ON THE TRAIL OF AN EXTINCT BIRD.

By C. W. De Vis, M.A., Corr. Mem.

The function of the wing in birds is in kind almost uniform, though in exercise it varies greatly. It is therefore probable that any variation observable in the form or relative dimensions of a constituent bone of the wing (the ulna, for example) has been brought about solely by the habitudes of the bird, or those of its ancestors, in the use of the power of flight. The extent of the variation so produced will be comparatively limited: inconspicuous, indeed, by the side of the results of diverse adaptation acting on the corresponding segment of the mammalian fore-limb. We are thus prepared to find the ulna maintaining in birds a general sameness of character. If we compare it with the humerus its uniformity is but accentuated: and naturally so since its surface is less subjected to the moulding agency of muscular origin and insertion than is that of the proximal segment of the lever, the recipient of the muscles moving the whole, and the purveyor of others which give motion to the distal segments. These considerations may serve to account for the fact that the differentiations of the ulna have been found too insignificant to be discussed by comparative osteology; and undoubtedly the bone is not that part of the bird's skeleton which throws most light on its general economy, yet it may be that it is not altogether impossible to find in the fossil ulna of a bird some guidance to the systematic place which should be assigned to the organization of which it formed a part. In the following attempt to do so the characters which have appeared to be available are the proportions of the bone discovered in its relative length and thickness, its curvature, the number, size and disposition of the tubercles corresponding to the secondary remiges, the shape of the shaft at its distal end, and the conformation of the articulating surfaces and parts adjacent to them.

Proportions: The ulna being in correlation with the rest of the wing bones, and, in conjunction with them, determining to some extent the shape of the complete organ, and this again being in relation with the volant activity of the bird, we might expect to be able to recognise a correspondence between the proportion of the bone and the bird's habits of flight; and in certain groups, as the petrels, swifts, and eagles, whose livelihood depends on continuous exertion of wing-power, we find that such a relation does exist. In the soaring birds there is a notable slenderness of the ulna, accompanying an elongation and narrowness of the wing, which we may conceive to be necessary to sustained buoyancy upon and rapid evolution in moving air; and had adaptation persisted in being the sole factor in the formation of the wing the task of placing an unknown bird amongst its kindred, as determined by their powers of flight, would have been comparatively easy. But it is clear that teleology may be at fault. A similar tenuity of the ulna is found in birds whose flight is not habitually sustained, though on occasion it may be long and rapid —for example, in storks, swans, and pelicans; nay even in others, as the giant kingfisher, whose wings serve only for short and laboured flight. Looking round for a solution of the difficulty, and seeing the prevalence of long necks in the birds last mentioned, we are for a moment tempted to abandon adaptation as a cause and suppose their long ulnas to be due to correlation of growth; but even this somewhat violent assumption would be illegitimate, seeing that plovers and sandpipers, with long ulnas, have short necks, while most ducks have, with long necks, short ulnas. The only plausible explanation seems to be offered by heredity. Though forbidden to account for the long ulnas of many existing birds by attributing them to adaptive modifications, we are permitted to conceive that they have been handed down from ancestral forms whose modes of flight required them, and retained by the prepotency of heredity over adaptation. If it be said that heredity as thus used is a convenient harbour of refuge for ignorance, be it so until we know better.

To acquire a definite notion of the extent to which the bird ulna varies in its proportions, the writer has prepared a tabular statement of the extreme length and minimum breadth of the bone from measurements of it in ninety-eight representatives of the larger sections of Australian birds; and from the measures of length and breadth has by the use of the formula, $\frac{\text{transverse}}{\text{longitudinal}} \times 100$, derived an index which may be called the ulnar index. By this proportions may be conveniently estimated, slenderness increasing as the index diminishes. The lengthiness of the entire table prohibits its introduction here; a summary may, however, be given if accompanied by the warning that in some families the indices are derived from one or two species only.

Table of Ulnar Indices in Birds.

Falconidæ	... ...	3·6	to 5·37
Strigidæ ...	... ...	4·05	— 4·64
Corvidæ ...	... ...	6·15	— 6·25
Paradiseidæ	... ...	6·11	— 7·94
Oriolidæ ...	... ...	6·74	— 7·6
Campophagidæ	... ...	5·39	— 7·55
Menuridæ	... ...	8·36	— 8·75
Ptilonorhynchidæ ...	...	6·62	— 6·85
Cuculidæ	... ...	3·9	— 7·53
Alcedinidæ	... ...	3·8	— 4·7
Caprimulgidæ	... ...	6·43	— —
Coraciadæ	... ...	5·2	— —
Psittaci	... ...	4·94	— 8·6
Columbæ	... ...	5·50	— 9·33
Megapodidæ	... ...	5·4	— 10 51
Otididæ ...	... ...	2·96	— 3·14
Rallidæ ...	... ...	4·92	— 8·28
Charadriidæ	... ...	3·65	— 5·91
Ardeidæ ...	... ...	2·81	— 4·67
Anatidæ ...	... ...	3·73	— 7·46
Pelecanidæ	... ...	3·4	— 5·16
Steganopodes	... ...	3·24	— 3·58
Podicipitidæ	... ...	3·69	— 4·69

The fossil ulna which has led to these measurements is in its greatest diameter 47·5 mm.; in its smallest, 3·5 mm.; it has consequently an index of 7·38.

