tooth-row 8; combined length of three anterior molariform teeth 3·1; length of lower tooth-row 7·2.

A female skull is smaller, 16 mm. in greatest length.

Hab. Alexandria, central part of Northern South Australia. Alt. 600'.

Type. Male. B.M. No. 6.3.9.77. Original number 111. Collected 30 April, 1905. Three specimens.

This remarkable little species looks externally like a more pallid representative of *Ph. minutissima*, but the peculiar characters of its skull and teeth show that it is really a quite distinct animal. I have much pleasure in naming it after Sir William Ingram, to whose initiative and generosity the Museum is indebted for the sending of a collector to this most interesting locality.

15. SMINTHOPSIS LARAPINTA Spencer.

♂. 101, 102, 112, 116. ♀. 93, 100, 119, 144. Alexandria, 600'.

♂. 146. S.W. of Alroy, Alexandria.

"Native name 'Baraga.' Caught among dead timber on plain."—*W.S.*

This is a very beautiful drab-grey species, with a contrasted dark line running down the muzzle, and with the centre of the sole naked as far back as a point equidistant between the heel and the tip of the hallux. It was first obtained at Charlotte Waters, Central Australia, during the Horn Expedition, and was described by Prof. Spencer, who unfortunately, working only from spirit-specimens, did not mention the dark facial line, which is, however, clearly marked in a metatype in the Museum collection.

S. nitela Collett*, of which we have a co-type, would appear to be the same animal, Dr. Collett having been misled by the absence of all reference to the facial line in the original description, and the metatype in the Museum having only been received

* P. Z. S. 1897, p. 334.

after his description was published. Dr. Collett's examples were from the Daly River, so that Alexandria is to a certain extent intermediate between the two localities.

16. *SMINTHOPSIS STALKERI*, sp. n.

♂. 174, 175. S.W. of Alroy, 800'.

A small species coloured like *S. larapinta*, but with more hairy soles and shorter tail.

Size rather less than in *S. larapinta*, but neither of the two specimens is more than just adult. Fur soft and fine, about 6 mm. long on the back. General colour above more buffy than in *S. larapinta*, the light rings on the hairs dull cream-buff, their fine tips dark brown. Under surface creamy white, the extreme bases of the hairs slaty. Head like back, a dark line on the forehead between the eyes, not so distinct or so long as in *S. larapinta*. Ears of medium length, quite unlike the long ears of *S. hirtipes*, pale grey throughout. Upper surface of hands and feet white. Palms and soles intermediate in their characters between those of the hairy-footed *S. hirtipes* and of the ordinary naked-footed species; the palms apparently with low granulated cushions, but these cannot be accurately described on dried specimens, even when re-damped; the soles with a compound cushion at the end of the metatarsus, as in *S. hirtipes*, but this is naked and granulated as in other species, and has three minute non-lineated pads upon it; the centre of the foot is finely hairy to beyond the tip of the hallux, a few hairs even extending to the back of the large compound pad. Tail shorter than in *S. larapinta*, incrassated at base; finely hairy, greyish white above and below, the tip not darkened.

Skull and teeth very much as in *S. larapinta*, the muzzle rather shorter; bullæ much smaller than in *S. hirtipes*.

Dimensions of the type, measured in the flesh:—

Head and body 70 mm.; tail 65; hind foot 15; ear 17.

Skull—greatest length 23·2; basal length 21·4; zygomatic breadth 13; nasals 8; combined length of three anterior molariform teeth 4·7.

The other specimen has head and body 72 mm.; tail 70.

Type. Subadult male. B.M. No. 6.3.9.91. Original number 175. Collected 1 August, 1905.

This pretty species forms an interesting link between the hairy-soled *S. hirtipes* Thos., described from Charlotte Waters, and the ordinary naked-soled species of the genus. Its shorter tail and more buffy colour will also distinguish it from *S. larapinta*.

Prof. Spencer's *S. psammophilus* would appear to have a similar foot-structure, but is considerably larger.

EXPLANATION OF PLATE XXXVII.

Fig. 1. *Mus forresti*, p. 538.

2. *Phascogale ingrami*, p. 541.

3. On the Skull of a Young Specimen of the Ribbon-fish, *Regalecus*. By W. B. BENHAM, D.Sc., M.A., F.Z.S., Professor of Biology in the University of Otago, and W. J. DUNBAR.

[Received April 2, 1906.]

(Plates XXXVIII. & XXXIX.*)

I. INTRODUCTION.

Whether the small Ribbon-fish described by me (1) as *Regalecus parkeri* be a distinct species, or, as seems probable, merely a young stage of the Great Ribbon-fish, *R. glesne*, it seemed desirable to have the skull described and figured for comparison with the detailed account of the latter fish published by Professor Parker in the 'Transactions' of the Society †.

The correct name for the Ribbon-fishes of the New Zealand as of other coasts is somewhat doubtful. Specimens have been described and named by Von Haast (2) as *R. pacificus*, and by Parker (3 & 4) as *R. argenteus*, while Forbes (5) inclined to the opinion that the specimen which came into his hands was identical with *R. grillii* of Lindroth. This matter of the synonymy was treated at some length by Parker, and after a comparison of the measurements and of other external features given by various naturalists for different specimens studied here and in the Northern hemisphere he came to the conclusion (3) that the specimens obtained in the neighbourhood of Dunedin belonged to a new species, *R. argenteus*: and under this title he described the skeleton in the Society's 'Transactions' (9), but in an "Addendum" to his second article (4) (inserted at the commencement of the volume, immediately following the titlepage) he expressed a doubt as to whether, after all, he was justified in this step. He wrote: "Everything seems to lead to the conclusion that most of the supposed species of *Regalecus* are identical, and that the more recent specific names (including *argenteus*) will have to give way probably in favour of Ascanius' original name *glesne*."

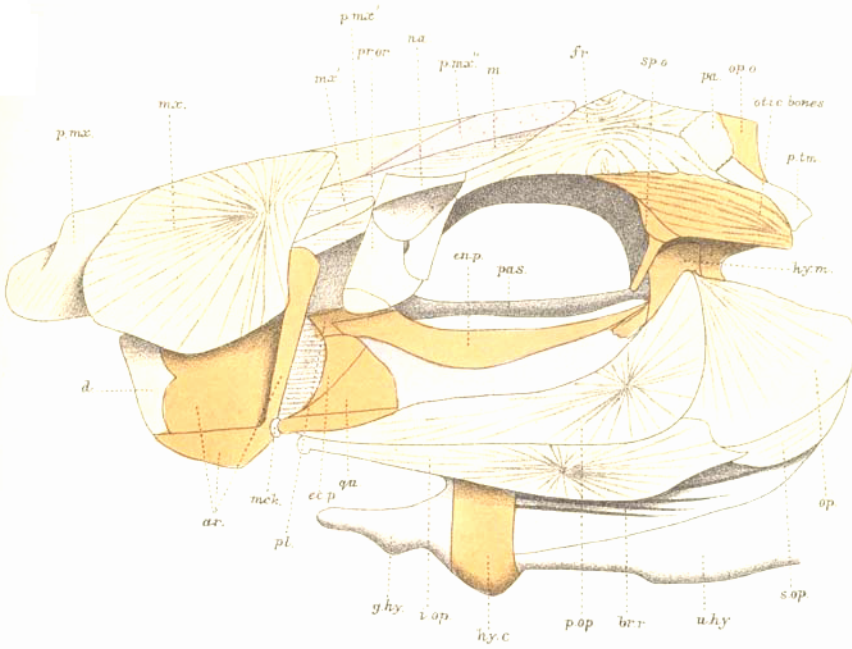
To the same effect wrote Goode & Bean in 1895 in describing the Ribbon-fishes of the North Atlantic (6). On p. 481 of 'Oceanic Ichthyology' they write:—"It is not certain that there is more than one species of *Regalecus*, although various names have been suggested in connection with the comparatively few individuals which, during the past century and a half, have been captured in the North Atlantic." Consequently, they register these fishes under the name *R. glesne*.

If this be the case, we have an interesting instance of a practically cosmopolitan deep-water fish.

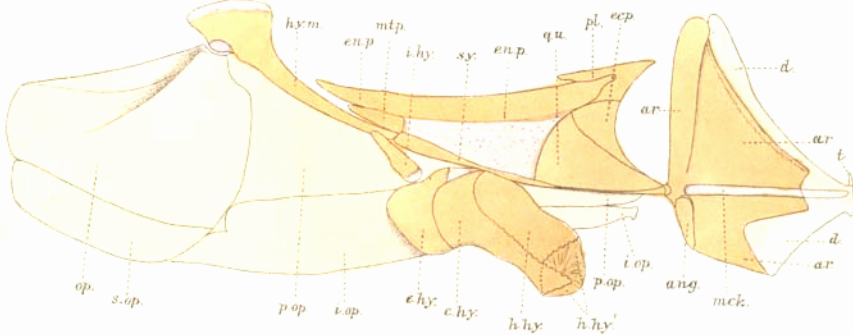
* For explanation of the Plates, see p. 556.

† For this purpose I handed the skull to my pupil W. J. Dunbar, who to my great regret was drowned just after the paper was completed in MS. I have retained his name as co-author, as he contributed the description and figures of this skull, and the notes comparing it with Parker's account.—W. B. BENHAM.

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Parker (3) dealt so fully with the various accounts of the specimens captured on the coasts of New Zealand and Australia, that it is needless for me to repeat the record. But since he wrote his second article in 1888, additional specimens have been recorded and described by Forbes (5), by Drew (7), and by Clarke (8), the last being a quite perfect individual, with the pectoral fins still uninjured, and the article is illustrated by a good figure of the entire fish.

