

LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS

590.5

FI

v.31

cop.3

NATURAL
HISTORY SURVEY

NATURAL
HISTORY SURV
LIBRARY

0.5
31 '16
0.3

FIELDIANA • ZOOLOGY

Published by
CHICAGO NATURAL HISTORY MUSEUM

Volume 31

MAY 14, 1947

No. 16

THE BACULA OF SOME FRUIT BATS (PTEROPUS)

D. DWIGHT DAVIS
CURATOR OF VERTEBRATE ANATOMY

The baculum has been used extensively in determining sub-generic affinities in certain groups of mammals, especially among rodents. It has long been known that a baculum occurs in most, probably all, genera of bats, but there has been little systematic study of this bone. Dr. A. J. Nicholson recently collected a series of fruit bats in New Hebrides and New Caledonia (Sanborn and Nicholson, 1947), and saved the bacula of nearly all the males he preserved. Three species of *Pteropus* are represented in the Nicholson collection, two of them by considerable series. Mr. W. J. Beecher collected a few fruit bats in alcohol while he was stationed in the Solomon Islands (Sanborn and Beecher, 1947), and the baculum has been removed from a specimen of *Pteropus rayneri* and one of *P. solomonis* collected by him. Thus representatives of five species were available for the present study.

Apparently the baculum has not been described for any member of the genus *Pteropus*. Wood Jones (1916), in describing the genitalia of *P. medius*, merely states that "there is a small broad ossicle in the glans." No one else seems to have mentioned this bone. The Nicholson series represents only a fraction of the many species of *Pteropus*, but it is of interest because it shows that several distinct types of baculum occur in this genus, while the sizable series gives an adequate idea of individual variation. Mr. Colin C. Sanborn suggested to me that this collection might repay a preliminary study.

Pohl (1928) pointed out that mere description of the baculum alone, without considering its relations to the rest of the penis, is unsatisfactory and likely to lead to erroneous conclusions. I heartily concur in this view, and have accordingly examined the penis of *P. rayneri* (an old, well-preserved male) in detail before removing the baculum. Pohl's rational terminology for the parts of the mammalian penis is used here.

The accompanying drawings were made by Miss H. Elizabeth Story, Assistant in the Division of Vertebrate Anatomy. In the species represented by more than one specimen, an average bone best typifying the characters of the species was selected for illustration.

THE PENIS

The penis of *Pteropus medius* was described and figured by Wood Jones. This organ in *P. rayneri* (fig. 19) agrees with his description in most of the essential features. It is situated on the anterior border of a nearly naked, darkly pigmented perineal area. The perineum is triangular, the anus forming the posterior apex while the two lateral angles lie over the testicles on either side of the penis.

The penis measures 28 mm. in length. It is somewhat flattened dorso-ventrally, measuring about 5 mm. in dorso-ventral diameter and about 8 mm. in transverse diameter. The skin of the shaft is pigmented, sparsely haired ventrally for about half its length, and reticulated with fine wrinkles. A median longitudinal raphe runs along the ventral surface of the penis and across the perineum to the anus. The raphe disappears on the prepuce, and is not continued into the frenulum as figured by Wood Jones for *Pteropus medius*. The short prepuce is thin and retractile, connected dorsally with the collum glandis by a small and inconspicuous frenulum.

The caput penis (glans of most authors) is quadrangular in outline, conspicuously flattened dorso-ventrally, and connected with the corpus penis by a distinct neck. Immediately above the meatus it bears a prominent tubercle, which is directed dorsally and anteriorly and stands well above the dorsal surface of the caput. This tubercle is supported by a similar tubercle on the baculum, over which the integument is thinly stretched. Ventrad of the meatus the caput is carried forward in a tongue-like projection. The meatus itself is a wide transverse terminal opening, considerably puckered ventrally and laterally; it is not "situated upon the upper surface of the glans" as stated by Wood Jones, who was misled by the fact that the ventral part of the caput projects slightly beyond the meatus.

On the ventral surface of the caput there is a sharply delimited tongue-shaped area, extending the entire length of the caput, that is thickly set with short, horny spines barely rising above the surface of the integument. A faint longitudinal raphe runs across this area from the frenulum to the tip of the penis. On the dorsal surface and sides of the caput the integument is raised into minute pustules

I
3/16
3
that give the surface a finely granular appearance. Spines occur nowhere except on the ventral area described above.

