THE WEAPONS AND WINGS OF BIRDS.

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A more accurate, if not a better, title for this article would perhaps be "Some weapons of birds," for the weapons to be considered are mainly such as are very evidently designed for offensive purposes, and a peaceably disposed bird might very well dispense with.

This paper does not treat of the beaks, claws, and ordinary spurs of birds, not only because they are pretty well known, but because peculiar modifications of bills and claws usually have more to do with preserving than destroying life, being related to some peculiarity of food or feeding.

The toothed beak of the falcon has, of course, a double purpose: to preserve the life of the falcon by destroying that of its prey, and the same is true of the spear-like bill of the heron, but the curious, crossed mandibles of the crossbill, the bent beak of the crook-billed plover, and the open bill of *Anastomus* all have to do with the mere procuring of food. Neither will we say anything of the ostrich, cassowary, and other big birds which strike with their feet, for although the feet are formidable weapons, they are designed rather for running than for fighting, except in the case of the cassowary, whose long, straight, sharp inner toe can inflict a serious wound. Leaving out all these birds, we are practically restricted to such as carry their weapons on their wings, and not only fight "tooth and claw," but buffet an adversary about the head, and have their spurs where they seem best adapted to do mischief. Rather strangely, it does not appear that birds with wing spurs are any more combative than those without, for, while the jacanas are said to fight well, Hudson, who studied them long and carefully, describes them as noisy birds, more given to scolding than to actual fighting.* Neither are the spur-winged plovers, which are also querulous and vociferous, said to be particularly pugnacious, although Gould says that *Lobivanellus personatus* uses its wing spur with good effect to repulse the attacks of birds of prey.† By no means all birds which fight with their wings have spurs upon them. The swan has none, and yet he is a famous fighter, and can deliver a tremendous blow, although the force and effect of a stroke of his pinions have undoubtedly been much exaggerated.

* Hudson, W. H., The Naturalist in La Plata.
† Birds of Australia, II, p. 221.

The common pigeon is another bird which uses its wings with good effect, and although the dove is held up as the type of gentleness, there are few birds of more quarrelsome disposition, and more given to picking upon their weaker neighbors. The company manners of the pigeon are unobjectionable, and the members of a flock will fly and feed abroad in harmony, but, once within the shelter of their own loft, woe betide the bird which dares put foot on his neighbor's territory, for he will be set upon and cuffed without mercy.

The pigeon, too, is a skilled boxer, feinting and guarding with one wing and striking with the other, the blow being delivered by the wing farthest from his opponent, the intention being that the wrist, which is the most effective part of the wing for striking a blow, shall strike the adversary about the head. While this mode of combat is not peculiar to pigeons, it is eminently characteristic of the group, so that they may be called pugnacious in the strictest sense of the term; the Latin verb *pugno* meaning specially to fight with blows of the fist, or, as we say, to come to fisticuffs.

Pigeons, according to our ideas, do not fight quite fairly, and if they have no positive spur upon their wings, they certainly come very near it. If one will carefully part the feathers on the outer edge of a pigeon's wing near the bend, commonly called shoulder, but really the wrist, he will find a small bare spot and a blunt, well-marked prominence, often covered with integument so thick and hard that it can almost be called horn. In some wild pigeons this tubercle or boss is well developed, especially in the curious Samoan *Didunculus*, while at least one extinct species was provided with a sort of natural slung-shot that must have added not a little to the effectiveness of a blow. This bird was the fat and flightless Solitaire, of Rodriguez, a near relative of the dodo, and, like it, a great, ungainly, aberrant member of the pigeon family, taller than a turkey.

All that we know about the Solitaire has been gathered from the journal of Francois Leguat, who tells us that, while the birds were nesting, they would not suffer any other bird of the same species to approach within 200 yards of the place. He writes—

> But what is singular the male will never drive away the females, only when he perceives one he makes a noise with his wings to call the female, and she drives the unwelcome stranger away, not leaving it till it is without her bounds. The female does the same to the males and he drives them away. The combats between them on this occasion last sometimes pretty long, because the stranger only turns about and does not fly directly from the nest.

Leguat says, furthermore, that "the bone of their wing grows greater toward the extremity and forms a little round mass under the feathers as big as a musket ball. That and its beak are the chief defense of this bird."

"As big as a musket ball" very aptly describes the swollen bone at the base of the metacarpus (fig. 1), and this, swung by the short, stout little

wing, must have been capable of hitting a pretty hard blow, even if, as is probable, it was surrounded by thick, callous skin. The outer end of the forearm (radius) is also rough and swollen, and it looks very much as if this enlargement of the bone had originally been brought about by the solitaire's combative habits, the wrist joint having been banged and bruised until that diseased outgrowth known as exostosis

Fig. 1.