Finally, a couple of years ago, a large specimen was reported to me as having been thrown on shore near the entrance to the Otago Harbour, but while my informant was engaged in telephoning to the Museum, to arrange for its despatch to me, the usual fate, in the form of boys and stones and sticks, awaited the rarity: so that by the time my informant returned to the shore the fish was so damaged as to be valueless.

We thus have records of more than a dozen of these rare fishes having been obtained in these seas within the last 50 years; and the majority on the coast of the South Island. Of these all but one have been apparently nearly or quite full-grown, reaching a length of from 12 to 18 feet, Drew's specimen being only 7 feet 4½ inches. Judging, however, from his other measurements, it appears probable that a part of the posterior end was missing: he says, "the fish ended abruptly with thick rounded end, and there were no spines at the caudal end." He does not state the height of this truncated extremity, and we are left in doubt as to how much is missing.

It is, however, to the markings on "*R. parkeri*" that I would draw attention. It will be remembered that one of the most striking differences in the external features of this specimen—apart from body-proportions—lies in its colour-markings.

Parker, Von Haast, Clarke, and others have described (and figured) the peculiar, irregularly vertical streaks of black or very dark-blue, irregular in form, size, and arrangement, but limited to the anterior region of the body.

Parker (4. p. 23) says:—"In addition [to these marks] the whole body was covered with oval or circular grey spots, covered, and thus toned down, by the silvery coating" (of the skin). "These very obscure spots are hardly visible in certain lights."

Clarke (8. p. 262) says of his specimen:—"As the fish gradually dried, numerous transverse markings developed themselves, more especially along the whole of the postanal division, and the round and greyish markings became more apparent."

Now, in "*R. parkeri*" the characteristic black, irregular streaks are entirely absent, but the silver ground-colour was traversed by "14 dark transverse bands set at fairly regular intervals from the back of the head to the end of the body. Each band extends over the entire depth of the body and is separated from its neighbour by a space about equal to its own length." "These colour-bands are not black, but extremely pale grey, and could only be recognised by reflection in certain lights, the grey

being due to minute pigment-cells below the silver" (Benham, *loc. cit.*). After being in formol for a couple of years these marks are still present, and more distinct than in the recently dead fish. Another feature in which *R. parkeri* differs from the specimens of *R. glesne* is in proportions of parts and in the greater number of dorsal fin-rays: for whereas, in most of specimens of the full-grown fish, these number from 200–260, as given for different individuals, there are 400–500 in the specimens of *R. parkeri*; but Forbes gives 422 as the total number in the full-grown individual described by him.

As the number of fin-rays in the dorsal fin has been utilised by ichthyologists as a specific character, this variation in the adults of what are regarded as one species is interesting.

For convenience of a comparison of "*R. parkeri*" with the adult forms, I here tabulate the series of measurements adopted by Parker and followed by Forbes and Clarke:—

The specimen A is the one described in the body of my article; B is that referred to in the footnote (1. p. 200), the skull of which is described below.

	A.	B.
Total length	3 ft. 9 in.	6 ft. 3 in.
Greatest height of body	0·75 inch	1·75 inch
Length of head (jaws retracted)	2·12 inches	3 inches
Preanal length (snout to anus)	13·25 "	22 "
Proportion of height to length	1 : 60	1 : 43
" length of head to total length	1 : 21·5	1 : 25
" preanal region to total length	1 : 3·3	1 : 3·4
" head-length to preanal length	1 : 6·36	1 : 7
" height to preanal length	1 : 17·5	1 : 12·5
Total number of dorsal fin-rays	(?) 397	450 to 500

In the adult fish the proportion	$\frac{\text{height}}{\text{length}}$	varies from	$\frac{1}{10}$	to	$\frac{1}{15\cdot6}$
" " "	$\frac{\text{head-length}}{\text{total length}}$	" "	$\frac{1}{14}$	to	$\frac{1}{27\cdot35}$
" " "	$\frac{\text{preanal length}}{\text{total length}}$	" "	$\frac{1}{2\cdot5}$	to	$\frac{1}{33\cdot6}$
" " "	$\frac{\text{head-length}}{\text{preanal length}}$	" "	$\frac{1}{6}$	to	$\frac{1}{7\cdot9}$
" " "	$\frac{\text{height}}{\text{preanal length}}$	" "	$\frac{1}{4\cdot3}$	to	$\frac{1}{5\cdot2}$

It is remarkable that, in the case of the first three relations, the high numbers are found in the longest specimen, that described by Forbes, in which, too, the number of fin-rays is excessive.

Otherwise one might state that these denominators decrease as the fish increases in length.

The really important differences in these relations occur in those cases in which the greatest height is a factor—which is very much less in proportion to the length in the young than in the adult.

If, then, "*R. parkeri*" be the young of *R. glesne*, we have not only a great change taking place during growth, in the proportions of all the parts, especially the height-length relation, but a diminution in the total number of fin-rays in the dorsal fin, and the breaking up of transverse coloured bands into oval and circular spots, and also the appearance in the fore part of the body of much darker irregular streaks.

We know that somewhat similar changes do take place in fishes belonging to the family in which *Regalecus* is included. In *Trachipterus*, for example, such changes are illustrated in Günther's 'Study of Fishes,' p. 521, and apparently Lütken had already expressed the opinion that such growth-changes would occur in *Regalecus* (3. p. 294).

I was disappointed in finding so little about this subject in the recent volume on Fishes in the 'Cambridge Natural History'; but in the systematic portion Boulenger (p. 714) remarks: "The life-histories (of Taniosomes) are still very imperfectly known, and great changes of form take place during growth;" but nothing further is said about the matter.

I have been unable, owing to the poverty of our libraries in New Zealand, to ascertain whether any, and if so what, work has been done on changes in the detailed structure of the skull during growth. The references to be found in Wiedersheim, or in Ziegler's 'Vergleich. Entwick. d. nieder. Wirbelthiere,' refer only to embryonic changes, so far as I have been able to ascertain from abstracts in the 'Zoolog. Jahresbericht.'

The present contribution, together with my previous article on the external form of *R. parkeri*, is a step in this direction, if this fish be, in fact, the young of *R. glesne*.

II. DESCRIPTION OF THE SKULL.

(By W. J. DUNBAR.)

A. *The Bones of the Upper and Lower Jaw.*

The *Premaxilla* consists of two regions, namely, a thin plate lying at the side of the oral aperture (*pmx.*), the "alveolar portion" of Prof. Parker, and a long dorsally situated "nasal process" (*pmx.*'), which is connected with its fellow of the other side by a laterally compressed plate of cartilage (*pmx.*"), Pl. XXXVIII. fig. 1 and Pl. XXXIX. fig. 3). This process extends back over the cranium on the dorsal surface, lying in a cartilage-lined "anterior dorsal" groove in which it can slide to and fro. In *R. glesne* the bone has relatively a much shorter nasal process, the two regions

being almost equal in length; whereas in the present species the nasal process is more than twice the length of the alveolar plate. Again, the longer axis of this plate is, in *R. glesne*, vertical and perpendicular to the nasal process, while in *R. parkeri* the longer axis of the plate is almost horizontal and parallel to the nasal process (Pl. XXXVIII. fig. 1).

The *Maxilla*, instead of being, as in a typical teleostean skull, a narrow rod of bone, is broad and subquadrate, marked on its outer surface by ridges—as in other dermal bones of *Regalecus*—which rise from a point near the dorsal posterior border (fig. 1). The maxilla overlaps the hinder part of the alveolar plate of the premaxilla, and can be distinctly seen through the silvery epidermis. On its inner side is a pronounced ridge, which is continued beyond the posterior margin of the bone as a peg-like process (*mx.*) lying alongside the nasal process of the premaxilla (Pl. XXXVIII. fig. 1 and Pl. XXXIX. fig. 3). The antero-posterior length is somewhat greater than the vertical height, whereas in *R. glesne* the bone is long and narrow, and is at least twice as high dorso-ventrally as it is wide: in fact its relation to mouth is more like that commonly met with in Teleosteans.

The lower jaw (Pl. XXXVIII. figs. 1, 2) consists of the usual three bones, the Dentary, the Articulare, and the Angulare, enclosing Meckel's cartilage, which is distinctly visible through them. The region above Meckel's cartilage may be termed the supra-meckelian, and the part below that line the infra-meckelian region. In *R. glesne*, Prof. Parker describes the supra-meckelian part of the lower jaw as having "something the form of an equilateral triangle and the infra-meckelian of a right-angled triangle with altitude about one-fourth of its base, so that the whole jaw comes to be rather higher than long." In the present species the height of the lower jaw is very much greater than the length, and the proportions of the two regions are different from *R. glesne*. The supra-meckelian portion has the form of an isosceles right triangle with one limb of the dentary as hypotenuse. The infra-meckelian portion is an irregular four-sided figure whose height is one half its length; it is thus just twice as high proportionately as that of *Regalecus glesne* (Pl. XXXVIII. fig. 2).

The *Articulare* (*ar.*) is a thin plate of bone somewhat triangular in form. The posterior side is vertical and extends upwards as far as the peg of the maxilla. This posterior margin is much thickened. The lower margin is also slightly thickened, and extends horizontally below Meckel's cartilage, overlapping and concealing the angulare externally. The third side slopes downwards and forwards and meets the dentary along the edge.

The *Dentary* (*d.*) is a V-shaped bone placed with the angle forwards and bearing at the extremity one tooth which is not present in *R. glesne*. The two limbs meet one another at an angle of 90°, one being directed backwards and upwards to meet the articulare above, the other passing below Meckel's cartilage to meet the lower border of the articulare.

The *Angular* (*ang.*) is a very small bone on the inner surface of the infra-meckelian part of the articulare. It does not meet the dentary as the angular of *R. glesne* does.

