59.82:14.78,7

Article V.—FURTHER NOTES ON PTILOSIS

By W. DeW. Miller

CONTENTS

Since the publication of 'Notes on Ptilosis, with Special Reference to the Feathering of the Wing' in 1915,[1] numerous additional notes on the subjects there treated have accumulated. These are presented in the present paper. As before, Gadow's very useful table in Bronn's 'Klassen und Ordnungen des Thier-Reichs (Vögel, Systematischer Theil)' has been used as a basis of reference. Where Gadow's notations err in whole or in part or where other important works of reference such as Ridgway's 'Birds of North and Middle America' show that certain errors are still prevalent it has seemed well to call attention to them here.

Eutaxy and Diastataxy

In my previous paper the Megapodidæ were listed as universally diastataxic, the Anhimidæ as comprising both eutaxic and diastataxic forms. The reverse is true in each case. *Megapodius* (two specimens of *M. reinwardti* and one of *M. cumingi* examined) and *Megacephalon* are diastataxic; *Leipoa* and *Alectura* (*Catheturus*) (one of each of the last three genera examined) are eutaxic.[2]

Anhima (*Palamedea*) was recorded by me as eutaxic on the published authority of Beddard and Mitchell, but I have since examined

[1] Bull. Amer. Mus. Nat. Hist., XXXIV, pp. 129–140.

[2] *Megapodius* and *Megacephalon* also agree in the presence of a small oil-gland tuft, wanting in *Leipoa* and *Alectura*.

That these resemblances indicate a close relation between *Megapodius* and *Megacephalon* is doubtful for they are very different in many respects, as in the form of the bill and head, scutellation of the tarsus, size of the two-webs, length and form of the claws, number of rectrices (12 and 18 respectively), and in nidification. Allowing for the close affinity of *Eulipoa* with *Megapodius*, both the latter and *Megacephalon* are very unlike any other members of the family. The arrangement of the webs of the toes in *Megapodius* is unique. In other birds with only one web it is between the third and fourth toes, while in *Megapodius* there is a small basal web between the second and third toes and no trace of one between the third and fourth.

three specimens of the horned screamer and can state positively that this species, like *Chauna*, is diastataxic. Of the latter genus three specimens of *C. chavaria* and two of *C. cristata* have been determined.

The appended list of Columbæ, arranged according to the nature of the secondary remex series, brings our knowledge of this feature in the pigeons up to date. The genera *Vinago*, *Turturœna*, *Calopelia*, and *Tympanistria* are given on the authority of Mr. George L. Bates (1918, Ibis, pp. 554–556). The numbers preceding the names are those of the genera in Sharpe's 'Hand-List.'

DIASTATAXIC

Treronidæ

1 *Sphenocercus sphenurus*
2 *Vinago calva*
5 *Treron nipalensis*
6 *Osmotreron bicincta*
" *vernans*
8 *Leucotreron occipitalis*
11 *Lamprotreron superba*
13 *Ptilopodiscus coronulatus*
15 *Chlorotreron iozona*
17 *Sylphitreron aurantiifrons*
28 *Muscadivores concinna*
35 *Myristicivora spilorhoa*

Columbidæ

2 *Lithœnas livia*
Stictœnas arquatrix
Chlorœnas flavirostris
" *rufina*
Columba palumbus
Œnœnas nigrirostris
4 *Turturœna iriditorques*
6 *Macropygia emiliana*
9 *Ectopistes migratorius*

Peristeridæ

1 *Zenaidura macroura*
2 *Zenaida zenaida*
5 *Amoropelia turtur* (*Turtur*)
7 *Streptopelia bitorquata*
" *capicola*
" *vinacea*
9 *Spilopelia chinensis*
20 *Œna capensis*
23 *Chalcophaps indica*
33 *Leptotila verreauxi*
35 *Oreopeleia montana*
" *albifacies*
42 *Calœnas nicobarica*

Gouridæ

1 *Goura victoria*

Didunculidæ

1 *Didunculus strigirostris*

EUTAXIC

Peristeridæ

11 *Geopelia tranquilla*
" *striata*
Stictopeleia cuneata
12 *Scardafella inca*
14 *Columbina picui*
15 *Chæmepelia minuta*
18 *Claravis pretiosa*
21 *Tympanistria tympanistria*
22 *Turtur afra* (*Chalcopelia*)
24 *Calopelia puella*
26 *Phaps chalcoptera*
27 *Histriophaps histrionica*
30 *Lophophaps leucogaster*
" *plumifera*
31 *Ocyphaps lophotes*
36 *Gallicolumba luzonica*
" *rufigula*
" *jobiensis*
38 *Leucosarcia picata*
41 *Starnœnas cyanocephala*

Salvadori's arrangement ('Catalogue Birds British Museum') is used in the table as a matter of convenience. The classification of the pigeons is a difficult problem and no satisfactory scheme has yet appeared.

It will be observed that all the eutaxic forms are in the Peristeridæ. The Treronidæ and Columbidæ are universally diastataxic so far as determined. *Goura* and *Didunculus* are also diastataxic and this is true of the first two subfamilies of Peristeridæ (Zenaidinæ and Turturinæ) so far as they are known. All the Notogean groups of Peristeridæ (Geopeliæ, part of Phabinæ, and part of Geotrygoninæ) are eutaxic, contrasting with the other groups characteristic of the Australian Region (Treronidæ, Gouridæ, Didunculidæ), which are diastataxic. *Calœnas* (diastataxic), while considered by Salvadori as forming a subfamily of Peristeridæ, is a very aberrant form and its curious range is neither distinctively Oriental nor Australian.[1]

Until recently the Rallidæ have been considered as a wholly diastataxic family. Bates in 1918 recorded *Himantornis* as eutaxic and two

[1]The condition of the wing as regards the fifth secondary has never been utilized taxonomically in this order for, until Mitchell's discovery that *Columbula* (*Columbina*) is eutaxic, the pigeons were supposed to be diastataxic throughout. Many genera remain to be determined in this and other characters and until this is done no final classification can be attempted. Enough data are at hand, however, to indicate the probably artificial nature of Salvadori's fourth and fifth subfamilies of Peristeridæ (Phabinæ and Geotrygoninæ). The members of these two groups characteristic of the Australian Region (i.e., Notogean) agree in having more than twelve rectrices and in being (so far as determined) eutaxic. The first five genera of Phabinæ form a natural group (all Ethiopian except *Chalcophaps*) of smaller birds with only twelve rectrices, some eutaxic and others diastataxic.

In the Geotrygoninæ the three American genera, *Leptotila*, *Osculatia*, and *Geotrygon*, have only twelve rectrices and (at least the first and third) are diastataxic. The remaining American genus, *Starnœnas*, has twelve rectrices, is eutaxic, and is remarkably characterized in several respects. The New World genera (*Osculatia* unknown) have small intestinal cæca, while these are wholly wanting in the Australian genera (of these two subfamilies) examined. In fact, the absence of cæca in Notogean pigeons in general is so nearly a constant feature that *Gallicolumba* (*Phlegœnas*) is the only known exception. They have, however, also been lost in many non-Australian genera of Peristeridæ.

Salvadori's characters separating the Phabinæ from the Geotrygoninæ are the presence of metallic spots on the wings in the former (absent in latter), and the stouter form, longer, stouter tarsi and shorter wings of the latter. But there is no definite line between the two groups in the tarsal characters, for in *Geophaps* (Phabinæ) the tarsi are relatively as long and stout as in *Leucosarcia* (Geotrygoninæ).

The Geopeliinæ also is probably an unnatural group. The two American genera, *Scardafella* and *Gymnopelia*, differ from the Australian Geopeliæ, and agree with the purely American subfamily Peristerinæ, in having but twelve rectrices and black under wing-coverts. The Geopeliæ agree with the other Australian Peristeridæ in having more than twelve rectrices. Furthermore, *Geopelia* lacks the ambiens muscle which is present in the two genera of Peristerinæ in which this character is known. Unfortunately, it has not been determined in *Scardafella* or *Gymnopelia*.

The prevalence of fourteen or more rectrices in the pigeons of the Australian Region, to whatever family they belong, is very striking and has hardly an exception, while all Eurasian and Ethiopian Columbidæ and Peristeridæ, and all American pigeons except *Zenaida* and *Zenaidura*, have but twelve tail-feathers.

The remarkable Nicobar pigeon (*Calœnas*), with its anomalous range, is diastataxic, and has twelve rectrices, in which combination it differs from all other Old World pigeons except the curious Philippine genus *Phapitreron* (if the latter is diastataxic as assumed), and probably a few other fruit pigeons.