PART OF WING OF SOLITAIRE, PEZOPHAPS SOLITARIUS.

Showing outgrowth of bone on radius and metacarpus (natural size).

Cat. No. 18251, U. S. N. M.

took place, and finally became a constant character of the bird. Dr. Weismann might object to this, but to a Neo-Lamarckian the thing seems quite plausible.

The true game birds, fowls and pheasants, which have spurs on their legs, have none on their wings, although, as everyone knows who has seen a quarrel in the barnyard, they use their wings in fighting. Some of their Australian cousins, however, the mound-builders, or megapodes, which have no leg spurs, have blunt tubercles on their wings, very much like those found among pigeons.

Although the swan, as we have seen, has no wing spurs and trusts to the sheer force of its wing stroke, some of its near relatives, the

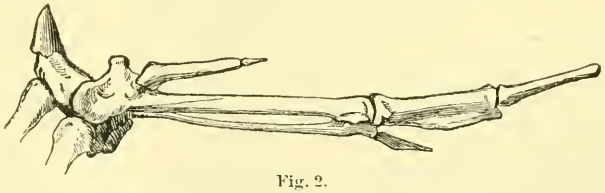

Fig. 2.

OUTER PORTION OF WING OF SPUR-WINGED GOOSE, PLECTROPTERUS GAMBENSIS.

Reduced.

African Spur-winged Geese (*Plectropteri*), have a very peculiarly armed pinion. The peculiarity lies in the fact that while in most spur-winged birds the spur does not occur upon the wrist itself, but upon the metacarpus, or next row of bones, in the Spur-winged Goose (fig. 2) that one of the wrist bones known as the *radiale* projects quite beyond the other bones and is capped with a sharp spur.

The majority of spur-winged birds are plovers, nearly related to the common Lapwing, *Vanellus cristatus*, and placed by different systematists in various genera and subgenera named from their spurs or the

face wattles which occur in some species, *Hoplopterus*, *Belonopterus*, *Lobivanellus*, and *Sarciophorus*. A curious fact about the wattled species is that there is a direct relation between the size of the wattles and the size of the spurs (fig. 3); when the spur is long the wattles are large, and when the spur is short the wattles are small. There is also in those species where the spur is small an increase in its size during the breeding season, so that it then becomes fully available as a weapon.*

There are no wattled lapwings in the New World, and only one species straggles northward beyond the latitude of the Himalayas. Africa, south of the Sahara claims half a dozen species, while seven

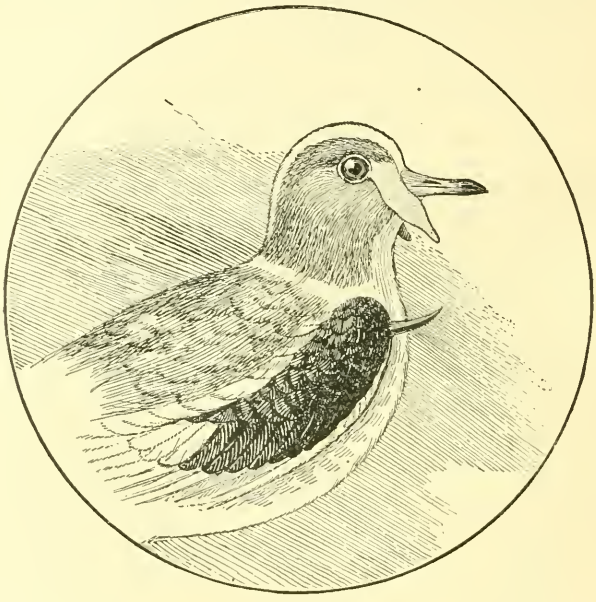

Fig. 3.

WATTLED PLOVER, LOBIVANELLUS ALBICEPS.

Reduced.

more are found between southern Asia and New Zealand. Spur-winged plovers without wattles occur in South America, Africa, and parts of Asia, but none come from Australia. A small and quarrelsome species (*Hoplopterus spinosus*) belonging to this latter group is very abundant in northeastern Africa, and its restless habits—for night and day it is continually on the move—are explained by the Arab tradition that on account of former laziness it was condemned to live in a state of perpetual unrest.