B. *The Suspensorium and Hyoid Arch.*

The *Quadrate* has the usual triangular shape with a curved base directed backwards; the apex, which is directed forwards, not downwards as in ordinary fish-skulls, articulates with the articulare at the level of Meckel's cartilage.

The *Ectopterygoid* (Pl. XXXVIII. figs. 1 & 2) is a small triangular bone lying in a nearly vertical plane. At its lower end the bone is pointed and gradually widens to its upper border, where it meets the palatine. The posterior margin fits on to the anterior upper margin of the quadrate, and the dorsal border continues the curve of that bone (Pl. XXXIX. fig. 7). Relatively it is a short bone compared with that of *R. glesne*, in which it projects for a considerable distance—almost half its total length—beyond the quadrate.

Behind the *Ectopterygoid* lie the *Ento-* and the *Metapterygoid*, extending below the orbit and curving in towards the middle line. The entopterygoid stretches from the posterior border of the palatine, pterygoid, and quadrate anteriorly to the hyomandibular posteriorly; only the upper margin is ossified, a considerable amount of cartilage still existing along the lower border. The metapterygoid is a very small ossification of oblong shape lying below the hinder end of the entopterygoid. In *R. glesne* the latter is a somewhat quadrate bone about as high as it is long. In the present species the great length and relatively small vertical height of this bone form a marked contrast, as it extends beyond the metapterygoid nearly to the hyomandibular, whereas in *R. glesne* the bone does not reach the hinder end of the metapterygoid. The metapterygoid, too, is longer and narrower, relatively, than in *R. glesne*, and wholly underlies the entopterygoid.

Above the pterygoid lies the *Palatine*, a V-shaped bone with the sharp apex directed forwards. The two limbs embrace the end of the mesopterygoid. Although this bone in *R. glesne* is very irregular, there is little indication of this deep notch.

The *Hyomandibular* articulates with the cranium just behind the orbit and below the pterotic. At this end it is broad and thick, but narrows to a point as it passes downwards and forwards. This narrow portion lies on the inside of the pterygoid plate. The articular end is capped by cartilage, and under this is a convex articulation for the opercular bone.

At its anterior, pointed, end the hyomandibular is connected with the *Symplectic*, which extends to the quadrate, thus connecting it with the hyomandibular. In shape the symplectic is a long rod-like bone, slightly curved and much more elongated than that of *R. glesne*.

The *Interhyal*, connecting the hyomandibular with the rest of the hyoid arch, articulates with it almost at the same point as the symplectic does. It is a small bone tipped at both ends with cartilage.

The rest of the hyoid arch is much compressed laterally so as to form the "hyoidean cornu" of Prof. Parker, and is made up of four bones, the epi-cerato- and two hypo-hyals. Of these the *Epihyal*, a flat semicircular bone, articulates with the interhyal, forming the upper rounded end of the cornu. It lies posteriorly to the ceratohyal as in *R. glesne*.

The *Ceratohyal*, like that of *R. glesne*, is the largest of these bones, but relatively much longer and narrower than in that species. It intervenes between the epihyal and the two hypohyals, forming the posterior lower margin and but a small part of the dorsal margin of the arch.

The *Hypohyals*, of which there are two, take a greater share in the formation of the "hyoidean cornu" than in *R. glesne*, being together almost equal to the ceratohyal. The larger and upper one forms most of the anterior margin of the cornu, while the smaller and lower one (*h.hy.*) forms the rest of the anterior and the whole of the mesial margin where the hyoidean cornu is attached to the glossohyal. This lower one seems forked on the inner side, but this is due to the lower corner of the ceratohyal overlapping and concealing part of it. In fig. 2 the concealed part of the margin is indicated by a dotted line.

C. The Opercular Bones.

Of these there are four, and all are visible through the skin of uninjured fish.

The *Opercular* itself is a subcircular bone having a concave facet for articulation with the hyomandibular. It has three borders, all curved, one of which faces anteriorly, one dorsally, and the other postero-ventrally. Below the opercular is the *Subopercular*, a narrow plate of very delicate bone. In neither of these bones is there a marked difference from the corresponding bones in *R. glesne* (Pl. XXXIX. figs. 6 & 7).

The *Preopercular* is one of the largest bones in the skull, extending from the anterior border of the opercular to the anterior end of the quadrate, making a total length of one and three-quarter inches. Thus it forms a considerable part of the suborbital region of the face. Instead of the greatest length being in a vertical direction as is usual, it is here in a horizontal direction. The difference between the preopercular in the two species is very marked. In the present species the greater part of the bone is horizontal and suborbital, whereas in *R. glesne* the greater part is vertical and postorbital. Again, in the latter species the anterior and posterior margins are gently and regularly curved, but in *R. parkeri* the lower margin is straight for some distance and then curves suddenly upwards (Pl. XXXVIII. fig. 1).

The *Interopercular* is as much elongated as the preopercular; but is not so broad and also presents considerable difference from that of *R. glesne*. In the latter the posterior margin is curved sharply upwards and the dorsal edge is straight; but in *R. parkeri* the posterior end of the bone is scarcely turned up and the upper margin is excavated. The markings on this bone originate almost exactly in the centre, whereas in *R. glesne* they are described as originating "at the junction of the anterior and middle thirds."

D. *The Cranium.*

After the removal of the jaws and suspensorium, the form of the cranium, as seen from the side (Pl. XXXIX. fig. 6), is somewhat like that of a bird's skull. This appearance is due to its length, to the large orbit, and to the beak-like prenasal rostrum. On the dorsal surface are two median grooves, lying end to end, meeting above the centre of the orbit (Pl. XXXIX. fig. 4). The anterior dorsal groove has as its floor a plate of cartilage named the "tegmen cranii" by Parker, while its sides are formed by the frontals. In this groove the nasal process (*pmx.*) of the premaxilla lies (Pl. XXXIX. fig. 3). The posterior groove has as its floor the supraccipital and as its sides the epiotics and parietals: it is scarcely existent in *R. glesne*. If the cranium of *R. parkeri* be compared with that of *R. glesne*, the most striking difference is the greater length and less vertical height in the present species. This excess of length is mainly due to the greater development of the preorbital region or "beak," which is nearly as long as the orbital region, whereas in *R. glesne* (Pl. XXXIX. fig. 7) it is less than half this proportion. The length of the cranium in the latter species is $1\frac{1}{2}$ times the greatest height, but the proportion of length to height in the present fish is 2:1. This difference in relative length is due partly to the greater development of the preorbital region, and in a small degree to the absence of the "subcranial crest" described by Parker, formed by parasphenoid, basi-occipital, and opisthotic.

The Occipital Region (Pl. XXXIX. figs. 4, 5, 6, 8).

The *Basi-occipital* forms the greater part of the occipital condyle (Pl. XXXIX. fig. 8), and is produced forwards and downwards as a median ridge which extends anteriorly to meet the end of the parasphenoid. In contrast to the condition in *R. glesne*, we may note that it is the most posteriorly placed bone in the skull (Pl. XXXIX. fig. 6). Dorsally and anteriorly it is bounded by the exoccipital and opisthotic, ventrally and anteriorly by the parasphenoid.

The *Exoccipitals* entirely bound the foramen magnum (Pl. XXXIX. fig. 8), each meeting its fellow below it, so that each takes a small share in the occipital condyle. The greater part of the exoccipital is a posterior vertical plate which extends upwards to meet the epiotic and outwards to meet the pterotic, while it sends

a process forwards to meet the great opisthotic (Pl. XXXIX. fig. 6).

The *Supraoccipital* is feebly ossified. Lying in the posterior dorsal groove and forming its floor, it is separated from the exoccipitals, however, by the epiotics—a very unusual condition (Pl. XXXIX. fig. 4). Anteriorly it reaches the meeting-place of the two dorsal grooves.

Otic Bones (Pl. XXXIX. figs. 4, 5, 6, 8).

Above the exoccipital lies the *Epiotic*, which is partly covered by the post-temporal. The position of the post-temporal is shown in Pl. XXXVIII. fig. 1 and Pl. XXXIX. fig. 8, but in the other figures it has been removed. The two epiotics nearly meet one another in the middle dorsal line, thereby excluding the occipital from the supraoccipital, which, as Prof. Parker pointed out, is a most unusual condition. The epiotic is a squarish bone as seen from above, raised into a prominent ridge along the dorsal surface, which forms the margin of the dorsal groove.

The *Pterotic* is a large well-ossified bone extending from the exoccipital to the posterior margin of the orbit. Dorsally it is bounded successively by the frontal, the parietal, and the epiotic bones, and ventrally it touches the sphenotic and prootic. The outer edge forms a prominent ridge under which the hyomandibular articulates. The pterotic is much grooved on its outer surface, the ridges being very delicate while the grooves are deep.

The *Sphenotic* is a more or less vertical bar at the posterior region of the orbit, forming the post-orbital process. The lower end slopes inwards and forwards to meet the upwardly-projecting process of the parasphenoid, and thus to form the post-orbital bar. Above, it touches the under surface of the pterotic and anteriorly the alisphenoid, while by a forward process it just reaches the frontal.

The *Prootic* lies below the ridge formed by the pterotic. It is bounded anteriorly by the sphenotic, ventrally by the opisthotic, and posteriorly by the exoccipital.

The *Opisthotic*, as seen in side view, is a large bone forming a plate above the parasphenoid and meets its fellow in the middle ventral line. Relatively it is a larger bone than that of *R. glesne*, and instead of the suture between it and the basioccipital being vertical, the opisthotic passes backward over the forward plate of the basioccipital to meet the exoccipital on the external surface of the skull (Pl. XXXIX. fig. 6). This external plate corresponds to Parker's "*oph.*"—the descending process. The other three processes which exist on the inner surface of the cranial wall are not figured. If the side view of the skull of *Regalecus* be compared with that of the Salmon, it will be seen that the opisthotic occupies the place of the prootic of the Salmon in its relation to the exoccipital and basioccipital; but Parker's dissection shows the true interpretation of the bone.

