this group of Hornbills may be regarded as a distinct generic type—
*Bycanistes.* I am also inclined to think that *Toccus* is a distinct
genus; it may be that the African forms are really distinct from
the Asiatic; but this is a matter that requires further study.

Col. Tickell⁷ has separated *Aceros* and those Hornbills such as
*Toccus* which are without casques from the other Indian Hornbills,
and has remarked that the two genera, which he terms *Aceros* and
*Buceros* respectively, have a different mode of flight.

*Aceros*, however, in my opinion should not be generically separated
from *Buceros*, the anatomical differences between the two genera
being so extremely slight.

*Ceratogymna* and *Sphagolobus* have a syrinx which differs in the
non-fusion of the last tracheal rings from the syrinx of *Buceros* and
particularly of *Aceros*, where the fusion between these rings is greater
than I have observed in any other Hornbill. But this peculiarity,
as also in the case of *Toccus* and *Bycanistes*, is correlated perhaps
with the small size of the birds.

2. On the Anatomy of Burmeister’s Cariama (*Chunga
burmeisteri*). By Frank E. Beddard, M.A., F.R.S.E.,
Prosector to the Society.

[Received October 31, 1889.]

Introductory.

The specimen which forms the subject of the present paper was
acquired by the Society in 1887 and died in 1888, being the fifth
example⁵ which the Society has obtained.

The bird itself was discovered only thirty years ago (in 1859)
by Dr. Burmeister, and was first described by Dr. Hartlaub⁶ in the
‘Proceedings’ of this Society. This description is confined to the
external characters, and to an interesting account, from Dr. Bur-
meister’s notes, of the habits of the bird. It is considered by Hart-
laub to present differences of subgeneric value from *Cariama cristata*.
Reichenbach afterwards⁶ placed it in a separate genus, a proceeding
which is approved of by Mr. Sclater⁸. A figure of the bird⁶ illustrates Mr. Sclater’s note which has just been referred to.

Later Dr. Burmeister⁷ gave a somewhat fuller account of its
external characters, agreeing with Reichenbach in distinguishing it
generically.

Dr. Gadow has given⁸ some account of the visceral anatomy of

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¹ Birds of India (MS.); this work is in the Society’s Library.
³ “On a new form of Grassatorial Bird nearly allied to the Cariama (*Dicholo-
⁴ Die vollständigste Naturgeschichte der Tauben, etc. p. 159.
⁵ P. Z. S. 1870, p. 666.
⁶ Loc. cit. pl. xxxvi.
⁷ Reise durch die La Plata-Staaten, Bd. ii. p. 506.
the two Seriemas; there appears, from what he says, to be no
difference between the two species, but his account is a very brief
one and confined to the principal characters; so far as it goes my
own observations are quite confirmatory of Gadow's paper. The bird
is regarded by Gadow as near to Otis and Grus; this view is still
retained by Dr. Gadow. The osteology and visceral anatomy of
Cariama cristata have been worked out by Burmeister. In the
course of the following remarks upon the osteology of Chunga,
which is compared with that of Cariama, I do not refer in detail to
Burmeister's description of the bones; as to the visceral anatomy I
have not much to add to Burmeister's description. Cariama is
regarded by Burmeister as forming with Psophia a special group
closely allied to Cranes and more remotely to Otis and the Rails;
the presumed affinities with Gypogeranus are quite superficial. Bur-
meister's views of the affinities of the bird are based upon visceral
as well as osteological characters, and I propose later on to examine
this matter in connection with Psophia, the anatomy of which I am at
present studying. I do not enter in this paper into the affinities of
Chunga and Cariama; I merely attempt to differentiate the two
genera and to show that they are to be distinguished by well-marked
osteological characters, although in the visceral and muscular ana-
tomy they are very similar.

**Osteology.**

The skull of Chunga (fig. 1, p. 596) is decidedly narrower in the
orbital region than that of Cariama (ibid. fig. 2).

The lachrymal bones project further out from the skull; in Cariama
the distal region of each of these bones is bent sharply down and
comes to lie at right angles; in Chunga the corresponding bones are
only gently curved and therefore appear to have a relation to the
skull different from that of Cariama.

On the under surface of the skull several well-marked differences
between the two types are recognizable.

The palatines in Chunga have a nearly straight posterior margin,
which lies therefore in a direction nearly at right angles with the
lateral margins of the bone.

In Cariama the angle formed by the external lateral and the
posterior margins of the bones is greater; that is to say, the pos-
terior margin of the palatine bone does not coincide so nearly with
the direction of the transverse axis of the skull as it does in Chunga.

The maxillo-palatines of Chunga extend further forwards than in
Cariama and each narrows gradually towards its anterior extremity;
in Cariama, on the contrary, these bones show a greater deficiency
in ossification anteriorly, and so come to be somewhat abruptly

1 "On the Taxonomic Value of the Intestinal Convolutions in Birds," P. Z. S.
1889, p. 303.
2 "Beiträge zur Naturgeschichte der Seriema," Abh. nat. Ges. Halle, i. (1854)
p. 17.
truncated. These bones are also less spongy and altogether more solid in *Chunga*.

The number of vertebrae and their distribution appear to be identical in the two types.

The first rib, although still rudimentary, is much larger in *Cariama*.

**Fig. 1.**

**Fig. 2.**

*Chunga hurmeisteri.* Skull, under surface.

P, palatines; b, supraorbital ridge.

