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### XXXI.—The lemurs of the Hapalemur Group

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them; two more or less sinuous lines from the inner end of the above, straight to the hinder margin, slightly more separated hindwards; two postmedial lines from the costa to a little below vein 2, somewhat separated from each other at the costa, connected near its end by a thin sinuous line with the lower end of the discoidal lines, and four small rings attached to the outer half of these two lines; some marginal spots and a little suffusion below the middle of the space between: hind wing with a dark lunular line at the end of the cell; two lines from the middle of the costa extending hindwards towards the anal angle, the lines anastomosing halfway down; a sinuous line from the costa near the apex to the anal angle, where it somewhat thickens; some suffusion at the apex of the wing; both wings with dark marginal line and yellow cilia, interlined by a pale brown line. Underside pale glistening yellowish white, the markings of the upperside more or less indicated. Body and legs yellow without any markings.

Expanse of wings, ♂,  $1\frac{7}{8}$  inch.

Hab. Arfak Mts., 6000', N. New Guinea.

Not unlike a very large *Margaronia cæsalis*, Walker.

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### XXXI.—*The Lemurs of the Hapalemur Group.*

By R. I. Pocock, F.R.S.

#### *On Hapalemur and Prolemur.*

IN addition to the skeleton and skull of the *Hapalemur simus* described by Beddard (P. Z. S. 1901, pp. 121–129), the Zoological Society's collection contains the following materials of *Hapalemur*, all the specimens being labelled *H. griseus*, Madagascar, without nearer locality:—

1. The skull of an adult but small specimen, without history of any kind.
2. The skin of a small, probably immature, male specimen which was received in Nov. 1887, and has never been described.
3. The skin of the adult male described by Beddard (P. Z. S. 1884, pp. 391–399), and later by Bland Sutton (P. Z. S. 1887, p. 369).
4. The skin and skull of an adult male dated June 9th, 1903, to Sept. 17th, 1904, which like no. 2, has never been described.

This paper is based primarily upon an examination of these examples.

The two species above named have quite an extensive literature. Skulls assigned to *H. griseus* have been figured on several occasions. To these and to the specimens in the Society's collection I shall revert later.

Good figures of the skull of *H. simus* have been published, notably by Gray (P. Z. S. 1870, pp. 829-830, figs. 1-4), by Jentink (Notes Leyd. Mus. vii. 1885, p. 33), by Milne-Edwards and Grandidier (Hist. Nat. Madag. Mamm., Atlas ii. pls. cxxii. G & H, 1890-1896), and by Elliot (Mon. Primates, i. pl. xvii., 1912); and it may be noted that these figures attest no structural variations of moment, suggesting that more than one form has been described under the name *simus*. As I shall presently attempt to show, this is not the case with skulls ascribed to *H. griseus*.

The generic name *Hapalemur*, proposed in 1851 by I. Geoffroy for the species then known as *Lemur griseus*, met with universal and unchallenged acceptance until 1912, when Elliot, misled by a superficial inspection of the text, substituted *Mioxicebus*—emended to *Myoxicebus*—on the alleged, but entirely erroneous, grounds that Lesson in 1840 had given the latter title to the type-species of *Hapalemur*. It is quite true that the first species cited under *Mioxicebus* was named *griseus*; but it is equally and obviously true that the diagnoses, both generic and specific, of *Mioxicebus griseus* have no applicability to *Hapalemur griseus*. On the contrary, they fit tolerably closely the species for which they were intended, namely, *Chirogaleus major*, then known as *milii*. It is possible that Lesson had at the time a specimen of a different but closely allied species of *Chirogaleus* before him; but until evidence on that head is forthcoming *Mioxicebus griseus* must stand as a synonym of *Chirogaleus major*. *Hapalemur* consequently resumes its former place in literature\*.

\* Another unnecessary change introduced by Elliot into the nomenclature of lemurs is the substitution of the new name *Altillemur* for *Opolemur* on the alleged grounds that Gray applied the latter generic term to *Chirogaleus milii*. That is an incorrect interpretation of the facts. *Opolemur* (P. Z. S. 1870, pp. 853-854) was proposed by Gray for a species represented in the British Museum by specimens which he wrongly identified as *Chirogaleus milii*. That his identification was erroneous is shown by the diagnosis and figures. The characters, stated and illustrated, of his *Opolemur* do not fit *Chirogaleus*; hence the former cannot be a synonym of the latter, as Elliot asserted, and *Opolemur* must be restored to use, if the genus it designates is maintainable, with *Altillemur* as its synonym.