Bones in the Orbit.

In front of the sphenotic are two pairs of bones contributing to the roof of the orbit—the alisphenoids and orbito-sphenoids (Pl. XXXIX. figs. 5, 6).

The *Alisphenoid* is a flat bone not quite reaching to the outer edge of the orbit. Between and somewhat behind the two alisphenoids is a large triangular foramen which Parker discusses at length. He mentions that the only difficulty in the way of the interpretation that these bones are alisphenoids is, that there is no foramen for the fifth nerve behind them; but he points out that in many mammals the first division of the fifth nerve passes out altogether in front of the alisphenoid. In the Rabbit, too, the first two divisions of the fifth nerve pass out of the skull by the sphenotic fissure, which lies between the alisphenoid and the basisphenoid. This is relatively in the same position as the foramen in the skull of *R. parkeri*. In front of the alisphenoid is a large bone extending as far forward as the mesethmoid. This Parker identified as the *orbito-sphenoid*. There is no suture in the middle line, so that the two bones must be here fused. The orbito-sphenoid is not perforated by the second nerve, which must pass out through the foramen between the alisphenoids.

Cranial Roof.

The roof of the cranial cavity is formed by the frontal and the parietal bones along with the median plate of cartilage, the "tegmen cranii" (Pl. XXXIX. figs. 4, 6).

The *Frontal* is a large bone, relatively much larger than in *R. glesne*, extending as far forwards as the ectethmoid and backwards nearly to the posterior end of the supraoccipital. Thus they form the greater part of the upper surface of the skull and the lateral margin of the anterior dorsal groove for almost its whole extent. Further, each sends back a small process on the mesial side of the parietal, which thus only just reaches the margin of the posterior dorsal groove by a corner. The frontals do not, as is usual in Teleosts, meet in the middle line, as Parker pointed out for *R. glesne*, but are separated by the "tegmen cranii." Posteriorly, the frontal meets the parietal and pterotic, and sends a process back under the parietals which nearly meets the epiotic. On the under surface of the skull the frontal is seen to form a supraorbital plate (Pl. XXXIX. fig. 5).

The *Parietal* is a small bone, very different in form and size from that of *R. glesne*; it is long and narrow, extending forwards between the frontal and the "tegmen cranii," and forming a rounded prominence at the side of the supraoccipital. In the present species, although the boundaries of the bone were very difficult to determine owing to its thinness and friability, it seems to have a very different form. The internal backward process of the frontal almost cuts off the parietal from participation in forming the side of the dorsal groove, and far from forming a

prominence as it does in *R. glesne*, it barely reaches the groove (Pl. XXXIX. fig. 4).

Preorbital Region.

In front of the orbit is the prenasal "beak," a solid structure composed partly of bone and partly of cartilage. It is compressed from side to side, with a sharp dorsal and ventral edge. The greater part of the beak is formed by the mesethmoid, which is mainly cartilaginous, and by the ectethmoid cartilage. The *Mesethmoid* is, as its name implies, a median sheet extending from the orbit half way to the anterior extremity of the "beak," where it meets another vertical plate, a part of the vomer. Its posterior end is laterally broadened and appears on the roof of the orbit, of which it forms the anterior median wall.

The *Ectethmoid* cartilage is a thick mass of cartilage (without any ossification, such as occurs in *R. glesne*) extending outwards at right angles to and continuous with the mesethmoid, forming a rounded prominence, the anterior boundary of the orbit. The lower margin of the prenasal rostrum is formed by the vomer. This bone tapers from its middle to each end; the anterior end curves sharply down to form a median tooth, and on each side of this are two smaller lateral teeth*. Of this there is no mention in the description of *R. glesne*. The posterior end of the bone meets the parasphenoid. As mentioned above, the vomer sends a vertical plate upwards to meet the mesethmoid by its posterior margin. Above this vertical sheet is a strip of cartilage—the prenasal cartilage—extending back over the mesethmoid to the "tegmen cranii" and forming the dorsal edge of the "beak." Behind the vomer, the *Parasphenoid* forms at least two-thirds of the ventral margin of the skull. It is sword-shaped, the posterior region or "handle" having two lateral projections—the "guards"—near this end. These slope outwards and very slightly backwards and sharply upwards to meet the sphenotics. In *R. glesne* the parasphenoid is greatly extended backwards and upwards as a vertical plate underlying and extending behind the basioccipital. In the present species there is, however, no trace of such a plate, and the posterior end of the bone tapers to a point which lies well in front of the hinder end of the basioccipital.

Lying in front of the orbit, close under the skin, are the nasals and preorbitals (Pl. XXXVIII. fig. 1). The *Nasal* is a small rod-like bone which articulates with the anterior end of the frontal and, passing forwards and inwards, abuts loosely against the sides of the premaxilla. Under the nasal lie the *Preorbitals*, two on each side. These three bones readily separate from the skull and are shown only in figure 1.

* The fact that this young specimen is provided with teeth in both the upper and lower jaw is suggestive; for in some of the specimens of *R. glesne* that have been described they are present (*vide* Günther), in others absent (*vide* Parker).

Summary.

From these notes, it will be evident that nearly every bone in the skull of this small Ribbon-fish differs, to a greater or less extent, either in form or proportions, from the corresponding bone of the Great Ribbon-fish.

The specimen was undoubtedly a young one—a fact which is shown not only by the amount of cartilage in the skull, but also by the condition of the ovary, in which all the eggs were small. There are, therefore, two possible explanations of the differences: (1) that the fish was the young of a known species, probably *R. glesne*, which is the common species; or (2) that the fish belongs to a different species. If the specimen is the young of *R. glesne*, the changes which it must undergo before becoming adult must be far-reaching, especially in the skull. For example, the posterior part of the parasphenoid must grow backwards with great rapidity, while the rest of the bone continues its ordinary growth. In order that the parietal could assume the position occupied by that bone in *R. glesne*, it would have to grow enormously antero-posteriorly; but, before it could do so, the backwardly directed process of the frontal, which lies between the parietal and the posterior dorsal groove, would have to disappear. The maxilla, too, would have to change its shape entirely. Now the maxilla is a particularly well-ossified bone—one of the best ossified in the skull—and so least likely to undergo further developmental change. Such great changes as are here indicated would hardly have been expected after the animal had attained more than its half adult length.

Conclusion.

Taking all the facts into consideration, it seems more than probable that the so-called *R. parkeri* is but the young stage of *R. glesne*.

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EXPLANATION OF THE PLATES.

LIST OF ABBREVIATIONS.

<i>als.</i> , alisphenoid.	<i>mtp.</i> , metapterygoid.
<i>ang.</i> , angulare.	<i>na.</i> , nasal.
<i>ar.</i> , articulare.	<i>os.</i> , orbito-sphenoid.
<i>b.o.</i> , basi-occipital.	<i>op.</i> , opercular.
<i>br.r.</i> , branchiostegal rays.	<i>op.o.</i> , opisthotic.
<i>c.</i> , occipital condyle.	<i>pa.</i> , parietal.
<i>c.hy.</i> , ceratohyal.	<i>pl.</i> , palatine.
<i>d.</i> , dentary.	<i>pas.</i> , parasphenoid.
<i>ec.p.</i> , ectopterygoid.	<i>p.mx.</i> , premaxilla.
<i>ect.eth.</i> , ectethmoid cartilage.	<i>p.mx.'</i> , post-nasal process of premaxilla.
<i>en.p.</i> , endopterygoid.	<i>p.mx.''</i> , post-nasal cartilage of premaxilla.
<i>ep.o.</i> , epiotic.	<i>pn.</i> , prenasal cartilage.
<i>e.o.</i> , exoccipital.	<i>pr.or.</i> , preorbital.
<i>e.hy.</i> , epihyal.	<i>p.op.</i> , preopercular.
<i>f.m.</i> , foramen magnum.	<i>pr.o.</i> , prootic.
<i>fr.</i> , frontal.	<i>p.tm.</i> , post-temporal.
<i>for.</i> , foramen between alisphenoids.	<i>pt.o.</i> , pterotic.
<i>g.hy.</i> , glosso-hyal.	<i>qu.</i> , quadrate.
<i>h.hy.</i> , hyoidean cornu.	<i>sy.</i> , symplectic.
<i>h.hy. & h.hy.</i> , hypohyals.	<i>s.op.</i> , subopercular.
<i>hy.m.</i> , hyomandibular.	<i>s.o.</i> , supraoccipital.
<i>i.hy.</i> , interhyal.	<i>sp.o.</i> , sphenotic.
<i>i.op.</i> , interopercular.	<i>t.</i> , tooth on dentary.
<i>m.</i> , membrane connecting some of the bones of the upper jaw.	<i>t.cr.</i> , tegmen cranii.
<i>mck.</i> , Meckel's cartilage.	<i>u.hy.</i> , urohyal.
<i>mx.</i> , maxilla.	<i>vo.</i> , vomer.
<i>mx.'</i> , process of maxilla.	<i>vo.'</i> , vomerine tooth.
<i>m.eth.</i> , mesethmoid.	

PLATE XXXVIII.

The figures are drawn $\frac{1}{4}$ th their natural size.

- Fig. 1. The complete skull of *Regalecus*, with the jaws protruded. (The outlines of the otic bones are not indicated in this figure.)
 2. The suspensorium of the left side, seen from within.

PLATE XXXIX.

- Fig. 3. Dorsal view of the complete skull of *Regalecus*.
 4. Dorsal view of cranium, after removal of the upper jaw.
 5. Ventral view of cranium.
 6. Side view of cranium.
 7. Front view of cranium.
 8. Hind view of cranium.