The largest and finest of the South American spurred plovers is *Belonopterus chilensis* (fig. 4), a species ranging southwards to Patagonia, and armed with a long, vicious-looking spur just at the base of the metatarsus. I was about to say "thumb," but it seems quite probable

*Jordan, Birds of India, III, 648.

that birds long ago lost their thumbs, and that the middle finger has come to do duty in its place. However, this digit has been termed thumb for a long time, and since it is one by analogy, we will still call it so.

There is a curious instance among the gigantic extinct group of reptiles, well named Dinosaurs,* where the thumb itself has become changed in function, and instead of aiding the other digits to lay hold of things, has become transformed into a long, sharp spike. This occurs in the Iguanodons (fig. 5), and among them the species particularly noticeable is *Iguanodon bernissartensis*, one of nearly two score that were happily swept into a convenient Jurassic gully and there remained for long ages, until brought to light by the picks of the coal miners of Bernissart. That in this case the spike did duty as a weapon is a little uncertain, and it may have served no more harmful purpose than that of ripping off the husk of some fruit or vegetable which formed part of the food of these great herbivorous reptiles.

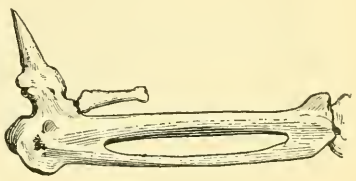

Fig. 4.

METACARPUS OF SPUR-WINGED PLOVER, BELONOPTERUS CHILENSIS.

Cat. No. 18546, U. S. N. M.

When these pointed thumb-spikes were first found, they were not associated with the fore limbs, and so in restoring the *Iguanodon* he was figured with the spike on the end of his nose, something like a rhinoceros.

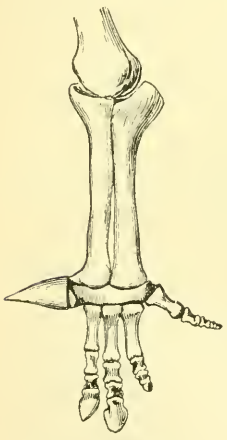

Fig. 5.

FOREARM OF IGUANODON, IGUANODON BERNISSARTENSIS.

Reduced.

The late Dr. W. K. Parker, in a memoir on the morphology of the duck and auk tribes, rather hints that the thumb of *Iguanodon* and the spur of *Chauna chavaria* are, morphologically, not so far apart.†

Another group of spur-winged birds is the *Jacanidæ*, a family of small birds related to the rails, having such long slender toes that they run as easily over lily pads and floating vegetation as other birds do over dry land. These little birds, which are found in the warmer parts of America, Africa, southern Asia, and Australia, like the spur-winged plovers, have a spur on the metacarpus, although it is not so large as in those birds. As in the spur-winged plovers we find spurs associated with wattles for the African and Asiatic species which have no wattles, have only rudimentary spurs, while the American species which have wattles have well-developed spurs.

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*Dollo, Note sur les Dinosauriens de Bernissart. Bull. Mus. Roy. d'Hist. Nat. Belge., 1882-1884, t. I, Pl. IX, t. II, Pl. VIII.

†The Morphology of the Duck and Auk Tribes. Cunningham Memoirs of the Royal Irish Academy. No. VI, pp., 55, 95.

The jacana, like the Hoactzin and Mound Builder, acquires its full activities at an early date, and Hudson says:

> While I was looking closely at one of the eggs lying in the palm of my hand, all at once the cracked shell parted, and at the same moment the young bird leaped from my hand and fell into the water where it swam rapidly to a small mound and escaping from the water, concealed itself in the grass, lying close and perfectly motionless like a young plover.
>
> I am quite sure that the young bird's sudden escape from the shell was the result of a violent effort to free itself, inspired by the loud persistent screaming of the parent birds which it heard while in the shell.

In the jacanas belonging to the genus *Metopidius* the spur is much reduced in size, but the bone of the wing itself is so modified as to become available as a weapon, being flattened and widened so as to be a scimeter on a small scale (fig. 6). The apparent drawback to this weapon lies in the fact that, like a two-edged sword, it must cut both ways, and unless the skin immediately over it is particularly dull and insensible *Metopidius* can not strike an adversary without feeling the effects of the blow himself. Whether or not this tends to promote peacefulness we do not know, but from what we know of bipeds, who claim to be higher in the scale of life, it may be presumed that *Metopidius* does not mind being hurt himself provided the "other fellow" is hurt still more.