So far as I am aware, the only other name which can come generically into the little group of lemuroid species exemplified by *griseus* of I. Geoffroy is *Prolemur*, which was used by Gray first in a subgeneric, then in a generic, sense for the species he described as *simus*. It appears to me that full generic rank should be assigned to this form. The characters upon which this opinion is based have been either figured or described by previous authors—notably by Gray, Beddard, Milne-Edwards, Grandidier, and Elliot,—who, however, did not attach so much importance as I do to the differences between *griseus* and *simus* where they were appreciated\*. These differences appear to me to be of considerably greater systematic value than those which distinguish such genera as *Chirogaleus* and *Microcebus*, for instance.

To our knowledge of *Prolemur simus* I have nothing to add. In the subjoined comparative diagnoses of *Hapalemur* and *Prolemur* I have merely made use of characters in *Prolemur* which have been stated by others or are apparent in their published figures.

*Hapalemur*, Geoffr.

Type, *griseus*, I. Geoffr.

Gland on forearm present in both sexes.

Nasals long, extending back beyond lacrymal foramina.

Interorbital constriction not exceeding half the width of the post-orbital constriction.

Mesopterygoid fossa much longer than its greatest width in front.

Width across paroccipital processes at most a little greater than length of nasals.

Malar orifice large, set back behind middle of orbit.

Symphysis of mandible strongly curved, chin rounded.

Ramus of mandible slightly everted behind dental line.

Upper  $pm^1$  much lower than canine, a little higher than  $pm^2$ ;  $pm^2$  and  $pm^3$  unlike in size and

*Prolemur*, Gray.

Type, *simus*, Gray.

Gland on forearm present in neither sex.

Nasals short, not extending back to level of lacrymal foramina.

Interorbital constriction considerably more than half the width of the postorbital constriction.

Mesopterygoid fossa shorter than its greatest width in front.

Width across paroccipital processes much greater than length of nasals.

Malar orifice small, set forwards nearly in line with middle of orbit.

Symphysis of mandible not strongly curved, chin flattish.

Ramus of mandible strongly everted behind dental line.

Upper  $pm^1$  slightly lower than canine, much higher than  $pm^2$ ;  $pm^2$  and  $pm^3$  approximately alike

\* Gray's opinion, for example, that the species described by Schlegel as *Hapalemur griseus* was the same as his *H. simus* attests failure in this respect on his part; and Beddard, when he suggested that Mivart had identified *simus* as *griseus*, must have overlooked that author's description of the teeth.

*Hapalemur*, Geoffr.

form;  $pm^3$  molariform, with quadrate inner lobe;  $m^1$  and  $m^2$  with simple cingulum, without accessory cusp; no trace of groove on the inner cusp of these teeth behind.

Legs shorter; skull about six-sevenths the length of the femur\*.

*Prolemur*, Gray.

in size and form;  $pm^3$  not molariform, with rounded inner lobe;  $m^1$  and  $m^2$  with bilobate cingulum, the posterior lobe cuspidate; the main inner cusp of these teeth grooved posteriorly.

Legs longer; skull about two-thirds the length of the femur.

*On the Species of Hapalemur.*

When *Hapalemur* was instituted two species were assigned to it by Geoffroy—namely, *griseus* and *olivaceus*. The latter was said to differ from the former in colour and in the shape of the lower jaw. Most subsequent authors have concurred in the specific identity of the two, and Milne-Edwards and Grandidier, who had access to Geoffroy's specimens, called *olivaceus* a variety of *griseus*; and their coloured figures show that *griseus* is lighter in tint than *olivaceus*. Elliot, however, admitted the two species because of the difference in colour and the larger size of the skull in *olivaceus*. The inference to be drawn from the literature, whether rightly or wrongly, is that the two forms may represent distinct subspecies, or possibly species, but that in any case they are closely related and exhibit few, if any, constant cranial differences except of size.

The three skins in the Zoological Society's collection are decidedly dark in tint, and may be described as dusky brown, the hairs being dark bluish grey annulated with rusty brown towards the tips. On the crown of the head the rusty brown is more in evidence, but round the eyes and on the cheeks it is less obvious. The underside is lighter than the upper. In the small specimen, received in 1887, the belly and thighs inside are bright buff, the throat grey. In the two others the throat is darker and the belly dark grey washed with brown. Provisionally I regard these skins as belonging to one and the same species and race, and the colouring enforces

\* Judging from M.-Edwards's figures of the skeletons of *H. griseus* and *P. simus*. For instance, in *H. griseus* the skull measures 73 mm. and the femur 90; in *P. simus* the skull is 81 mm. and the femur 120.