It is generally recognized that the Peristeridæ cannot be regarded as more than a subfamily of the Columbidæ. Blanford denies them even this rank, at least so far as the relation of the Turturinæ (of Salvadori) to the Columbidæ is concerned. He also reduces the Treronidæ to subfamily rank.

It appears, then, that the changes that must eventually be made in Salvadori's arrangement will include the union of the Notogean members of the Phabinæ and Geotrygoninæ in one subfamily, which will probably include *Geopelia* also; and the transfer of *Scardafella* and *Gymnopelia* to the Peristerinæ. Not only do the characters justify these changes but the groups become much more plausible from the viewpoint of geographic distribution.

In 'The Birds of North and Middle America' (Part 7, p. 282) *Eupelia* and *Chæmepelia* are given as diastataxic ("aquinto-cubital"). The latter, at least, is eutaxic, and it is probable that Mr. Ridgway intended to use this character on the succeeding page to separate *Claravis* (eutaxic) from *Leptotila* (diastataxic).

species of *Sarothrura* as incompletely so. Through the kindness of Mr. James P. Chapin I am able to record for the first time three or four other eutaxic genera. The genera determined by Mr. Chapin are marked by an asterisk. The others are from my own notes, except *Himantornis hæmatopus* recorded by Bates.

It will be noticed that all the gallinules and coots thus far examined (genera Nos. 46 to 55) are diastataxic. Also that *Creciscus leucopyrrhus* differs from *C. coturniculus* and *C. (Rufirallus) melanophaius*. Mr. Ridgway remarks in describing his genus *Limnocrex* (type, *Creciscus cinereiceps*) that *C. leucopyrrhus*, which he had not seen, might possibly be referable to it.

Sarothrura is of special interest owing to the variations in this feature not only between the species but within specific limits. Bates recorded two species, *S. böhmi* and *S. rufa bonapartei* (a single specimen of each), as diastataxic as regards the upper coverts, eutaxic as regards the lower coverts. One of the two specimens of *S. rufa elizabethæ* determined by Mr. Chapin was likewise partially diastataxic, while the other one was completely so. The same inconstancy was found in the two skins of *S. lugens* examined. *S. insularis* and *S. elegans* were found to be completely diastataxic, while *S. pulchra* was perfectly eutaxic.

So far as known, the only other bird genera (taking Sharpe's 'Hand-List' as the standard) that include both types of wing are *Ceryle*, *Halcyon*, and *Chætura*. *Chlororceryle* is, however, amply distinct from *Ceryle; Streptoprocne* is very different from *Chætura;* and *Halcyon* is a composite group which at present is often broken up. *Sarothrura* is a more difficult problem owing to the intermediate nature of some of the species in this character. The taxonomic value of this feature in *Sarothrura* is comparable to that of the relative development of the tenth primary in *Vireosylva* and *Lanivireo*.

RALLIDÆ

Diastataxic

1	*Rallus virginianus*	*33	*Sarothrura* pt.
3	*Hypotænidia philippensis*	*36	*Coturnicops noveboracensis*
10	*Aramides albiventris*		" *notata*
	" *ypecaha*	*37	*Poliolimnas cinereus*
13	*Ocydromus* sp.	*38	*Porzanula palmeri*
*19	*Canirallus oculeus*	*39	*Creciscus coturniculus*
20	*Rallina euryzonoides*	*	*Rufirallus melanophaius*
30	*Porzana carolina*	*41	*Limnocorax niger*
	Porzanoidea tabuensis	46	*Microtribonyx ventralis*
	Nesophylax ater	49	*Gallinula frontata*
*31?	*Pennula ecaudata*		" *galeata*

Diastataxic (*continued*)

50	*Porphyriops melanops*	*54	*Notornis alba*
52	*Ionornis martinica*	55	*Fulica atra*
53	*Porphrio calvus*		" *americana*
	" *poliocephalus*		" *leucoptera*

Eutaxic

*4?	*Nesolimnas dieffenbachi*	*	*Anurolimnas hauxwelli*
17	*Himantornis hæmatopus*	*33	*Sarothrura pulchra*
*	" *whitesidei*	*34	*Rallicula forbesi*
*28	*Anurolimnas castaneiceps*	*39	*Creciscus leucopyrrhus*

To the growing list of eutaxic forms can now be added the remarkable Madagascan group comprising *Mesitornis* and *Monias*. Mr. Chapin has shown the relationship between these two genera and determined that both are eutaxic.

Dr. P. R. Lowe has recently proved that the African genus *Ortyxelos* is a Hemipode allied closely to *Turnix*. Like the latter it is (according to Lowe) eutaxic, these two genera differing in this respect from the very distinct Australian genus *Pedionomus*, which Gadow states is diastataxic.

In the list published in my former paper the sun bittern (*Eurypyga*) was, by a careless error, placed with the other aberrant gruiform birds among the eutaxic forms. A fresh specimen of each species shows that this genus is typically diastataxic, thus differing from the Cariamidæ, Psophiidæ, Rhinochetidæ and Mesitornithidæ and agreeing with the true cranes, the bustards and most of the rails.

The diurnal birds of prey (Falconiformes) and the parrots (Psittaci) are without exception, so far as known, diastataxic. As examination of the smallest member of each group—*Microhierax* and *Micropsitta* (*Nasiterna*)—proves them to be diastataxic, it is altogether likely that there is no exception in either order. This is the more probable because the character has been determined in numerous genera of each group including virtually all the main types.

All of the families of Steganopodes are diastataxic but there is an exception in the Phalacrocoracidæ. A specimen of the flightless cormorant (*Nannopterum harrisi*) recently studied in the flesh was typically eutaxic, that is, on both dorsal and ventral surfaces of each wing. It will be of interest to determine this character in *Pallasicarbo*.

It is now clear that both styles of wing are found in the swifts. Sclater's statement that the tree swifts (Hemiprocnidæ) are eutaxic is erroneous, for Pycraft has recorded *Hemiprocne mystacea* as diastataxic. My own observations confirm Pycraft and show that *H. longipennis* and

H. comata also are diastataxic, and H. L. Clark has recorded that *H. coronata* is the same.

The true swifts include both types. Clark records *Cypseloides* (*Nephœcetes*) *niger* and *Streptoprocne zonaris* as diastataxic and, as regards the latter, two specimens examined by me confirm this. The following are eutaxic: *Collocalia, Chætura pelagica,* and *Hirundapus caudacuta* of the Chæturinæ; *Tachornis parva, Aëronautes melanoleucus* and *Micropus melba, M. æquatorialis* and *M. caffer* of the Micropodinæ. Thus, all of the second subfamily so far examined are eutaxic. The latter (except *Hirundapus*) were recorded for the first time by Clark and as to *Chætura pelagica* I can confirm his determination. The *Hirundapus* was recorded by Pycraft. Sclater gave *Collocalia* as diastataxic while Clark records it as eutaxic, so that more information is needed regarding this genus.

In my previous paper overlooking Clark's record of certain genera as diastataxic, it was stated that authors had universally given the hummingbirds as eutaxic. Clark found at least one trochiline hummingbird that was eutaxic in one wing, diastataxic in the other. With this exception, all the Trochilinæ and Lophornithinæ determined are diastataxic. I have already recorded two genera of Phœthornithinæ (*Phœthornis* and *Glaucis*) as eutaxic, and to these can now add *Eutoxeres.*

The appended list records the Trochilidæ so far as they have been determined regarding this character.

DIASTATAXIC

Trochilinæ

9	*Campylopterus hemileucurus*	49	*Oreotrochilus pichincha*
15	*Patagona gigas*	*52	*Eugenes fulgens*
26	*Chlorostilbon* sp.	*53	*Lampornis clemenciæ*
31	*Cyanophaia wagleri*	67	*Ensifera ensifera*
*32	" *cæruleolavata*	70	*Boissoneana flavescens*
	Thalurania colombica	92	*Heliothryx* sp.
36	*Colibri iolotus*	*105	*Archilochus alexandri*
38	*Anthracothorax gramineus*	*106	*Selasphorus rufus*
*	" *violicauda*	*	" *platycercus*
40	*Chrysolampis elatus*	*110	*Orthorhynchus exilis*
*46	*Leucochloris albicollis*		

Lophornithinæ

115	*Lophornis helenæ*	*Lophornis magnifica*
	" *ornatus*	

EUTAXIC

Phœthornithinæ

5	*Glaucia hirsuta*	7	*Eutoxeres aquila*
6	*Phœthornis guyi*		

The species recorded by Clark are marked by an asterisk. No. 32, *Cyanophaia cæruleolavata*, was found to be eutaxic in one wing.