*Cariama cristata.* Skull, under surface.

Lettering as in fig. 1.

and the 3rd to 5th and 6th ribs have strong hooked uncinate processes; the sternal rib of the 3rd rib (the first complete rib) is as strong in proportion as are the following sternal portions. There is no rudimentary rib behind the 7th (see fig. 4, p. 599).
In Chunga (fig. 3, p. 598) there are differences in all the points just enumerated. The first rib is very rudimentary; only ribs 4, 5, and 6 (i.e., one less than in Cariama) are furnished with uncinate processes, which are straight, directed upwards and backwards, and not curved; the sternal half of the first complete rib is slender. There is a rudimentary 8th rib on each side; on the left side of the body it consists of a curved piece continuous below with the sternal portion of the 7th rib; on the right side a shorter piece lies along the posterior border of the sternal half but not fused with it; there is also a small rudiment of a vertebral rib attached to the transverse process of the 8th dorsal vertebra.

The proportion between the length (from point to point) of the lateral margin of the sternum and the length of the space occupied by the attachment of the sternal ribs is:

- in Cariama, 2.4 : 1.35,
- in Chunga, 2.5 : 1.15,

showing that in the latter genus the attachments of the ribs are more crowded together than in the former; at the same time the first sternal rib is attached much nearer to the anterior lateral process of the sternum in Chunga than it is in Cariama. The sternal rostrum is more developed in the latter type, and there is a difference in the shape of the sterna on a lateral view which will be more easily appreciated by an inspection of the accompanying woodcuts (figs. 3, 4) than by a description.

In the pelvis (see figs. 5, 6, pp. 600, 601) the chief differences are, firstly, that the ilia extend rather further forwards in Cariama, very nearly reaching the last rib but one; in Chunga the anterior extremities of the ilia only just get beyond the seventh rib. Secondly, the line of junction of the transverse processes of the lumbar vertebrae with the border of the first acetabular ilium forms a straight line; in Chunga the corresponding line is curved. The breadth of the pelvis is greater in Chunga, the proportion between length and breadth in the two types being as follows:

<table>
<thead>
<tr>
<th>Length of pelvis</th>
<th>Breadth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chunga .... 2.95</td>
<td>1.6</td>
</tr>
<tr>
<td>Cariama .... 3.25</td>
<td>1.6</td>
</tr>
</tbody>
</table>

These measurements of breadth are taken from the extremities of the post-trochanteric processes, which are well marked in both these birds, but perhaps if anything rather more marked in Chunga. If these measurements had been made between the antitrochanteric processes, the contrast between the two types in the proportions between length and breadth of the pelvis would have been greater than is indicated in the above table; these processes are more strongly developed and project further out in Chunga than they do in Cariama.
ANATOMY OF BURMEISTER'S CARIAMA.

Fig. 4. Cariama cristata. Ribs, sternum, and pelvis, seen from the side.
Pterylosis, Myology, and Visceral Anatomy.

The pterylosis of Chunga does not differ in any points from that of Cariama. The oil-gland was quite nude with a long duct.

Fig. 5.

Comparing the viscera generally with Burmeister's description and figures of Cariama, I do not find any points of difference between the two.
I may remark, however, that in *Chunga* there are considerable traces of the right aortic arch in the shape of a fibrous band attached to the aorta just in front of origin of the cæliac axis. This may perhaps be regarded as a point of resemblance with the Accipitres: it is true that in other birds besides the Accipitres the ligament

1 I have not had an opportunity of finding out whether *Cariama* shows the same structure.

corresponding to the right aortic arch is present; but its presence is found in so many Accipitres that it is highly characteristic of them.

I quote from MS. of Garrod the following measurements of the various parts of the alimentary tract to show how close is the resemblance between the two:

<table>
<thead>
<tr>
<th>Cariama</th>
<th>Chunga</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small intestine</td>
<td>33</td>
</tr>
<tr>
<td>Large intestine</td>
<td>3</td>
</tr>
<tr>
<td>Cæca</td>
<td>8.75</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The expansor secundariorum is as in Chauna and Cariama. There is no biceps slip to patagial tendon as in Cariama. The anconeus has an accessory flat tendon attaching it to humerus.

The pectoral muscle arises from the whole of the sternum, which is free from the origin of the second pectoral; it also arises from the aponeurosis of the second pectoral. It is partially divided by a septum into two muscles.

The tensores patagii brevis and longus appear to form one muscle at their origin; this muscle receives a tendon from deltoid ridge of humerus. The tendon of brevis is very large and flattened out, but as it is accurately figured by Fürbringer I do not describe it more fully. A drawing of Prof. Garrod’s shows that in Cariama the tensor brevis tendon is similar, and he particularly states that there is no biceps slip; neither Fürbringer nor myself have found a biceps slip in Chunga.

The accessory femoro-caudal is present in Cariama, and it is stated by Garrod in a MS. note to be missing in Chunga; however, I found this muscle in the specimen dissected by me; it was thin and slender, and became tendinous in the middle between its origin and insertion.

The biceps brachii in Chunga is bifid at its insertion.

3. On the Relations of the Fat-bodies of the Sauropsida.

By Gerard W. Butler, B.A. (Communicated by Prof. G. B. Howes, F.L.S., F.Z.S.)

[Received November 26, 1889.]

(Plates LIX. & LX.)

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1 Untersuchungen z. Morph. u. Syst. Vögel, Taf. xx. fig. 9.

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