In the Zoological Society's specimen of *P. simus* the femur is actually a little longer, being 122 mm. to the head, whereas the skull is shorter, namely, 75 mm. The skeleton, however, is that of an immature specimen, with the last molar teeth still buried in the bone, as Beddard's figure indicates. Probably the skull would have increased in length proportionately much more than the femur.

Unfortunately the leg-measurements of *H. schlegeli* are unknown. Hence the character above stated can only be used provisionally in a generic sense.

the conclusion that they are the *olivaceus*-form of *griseus*, and not typical *griseus*. This conclusion is borne out by the skull of the example received on 9. 6. 03, which is a little larger than the skull of *griseus* figured by Milne-Edwards and Grandidier. It also has the muzzle less steeply inclined, the posterior half of the zygomatic arch a little more arcuate, and the glenoid a little lower with reference to the dental line. I have not sufficient material to judge of the systematic value of these differences. Otherwise the two skulls are very much alike; and it is possible that M.-Edwards's illustration, as suggested below, was taken from an example of what he called the *olivaceus* variety of *griseus*.

I stated above that skulls of specimens assigned to *Hapalemur griseus* have been figured on several occasions; and the figures indicate confusion of more than one form under that name. For instance, if the figure of the skull published by Schlegel be compared with that published by Milne-Edwards and Grandidier, it will be seen that the differences between them fall quite outside the limit of individual variation exemplified by *Prolemur simus* or by any single species of the Lemuridæ known to me. Gray, indeed, declared that Schlegel had drawn the skull of an example of *Prolemur simus* in mistake for *Hapalemur griseus*. With this opinion Beddard was disposed to agree, and Jentink tried to account for the error of this view by explaining that Schlegel's illustration was inaccurate, apparently because it did not agree with the skulls that he possessed. Doubtless it did not; but in my opinion Schlegel's figure was exact in all essential points, seeing that it agrees singularly closely with the adult skull in the Society's collection mentioned first on my list in the opening paragraph of this paper.

Similarly, the skull of the specimen that lived in the Gardens from June 1903 to Sept. 1904 agrees in the main, though not so closely as in the other case, with the skull of *H. griseus* figured by Milne-Edwards and Grandidier. Since these French authors had access to Geoffroy's type of *griseus*, it must be assumed that the example they identified as *griseus* belonged to that form or to *olivaceus*, which was regarded as the same, and that Schlegel's example was wrongly referred to *griseus*. Confirmation of this conclusion was supplied by Elliot, who also saw the specimens in the Paris Museum, and remarked in connection with Schlegel's illustration:—"This figure is badly drawn, or does not represent the skull of *H. griseus*. It is altogether too broad, especially the muzzle." From this passage it seems that Elliot was not prepared altogether to accept Jentink's verdict as to the inaccuracy of

Schlegel's figure, and that the possibility of another species being concerned dawned upon him. Nevertheless, the shortness of the muzzle misled him apparently in the matter of its apparent superior width.

Both the literature, therefore, and the skulls in my possession attest the existence of two well-marked species of *Hapalemur*—one exemplified by the small skull above referred to, which probably belongs to the form Schlegel identified as *H. griseus*, the other being the true *griseus* of Geoffroy, which has been well figured by Milne-Edwards and Grandidier. The former species I propose to describe as new, taking the skull in the Zoological Society's collection as the type. Since the only other skull I have at hand is that of the specimen determined, for reasons already stated, as *olivaceus*, I have diagnosed the new species with special reference to *olivaceus* rather than to *griseus*, although the differences between it and Milne-Edwards's figure of the skull of *griseus* are almost as well marked.

*Hapalemur schlegeli*, sp. n.

? *Hapalemur griseus*, Schlegel, in Pollen & Van Dam, Rech. Faune de Madag., Mamm. et Ois. p. 6, pl. vii. figs. 4 a-d (skull). Nec *H. griseus*, Is. Geoff.

Skull (type) considerably shorter but relatively broader, higher, and more arched antero-posteriorly along its upper profile, and less hollowed between the postorbital processes, than in *H. olivaceus*, the orbits relatively larger, with the inferior edge much more salient, giving a strongly sinuous curvature to the outline of the malar arch, and causing a deeper groove along the outer surface of its suborbital portion; the upper surface of the muzzle more depressed and curved, the upper portion of the maxilla compressed along the nasal suture, the lateral edge of the anterior nares emarginate in profile view, this orifice slightly higher than wide, compressed above. In *H. olivaceus* the muzzle and anterior nares are not compressed above and the latter orifice is slightly wider than high. The zygomatic arch and postorbital bar are relatively stouter than in *olivaceus*; the mastoid is inflated, reducing the paroccipital process, and the upper edge of the zygoma is not continued as a crest back to the occiput as it is in *H. olivaceus*, where the mastoid is not inflated but flat, leaving the paroccipital processes salient. The basicranial axis is more steeply inclined, so that the bullæ and occipital condyles are set considerably lower with reference to the alveolar border of the maxilla than in *olivaceus* \*.