In this list Ridgway's division of the Trochilidæ into three subfamilies has been followed but I doubt that the Lophornithinæ can be maintained. One of the characters of this group is the conspicuously narrowed outer web of the ninth (next to outermost) primary, but *Discosura* (which was apparently not examined by Ridgway in this connection), while closely allied to *Popelairia*, has a normal ninth primary.

The following lists bring up to date our knowledge of this subject, so far as regards the distribution of diastataxy and eutaxy throughout the class.

1. Universally Diastataxic

Pygopodes (Loons; Grebes)
Tubinares (Petrels, Albatrosses)
Herodiones (Herons, Storks)
Phœnicopteres (Flamingoes)
Anseres (Swans, Ducks, Geese)
Anhimæ (Screamers)
Accipitres (Hawks, Vultures, Secretary-bird)
Grues veri (True Cranes, Limpkin)
Otides (Bustards)
Lari (Gulls)
Alcæ (Auks)
Pterocletes (Sand-grouse)
Psittaci (Parrots)
Striges (Owls)
Caprimulgi (Oil-bird, Frog-mouths, Nightjars)
Coraciæ (Rollers).[1]

2. Groups Containing both Eutaxic and Diastataxic Forms

Megapodiidæ (Mound-builders) *Megapodius* and *Megacephalon* diastataxic; *Leipoa* and *Alectura* eutaxic.
Columbæ (Pigeons) Treronidæ, Gouridæ, Didunculidæ, diastataxic; rest varied.
Ralli (Rails, Fin-foot) Most Rallidæ, diastataxic; rest and Heliornithidæ, eutaxic.
Limicolæ (Plovers, Snipe, etc.) *Philohela* alone known to be eutaxic.
Turnices (Hemipodes) *Pedionomus*, diastataxic; *Turnix* and *Ortyxelos*, eutaxic.
Grues aberrantes. Sun-bittern, diastataxic; Seriema, Trumpeter, Kagu, eutaxic.
Steganopodes (Cormorants, Pelicans, etc.) *Nannopterum* eutaxic; all others diastataxic.
Halcyones (Kingfishers) Several genera of each style.
Micropodii (Swifts) Hemiprocnidæ, diastataxic; Chæturinæ varied; Micropodinæ, eutaxic.
Trochili (Hummingbirds) Phœthornithinæ, eutaxic; all others diastataxic.

3. Universally Eutaxic

Struthiones (Ostrich)
Rheæ (Rheas)
Tinami (Tinamous)
Cracidæ (Curassows)
Gallinæ alectoropodes (Grouse, Partridge, Pheasants)
Opisthocomi (Hoatzin)
Mesitornithes (*Mesitornis*, *Monias*)

[1]Recent examination of a skin of *Coracopitta pittoides* and one of *Brachypteracias leptosomus* proves that the grand rollers are, like the typical rollers, diastataxic.

3. UNIVERSALLY EUTAXIC (*continued*)

Coccyges (Cuckoos; Turacos)
Meropes (Bee-eaters)
Momoti (Motmots, Todies)
Trogones (Trogons)
Bucerotes (Hornbills, Hoopoes)
Colii (Mouse-birds)
Picariæ (Jacamars, Barbets, Woodpeckers, etc.)
Passeres (Broad-bills, Tyrant-birds, Ant-birds, Lyre-birds, Song-birds, etc.)

FIRST PRIMARY COVERT

Little can be added to the statement in my previous paper that the greater upper covert lying between the inner two primaries is reduced only in certain alectoropodous Gallinæ, in *Turnix*, and in most parrots.

In the vast majority of birds, including all types of wings, even the weak-winged rails, small passeres, and hummingbirds, this feather is perfectly normal in all respects or at most slightly reduced in size. Except for the groups first mentioned above, the proximal covert is less than three-fourths as long as the next one only in a few pigeons (*Columba*, *Macropygia* and *Streptopelia*, but the reduction neither marked nor constant) and in *Rhinochetus jubatus*, in which the feather equals three-fourths in one bird, and is slightly less than three-fourths in the other specimens examined.

In the higher Gallinæ the covert averages about three-fourths, being always less than this in the three genera of grouse examined, and equal to or more than three-fourths in *Pavo* and the Numididæ, the other groups averaging intermediate. In the Gallinæ and in *Turnix* the covert is always pennaceous, at most slightly frayed along the edges, and, with the exception of a single specimen of *Francolinus francolinus*, it is always decidedly more than half as long as the second covert.

The parrots are of particular interest as regards this covert, being the only group of birds in which it is ever reduced to a true vestige or even absent. There is little or no reduction in the Cacatuidæ, Strigopidæ, Nestoridæ, and in *Psittrichas* (*Dasyptilus*). In these the first covert is at least 70% of the length of the second. It is distinctly better developed in *Leptolophus* (*Calopsitta*) than in any other member of the order, usually more than 90% of the length of the next covert and perfectly normal in form and texture.

In the Platycercinæ (excluding *Lathamus*, i.e., *Nanodes discolor*, which certainly is not a member of this group) the covert is distinctly though not greatly reduced, averaging scarcely less than 70% of the second covert, and in the single specimen of *Micropsitta* (*Nasiterna*) examined it was exactly 70%.

In the Psittacinæ (excluding *Psittrichas*) it is less than 70%, except in one specimen of *Coracopsis nigra* in one wing of which it was 75% and perfectly pennaceous. In all other Psittaci it is less than 70%, except for *Amazona imperialis*, of which a single specimen has been examined. This includes all American parrots, the Paleornithinæ and the Trichoglossidæ (including *Lathamus*).

The covert is most reduced in the Arinæ (Conurinæ), in which it is frequently a downy vestige less than one-third the length of the next, and is often completely wanting in *Eupsittula*, *Pyrrhura* and allied genera.[1]

Vestigial Eleventh Primary

The remicle is normally present in the Tubinares, including *Oceanites*, *Pelagodroma*, *Fregetta*, and *Prion*. The single specimen of *Oceanodroma melania* examined had a remicle 10.5 mm. long, but in *Oceanodroma leucorrhoa* (several wings examined) there was no trace of this small quill.

The remicle is a constant feature in the Alcidæ and Laridæ. In the allied group, Limicolæ, it has been lost in two groups, the painted snipes (*Rostratula* and *Nycticryphes*) and the jacanas (at least in *Jacana spinosa*). In the true cranes, Gruidæ, the eleventh quill has been lost in *Balearica* (two specimens of *B. pavonina* examined). I can confirm Gadow's record of the presence of only ten primaries in all the aberrant gruiform birds (*Cariama*, *Psophia*, *Eurypyga*, and *Rhinochetus*) but he erroneously gives *Aramus* as having eleven, whereas in the three specimens examined (two from Florida and one from Nicaragua) there were only ten quills. In both *Mesitornis* and *Monias* there are ten functional primaries and no eleventh quill.

The Rallidæ is a group in which the remicle is at best extremely vestigial and is often wholly wanting. It does not appear to be generally known that in certain small flightless rails there is a reduction in the number of large primaries. In *Porzana* (*Nesophylax*) *atra* and *Pennula ecaudata* the tenth quill is wanting and the ninth is even shorter than the first. *Porzanula palmeri* has only eight primaries, the eighth equalling or slightly longer than the first. A single specimen of each of the last two species was examined by Mr. Chapin, and I am indebted to him for the privilege of recording this information.

[1]Mathews and Iredale have made the cockateel (*Leptolophus*) a monotypic family, Leptolophidæ, which they place in the superfamily Psittaculoidea, associated with Pezoporidæ, Platycercidæ, Polytelidæ and Psittaculidæ (Paleornithidæ *olim*). Heretofore *Leptolophus* has usually been placed with the cockatoos (Cacatuidæ), with which it agrees in the doubly complete orbital ring, powder-down patches, gall-bladder, crest, and coloration. The complete development of the first primary covert is additional evidence that this position is the correct one.

The storks (Ciconiidæ) have eleven large primaries. The remicle which is homologous with that of birds with ten functional quills is usually present, but I failed to find it in the three specimens of *Anastomus lamelligerus* examined. Neither could it be found in a skin of the shoebill, *Balæniceps rex*, but Dr. P. Chalmers Mitchell records it in a bird studied by him, so that examination of additional specimens is desirable.

Among the herons (Ardeæ) the remicle, which is usually well-developed, is entirely absent in the boatbill (*Cochlearius*, two specimens). It is unusually small and degenerate in *Botaurus lentiginosus* and *Ixobrychus exilis*. In *Doriponus* (*Agamia*) it is very small, apparently sometimes wanting, and is doubtfully present in *Gorsachius*.