4. On Worms of the Family *Gordiidae* from Corea.

By Dr. VON LINSTOW *.

[Received May 1, 1906.]

(Text-figure 95.)

These worms were obtained by Mr. Malcolm P. Anderson, who has been sent out to the Far East by H.G. the Duke of Bedford to make collections of the Fauna. They consist of specimens of two new species.

* Communicated by F. JEFFREY BELL, F.Z.S.

GORDIUS PALLIDUS, sp. n. (Text-fig. 95 A.)

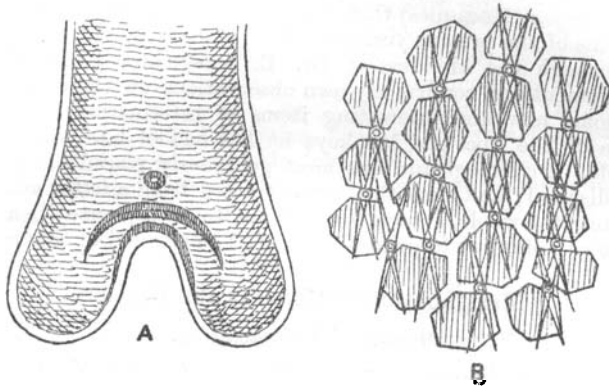
Locality. Freshwater pond in Korea. Three males.

Length, respectively, 265, 292, and 305 mm.

Breadth: at the anterior end, 0.59 mm.; in the middle, 0.75 mm.

Colour yellowish white. A broad, crescentic, cuticular fold on the ventral side at the posterior extremity, the inner sides of the posterior lappets and a ring around the cloacal opening yellow-brown.

Text-fig. 95.



A. *Gordius pallidus*. Posterior extremity of the male from the ventral aspect.

B. *Parachordades coreanus*. Cuticle.

The posterior end of the body is produced into two rounded lappets. The cuticle is traversed, at an angle of from 50° or 130° , by two bands separated by an interval of from 0.031 to 0.039 mm.; between these bands are two systems of fine lines, running in the same direction as the bands but too minute to measure.

PARACHORDADES COREANUS, sp. n. (Text-fig. 95 B.)

Locality. A freshwater stream, Korea. One female.

Length 322 mm.

Breadth: at the anterior end, 0.28 mm.; in the middle, 1.18 mm.; at the posterior end, 0.71 mm.

Colour dark brown; anterior end whitish, without a cervical band.

The rounded posterior extremity is sharply truncated. The cuticle exhibits five- to six-sided patches of from 0.026 to 0.031 mm. in size; between the patches there are glistening knobs each surrounded by a light-coloured ring, from which two lines pass outwards at a definite angle. The cuticle also exhibits two extremely delicate systems of lines parallel with those just described, and a third system running longitudinally.

5. Notes upon Menstruation, Gestation, and Parturition of some Monkeys that have lived in the Society's Gardens.

By REGINALD I. POCKOCK, F.L.S., Superintendent of the Gardens.

[Received May 15, 1906.]

The matter contained in the following pages is an amplification of notes upon the reproductive phenomena of certain Cercopithecoid Monkeys and Baboons that recently lived, or are still living, in the Society's Gardens, and upon the offspring of some species of *Macacus* (Macaques) that bred in the Menagerie in the early months of the present year (1906).

Through the kindness of Dr. E. Steegmann I am able to supplement and confirm my own observations on these questions by some new and interesting items of information concerning some of the Apes and Monkeys he has had of late years in his hands. Dr. Steegmann has most generously placed his notes at my disposal; and since they are extracted from a letter and form a connected whole, I have decided not to incorporate them with my own notes but to print them in full at the end of this paper.

MENSTRUATION IN MONKEYS AND BABOONS.

Menstrual Inflammation.

It is well known that the females of many Monkeys and Baboons when "on heat" exhibit extreme inflammation of the naked area surrounding the genital and anal orifices. The swelling, however, does not take place in all species of Cercopithecidae. I have never detected it in any of the Guenons (*Cercopithecus*) nor in Macaques (*Macacus*) of the Common (*fascicularis* = *cynomolgus*), Bonnet (*sinicus*), Rhesus (*rhesus*), and Japanese (*fuscatus*) species. On the other hand, it is very conspicuous in Mangabeys (*Cercocebus*) of the Sooty (*fuliginosus*), White-crowned (*lunulatus*), and White-collared (*ethiopicus*) species; in all the Baboons (*Papio*) of which I have seen adult female examples, namely, the Chacma (*porcarius*), Guinea (*sphinx*), Green (*olivaceus*), Yellow (*cynocephalus*), and Hamadryas (*hamadryas*), and in the Pig-tailed Macaque (*Macacus nemestrinus*).

The present state of my knowledge on the subject may be summarised as follows:—

- a. A conspicuous subcaudal inflammatory swelling in the adult female when "on heat."

Cercocebus fuliginosus, *ethiopicus*, *lunulatus*.

Macacus nemestrinus and *M. sp.?*

Papio porcarius, *cynocephalus*, *sphinx*, *olivaceus*, *hamadryas*.

- a'. No such swelling in the female.

Cercopithecus—all the common menagerie species.

Macacus sinicus, *fascicularis*, *rhesus*, *fuscatus*.

Needless to add, this is hardly the classification to be expected on *à priori* grounds from the usually accepted views of the affinities of the species concerned. It seems to me to be probable that the swelling will be found to be characteristic of all the species of Mangabeys and Baboons; but in the case of the Macaques no generalisations can be drawn until further observations have been made. In 1904 I recollect seeing in the Berlin Gardens a female Macaque of a species whose name I have now forgotten, with the swelling like that of *M. nemestrinus*. Thus at least two species of this genus fall under section *a* of the above-given table. On the other hand, it is by no means certain that all the forms related to *rhesus* and *fuscatus* can be ranged with these species under section *a'*. For example, P. L. Sclater (P. Z. S. 1864, p. 710) says that a female of the Formosan Macaque (*M. cyclopis*) upon reaching maturity "acquired a most extraordinary development of the parts surrounding the organs of generation." The figure that accompanies this description, however, shows a long lobate swelling extending on each side down the back of the thigh and along the proximal third of the tail—a development quite unlike anything known to me in other species. It is significant, too, that Sclater speaks of this swelling as if it were permanent and not periodic. If permanent the development must probably be of a different kind from that now under discussion. If periodic and connected with menstruation it must indicate an important physiological difference between *M. cyclopis* and *M. rhesus*, two species structurally somewhat nearly related.

The swelling may be nothing but a useless correlative or accompaniment of the physiological processes incidental to menstruation. But, in my opinion, the development of a highly vascular, sensitive, and thin-skinned outgrowth of this nature—an obvious inconvenience to the monkey, since it involves special precautions to prevent injury, impairs activity, and is liable to laceration when quarrels arise—probably, rather than otherwise, carries with it some compensating advantage to the species. What may this be? Possibly the following considerations may throw some light on the subject. The similarity in form and colour between male and female Monkeys leaves no clue to the sex of a particular individual when seen at a distance. The males, moreover, are not apprised by the sense of smell of the condition of the females when "on heat" as are the males of Carnivora, Ungulata, Rodentia, and of other orders of Mammals. Hence it may be that the function of the swelling in question is to serve as a source of information to the males on the two points mentioned above. I think it may be claimed that such information is of use for the maintenance of the species. But whether the usefulness in these particulars of the swelling be or be not the factor that has guided its evolution, it is difficult to see how such a coloured excrescence can fail to convey the said information in the case of animals so intelligent and keen-sighted as Monkeys. For, as is fully attested by flowers like scarlet geraniums and by

fruits like ripe tomatoes or cherries—which are conspicuous, be it noted, for the purpose of attracting attention,—no colour is more conspicuous in green foliage by daylight than bright red. Red is also in an eminent degree visible at a great distance in the open, as a scarlet uniform proves. The crimson swelling, therefore, must, it appears, reveal to the males the sex and condition of adult non-pregnant females alike in the case of Mangabeys which live in the forests and of Baboons which frequent open rocky country.

Again, preferential mating cannot perhaps be altogether eliminated as a factor in the question. It may be that the colour and inflammation appeal to the æsthetic sense and sexual emotions of the males and act as an aphrodisiac impelling them to pair with females in which the characters are pronounced rather than with those in which they are poorly developed or absent. Preferential mating on the part of females was regarded by Darwin and others as the principal agent in fostering and fixing (not causing *ab initio*) ornamental colours and crests characteristic of males. If females are thus influenced, why not males? Whether or not the theory can be logically and confidently applied to animals probably remote from Man in mental processes, it seems illogical to exclude it as a probable factor in determining the development of female sexual ornamentation in the case of animals with so many human attributes as Baboons and Monkeys.

Menstrual Hæmorrhage.

In females of two species of Baboons, namely, a Chacma (*Papio porcarius*) and a Yellow (*P. cynocephalus*), I have noticed that the period of "heat" is heralded by inflammation of the genito-anal area and is followed after a day or two by a show of blood which continues for four or five days, during which time the inflammatory swelling gradually increases in size. The quantity of blood emitted varies greatly in the two specimens. In the Chacma it is relatively small, sufficient only to stain with small patches the floor of the cage; in the Yellow Baboon, a younger animal, the amount is at least ten times as great, so that the cage becomes quite unsightly. It is probable, I think, that the variation in the quantity given out by the two animals is merely an individual characteristic and is not connected with their specific distinctness. After the hæmorrhage stops, the swelling continues to grow and extends laterally so as to conceal completely the ischial callosities and the naked skin adjacent*. It reaches its maximum in about two weeks' time and remains at that stage for about one week. It then begins to shrink and in

* The swelling involves the whole of the circumanal area, so that the anal and the vaginal orifices are thrust considerably behind their normal position. Pairing between the sexes takes place after the hæmorrhage has ceased. The correlation between the swelling in the female and the extreme length of the intromittent organ in the male of Baboons is obvious.

about another two weeks has disappeared, so that the female at a distance is indistinguishable from the male. After a few days' rest inflammation again sets in and is almost at once followed by the appearance of hæmorrhage.