\* This difference is not so marked between the skulls of *H. schlegeli* and *H. griseus*, judging from M.-Edwards's figure of the latter.



Teeth of *H. schlegeli* shorter and narrower.

The typical skull of *H. schlegeli* has fully erupted and complete dentition and the sutures nearly obliterated. The obliteration, however, has not extended to quite the same extent as in the skull referred to *H. olivaceus*. Nor is there in the skull of *H. schlegeli* a median sagittal ridge on the parietal region. The low temporal crests are merely confluent near the middle of the parietals. The difference in this respect may be due to difference of age; but this is uncertain. When the two skulls are placed side by side on a flat surface they are practically the same height, despite the considerable disparity in length.

The differences in the shape and the dimensions of various parts of the skulls may be appreciated from the subjoined table of measurements of the type of *schlegeli* and of my skull referred to *olivaceus*. In the third column are given the dimensions taken from the figures of the skull named *griseus* by M.-Edwards:—

	<i>schlegeli.</i>	<i>olivaceus.</i>	<i>griseus.</i>
	mm.	mm.	mm.
Basal length .....	52	64	60
Length of palate along middle line ....	25	31	29
Length from post. edge of postorb. bar to tip of pmx. ....	36	42	37
Length from post. edge of orbit to lacrymal foramen .....	19	19	19
Height of orbit .....	14	14	14
Height from alveolar border to lower edge of orbit .....	9	12	10.5
Width of cranium .....	31	33	33
Width of postorbital constriction .....	23	19	19
Width of interorbital constriction .....	8	10	10
Width across zygomata (postorbital) ..	44	49	48
Width across orbits .....	39	40	40
Width of muzzle above canines .....	14	17	16
Length of mandible from condyle .....	41	52	48
Width of upper pm <sup>3</sup> .....	4.5	5.5	5

Skulls assigned to *H. griseus* have also been figured by Jentink (Notes Leyden Mus. vii. pls. i. & ii. figs. 3-4, 1885) and by van der Hoeven (Tijds. Nat. Geschied. 1844, pl. i. fig. 1); but in both cases there are discrepancies in the dimensions of the superior and lateral views which make it impossible to tabulate the measurements. For instance, in the case of Jentink's specimen the superior view of the skull is 65 mm., the lateral view 62.5, whereas the lateral view of the mandible from the condyle is 44 and the superior view 40.

In Hooeven's figure the superior view of the cranium is 59, the lateral view is 63. It may be noted that in M.-Edwards's figure of the skull of *griseus* the measurements coincide, as should be the case, both from the lateral and superior aspects.

Turning to Jentink's text, we find it stated that sixteen adult skulls measured 61 mm. in total length and 42 in width across the zygomata. They are thus considerably smaller than the skull of *griseus* figured by M.-Edwards, which is 73 mm. long and 48 broad, while my *olivaceus* is 76 mm. long and 49 broad. Clearly, therefore, Jentink's skulls were considerably smaller than the one depicted by Milne-Edwards and than the one I have described as *olivaceus*. This suggests the possibility of Milne-Edwards having described a skull of *olivaceus* as *griseus*, a course he might very well have adopted, seeing that he regarded *olivaceus* merely as a variety of *griseus*. Again, if the specimen figured by Jentink be a true sample of the sixteen he had for examination, they all differ from my *olivaceus* and Milne-Edwards's *griseus* in having a very much thinner postorbital bar. This, however, like the smaller size, may be a matter of age. Moreover, it will be noticed that the temporal crests are subparallel, showing scarcely any sign of convergence as far back even as the interparietal region, whereas in my *olivaceus* and M.-Edwards's *griseus* these ridges coalesce and form a fairly strong sagittal crest over the middle line of the parietal region.

But, whether Jentink's skulls represent a form distinct from M.-Edwards's *griseus*, or are merely less well-developed individuals of the same species, it is quite clear they are not referable to the same form as the one I have named *schlegeli*. They are too long and narrow, have very slender postorbital bars, and the frontal bones are depressed as in my skull of *olivaceus*.