The baculum in *Pteropus* lies in the caput penis, where it is situated above the urethra. In most of the species examined the lateral expansions of the bone arch down over the urethra like a roof. The bone is covered only by the integument of the caput penis anteriorly and dorsally, so that in most species its anterior and

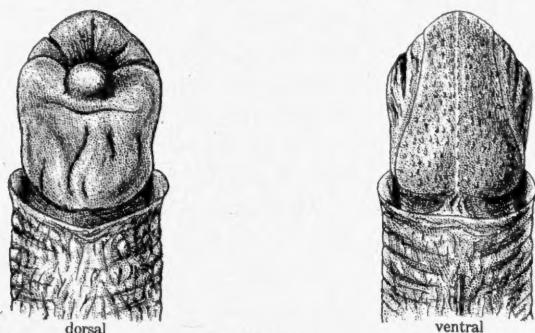


FIG. 19. Distal end of penis of *Pteropus rayneri*. In the dorsal view the outline of the baculum, which is situated in the dorsal part of the caput penis, is readily seen. $\times 2$.

lateral outlines can easily be seen without dissection. It does not extend posteriorly beyond the base of the prepuce, into the corpus penis.

THE BACULUM

Pteropus ornatus. Figure 20.

Twenty-two adult specimens were examined. The bone is a thin plate, bell-shaped in outline. The anterior border is straight or very slightly crenulated; the lateral border has an ear-like expansion anteriorly, and posteriorly curves smoothly to the posterior midline. The posterior part of the bone is composed of a pair of spatulate prongs that curve toward the midline, where they meet broadly. The prongs surround a medial heart-shaped opening in the posterior half of the bone.

The bone is curved in two planes. The cross section is a shallow, dorsally convex arch, and the longitudinal section is a similar, dorsally concave arch.

The baculum is slightly longer than wide. Length in twenty-one specimens averaged 8.3 ± 0.18 mm. (extremes 7-10 mm.); greatest

width averaged 7.7 ± 0.15 mm. (extremes 6.5–8.9 mm.). In three specimens the width equaled or slightly exceeded the length.

There is considerable variation in the series examined, although the general pattern of the bone remains the same. There is a slight indication of a median protuberance at the midline of the anterior border, in the form of a very slight rounded prominence, in two of the adult specimens. This is suggestive of the anterior tubercle in *rayneri* and *otinus*, but is far less prominent and well defined. The posterior prongs meet more or less broadly at the posterior midline in eleven specimens; in the remaining eleven a narrow gap remains between them; in only one specimen do the prongs actually fuse. These may well represent age differences. The size of the medial opening in the bone varies enormously. In four specimens it is little more than a pinhole; in most it is an elongate heart-shaped opening about a millimeter in length; in four it is a large fenestra 4 mm. or more in length. The anterior median spicule that gives the opening its heart shape is lacking in about half the specimens (including those in which the opening is reduced to a mere perforation). In one specimen there is a healed fracture across the bone at the level of the anterior border of the medial opening.

In a juvenile specimen the bone is much smaller (length, 4 mm.; width, 3.9 mm.), with all the adult features present but much less pronounced.

Pteropus geddei. Figure 20.

Eight adult specimens were examined. The baculum is nearly identical with that of *P. ornatus* but averages slightly smaller in size. Length in eight specimens averaged 7.4 ± 0.13 mm. (extremes 6.9–7.9 mm.); greatest width averaged 7.3 ± 0.27 mm. (extremes 6.4–8.8 mm.).

There is less variation than in the much larger series of *ornatus*. None of the specimens has any indication of an anterior median prominence. The posterior prongs are fused in three of the eight adult bones. The range of variation in the size of the medial opening is less; in none is it reduced to a pinhole, but in one specimen it approaches the large fenestra sometimes seen in *ornatus*.

Two juveniles represent different stages of ossification. In one (length, 2 mm.; width, 2.4 mm.) the bone is a nearly flat plate, with no indication of the posterior prongs. In the other (length, 5.6 mm.; width, 4.7 mm.) the adult features are present, but much less pronounced.

It is unlikely that individual bones of *ornatus* and *geddei* could be distinguished with certainty.

Pteropus eotinus. Figure 20.

Four adult specimens were examined. The baculum is very distinct from that of the two preceding forms, but obviously represents the same basic type. The antero-posterior diameter is rela-

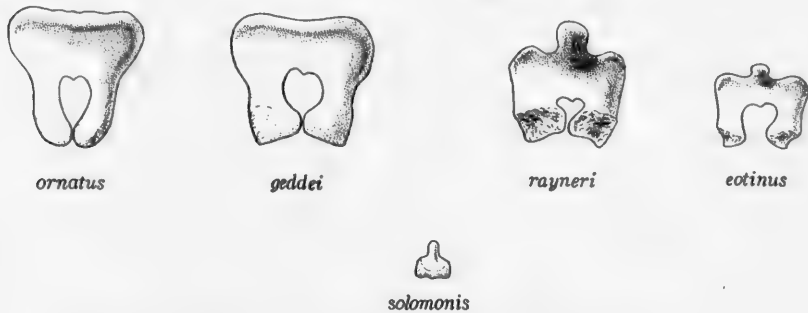


FIG. 20. Dorsal views of bacula of five species of *Pteropus*. $\times 2$.