The remicle is unusually large in many diurnal birds-of-prey (*Falconiformes*), notably in the condors, vultures, *Serpentarius*, *Terathopius*, *Aquila*, *Spizaëtus bellicosus*, and *Pandion*. The other extreme is reached in *Accipiter*, *Ictinia* and the Polyborinæ. Although the remicle is normally present in a very degenerate condition in *Accipiter velox*, no certain trace of it could be found in any of the four specimens of *A. cooperi* examined. In the one *Ictinia plumbea* there was, in one wing only, a tiny vestigial feather that may have represented the eleventh quill. The two examples of *Polyborus cheriway* determined had no remicle whatever, but in a skin of *P. plancus* there was a well-developed vestige 18 mm. long. In three specimens of *Ibycter* (two of *I. megalopterus* and one of *I. ater*) no eleventh remex could be found. Apparently, therefore, this quill is usually absent in the Polyborinæ. In the smallest form of the order, *Microhierax* (*M. fringillarius* and *M. erythrogonys* determined), the remicle is very small but distinct.

In the owls (Striges) a small remicle is normally present but in the two specimens of *Glaucidium* (*G. brasilianum* and *G. siju*) examined not only the eleventh remex but the eleventh lower covert as well was absent. Bates, however, records the quill as present in his one example of the African *G. sjöstedti*, and both the remicle and the eleventh lower covert are constantly present in the Asiatic *G. cuculoides*.

The Caprimulgi (including Podargidæ) are given by Gadow as having but ten primaries. H. L. Clark states (1901, Auk, p. 168) that the specimen of *Podargus* described by him had but ten. Sclater (1866, Proc. Zool. Soc., p. 581) also gives ten, "of which three are on the metacarpus," but this statement, which is perpetuated by Hartert in the British Museum Catalogue, is an obvious error for no bird with a normal wing has fewer than six metacarpal remiges. The single fresh specimen of *Podargus strigoides* examined by me had a pennaceous remicle 25 mm.

long. There was no greater under covert on the distal side of the tenth primary and for this reason special care was taken to assure myself that this small feather was actually the remicle and not a covert. This is strongly indicated by the position of the feather on the edge of the wing, close to the upper covert, by its form and texture, and particularly by the fact that its calamus is decidedly longer than that of the outermost lower covert. Ordinarily, of the two feathers, the eleventh primary and the eleventh lower covert (which lies between the tenth and eleventh primaries), the remex is the first to be lost, but apparently in *Podargus*, as in the Alcedinidæ, the covert has been lost and the remicle retained.

In the swifts and ordinarily in the nightjars there is, exclusive of the upper covert, only a single small feather on the outer side of the tenth primary. In my notes a little doubt was expressed in the case of *Streptoprocne* and *Nyctidromus* as to the identity of this feather but, judging by other members of each family, I believe that it may safely be considered as the eleventh lower covert. However, in the Australian nightjar, *Eurostopodus mystacalis* (of which several skins have been examined), both the covert and the remicle are present, a rather surprising exception to the absence of the latter in the Caprimulgidæ. Thus the nightjars are moved a trifle nearer the owls and farther from the swifts.

Gadow credits the hornbills (Bucerotidæ) with eleven primaries, but in all those examined by me (*Bucorvus*, *Anthracoceros*, and *Lophoceros*) there are only ten, the remicle being absent.

Sundevall records eleven primaries in the turacos (*Musophaga* and *Corythaix*), but Gadow gives the number for the family as ten, and I have found but ten in *Turacus* and in *Crinifer* (*Chizærhis*) *concolor*.

That the remicle occasionally reappears in groups which normally lack it is shown by a specimen of the domestic fowl (*Gallus*) in which there was a small eleventh quill 14 mm. long. There was no eleventh lower covert. In a single specimen of *Argusianus grayi* and in one of *Numida galeata*, this eleventh covert (normally absent in all Gallinæ) was present, but no eleventh quill.

The remicle of eleven-primaried birds is homologous with that of twelve-primaried forms, in both of which it is the distal predigital: The remicle of ten-primaried birds (the so-called "9-Primaried" forms), however, is the proximal predigital and hence is merely analogous with that of other birds. In the "9-Primaried" Oscines this tiny quill is, so far as known, invariably present. Outside of the Oscines the Indicatoridæ is the only "9-Primaried" group, and probably some members of the family are nine-primaried in the strictest sense, for in two skins of

Prodotiscus the tenth primary is apparently wholly wanting. In most other honey guides the small quill is present, but even more reduced than in any of the Oscines.

Functional Primaries

The number of primaries is, as is well-known, a very constant feature throughout large groups of birds, yet individual variation is not rare. Bates records a specimen of *Glaucidium sjöstedti* with eleven large primaries, and states that he had observed several cases of this abnormality in other orders. My notes include the following records.

Necrosyrtes pileatus, ten functional primaries in one wing, eleven in the other (the remicle also present in each wing). *Ixobrychus exilis*, ten large primaries in the left wing, eleven in the right (minute remicle apparently present in each wing). *Philohela minor*, ten large primaries in the left wing, eleven in the right (three outer quills in each wing shortened and greatly narrowed as usual in this species; the remicle, normally present, was not determined with certainty). In two cases, an ibis, *Carphibis spinicollis* and a parrot, *Alisterus cyanopygius*, there were in each wing only nine large primaries, with no evidence of loss by molt or accident. Special mention must be made of the remarkable variations in the number of primaries in the loons (*Gavia*). In the three specimens of *Gavia stellata* seen in the flesh the normal number of quills, ten large ones and the remicle, were present.

On the other hand, of the three fresh specimens of *G. immer* examined, no two had the same number of primaries. Excluding the remicle, which was always present, the numbers were: ten in each wing; eleven in each wing; eleven in one wing, twelve in the other. The last specimen was an October bird of the year, and it is the only case in which I have found two extra quills in the wing. It will be interesting to learn by examination of a large series to what extent the loons vary in this respect. While some of the birds with an abnormal number of remiges have been captive specimens, others were wild birds, and there is no reason to believe that the variations are induced by captivity.

The following table shows our present knowledge of the number of primaries throughout the class. The remicle is noted separately.

The Number of Primary Remiges in Birds

16
Struthionidæ

12
Rheidæ

11+1

Podicipitidæ
Ciconiidæ (11 in *Anastomus*)
Phœnicopteridæ

10+1

Gaviidæ
Tubinares
Steganopodes
Ardeæ (10 in *Cochlearius*)
Ibides
Anseres variable in *Nesonetta*
Anhimidæ
Cathartidæ
Accipitres (10 in Accipiter pt. and Polyborinæ pt.)
Ralli (exceptionally 9 or 8; remicle always small, sometimes absent)
Heliornithidæ
Gruidæ (10 in *Balearica*)
Otididæ
Limicolæ (10 in Jacanidæ and Rostratulinæ)
Pteroclidæ (11th small)
Lari
Alcæ
Striges (10 in *Glaucidium* pt.)
Coraciidæ
Alcedinidæ
Meropidæ (11th very vestigial; 10 in Meropinæ)
Momotidæ
Caprimulgi (10 in all except *Podargus* and *Eurostopodus*)
Capitonidæ (doubtless 10 in some)
Ramphastidæ
Picidæ (10 in some groups)
Passeres pt. (10 in many; 9+1 in "9-Primaried" Oscines)

10

Scopus
?*Balæniceps*
Crypturi
Galli
Turnicidæ
Mesitornithidæ
Aramidæ
Cariamidæ
Eurypygidæ
Rhinochetidæ
Columbæ
Opisthocomi
Musophagi
Cuculi
Psittaci
Todidæ
Bucerotidæ
Upupæ
Coliidæ
Macrochires *s. s.*
Trogonidæ
Galbulæ
Indicatoridæ (10th vestigial, sometimes absent)
Passeres pt. (10th vestigial in "9-Primaried" groups)

Alula

In my previous notes three genera, *Psophia*, *Tapera*, and *Chizærhis*, were recorded as being unique in having the first alula quill shorter than the second. This is so also but to a less degree in certain Rallidæ; in others the first two quills are equal, while in the coots and gallinules the first is always the longest feather. In the tinamous, certain cuckoos, and most turacos, the first and second quills are about equal.

In the Passeres the first alula quill always exceeds the second. The number of quills is almost universally three or four, five in *Gymnorhina* and *Struthidea*, and apparently six or seven in *Menura*, in which the first is scarcely longer than the second. In the Caprimulgidæ four is the typical number, and Clark is in error in recording[1] only three quills in each of the four genera of North American Caprimulgidæ studied by him.