There is no occasion to publish a figure of the type-skull of *H. schlegeli*, since it is in almost punctilious agreement with Schlegel's illustration, which shows the inflation of the malaroid, the sinuous curvature and suborbital salience of the malar arch, the thickness of the postorbital bar, the large orbits, the cranial width, the curvature of the upper profile, the shortness of the muzzle, etc. One rather marked difference in the tip of the muzzle may be explained, I suspect, by the cutting away of this part of the skull in Schlegel's example when it was removed from the skin. The incisor teeth are missing, as others have remarked, and this defect suggests that a portion of the premaxilla may have been cut away. If so, the ends of the nasals may have been truncated at the same time. This, however, is merely a suggestion. In the

type-specimen also the angle of the mandible is less rounded and the upper end of the coronoid is thinner, longer, and less curved than shown in Schlegel's figure.

The specimen described by Schlegel as *H. griseus* was discovered by Pollen at Ambassuana, three days' journey from the north-west coast of Madagascar. If, as I suspect, the type of *H. schlegeli* belongs to the same species, it probably came from the north-west coast of Madagascar, possibly also from Ambassuana.

### *The Arm-glands of Hapalemur.*

The presence of glands on the forearm in *Hapalemur griseus*—or, rather, *olivaceus*, for such one of the specimens proves to be—was first pointed out by Beddard, who also ascertained, from Jentink and Milne-Edwards, that no such glands are developed in *Prolemur simus*. This character alone is sufficient, in my opinion, for generic separation of the two species.

In the two male specimens of *H. olivaceus*\* in which he described the glands, he pointed out that the naked tract of skin above the wrist was covered with long and coarse papillæ; but, judging from his figures, the papillæ were much better developed in the first specimen examined than in the second.

In the two other skins in the Society's collection, which Beddard did not see—namely, the small one received Nov. 10, 1887, and the adult received June 9th, 1903,—the gland differs in that the tract of integument is comparatively smooth, being merely roughened, so far as can be judged on the dried skin, with fine granular papillæ.

With regard to the glands on the upper arm, regarded by Beddard (but, I think, wrongly) as mammæ, I can find no trace of them in the small and presumably immature skin; and in the adult skin with the glandular tract of the forearm nearly smooth they are less well developed than in the specimen in which they were first detected—namely, the one with the glandular area of the forearm exceedingly coarsely papillate.

I do not think any special importance should be attached to these differences, because in *Lemur catta*, which possesses similar glands, the spur on the glandular tract of the forearm, which may be compared to the papillæ in *Hapalemur*, varies

\* I have the dried skin of the example described by Beddard in 1884. Of the second specimen described in P. Z. S. 1891, p. 449, and 1902, p. 159, no history was given, and the skin was not preserved. Probably it was *olivaceus*.

in development with age, being larger in older specimens, and the gland of the upper arm is, I believe, subject to seasonal changes in size.

The occurrence of similar glands in two such widely different species as *Lemur catta* and *Hapalemur griseus*, and their complete absence in the other species referred to *Lemur* and in *Prolemur simus*, is a remarkable fact.

### XXXII.—*Some Notes on Three-toed Sloths.*

By OLDFIELD THOMAS.

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To those whose interest it is to compare zoological characters in their relation to geographical distribution no group of Mammals is so unattractive as the sloths, on account (1) of their variability, especially in the skull, in specimens from the same place, (2) the slight and intangible characters that distinguish specimens from the most distant localities, and (3) the great state of confusion that has resulted from the descriptive efforts of Wagler, Gray, and Fitzinger. Early descriptions, without statements of locality, have been made the basis of various names, and it is a matter of the greatest difficulty to disentangle the confusion.

The present notes make no pretence of being complete, and are purposely worded somewhat vaguely, as such are the difficulties of the case that there is hardly a statement I can make which may not prove liable to modification as fuller series from all localities are studied.

Firstly, with regard to genera, I am disposed to recognize the collared sloth, *Bradypus torquatus*, Desmarest, 1817 (not Illiger, as usually quoted, for the latter author's two references are both *nomina nuda*), as forming a special genus, which may be distinguished by the inflated pterygoids, better developed premaxillæ, the median spout-like projection on the mandible, and the absence of a dorsal gland or "speculum" in the male\*, all these characters being as in *Choloepus*. The generic name of *Sceopopus*, Peters, is available for it.

\* I can by no means subscribe to Dr. Allen's conclusion (Bull. Am. Mus. xx. p. 339, 1904) that "the presence or absence of this highly differentiated patch is not sexual"—a conclusion based on what I must consider the incorrect sexing of certain "females" by one of his collectors. Not only has it long been generally accepted that the speculum is characteristic of the male, but I find that in every specimen without speculum in our collection mammæ are to be found, while in no example with speculum is there any trace of them. With so large a collection, including so many different forms, this evidence appears to me conclusive,