tively much shorter, so that the bone is wider than it is long. The outline of the bone bears a striking resemblance to a conventionalized eagle. The anterior border bears a prominent tubercle at the midline. The tubercle, which has a smoothly rounded tip and a slightly constricted neck, is directed upward at an angle of about 45° . The anterior corners of the bone are conspicuously thickened, and the ear-like expansion of the lateral border is absent. The posterior prongs are widely separated at the posterior midline, so that the medial opening seen in the preceding forms is here a deep notch. There is a conspicuous dorsal scar across the posterior end of each prong for the attachment of the corpus fibrosum. The anterior medial spicule that gives the heart shape to the opening in *ornatus* and *geddei* is well developed in *eotinus*. The two curvatures in the bone described above are also present in *eotinus*.

Length in four specimens averaged 4.5 mm. (extremes 4.1–5.0 mm.), exclusive of the anterior tubercle. Width averaged 5.4 mm. (extremes 5.2–5.5 mm.).

There is relatively little variation among the four specimens examined. In one the posterior notch is only a shallow incisure, so that the prongs are hardly more than indicated. In another bone the median spicule is elongated into a spine extending more than halfway to the posterior edge of the bone.

Pteropus rayneri. Figures 19, 20.

One adult specimen was examined. The baculum is almost identical with that of *eotinus*, except in size. The posterior prongs are produced medially (somewhat asymmetrically), so that they are almost in contact at the midline, but this may well represent an individual variation.

Length (exclusive of anterior tubercle), 5.6 mm.; width, 6.9 mm.

Pteropus solomonis. Figure 20.

One adult specimen was examined. The baculum is minute, and differs radically from that of any of the other forms examined. It is a small triangular bone, the apex of which is formed by an anterior tubercle similar to that seen in *eotinus* and *rayneri*. This tubercle formed the core of a prominent papilla on the caput penis, similar to that found in *rayneri* (fig. 19).

The tubercle forms the major part of the bone in *solomonis*. From the rounded head of the tubercle a neck flares back to the body of the bone, which consists of a small rectangular plate hardly wider than the base of the neck. The posterior border of the plate has a shallow notch on either side of the midline. The anterior tubercle arches dorsad at an angle less than 45°.

Length (including anterior tubercle), 2.3 mm.; width, 1.8 mm.

DISCUSSION

The material available for this study is inadequate for any but the broadest generalizations.

Despite radical differences among the five species studied, all represent modifications of the same basic pattern: a thin plate in the dorsal part of the caput penis, expanded laterally over the urethra, and produced posteriorly into a pair of spatulate prongs on which the corpus fibrosum attaches. In *eotinus* and *rayneri* a prominent anterior tubercle, supporting a conspicuous element in the external armature of the caput, is added. But the fundamental pattern of the bone is unaltered. The widest departure from this pattern is seen in *solomonis*, where apparently the anterior tubercle is preserved, while most of the plate, including the posterior prongs, is suppressed. Nevertheless, the *solomonis* type can easily be derived from the *eotinus-rayneri* type.

The bacula of the five species fall into three well-marked groups: (1) *ornatus* and *geddei* are indistinguishable; (2) *eotinus* and *rayneri*

differ from each other only in size; and (3) *solomonis* differs from either of the other groups. It is of interest to compare this breakdown with the subgeneric groupings that Andersen (1912) arrived at on the basis of other characters. Andersen associated *ornatus* and *solomonis* in his *hypomelanus* group, but we have seen that these have radically different bacula. He places *geddei*, which has a baculum indistinguishable from that of *ornatus*, in his *mariannus* group. *Pteropus rayneri* is the type of his *rayneri* group, but *eotinus*, which has a baculum very similar to *rayneri*, is placed in his *samoensis* group.¹

Thus it appears that further study of the baculum in the genus *Pteropus*, on the basis of more adequate material than is available to me, would undoubtedly result in considerable revision of the superspecific groupings. It is probable that comparative study of the penis, especially the caput penis, would also prove useful.

REFERENCES

ANDERSEN, KNUD

1912. Catalogue of the Chiroptera in the collection of the British Museum. Second Edition. 1, Megachiroptera. ci+854 pp., 79 figs. British Museum, London.

POHL, LOTHAR

1928. Zur Morphologie der männlichen Kopulationsorgane der Säugetiere. Zeitschr. Anat. Entwg., **86**, pp. 71-119, 8 figs., 3 pls.