Outermost Primary Covert

No parallel to the remarkably enlarged outermost upper greater primary covert of the trumpeter (*Psophia*), previously recorded by me, has been found, but several cases of a moderate enlargement of this covert have come to light, namely in *Cariama*, *Chunga*, *Meleagris*, *Numida*, *Jacana*, *Cochlearius*, *Strigops*, *Centropus*, several genera of Tyrannidæ (as *Todirostrum*) and in *Smithornis* (the last recorded by Bates), in all of which the outer covert is somewhat longer than the next one. I have never found this covert altogether wanting (in eleven- or twelve-primaried groups) but in many Gallinæ it is reduced to a vestige.

Rectrices

There is considerable variation in the number of rectrices among the small crakes (Rallidæ) and this, when determined in all the species, may be useful in the delimitation of genera, particularly in connection with the presence or absence of the fifth secondary-covert. *Porzana carolina* has twelve tail-feathers, while in *P. flaviventris*, lately separated by Ridgway as *Hapalocrex*, there are ten. *Porzanoidea tabuensis* has ten, but *P.* (*Nesophylax*) *atra* has only eight. In *Coturnicops noveboracensis* and *Creciscus jamaicensis* there are ten rectrices, while *Creciscus viridis* (*cayennensis*) has only eight. In the remarkable African wood-rail, *Himantornis*, there are only eight rectrices.

As to *Psophia* Beddard states: "there are apparently ten rectrices (not twelve, as Nitzsch stated)." Three specimens of *P. crepitans* bear

[1] 1895, Proc. U. S. Nat. Mus., XVII, p. 553.

out Beddard's opinion; two of these had ten tail-feathers, the third only nine, but one apparently lost.

There is need of further investigation of the number of rectrices in the Ardeidæ. The bitterns, Botaurinæ, are supposed to be distinguished from the typical herons, Ardeinæ, by possessing only ten rectrices, as well as by having only two pairs of powder-down patches and differently proportioned feet and claws. *Zebrilus*, however, though a heron judged by its toes, claws, and three pairs of powder-down tracts, has only ten tail-feathers as in the bitterns. In certain of the smaller bitterns there are, as recorded by Beddard, only eight rectrices. This is true of *Ixobrychus exilis*, *I. erythromelas*, and *I. involucris*, but in the Old World members of the genus (excepting possibly the Australian *I. dubius*) there are ten rectrices. In one specimen of *I. minuta* and one of *Botaurus lentiginosus* I found the unusual number of eleven.[1] Beddard also records variation in *Botaurus*.

The owls (Striges) with the single exception of *Micropallas* are recorded as having twelve tail-feathers. Another exception is found in the Cuban *Gymnasio lawrencei*, which, like *Micropallas*, has but ten rectrices. This statement is based on three skins, and careful examination failed to show that any feathers were missing. There is no doubt however that the Porto Rican species, *G. nudipes*, has twelve rectrices, as shown by several specimens. *G. lawrencei* also differs from *G. nudipes* (type of the genus) in having the upper third of the tarsus densely feathered instead of having the tarsus almost wholly naked, and there are decided differences in coloration. Probably *G. lawrencei* should be generically separated under the name *Gymnoglaux* Cabanis.

So far as I am aware the cuckoos (Cuculidæ), with the exception of the Crotophaginæ, have ten tail-feathers. Beddard's statement (1898, 'Structure and Classification of Birds,' p. 272) that there are only eight in *Saurothera* is erroneous, the normal number being ten.

Pycraft (1907, Ibis, pp. 232 to 233) records ten rectrices in *Colius affinis*. This may be the full number in certain species of *Colius*, but in *C. striatus*, of which four skins are available, there are twelve.

As pointed out in my previous paper the motmots (Momotidæ), except *Momotus*, have normally but ten rectrices. Several exceptions, however, have been noted and evidently the number of tail-feathers in some of the genera at least is an unstable character. The exceptional specimen of *Baryphthengus ruficapillus* already recorded by me had six

[1]It is possible that the absence of a vinculum between the two deep plantar tendons will prove to be a constant character of the Botaurinæ. Beddard records this feature in *Botaurus stellaris*, *Ixobrychus involucris*, and *I. exilis*. I have determined it in *Botaurus lentiginosus* and *Ixobrychus exilis*.

rectrices on one side of the tail (the other side being imperfect). A skin of *B.* (*Urospatha*) *martii semirufa* recently examined (Princeton Museum) has six rectrices on one side, five on the other (this evidently the full number, the fifth feather of one side being intermediate in length between the fifth and sixth of the opposite side). In *Eumomota superciliaris* also the number varies. Of twenty-four skins examined, twenty-two have ten rectrices, one has eleven (full number evidently) and one has twelve. In the last specimen (A. M. N. H. No. 143817), the outer pair of rectrices is, relative to the next pair, much longer than in *Momotus lessoni*, and even of considerably greater actual length than in the latter.

All of the several hundred known species of hummingbirds (Trochilidæ) have ten tail-feathers. The adult male of *Loddigesiornis mirabilis* is credited with only four, but Mr. Ridgway has suggested[1] that careful examination would probably reveal the apparently missing rectrices, and the surmise proves to be correct. Four specimens of this rare species have recently been acquired by the Museum, one of them an adult male with a perfect tail. In this bird I find the full number of ten rectrices. Those heretofore recognized are the first or central pair, which are only 12 mm. long and hidden by the coverts, and the greatly lengthened racket-like fifth or outermost pair. Crowded in between these quills are three vestigial rectrices, the innermost (second) 3.5 mm. long, the next (third) slightly smaller, and the outermost of the three only 2 mm. long. The vanes of these reduced rectrices are degenerate in structure but relatively broad.

Among the true woodpeckers (Picidæ *s. s.*) *Campephilus* (*Megapicos*) *pollens* remains the only exception to the presence of twelve tail-feathers. In an allied species, *Chrysocolaptes hæmatribon*, however, there is in one specimen examined an approach to *Megapicos* in the reduction of the outer rectrices, and one of the vestigial sixth pair has been suppressed. Beddard's record of only ten rectrices in *Tiga shorei* was based on an imperfect or abnormal bird, for the specimens examined by me have the full number.

There has been much confusion as to the number of tail-feathers in the piculets (Picumnidæ). Some of this is doubtless due to Sundevall, who recorded ten rectrices in those having twelve because he did not consider that the vestigial sixth pair counted as tail-feathers. In *Nesoctites* and in *Picumnus* (including *Vivia*) there are twelve rectrices exactly as in the wrynecks and woodpeckers. *Sasia* has lost the small sixth pair and has ten rectrices, while in *Verreauxia* still another pair

[1] 1892, 'The Hummingbirds,' Report of the U. S. Nat. Mus. for 1890, p. 300.

has been lost and there are only eight feathers. This statement is based on the series of this rare African piculet collected by Chapin, and in no specimen are there more than eight tail-feathers.

In many species of antpittas, *Grallaria* (including *G. rufula*), there are twelve rectrices. Mr. Ridgway has separated from true *Grallaria* a well-marked group of small species under the name of *Hylopezus*, but erroneously credits them with twelve rectrices as in *Grallaria*. Examination of about twenty-five skins of *H. intermedius*, *H. dives*, and *H. perspicillatus* fails to disclose more than ten rectrices in any bird.

The only American wren (Troglodytidæ) credited with fewer than twelve tail-feathers is *Thryorchilus*. But there are only ten in *Henicorhina*, in *Microcerculus*, and in the smaller species of *Leucolepis*. The peculiar large species of the last named genus, *L. thoracicus*, has twelve rectrices.[1]

Many cases of individual variation in the number of rectrices have been observed and will be recorded at some future time.

Oil-Gland and Its Tuft

Gadow marks the oil-gland as tufted in all the families of gallinaceous birds, while Sharpe gives it as nude in Megapodiidæ, feathered in the rest. In his key to the families of Gallinæ Mr. Ogilvie-Grant ('Cat. Bds. Brit. Mus.') distinguishes the Megapodiidæ from the Cracidæ by this character.

There is no doubt that the oil-gland is perfectly bare in *Alectura* and *Leipoa*, but each of the two fresh specimens of *Megapodius reinwardti* (*duperreyi*) examined had a small circlet of feathers three millimeters long, and a vestigial tuft was also found in a mounted specimen of *Mega-*

[1] *Leucolepis thoracicus* differs in several other respects from the four or five more typical species of the genus (the type of which is *L. musicus*=*L. arada*). Taken in connection with the difference in the number of rectrices, which in the Passeres is almost invariably a generic character, I believe that *L. thoracicus* should be generically separated and propose for it the name **Rhinorchilus**.