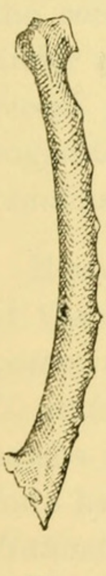
Proceeding to compare it with those of recent birds, we may at once exclude from further consideration those which have a greatest index below 7·38, or a smallest index above it. Nine families will then remain, the *Paradiseidæ*, *Oriolidæ*, *Campophagidæ*, *Cuculidæ*, *Psittaci*, *Columbæ*, *Megapodidæ*, and *Anatidæ*.

Form of Shaft: The ulnar shaft in birds assumes towards its distal end four modifications of form, which may be distinguished as cylindrical, subcylindrical, compressed, and trihedral. It is compressed in the *Paradiseidæ* and *Cuculidæ ;* subtrihedral in the *Megapodidæ* ; cylindrical in the *Psittaci*. In the remaining five families, and in the fossil, it is subcylindrical, the cylinder being flattened on the dorsal surface.

Curvature of Shaft: To afford space for the interosseous bodies and tendons of the long flexors and extensors the avine ulnar curves outwards, the curvature varying considerably in degree and location. In the majority of birds the curvature is almost confined to the proximal half or third of the shaft, which becomes straight, or nearly so, for the rest of its length ; in others the shaft is curved throughout, its contour forming a continuous and almost symmetrical arch. The *Campophagidæ*, *Oriolidæ*, *Paradiseidæ*, *Rallidæ*, and the larger *Anatidæ* conform to the general rule. The fossil ulna, on the other hand, is regularly arched, as it is in the pigeons and ducks, and the bird represented by it probably belonged to one or other of these last groups.

Remigial processes : Arranged in a single or double row along the bone, but generally more or less indistinct at either end, these outgrowths present themselves in much diversity of size and number, the latter in correspondence with the length of the bone, the former exhibiting no such correspondence, but being, on the contrary, frequently greater, though not unfrequently nearly obsolete, in the shorter winged birds. The contrast here indicated is exemplified by the pigeons and ducks, and it enables us to make a final selection in our determination of the fossil.

The regularly arched ulnas found among the ducks have remigial tubercles which are either small and low, or evanescent. The pigeons have them constantly, and sometimes in pronounced development. In *Lopholaimus antarcticus* they are almost as large relatively to the size of the bone as in *Menura*, in which they attain a greater size than in any other bird known to the writer. In the fossil ulna they are as distinct as in *Lopholaimus*, although the bone itself is much more slender than the ulna of that pigeon. It is amongst the pigeons, therefore, that we must place our extinct bird. It remains to ascertain its position among the genera of the *Columbæ*. It cannot be a *Leucosarcia*, for the ulnar index in that genus is much too high—namely, 9·33. On the other hand, *Lopholaimus*, with an index ranging from 6·43 to 6·57, *Goura* with a range from 5·50 to 5·71, *Myristicivora* with an index of 6·8, and *Megaloprepia* with one of 6·64 may be excluded for the opposite reason. The middle terms are *Macropygia*, having an index of 7·85 to 8·05, *Erythrauchen* (index 7·79 to 8), and *Chalcophaps* (index 7·18 to 7·79), which last might include the fossil, with an index of 7·38. But though in proportions it is at one with *Chalcophaps*, on a close comparison of its arthral surfaces with those of the genera referred to it is in them found to resemble more nearly *Megaloprepia* and *Erythrauchen*. Finally, a glance at the size of the remigial tubercles of the fossil gives decision to the opinion, already half formed, that it belonged to a genus of pigeons distinct from all three. The name suggested for the supposed genus, *Lithophaps*, is, of course, provisional, since it connotes distinctive features which may, when we know more of the skeleton, be found to coexist with characters assimilating it to some known genus; it merely records a seemingly reasonable judgment on the scanty evidence before us.



The characters of the genus so far known are those of the ulna.

Ulna stout, index 7·38, subcylindrical, continously arched, with a single row of eight strong remigial tubercles; arthral surfaces nearly as in *Megaloprepia*.

The species may be distinguished as *L. ulnaris,* with characters as yet undistinguishable from those of the genus.

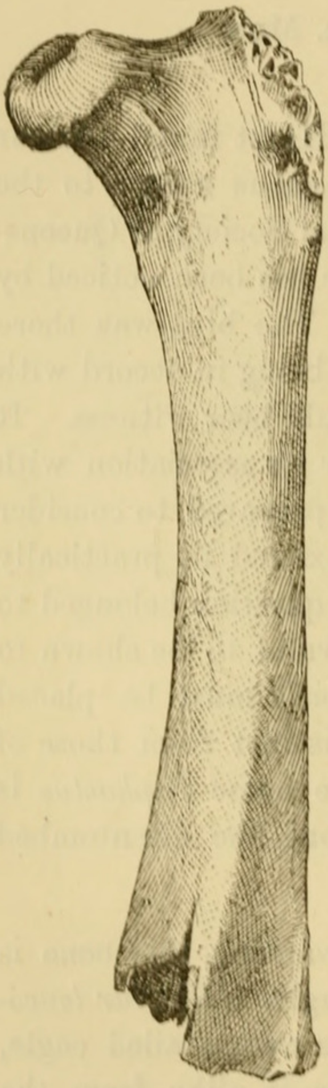
Hab : Darling Downs, in deposits of the Nototherian period. Collected by Mr. H. Hurst, in the neighbourhood of Warwick.