In the case of the female Chacma, the data upon which the foregoing epitome is, in the main, based are as follows:—

April 11-12 ...	Hæmorrhage.	Inflammation very perceptible.
" 14 ...	" "	Swelling still larger.
" 16 ...	No hæmorrhage.	" "
" 20 ...	" "	" "
" 25 ...	" "	Swelling full-sized.
" 26-30 ...	" "	" "
May 1-4 ...	" "	Swelling gradually shrinking.
" 14 ...	" "	Swelling disappeared.
" 18 ...	Hæmorrhage started.	Inflammation slight.
" 22 ...	" continued.	Swelling increasing.
" 25 ...	No hæmorrhage.	" "
" 30 ...	" "	" full-sized.
June 6 ...	" "	" sunk to half size.
" 12 ...	" "	Swelling nearly disappeared.
" 14 ...	" "	" " "
" 15-18 ...	" "	No swelling.
" 19-20 ...	" "	Very slight swelling and inflammation.
" 21 ...	Hæmorrhage started.	

Thus between four and five weeks—or, to be more accurate, thirty-two days—elapsed between the cessation of the hæmorrhage in April and its recommencement in May, and nearly four weeks—that is to say, twenty-seven days—between its cessation in May and its recommencement in June.

The period of "heat" in this Baboon may therefore be described with perfect accuracy as "menstrual," *i.e.* of monthly occurrence.

Hæmorrhage does not, however, take place in all female Baboons. There is, for example, a young female W.-African Baboon (*Papio sphinx*), now living in the Gardens, in which there is no show of blood; and although the swelling indicative of "heat" arises, it does not reach the enormous size characteristic of the Chacma, but involves merely the median subcaudal area of the rump without extending laterally over the ischial callosities. I do not know whether this is an individual peculiarity, or whether it is typical of the species, or whether it is merely assignable to the youth of the Baboon in question.

So far as my experience goes, hæmorrhage does not, as a rule, occur—or only occurs in a negligible quantity—in females of the

genus *Cercopithecus* and also in the Rhesus, Common, and Japanese Macaques; but I learn from Dr. Hamish Nicol that a Bonnet Macaque (*M. sinicus*) he had for some years in captivity always showed a bloody discharge at menstruation, so much so as to redden the places where she sat and compel her confinement to the cage for the two or three days that it lasted*.

Reviewing the above-mentioned facts it seems to me to be impossible to draw any satisfactory conclusions with regard to the incidence of menstrual hæmorrhage in Cercopithecidae. In Baboons it may or may not take place and may be great or little in amount. It has been noticed to occur in some profusion in a female *Macacus sinicus*, and not to occur appreciably in a female of the closely allied species *M. fascicularis*. Obviously, therefore, it cannot be associated with the inflammatory swelling of the genito-anal region; and it is hardly likely to have a specific value in taxonomy. Perhaps the nearest guess at the truth that can at present be made is the surmise that it is dependent on the constitution or health of the individual.

PREGNANCY AND PARTURITION IN MACAQUES.

In the first half of the current year three Monkeys were born in the Gardens, namely: a Japanese Macaque (*Macacus fuscatus* = *speciosus*) on Jan. 10th; a hybrid between a male Common Macaque (*Macacus fascicularis* = *cynomolgus*) and a female Pig-tailed (*M. nemestrinus*) on March 1st; and a hybrid between the same male Common Macaque and a female Rhesus (*M. rhesus*) on April 27th. Congress between the parents of the Japanese Macaque was not seen, and the young was born at night. No observations, therefore, were made upon the period of gestation and parturition in this species.

The same remarks apply to the young born from the specimens of *M. fascicularis* and *M. rhesus*, except that the devouring of the placenta by the mother was noticed by the keeper in charge.

In the case of the hybrid *M. cynomolgus* and *M. nemestrinus* practically all the stages of parturition were watched. Unfortunately the young was born dead, or died soon after birth †.

Pregnancy.

Neither the Pig-tailed nor Japanese Macaque was known to be pregnant, in spite of the large size of the young. In the case of the Japanese Macaque this was due to the long and thick hairy winter coat of the mother; and in the case of the Pigtail to the

* This Monkey, I hear on the same authority, was addicted to masturbation—a habit by no means uncommon in males of some Baboons and Anthropoid Apes (Chimpanzee, Orang), but of very rare occurrence, I believe, in females.

† I was not myself present on the occasion. For the information given above I am indebted to the two keepers, Harrod and Rodwell, whom I cross-examined independently without finding any important discrepancies in their accounts.

inactivity of the Monkey, which was out of health and habitually sat with her knees pressed against her abdomen and her arms folded across them. The Rhesus, however, who was very active, showed decided signs in the enlargement of the nipples and the swelling of the abdomen, more particularly in its anterior portion behind the thorax. As compared with the human species the alteration in appearance due to pregnancy was small, although the fetus was comparatively larger in the Monkey. A week or two before the birth of the young, the Rhesus in one night lost all the hair off her cheeks. The skin was perfectly healthy, and looked as if it had been shaved clean. The bareness gradually spread on to the front of the shoulders and chest, extending ultimately to and round the nipples. It persisted until the young was about six weeks old; but within two months of birth the naked areas were covered with a coating of short hair.

Period of Gestation.

A small and not fully grown specimen of the Pig-tailed Macaque (*Macacus nemestrinus*) was observed to be in season in the latter part of August, 1905*, and to be covered more than once by a male of the so-called Common Macaque (*M. fascicularis*). There was no subsequent menstruation. Hence it may be inferred that conception took place some time between the middle of August and the beginning of September.

Soon afterwards the Monkey was removed from that cage and placed, together with another female of the same species, in a cage with an adult male hybrid between a Pig-tailed and Common Macaque bred in Singapore by Mr. H. N. Ridley. The behaviour of this male towards the two females was markedly different. Beyond tyrannising over the female in question and keeping her in a state of nervous subjection, he treated her with complete indifference. The other female, on the contrary, was regarded with decided favour. Possibly his disregard for the pregnant female was due to her condition. This may have brought about some subtle change in her, a difference or deprivation of odour may be, which perhaps robbed her of an attractiveness she might otherwise have held for him. In the winter she was placed in another cage and was not in company with a male Monkey of any kind until the young was born on March 1st.

Judging by analogy of the human species, the fetus was very nearly, but not quite, at full term. The nails were completely formed; but the testicles had not descended into the scrotum. They had passed out of the abdominal cavity and were lying in the pelvic rim, the left a little lower than the right. Inguinal

* I am able to fix this date within a few weeks from the testimony of one of the keepers, Rodwell, who being a newly appointed and inexperienced hand was profoundly impressed by the excessive inflammation of the genito-anal area exhibited by the Monkey at the time. This man came on duty on Aug. 7th, and assures me that he noticed the phenomenon within the following week or two.

position of the testicles in the human foetus suggests a month's prematurity; but in the Monkey, where development is more rapid, it probably denotes a shorter period, perhaps about two or three weeks. Hence assuming that the young Monkey under discussion may have been premature by about that length of time on March 1st*, and that conception occurred at some date in the latter half of August, it may be concluded with some confidence that the period of gestation in the Pig-tailed Macaque is not more than seven and not less than six months. It does not appear to me that the data furnished by the present case justify a more exact estimate of its duration. The probability of the correctness of this calculation is supported by R. B. Sányál's† statement that a female *Cercopithecus cynosurus*, in the Calcutta Gardens, carried her young seven months.

Parturition.

The Pig-tailed Macaque in which parturition was observed refused food during the day, and seemed to be generally low-spirited and out of health. The precise time at which labour began is unknown. The first indication that it was in progress was the utterance of a scream by the mother late in the afternoon. The birth, a case of foot-presentation, took place about one hour afterwards. The Monkey remained seated on the perch during this time, aiding the extrusion of the young with her hands when a labour-pain supervened, and cleansing her offspring with her hands and licking them afterwards in the intervals.

Towards the end of the time, the contractions of the uterus took place at intervals of about five minutes, the screams and moans of the mother attesting the suffering she endured. The concluding stages and the severance of the umbilical cord could not be seen on account of darkness; but the placenta was found on the floor of the cage next morning detached from the young, which was dead, with its head partially crushed, as if by a fall or by being stepped upon. Whether the crushing of the head by either of these means was the cause of death, or whether the mother let the dead body fall on its head from the perch to the floor, is not known.

If this had been the only case to supply data regarding parturition in Monkeys, the following inferences might have been drawn: (1) that the process is painful; (2) that it lasts for about one hour; (3) that the placenta is not devoured by the mother.

But, so far as the suffering is concerned, there is no evidence

* I am not sure of the accuracy of this inference, because in the young male hybrid between *M. rhesus* and *M. fascicularis*, now living in the Gardens, the scrotum, which is of large size, appeared to be empty at birth and the testicles inguinal in position. The same appearance is presented by these organs now that the animal is five weeks old.

† Quoted by W. L. Sclater, *Mammals of S. Africa*, p. 9. Blanford also says that the period is about seven months in Indian Macaques (*Faun. Brit. India, Mamm.* p. 13).

that it is considerable in normal cases, and Dr. Steegmann's observations prove that the actual birth may be accomplished in not more than fifteen minutes. Both the suffering and the duration of the birth in the Pigtail must be attributed, I think, at all events in part, to its being a case of foot-presentation, which I assume, from the analogy supplied by other animals, to be abnormal*. Abnormality was further attested, as I afterwards learnt, by the leaving of the placenta by the mother, for Dr. Steegmann's evidence on this point was fully confirmed by the behaviour of the female Rhesus, who was actually seen by the keeper, Heffer, to devour the placenta entire.