Rhinorchilus thoracicus is a somewhat larger bird than any of the species of *Leucolepis*, with proportionately larger bill and feet. The tail is relatively longer, much more than half as long as wing (instead of equal to or little more than one-half), of twelve instead of ten rectrices, the webs of which are more lax. The wing is relatively somewhat smaller with shorter tip, the eighth primary equalling or shorter than the first (innermost), instead of longer than the first (usually at least equal to the second, often equalling or exceeding the third, in *Leucolepis*).

The mesorhinium is more strongly compressed and elevated, the nasal depression running farther forward; the nostril nearer to the tomium than to the culmen (midway between or nearer the culmen in *Leucolepis*). Distal half of bill depressed rather than compressed, the culmen somewhat flattened and usually more abruptly decurved terminally, the tip of both maxilla and mandible broader and more obtusely rounded. Sides of head more densely feathered, no marked bare postorbital space. The bristly frontal and loral feathers are more highly developed, being looser webbed, longer, and more erect (closely approached by *C. salvini*). The remiges and rectrices are uniform blackish-brown, unbarred, as are the wing- and tail-coverts. (In *Leucolepis* the wing-quills and their coverts and the tail-feathers are always barred.) This color distinction holds in juvenal plumage also.

R. dichrous is only a slight race of *R. thoracicus*. The distinct species of *Leucolepis* are *L. arada*, *L. phæocephalus*, *L. lawrencei*, *L. modulator* and *L. salvini* (the latter perhaps a race of *L. modulator*). The generic name *Cyphorhinus* Cabanis, 1844, used until 1902 for this group, is preoccupied by *Cyphorina* Lesson, 1843. The type of *Cyphorinus* is *C. thoracicus*, and accordingly for those who consider a difference in gender ending a sufficient distinction *Cyphorhinus* will replace *Rhinorchilus*.

cephalon. Thus this feature, like that of the fifth secondary-covert, is variable in the Megapodiidæ. On the other hand in all the Cracidæ the tuft is virtually vestigial. In the two fresh specimens of *Ortalis vetula* examined the tuft was reduced to a tiny vestige only one millimeter long in one bird, while in the other bird the gland was apparently bare.[1]

In the Rallidæ the oil-gland tuft is normally well developed. Although it is as large in the coots and in *Gallinula* as in any member of the family, it is small or even vestigial in *Porphyrio* and in *Ionornis martinica*. Furthermore, while large in *Ocydromus*, it is entirely absent in *Himantornis*. Thus this African wood rail, which is noteworthy in having only eight rectrices, a eutaxic wing and in having the aftershaft minute in some feathers and wholly absent in others, is, so far as we at present know, unique in the family in its nude oil-gland. Beddard is in error in recording the tuft as absent in *Porzana carolina* (1898, 'Structure and Classification of Birds,' p. 321).

Gadow gives the oil-gland of *Eurypyga* as bare; Beddard states that it is "generally nude but occasionally tufted." In each of my two fresh examples, one of each species, there was a small tuft present. In the strange passerine-like Madagascan genus *Monias* the oil-gland appears to be entirely absent.

Gadow records the oil-gland as tufted in all the Ardeæ and Beddard gives it as bare only in *Cochlearius*. There are, however, several exceptions among the true herons. I have found the tuft present in the following: *Pyrrherodias manillensis* (two birds, tuft fair sized), *Ardea melanocephala* (tuft very small), *Florida cærulea* (vestige), *Nyctanassa violacea* (small), *Nycticorax nycticorax* and *N. caledonicus* (fair-sized), *Butorides virescens* and *B. stagnatilis* (fair-sized), *Tigrisoma lineatum* (small), *Heterocnus cabanisi* (fair-sized), *Botaurus lentiginosus* (small), *Ixobrychus exilis* and *I. involucris* (small). In the following species the tuft is wholly absent: *Ardea goliath, A. herodias, A. cocoi, A. occidentalis, Notophoyx novæhollandiæ, N. pacifica, Egretta candidissima, Hydranassa tricolor, Cochlearius cochlearius*. In *Balæniceps* the tuft is very much larger than in any heron. This remarkable bird is also stork-like rather than heron-like in having a well-marked claw on the pollex.

Examination of three skins of the pigmy falcon (*Microhierax fringillarius*) reveals the first known exception in the Accipitres to the presence

[1]These two families differ in the number of carotid arteries, in the development of the aftershaft and in the average relative length of the first secondary, but it is difficult to find any obvious and constant external difference between them. In the Megapodiidæ there are only four developed alula quills, whereas in the Cracidæ there are five or six or sometimes apparently even seven.

of an oil-gland tuft. In all three specimens the oil-gland is quite nude. In *Polihierax* the tuft is well developed.

Regarding the owls it is commonly stated that the oil-gland is bare except in the barn owls (*Tyto*) in which Nitzsch found a minute tuft. Beddard records a similar vestigial tuft in *Asio otus*. The following lists summarize my notes on this subject, one specimen of each species having been determined unless otherwise indicated. The species in which not the slightest trace of a tuft could be seen, even below a ten-power lens, are the following: *Rhinoptynx clamator, Ketupa ketupa, Ciccaba nigrolineata, Cryptoglaux acadica* (2), *Speotyto cunicularia* (2), *Glaucidium brasilianum.*

In the following species a vestige of the tuft could always be detected, with the exception of seven of the twelve examples of *Bubo virginianus* and one of the two *B. africanus,* in which the gland was absolutely bare: *Asio wilsonianus* (4), *Ketupa ceylonensis, Ninox boobook, Strix varia* (4), *Scotiaptex nebulosa, Bubo lacteus, Bubo bubo* (2), *Bubo virginianus* (12, only 5 with traces of tuft), *Bubo africanus* (2, only one with tuft); *Nyctea nyctea* (2); *Pulsatrix perspicillata, Otus asio* (9), *Otus choliba, Gymnasio lawrencii, Tyto pratincola* (6), *Tyto alba.*

The number of minute feathers forming the vestigial tuft varied from one to twelve, but even in the latter case (one specimen of *Asio wilsonianus*) the longest one was only one millimeter long. In *Ketupa ceylonensis* there was a single, virtually microscopic shred. My observations on *Tyto* confirm Nitzsch's statement that the gland invariably bears two tiny feathers. These average longer than in any of the Strigidæ, in which the longest feather is rarely as much as two millimeters long. In *Bubo lacteus,* which is exceptional, it was four millimeters; in *Tyto* four and one-half.

The power of heredity to perpetuate these minute and apparently utterly useless vestiges through countless generations is surely most remarkable.

The oil-gland is invariably tufted in the honey guides (Indicatoridæ), but the tuft is vestigial in *Prodotiscus.*

Since the publication of my previous paper I have examined the few genera of barbets (Capitonidæ) and woodpeckers (Picidæ) that were not available at that time. Among the African barbets a small tuft is present in *Trachylæmus purpuratus,* but none in *Trachyphonus* (*T. cafer, T. margaritatus*). *Gymnobucco* agrees with *Heliobucco,* as expected, in having a nude oil-gland. *Buccanodon duchaillui,* however, also lacks the tuft and differs thus from its supposedly nearest ally, *Pogoniulus* (*Xy-*

lobucco or *Barbatula*), in which the tuft is invariably present. This difference justifies us in recognizing *Buccanodon*, as was done by Reichenow on the basis of its larger hallux, although later Oberholser questioned its validity. There are several other differences between the two genera but these are the most important. *Viridibucco* (*V. simplex*, *V. leucomystax*) agrees with *Pogoniulus* in the presence of a small tuft, while in *Smilorhis kilimensis* and *Stactolæma anchietæ* this is absent.

To summarize the condition of the oil-gland in the barbets, we find the tuft invariably present in all American and Oriental genera (thin and sparse in the very distinct *Calorhamphus*, dense in the rest), and of the Ethiopian forms present in *Trachylæmus*, *Pogoniulus*, and *Viridibucco*. The tuft is absent in the following, all African: *Pogonorhynchus* (including *Erythrobucco*), *Melanobucco*, *Lybius*, *Tricholæma*, *Gymnobucco*, *Heliobucco*, *Smilorhis*, *Buccanodon*, *Stactolæma*, *Trachyphonus*.

Among the woodpeckers the presence of the tuft has been determined in *Trichopicus cactorum*, *Sapheopipo noguchi*, *Ceophlœus galeatus* and *Ceophlœus* (*Neophlœotomus*) *schulzi*. The tuft is usually absent in *Chrysocolaptes* (*Reinwardtipicus*) *validus;* present in about seven-eighths of the specimens of the various species of true *Chrysocolaptes*. There are no genera with constantly bare oil-gland, except the four Oriental genera already recorded, viz., *Dinopium* (*Tiga*), *Brachypternus*, *Gecinulus* and *Chloropicoides* (*Gauropicoides*).