SANBORN, C. C., and BEECHER, W. J.

1947. Bats from the Solomon Islands. Jour. Mamm. (in press).

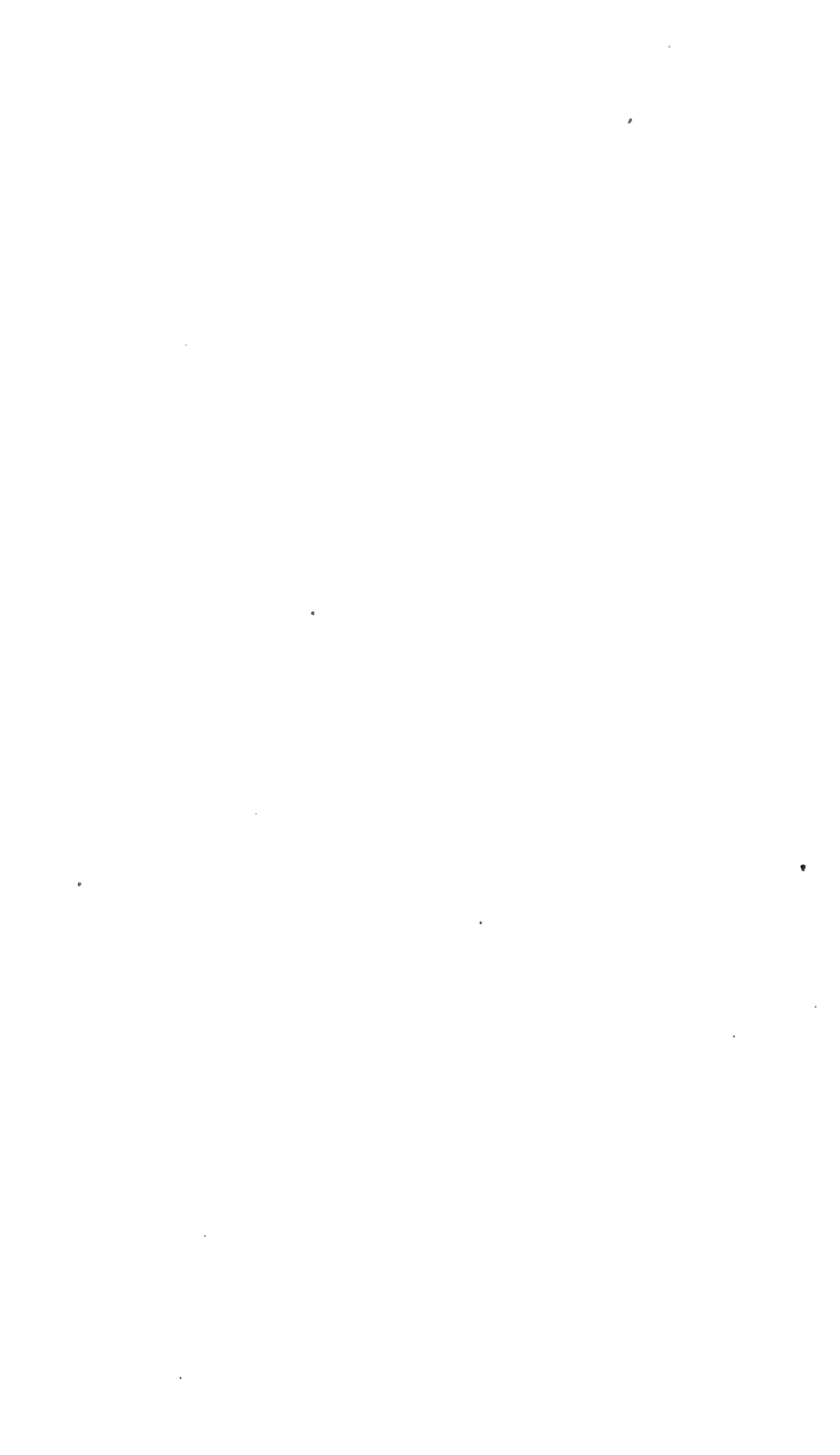
SANBORN, C. C., and NICHOLSON, A. J.

1947. Bats from New Caledonia and New Hebrides. Fieldiana (in press).

WOOD JONES, FREDERIC

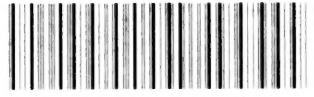
1916. The genitalia of the Chiroptera. Jour. Anat. (London), **51**, pp. 36-60, 11 figs.

¹ *P. eotinus* was described after 1912, and hence does not appear in the British Museum Catalogue.





UNIVERSITY OF ILLINOIS-URBANA



3 0112 027924171