Devouring the placenta by the mother seems to be the invariable rule in all species of Mammalia, with the exception of Man†. The habit has no relation to the natural food of the species, being common to purely herbivorous ruminants, to herbivorous or omnivorous rodents, to Monkeys, and to Carnivora. The catholicity of the habit suggests that it must have some significance from the point of view of utility to the species practising it. In the case of animals like Rabbits, Rats, and Carnivora, where the mothers lie up with helpless young, a certain measure of utility may lie in the necessity for keeping the spot clean and sweet-smelling.

That this is not a complete explanation, however, is suggested by the reflection that in the case of Ungulata the young are active and soon after birth wander away with the mother. The same argument applies to Monkeys, where the young are born in trees and are carried away by the mother directly afterwards. Again, some animals, as is shown by the female N.-American Wolf (*Canis occidentalis*), now in the Zoological Gardens, stay for a couple of days with their young without feeding. In instances of this kind it is conceivable that the eating of the placenta has a nutritive as well as a hygienic significance. But this view of the matter does not meet the case of Antelopes and their allies, which will start grazing as soon as the young is born. That the habit has some deeper meaning than those discussed above seems therefore to be probable. Perhaps, as has been suggested to me by Dr. J. Rose Bradford, the hastening of milk-secretion is its underlying physiological cause. In this hypothesis may possibly be found the explanation of the delay that commonly occurs in the human female between parturition and lactation, since practical synchronism between the two phenomena is met with in placentivorous mammals.

The amount of hæmorrhage that took place after birth differed greatly in the Japanese and Rhesus Macaques. In the Rhesus scarcely any was noticed, but in the Japanese it continued for two days and was quite considerable in quantity.

* Dr. F. G. Parsons, F.Z.S., suggested at the Meeting when this paper was read that the length of time occupied by the birth might have been due to the young being the first to which the mother had given birth.

† I have been unable to discover if the instinct has been retained by any savages.

CONDITION AND BEHAVIOUR OF THE YOUNG AT AND AFTER BIRTH.

At birth, Monkeys of the genera *Macacus* and *Cercopithecus* are clothed with hair not differing materially in thickness, length, and distribution from that of their parents. In this respect they differ markedly from newly born Chimpanzees, which, as I am told by Dr. Steegmann, are nearly naked at birth. The smallest Chimpanzees that have come under my notice were thickly coated like the adults, with the exception of one young female, perhaps from twelve to eighteen months old, in which the head was bald, but became covered subsequently. Dr. Steegmann, on the contrary, has had in his hands newly imported specimens, believed to be about six months old, which were almost destitute of hair. Thus, in the nakedness of the young, Chimpanzees are more like Man than they are like Cercopithecine Monkeys. They show, indeed, the commencement of the postponement in the growth of the body-hair characteristic of Man, where, apart from its local development at puberty in both sexes, it only appears with any degree of luxuriance upon the appendages, ventral surface, and to a lesser degree upon the back in some, mostly middle-aged or old males*.

In the young of the Japanese Macaque and in the hybrid *M. rhesus* \times *M. fascicularis* the colour differs considerably from that of the adults of these species. The hairs are uniformly tinted throughout, being in the first-mentioned form olive-grey, and in the second blackish grey, without gloss and without any subapical pale area.

As recorded by Dr. H. O. Forbes, this was previously known to be the case in the Japanese Macaque, as also was the absence of the red hue in the face. It was not, however, previously known, so far as I am aware, that the infant coat is moulted during the fifth month and gradually replaced by a coat resembling in colour that of the parents. The little Japanese Macaque was born on Jan. 10th, and the moulting which set in near the beginning of May was finished by the end of that month, with the exception of a dark tuft of hair on each cheek, which was unchanged by the end of September.

Newly born Macaques differ extraordinarily in the matter of activity and independence from human babies, which remain practically helpless for at least a year. The Monkeys are able soon after birth to maintain a secure hold of their mother by clutching the hair of her sides with hands and feet, and within a week can crawl feebly about unaided. This was particularly noticeable in the case of the young Rhesus \times Common Macaque, which I saw trying to creep over the straw of her cage when only four days old. When between four and five weeks old it could climb up the bars and about the perches of the cage with considerable activity and skill. The young Japanese Macaque appeared to be less pre-

* This remark applies particularly to the xanthochroic and melanochoic Europeans, and still more so to the Todas of Hindostan and to the Ainos of N. Japan.

cocious, but to what extent this was due to the greater solicitude of the mother in keeping the baby with her, either to protect it from the cold* or from the Monkeys in the adjoining cages, it is impossible to say. Certain it is, however, that long after the baby was able to crawl the mother habitually frustrated its efforts at independence by pulling it to her side before it could get out of arm's reach. The male took no share in nursing or tending to the young. He treated it with complete indifference, and with good-humoured tolerance allowed it to take the liberty later on of climbing over his back and pulling his hair. When sleeping, the parents usually sat front to front with the little one between them, completely concealed by their long and thick coats of hair. In addition to nursing and suckling the baby in the usual way, the mother kept it clean, as dogs and cats clean their puppies and kittens, namely by licking up the excrement and urine while being passed. It was amusing to see her every now and again seize the baby by the tail and inspect its hind-quarters for indications of excretion.

I have never seen the young Macaques suck more than one teat at a time. In this they differ from the baby Vervet (*Cerco-pithecus lalandii*) born in the Gardens in 1893, which is alleged to have held both nipples in its mouth at once (P. Z. S. 1893, p. 615). They soon began to feed on their own account. When four weeks old the baby Rhesus \times Common Macaque helped himself to his mother's bread and milk and at two months was trying, albeit ineffectually, to crack nuts. I did not see the young Japanese Macaque eat anything until six weeks old. At five months he was still being suckled. He was weaned when he was between seven and eight months old.

AGE OF MONKEYS.

I am not aware of any statistics as to longevity in Monkeys. It is interesting therefore to put on record the fact that Col. S. M. Benson kept, he informs me, a Rhesus Macaque alive for twenty-eight years. The animal ultimately died of heart disease, and was probably about twenty-nine years old at the time.

Supplement by Dr. E. J. STEEGMANN †.

My experience of birth amongst Monkeys is limited to one kind, the common Indian Rhesus, and the cases are few in number. All the females that gave birth to young ones were already pregnant when I bought them, and I have absolutely failed to

* This Monkey, be it remembered, was born on Jan. 10 in an unwarmed open-air cage separated by wire partitions from cages to the right and left, containing Baboons and Monkeys of diverse species. The baby of the Rhesus, on the contrary, was born on April 27th in a warmed house, and two days afterwards was transferred with its mother to a cage boarded off from adjoining cages.

† These notes were kindly compiled by Dr. Steegmann in reply to certain definite questions on matters about which my knowledge was defective or my observations wanted confirming.

breed from the commencement. I have therefore no facts whatever that can throw any light on the question of the length of gestation.

Altogether, I have had five Rhesus Monkeys born in captivity, four of them apparently at full time and the fifth prematurely. I have also had several other mothers which gave birth to young within six days of arrival.

The following facts are only ones on which I can speak with certainty from my own observations.

The signs of pregnancy in the female are not easy to recognise. I have purchased several under the impression that they were with young, and on subsequent post-mortem examination found no sign. Those females that were really pregnant showed considerable enlargement and prominence of the abdomen. The breasts were swollen, but in only one case could I detect any areola round the nipple, and this may of course have been normal. The pregnant animals appeared to be just as active as the others.

There was in all cases a very large amount of liquor amnii.

Unfortunately, I never saw the actual delivery of the young. In one case I could fix the time within 15 minutes, in the other I did not see the young ones till from two to three hours after birth.

I do not know how the mother separates the umbilical cord, but I suppose it is by biting. Examination of the abdominal end of the cord showed a condition that would have been caused by a clean bite rather than a tear. I have no doubt that the mother eats the placenta. I could never find a trace of it, even in the case that I saw within a quarter of an hour of delivery.

In the one case where the young was born apparently before full time, the mother had been ill some days previously. She was very wild and nervous, and resented any interference. The sign of ill-health was the one to which I generally attach a good deal of importance in Monkeys, namely, loss of appetite. I also noticed once or twice a slight discharge of what looked like blood-stained mucus from the vulva. This discharge may have been normal, though I never noticed it in any other Monkey before the birth of the young one. I have frequently seen a bloody discharge from the rectum in Monkeys, both male and female. In this particular case I found the young one dead in a corner of the cage. It had evidently been dead some hours, but had been born alive. There was no sign of the mother having killed it, at least there were no wounds or injuries to be seen, but she had tried to push it out of the cage, and was sitting as far away from it as she could when I first saw her. The placenta was still attached to the young by the umbilical cord, and no attempt seemed to have been made to separate it. No reliable data can be drawn from this placenta, as it was obviously not normal nor healthy. The young animal was fully developed, except for the teeth, which had not appeared. All the others that were born here had teeth.

The mother of this one died a few days after its birth, but the uterus was in too septic a condition for any satisfactory examination.

In all cases where the young were born alive the thing that struck me most was the extraordinary strength and activity they displayed practically immediately after birth. The one I saw when it was certainly not more than twenty minutes old could already cling by itself to its mother whilst she climbed about the cage. They hold on to the mother's fur by both hands and feet, and frequently also hold the nipple in their teeth. I am not able to form any opinion as to how long the young suckle; they can certainly eat solid food within less than a month of birth. One young Rhesus I had was born not more than a week before arrival. The mother died when it was between three weeks and a month old, and I had no difficulty in rearing it by hand, as it could drink and eat soft food.