In one group of African woodpeckers, however, the oil-gland itself has been entirely suppressed. This group comprises the following species of *Campethera: C. maculosa*, *C. permista*, *C. caroli*, and *C. nivosa*.[1] Because of this and other differences the genus *Campethera* should probably be restricted to these species, the others, including *C. tæniolæma*, which have a tufted oil-gland being referred to *Chrysopicos* (type *C. nubica*). This is the only known instance of the loss of the oil-gland in the Picariæ (antiopelmous birds), and the only other cases in the Coraciiformes are in the Caprimulgi (*Podargus* and *Nyctibius*).

Two more genera of parrots must be added to the five already known to have no oil-gland. These are *Anodorhynchus* and *Orthopsittaca*, several specimens of each of which have been seen. An excellent character is thus added to those distinguishing the latter genus from *Ara* and *Diopsittaca*. The five other genera lacking the gland are *Amazona*, *Pionus*, *Graydidascalus*, *Brotogeris* and *Tirica*. It will be noted that all seven genera are American.

[1]This feature first observed by me several years ago has been discovered independently by Bates, but not yet published by him.

Aftershaft

The *Apteryx* is rightly considered as lacking the aftershaft, yet this is not invariably so. In one bird of the streaked type three feathers were examined and all were perfectly simple. In a specimen of *A. mantelli* two of the three feathers examined were similar, but the third, a feather 90 mm. long (excluding calamus), had a minute vestige of an aftershaft 4 mm. long, a single shred with a few terminal barbs.

Gadow marks the aftershaft in the tinamous (Crypturi) as vestigial or absent. Beddard states that "it is apparently in the process of disappearing among the Tinamous," vestigial in *Nothocercus* and absent in *Tinamus solitarius*. My records also show that the aftershaft is vestigial in *Nothocercus* and *Tinamus*. In some specimens of the latter, the aftershaft is wholly absent (the web not even crossing shaft), at least in the few feathers examined; in other individuals while absent on certain feathers a small one was present on others, usually less than one-fourth as long as the feather, in one case somewhat more than one-third, but its rachis always short. In *Crypturus* and *Crypturellus* the aftershaft is somewhat better developed. In *Rhynchotus, Nothoprocta, Nothura* and *Calopezus*, it is very well developed, decidedly more than half to three-fourths the length of the feather, and with an excellent rachis, much resembling the aftershaft of a grouse or pheasant.[1]

Beddard's statement that neither *Heliornis* nor *Podica* has an aftershaft is strictly true as to the former but not so regarding the latter. In several feathers from both dorsal and ventral surfaces of *Podica senegalensis* and *P. camerunensis* I find a small aftershaft varying from one-eighth to one-third as long as the feather, and with a short but distinct rachis. Other writers, including Gadow, have invariably recorded the aftershaft as absent in the sun-grebes.

Beddard, referring to the Steganopodes, states that "the aftershaft is minute but distinct in *Fregata*, apparently absent in *Plotus* and other genera." I have found no constant difference in this respect between any of the families of this order. In *Pelecanus* and *Anhinga* (=*Plotus*) the ventral side of the shaft is perfectly bare at its junction with the calamus; in *Sula*, *Phalacrocorax*, and *Phaëthon* the shaft is sometimes bare, sometimes crossed by a short fringe of barbs, and in *Fregata* this fringe appears to be a constant feature.

---

[1]The division of the Crypturi into two subfamilies depending on the presence or absence of the hallux is purely artificial. There are many other characters to consider, such as the intestinal cæca, aftershaft, wing-formula, bill, powder-downs, rectrices, and tarsal scutellation. Of these the aftershaft is one of the most important.

There appears to be a difference of opinion as to whether any owls possess the aftershaft. Gadow gives it as absent or vestigial; Clark states that it is absent in the owls examined by him, including *Tyto*; Beddard says that "it is often given as a character of the owls that there is no aftershaft. There is, however, a small one in *Strix*" (i.e., *Tyto*). This disagreement may be due to a difference of opinion as to what constitutes an aftershaft. In all of the numerous genera of owls examined by me, including *Tyto*, I have found the web of each side of the feathers running down to the base of the shaft and completely across its ventral side, thus forming a fringe of barbs at the point from which the aftershaft springs, when present. Judging by intermediate stages noted in the Anseres this fringe is to be considered as a degenerate aftershaft although there is no common shaft whatever even at the extreme base. In the feathers of the barn owl (*Tyto*) examined (three specimens) I have found the same structure as in other owls.

Both Gadow and Beddard mark the aftershaft absent in the Alcedinidæ. This is so in *Alcedo ispida*, at least in six feathers from different parts of one bird, and in a specimen of *Ceryle rudis* (two flank feathers examined). In all other species studied however I have found a small but distinct aftershaft. This is the case in *Megaceryle torquata*, *M. alcyon* (usually one-seventh to nearly one-half length of feather), *Chloroceryle amazona* (more than one-third), *C. americana*, *C. inda* (more than one-half but very fine), *Ramphalcyon gurial* (small), *Clytoceyx rex* (a small vestige), *Dacelo gigas* (3 specimens; in each case a small aftershaft on some feathers, none at all on others), *D. intermedia* (small on some feathers, absent on others).

It has been supposed that the hoopoes (Upupæ) lack the aftershaft. This is probably so in *Upupa*, of which one specimen has been examined and no trace of the aftershaft observed; but, to my surprise, a recently acquired fresh specimen of a wood hoopoe, *Phœniculus* (*Irrisor*) *erythrorhynchus*, showed a well-marked though very slender aftershaft on the feathers of all parts of the body. The rachis is very short and slender and the aftershaft is remarkably like that characteristic of the songbirds (Oscines). On an interscapular feather it was two-thirds as long as the feather, and on a rump feather 26 mm. long, the accessory plume was 22 mm.

Ridgway (1914, 'Bds. N. and M. Amer.,' part VI, p. 2) uses the aftershaft to distinguish between the barbets (Capitones) and the toucans (Ramphastides), stating that it is present in the former, wanting or rudimentary in the latter. This is evidently taken from

Gadow's table of characters. No such distinction can be made, for after examining the feathers of several genera of each group I can not find even a definite average difference between them. The aftershaft of both is essentially like that of the woodpeckers, and these are all decidedly oscine, but more luxuriant and with a distinctly better developed rachis than in the latter type. In the toucans the aftershaft is sometimes actually as long as the main feather. Gadow marks the aftershaft as vestigial in the Picidæ. This may be considered correct as regards its structure, but in the piculets it is nearly or quite as long as in the toucans, and little shorter in the true woodpeckers.

Again in the Caprimulgi Gadow gives this secondary plumule as vestigial or absent, but in the typical nightjars and in *Ægotheles* the aftershaft though shorter than in woodpeckers is much less degenerate in structure. It is often two-thirds as long as the feather, with a rachis more than half its own length.

As regards the aftershaft "in the aberrant *Steatornis* it is not absent (as Garrod asserted)" (Beddard). We shall agree with Garrod or with Beddard according as we regard the fringe of barbs at the base of the shaft as an aftershaft or not. In the feathers examined from various parts of the body of several specimens of the oil-bird, the structure is exactly as in the owls, the independent barbs crossing the shaft and continuous with the lateral barbs of the feather. In both *Podargus* and *Batrachostomus* there is a true aftershaft, more degenerate than in the Caprimulgidæ, particularly in *Podargus*.

The following is a provisional list of the groups in which the aftershaft is wholly absent or is represented by a well-marked fringe of independent barbs. In all other groups of carinate birds there is a true aftershaft although it is often small or very degenerate in structure.

AFTERSHAFT ABSENT

Struthionidæ
Rheidæ
Steganopodes (slight fringe crosses shaft in some)
Anhimæ (slight fringe crosses shaft in some)
Columbæ
Cuculidæ
Bucerotidæ
Upupidæ (excluding Phœniculidæ)
Bucconidæ
Menuridæ
Eurylæmidæ
Clamatores (except *Acanthisitta;* rarely a trace in Tyrannidæ)
Oscines (a few genera)

WELL-DEVELOPED FRINGE

Anseres (true aftershaft rarely indicated)
Cathartæ
Striges
Steatornithidæ

Powder Downs

Many years ago Mr. Ridgway pointed out that in *Tigrisoma* (including *Heterocnus*) the two pairs of ventral powder-down patches are connected along each side of the body. This is the case I believe in all the species. Thus there is a continuous tract of powder-downs from the root of the neck (the head of the coracoid) to the base of the tail, this tract being in *T. cabanisi* 25 cm. long.