NOTE ON AN EXTINCT EAGLE.

By C. W. De Vis, M.A., Corr. Mem.

In company with *Lithophaps ulnaris*, Mr. Hurst found a femur of an eagle which is irreconcilable with any genus known to the writer. But, in the "Proceedings of the Royal Society of Queensland" (Vol. vi., p. 161), a humerus of an eagle has been noticed by him under the name of *Uroaetus brachialis.* The bird was there referred provisionally to the extant genus as being in accord with it so far as one extremity of a long bone could bear witness. It has now become more than doubtful whether its association with *Uroaetus* can be maintained. If we are not prepared to consider it more probable that two species of eagles existed in practically the same habitat than that the two bones in question belonged to the same bird, and of this there is nothing valid to be shown to the contrary, then the specific name *brachialis* must be placed under a new genus, for the femur is quite distinct from those of recent genera. For this probable genus the name *Taphaetus* is suggested in allusion to its appearance among the disentombed remains of its contemporaries.

Restoring the condylar region, which is wanting, this bone is of the same length as that of the male sea-eagle, *Haliastur leucogaster*, and $7\frac{1}{2}$ mm. shorter than in a female wedge-tailed eagle, *U. audax.* The femoral index 9·4 separates it alike from the hawks and kites, with a much lower, and from *Baza* which has for a hawk the exceptionally high one of 10·4 ; it likewise excludes *Haliaetus*, which has the highest observed in the Falconidæ, 10·88, but agrees fairly well with that of *Uroaetus*, *Nisaetus*, *Haliastur*, and *Pandion ;* the last named genus is, however, put out of court by the want of a pneumatic foramen adjacent to the trochanterian ridge, an abnormality not presented by the fossil. From the other genera it differs as follows :—The "neck" being longer the proximal end of the shaft is in consequence notably broader—the neck itself is also broader in the opposite direction between the head and the trochanter. The entoanconal surface of the upper part of the shaft as far as the *extensor cruris* ridge is much flattened, and between the head and the pneumatic foramen becomes concave. The pneumatic foramen is remarkably small, about half its customary size in recent genera, and is partially concealed by a deflection of the sharp edge of the trochanterian ridge. When the bone rests on its outer side the flattening of the anconal surface proximally and of the palmar distally brings into prominence the pectineal ridge, which thus forms a high and sharp inner margin; this ridge is continuous from the entepicondyle to within a short distance from the head, where it ends in a distinct tubercle representing a third trochanter, a feature rarely occurring in the femora of birds. The *extensor cruris* ridge descends much further on the anconal surface than in existing genera of the family. On the palmar surface the linea aspera commencing low down as a faint ridge enlarges into a well marked eminence opposite the interval between the end of the pectineal ridge and the medullary orifice, sending off a short branch towards the latter, and continuing its main course upwards with a strong curve towards the palmar end of the muscular area of the trochanter. The pit above the entepicondyle absent in *Haliaetus* and *Haliastur* is in the fossil situated in the mouth of the groove between the condyle and epicondyle.



The characters of the genus are for the present but the leading characters of the femur.

Femur stout (index circ. 9·4), proximal end transversely expanded, shaft compressed, pneumatic foramen small; a rudimentary third trochanter, entepicondylar pit between condyle and epicondyle.

NOTES AND EXHIBITS.

Mr. Musson sent for exhibition a collection of 63 species of New Zealand land and freshwater mollusca collected by him during a recent visit, and determined by Mr. Suter, of Christchurch.

Mr. De Vis sent for exhibition the bones of fossil birds described in his papers.

Mr. Hedley exhibited a number of the more remarkable land shells from New Guinea in illustration of his paper.

Mr. Trebeck exhibited galls of certain diptera (*Phytomyzidæ* and *Cecidomyidæ*) from Mount Wilson.

Dr. Cox exhibited a specimen of the rock lily (*Dendrobium speciosum*), throwing off a bud in a somewhat remarkable manner.

Mr. Skuse drew attention to an interesting article in the last number of the *Pharmaceutical Journal of N.S.W.*, on insects injurious to drugs, one of them probably the same species of moth as was exhibited by Mr. Froggatt at the Society's meeting in March, 1890, the insects shown having pupated in a tin of cayenne pepper.

Mr. Fletcher exhibited for Mr. J. H. Rose two living specimens of an inland species of frog (*Chiroleptes platycephalus*, Gthr.), obtained near Walgett, previously only recorded from Bourke and Dandaloo, N.S.W. It is nocturnal in its habits and an expert burrower, Mr. Rose reporting that he has never met with it above ground during the daytime.