One Monkey born here I kept with its mother for six months, and another for about seven. Both these young animals suckled all the time, although they also, during the greater part of it, shared the ordinary food given to the mothers.

The last point that is at all useful is the fact that young Rhesus Monkeys are born completely covered with hair, in all respects resembling the hair of the adult animal. I think that probably this is a feature in which they differ from Anthropoids.

I have reason to believe that Chimpanzees are born entirely or nearly naked. I have had eight young Chimpanzees imported. They were not less than six months old, though one of them was certainly more. Seven of these animals had very little hair indeed; most of them were practically naked on the ventral surface, but had scanty fur on the head and back. I have had a large number of other young Chimpanzees, but all of them had good coats. Unfortunately, all the seven uncovered young ones died of broncho-pneumonia soon after arrival, so I had no chance of observing when the coat appeared.

I tried an experiment to see if Rhesus would breed in captivity. One of the mothers whose baby had actually been born here was very tame and not easily frightened. I kept her with the young one, suckling all the time, for six months. I then put her in another large cage with an adult male Rhesus, and kept them together for another six months. During the whole of the time they were together they copulated frequently. Both my man and I witnessed this on many occasions. I then kept the female alone for three months. She had the appearance of being pregnant (enlarged abdomen and swollen breasts). At the end of three months she became ill and died. On post-mortem examination there was no sign of pregnancy. The uterus was no larger than that of an ordinary adult Rhesus, and the ovaries, &c., were normal. The post-mortem did not reveal the cause of death.

I cannot say anything about menstruation in the Rhesus during pregnancy or suckling, as I have not been able to make reliable

observations on this point even in the non-pregnant adult female. There is certainly no swelling of the vulva and perinæum such as occurs in the Baboon, and I have never noticed any discharge. As I have already said, the Rhesus often suffers from some inflammatory condition of the large intestine causing a discharge of bloody mucus from the rectum, and this may have been mistaken in some cases for menstrual blood*.

6. Additions to the Herpetology of British East Africa.

By G. A. BOULENGER, F.R.S., F.Z.S.

[Received May 10, 1906.]

(Text-figures 96-98.)

Seven years ago I described and figured in these Proceedings† a species of the genus *Lacerta*, belonging to the group of *L. muralis*, discovered by Mr. F. J. Jackson in the Mau Ravine, Uganda. This was a very unexpected discovery, considering the range of the genus; it is now paralleled by Mr. Degen's find, also in Uganda, of a Lizard of the genus *Algiroides*, the known distribution of which was believed to be restricted to Sardinia, Corsica, the East Coast of the Adriatic, and Greece. The collection made in Uganda by Mr. Degen, which has been productive of so many new fishes, has also yielded a new Snake and a new Toad, which are here described.

ALGIROIDES AFRICANUS, sp. n. (Text-fig. 96.)

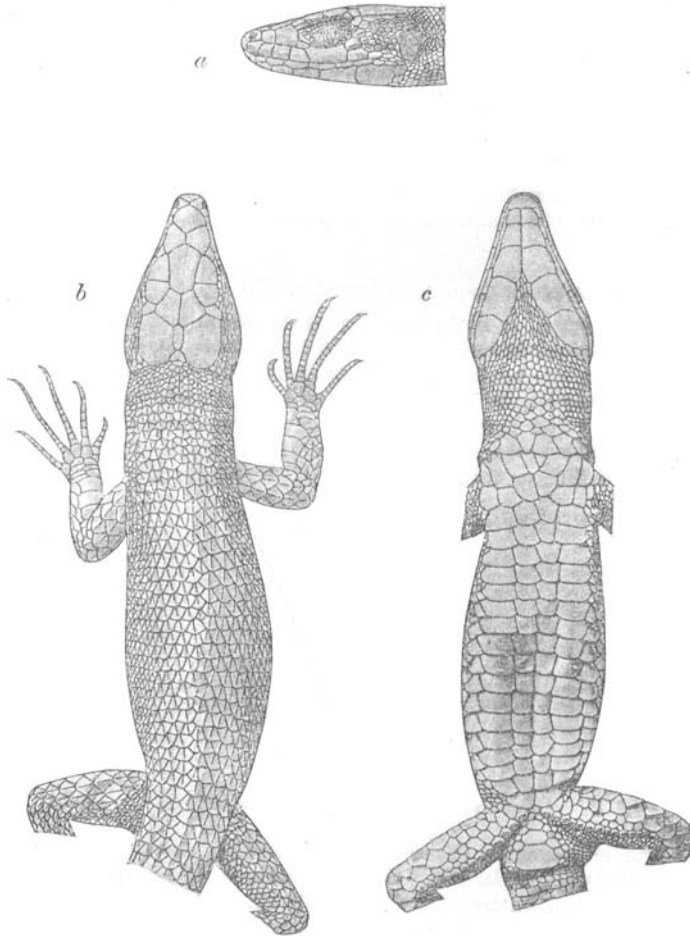
Head strongly depressed; snout rather long, obtusely pointed. Rostral not entering the nostril; a single postnasal; four or five upper labials anterior to the subocular; a series of granules between the supraoculars and the supraciliaries; occipital shorter and a little broader than the interparietal; temple covered with uniform small keeled scales. No gular fold; 19 scales in a line between the third chin-shields and the collar, those in front of the latter enlarged and faintly keeled; collar with serrated edge, composed of 6 plates. Dorsal scales more than twice as large as the laterals, diagonally keeled, obtusely pointed, the strong keels converging towards the median line; 24 scales across the middle of the body; two or three lateral scales correspond to the length of

* [Evacuation of apparently blood-stained faeces appears to be not an uncommon phenomenon in Monkeys. Dr. Mary Gordon, F.Z.S., tells me she has noticed it in a Diana (*Cercopithecus diana*) and a Mozambique Vervet (*C. pygerythrus*), but is not sure that the staining was caused by blood. I have myself been completely deceived by the faeces of a Chimpanzee, which, while in perfect health, passed a stool suggestive of serious intestinal ulceration. I subsequently learnt that she had been fed the previous day upon blood oranges! In any case, whether the staining is sometimes due to blood, as Dr. Steegmann says, and sometimes not, it appears to occur in Monkeys in other respects perfectly healthy and passing normal faeces. This conclusion may be useful to those who keep Monkeys, since it shows that the occurrence of such staining does not necessarily indicate treatment for colitis or enteritis.—R. I. P.]

† 1899, p. 96, pl. x.

a ventral. Ventrals in 6 longitudinal series, median and outer series considerably narrower than the others, and 18 transverse series. Præanal plate with two small azygous plates in front of it and small scales on the sides. The hind limb reaches between the

Text-fig. 96.

*Algiroides africanus.*

a, side view of head; *b*, upperside, and *c*, underside of body.

collar and the ear; foot once and one-fourth the length of the head. Femoral pores 13-15. Coppery brown above, with a well-defined dark brown lateral band and small dark brown spots on

the back; a light streak from the upper lip to the shoulder, interrupted by the lower border of the tympanum, and continued as a series of round spots on the body; upper surface of tail with dark and light bars; lower parts orange (green in spirit), the throat yellowish.

A single male specimen from Entebbe.

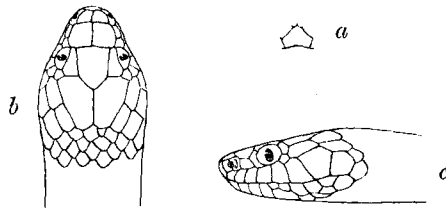
From snout to vent.....	51 millim.
Head.....	14 "
Width of head.....	9 "
From end of snout to fore limb...	20 "
Fore limb.....	22 "
Hind limb.....	30 "

This lizard resembles strikingly *A. nigropunctatus* D. & B., from the East Coast of the Adriatic and the Ionian Islands, differing principally in the scaling of the temple and in the single postnasal shield.

LEPTODIRA DEGENI, sp. n. (Text-fig. 97.)

Rostral small, a little broader than deep, just visible from above; internasals not or but slightly broader than long, much shorter than the præfrontals; frontal once and a half as long as broad, a little longer than its distance from the end of the snout, shorter than the parietals; loreal much longer than deep; one præ- and two postoculars; temporals 1 + 2; eight upper labials, fourth and fifth or third, fourth, and fifth entering the eye; three

Text-fig. 97.



Leptodira degeni.

a, rostral; *b*, upper, and *c*, side views of head.

pairs of chin-shields, the anterior longer than broad and in contact with five lower labials. Scales smooth, in 19 rows. Ventrals 170-175; anal entire; subcaudals 32-33. Dark brown above, the outer rows of scales lighter, or whitish in the centre; upper lip and lower parts yellowish white, with a brown line along the middle of the tail.

Total length 450 millim.; tail 50.

Two specimens from Entebbe.

Distinguished from *L. hotambæia* Laur. by the narrower rostral, the longer loreal, and the absence of black on the temple.

BUFO VITTATUS, sp. n. (Text-fig. 98.)

Crown without bony ridges; snout short, rounded, with distinct canthus; interorbital space concave, narrower than the upper eyelid; tympanum very distinct, nearly as large as the eye and close to it. Fingers rather pointed, first not extending beyond second; toes one-third webbed, with simple subarticular tubercles; two moderate metatarsal tubercles; no tarsal fold. The tarso-metatarsal articulation reaches the tympanum. Upper

Text-fig. 98.

*Bufo vittatus*.

parts with round or oval warts of unequal size, which are conical on the sides; parotoids narrow, feebly prominent, broken up into warts. Reddish brown above, with six interrupted black longitudinal bands on the back and cross-bands on the limbs; pale brick-red beneath, with large greyish spots.

From snout to vent 37 millim.

A single female specimen from Entebbe.

Near *B. funereus* Bocage. Distinguished by the shorter inner finger and the much larger tympanum.