There is a further remarkable feature of certain of the species that has apparently been heretofore overlooked. In *T. cabanisi* there is, in addition to the other tracts, a narrow patch of powder-downs 65 mm. long on each side of the median line of the upperback, bordering the inner edge of each lateral half of the dorsal tract. These two powder-down tracts are separated 15 mm. by the spinal apterium, and run 20 mm. back of the point of insertion of the last long interscapular feathers.

These interscapular powder-downs are also present but less highly developed in *T. salmoni*. In *T. lineatum* (*brasiliense*), however, they are absent.[1]

It should be noted that the African tiger heron, *Tigriornis leucolophi*, has normal ardeine powder-downs (three distinct, unconnected pairs) and they are gray instead of pure white as in the American species. It may also be recorded that the remarkable South American genus, *Zebrilus*, has three pairs of tracts, differing thus from the bitterns with which it agrees in having but ten tail-feathers.

The presence of powder-down patches on the upper back has been given as one of the few family characters of the boatbills (Cochleariidæ). Now that this feature is found to be shared by certain true herons it becomes more than ever doubtful whether *Cochlearius*, despite its remarkable bill, merits more than subfamily rank.

---

[1] *Tigrisoma cabanisi* has been separated (*Heterocnus* Sharpe, 1895) from the other members of the genus because of its bare throat. The remaining species also differ considerably among themselves. *T. salmoni* is unlike *T. lineatum* (the type of *Tigrisoma*) in having interscapular powder-downs, in which it agrees to a degree with *T. cabanisi*, and it differs from both these species in its smaller, thicker bill with decidedly curved culmen. The general coloration of all the American tiger herons is essentially similar and it is doubtful whether more is not lost than is gained by dismembering so natural a group. The differences in the powder-down tracts is a rather important character, however, for I do not recall any other case in which the number of tracts varies within generic limits. Surely *Heterocnus* should not be recognized unless *T. salmoni* and its near allies are also separated generically. If this is done, the name *Tigribaphe* Reichenow must apparently be used for the additional genus.

Tigribaphe was based by Reichenow (1912, Orn. Monatsber., XX, p. 61) on a supposed new species of tiger heron believed to have come from Victoria Nyanza, Africa. Chapin found by examination of the type that it was actually a South American species and this fact has been recorded by Sclater in his 'Systema Avium Ethiopicarum' (1924, Pt. 1, p. 30). Both Chapin's notes and Reichenow's description indicate that the type is either *T. salmoni* or a closely allied form; Reichenow particularly mentions its somewhat *Nycticorax*-like bill.

It has doubtless been pointed out before this that the diagnostic characters of *Tigrisoma* and *Heterocnus* are transposed in the key to genera of the 'British Museum Catalogue' (Vol. XXVI, p. 59).

The tiger herons have none of the structural features of the bitterns, and in the distribution of powder-downs they are even further from the latter than are the more typical herons. The name tiger bittern, often applied to them, is therefore misleading and should be replaced by tiger heron.

I have found no reference to powder-downs in the Striges, but in the barn owl (*Tyto pratincola*) there is a well-marked patch on each side of the rump, as well as scattered downs on the interscapular and scapular regions and on the breast.

After handling in the flesh many birds of almost every family, it is my belief that powder-downs exist in an incipient or vestigial condition in many groups not credited with them, but it is not always easy to be certain in such cases whether the suspected powder-downs are truly such or not.

My notes on a specimen of an adult fruit pigeon, *Osmotreron vernans*, state that the green of the plumage was "mealy" and the underside of the slate-colored remiges whitened as though by contact with powder-downs. Examination showed numerous downy feathers on the sides of body and sides of rump that are quasi powder-downs if not typical ones, and which whiten the fingers when rubbed between them.

In two species of thick-knees, *Œdicnemus bistriatus* and *Burhinus grallarius*, powder-downs were observed. In the former, these were scattered on the upper surface of the wings about the bases of the secondaries, and on the rump, particularly on its sides. In the latter species the downs were present on the wings at least.

In a female of the European bustard, *Otis tarda*, there appeared to be powder-downs on the sides of the breast and sides of the rump. Pulviplumes appear to be of rather general occurrence in the true cranes (Megalornithidæ), but never in patches. I have found them, scattered among the ordinary down, in *Megalornis* (*Grus*) *mexicanus*, *Anthropoides virgo* and *Tetrapteryx paradisea*. In *Megalornis grus* and *Mathewsia* (*Antigone*) *australasiana* they were observed on the wings. In *Monias benschi* there are, as already recorded by Mr. Bangs, definite powder-down patches. Again in the whippoorwill, *Antrostomus vociferus*, I recorded that the dark, gray semiplumes covering the breast and belly between the branches of the ventral tract, also on the rump, were whitened as though from powder-downs. The general contour plumage was not at all powdery.

Powder-downs have not heretofore been recorded in the Picaridæ (antiopelmous zygodactyl birds) but I have found them in the large woodpecker, *Mulleripicus pulverulentus*, on the sides and rump, and traces of them on the sides in *Thriponax javensis*, *Lichtensteinipicus fulvus*, and perhaps in *Ceophlœus lineatus*.

Natal Down

Gadow's table is rather misleading in giving the young as bare in some Steganopodes. The nestlings of *Phalacrocorax*, *Anhinga*, and *Pelecanus* (as made clear in the text of Gadow's work), are naked when hatched but later acquire the down. In the other families the young are clothed with down nearly or quite from the first.

The young of cuckoos and turacos were long supposed to be naked and are thus marked by Gadow. It is now known that this is not altogether correct but, because Ridgway as late as 1916 ('Bds. of N. and M. Amer.') gives among the characters of this order "young gymnopædic," it seems desirable to here state what is known.

In *Cuculus* and *Chrysococcyx* there is no natal down, so far as can be judged from nestlings in juvenal plumage. In *Coccyzus*, on the other hand, the young have a hair-like natal plumage, as recorded by Herrick and shown by specimens in the American Museum collection. Shelford has recorded the peculiar white hair-like plumage of the young of *Centropus*, and this is excellently shown in a specimen of *C. neumanni* collected by Chapin. The upper surface is covered with a mantle of long, rather harsh white hairs, and there are much shorter inconspicuous hairs on the ventral tract.

Among the turacos the young of only *Turacus* and *Corythæola* are known to me and both are covered with short blackish woolly down. This has been recorded in *Corythæola* by Reichenow also ('Vögel Afrikas').

So far as known, the only birds in which the young have no downy stage are found among the Coraciiformes and Passeriformes. In these groups only the owls and the nightjars (and *Menura* ?) have densely downy young.

The young of the hummingbirds are given as gymnopædic by Gadow, Ridgway and other authorities. This is not strictly true in some species, at any rate, for in two nestlings of *Colibri* (*Petasophora*) sp. in the collection the rump feathers bear long ochraceous-buff filaments of down.

Gadow omits from his table of characters any notation regarding the young of the colies and the trogons. In the text, he states that the young colies are naked, but Chapin tells me that the nesting of *Colius nigricollis* is sparingly downy. On the other hand, in comparing the trogons with related groups Gadow credits them with downy young. Ridgway states that they are gymnopædic and this is further indicated by nestlings of *Apaloderma narina* and *Trogonurus ambiguus*, which show no down whatever adhering to the juvenal feathers.

Gadow does not indicate this character in the Bucconidæ or Galbulidæ, and I therefore record the condition of the young of *Chelidoptera* (Bucconidæ), which Mr. George K. Cherrie tells me is perfectly bare.

In the Passeres the young are commonly furnished with tufts of down, which as a rule is better developed in the Clamatores than in the Oscines. I have examined downy young of Hylactidæ (*Scytalopus*), Furnariidæ (*Cinclodes*), Cotingidæ (*Rupicola; Ptilochloris* so figured and described), Tyrannidæ (*Sayornis, Empidonax,* etc.), and numerous families of Oscines. In a few Oscines, however, the young appear to be entirely bare. This is the case in *Cyanocitta cristata*[1] and *Calocitta formosa* examined by me, in *Lanius ludovicianus* (two nestlings in collection), in *Gymnostinops montezuma* (recorded by L. S. Crandall), and in *Munia oryzivora* (recorded by J. P. Chapin). In none of the Passeres examined has there been any down on the interscapular section of the dorsal tract, nor, with the exception of *Cinclodes rivularis,* on the anterior portion of the ventral tract.

[1]In his 'Plumages and Moults of the Passerine Birds of New York' Dr. J. Dwight describes the "natal down" of the blue jay as "pale mouse gray." Inspection of his specimens with Dr. Dwight indicates that this statement was probably based on an immature bird in which the downy aftershaft of a reversed feather was mistaken for a neossoptile.