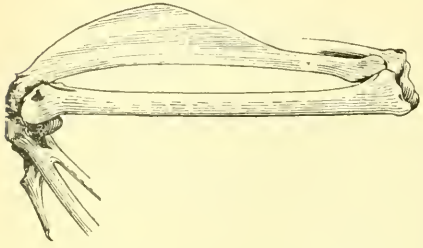

Fig. 6.

FOREARM OF AFRICAN JACANA, METOPIDIUS AFRICANUS.

Natural size.

Cat. No. 18785, U. S. N. M.

Largest and most formidable of all spur-winged birds are the Screamers (*Anhimidæ*), three species of birds related to the ducks, although they do not look it, and restricted to South America.*

These birds have two spurs, instead of one, upon the outer part of the wing (fig. 7), the outermost a short affair, the inner an ugly three-sided, stiletto-like blade, about an inch and a quarter long and almost as sharp as a needle. In fact, it is not unlike part of one of those large needles used by sail-makers known as roping needles, and it would seem quite capable of being driven completely through a man's hand by a stroke of the screamer's powerful wing. And yet we are told that the screamers are peaceable birds, associating amicably in large flocks, so that this array of spurs, like our modern ironclads, is strictly in the interest of peace.

*South America is particularly rich in anomalous birds, remnants or relics, one might say, of a bygone avifauna. The Hoactzin, *Opisthocomus cristatus*, forms an order by itself, and the three species of screamers, *Anhima anhima*, *Chauna chavaria* and *C. derbina* form another. So do the Tinamous (*Crypturi*), while the Trumpeter (*Psophia crepitans*), Cariama (*Cariama cristata*), and Guacharo Bird (*Steatornis caripensis*) each and all are isolated forms.

From spurs to claws is an easy transition, since the only difference between them is in their location, claws being at the ends of toes and fingers, while spurs are placed on or near the ankle and wrist. While the claws on a bird's wing, for claws as well as spurs are found there, serve no purpose as weapons and are seemingly of no use at all in old birds, they have a great deal of interest attached to them.

One who has had the good fortune to see the purple gallinule in its native swamps may have seen the little ones climbing out of their nest and scrambling over the branches very much like four-footed animals. Or, if not the purple gallinule, he may perhaps have seen the young of its humble relative, the Florida gallinule, pulling itself up some little incline by its wings, something as a bat hooks himself along.* If the

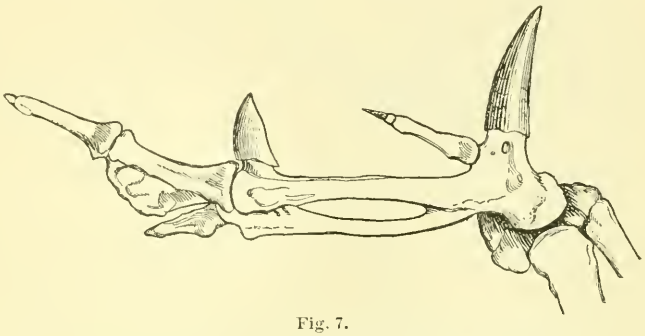

Fig. 7.

OUTER PORTION OF WING OF SCREAMER, ANHIMA ANHIMA.

Reduced.

observer has investigated he will have found on the outermost finger of the wing a small, sharp claw, and may have wondered what this claw was doing there.

This claw is of very common occurrence, and is especially frequent among water birds, or those which are lowest or most generalized in their structure. Sometimes this claw is so small as to almost escape detection, and again, as in the turkey buzzard, it may be so large that it can be found at once. Occasionally, very occasionally in fact, there is a second minute claw, or rudiment of a claw, hidden among the feathers at the very end of the wing bone, but this needs to be carefully looked for. Without a knowledge of fossil birds, it might be difficult to satisfactorily explain the presence of this useless claw, but if we regard rudimentary organs in existing forms as shadows of the past and vestiges of complete useful parts in extinct animals, the reason for its presence is clear, and we will look upon the little wing claws of modern birds as reminiscences of well-clawed ancestors. The earliest bird with which we are at present acquainted is the well known *Archæopteryx*, from the lithographic states of Solenhofen, Bavaria, and this form seems not only to have had wings for flight, but hands for climbing.

*Nuttall Bulletin, 1882, p. 124, and The Ibis, 1889, p. 577.

Unfortunately there is still some doubt as to the exact structure of the wing of *Archæopteryx*, and it seems probable that it is misrepresented in most text books.* One thing, however is undeniable, there were in this wing 3 well-formed, clawed fingers, and if only 2 of them were free, *Archæopteryx* could certainly climb about very readily.

It seems quite a transition from the long-tailed, toothed *Archæopteryx*, with its three clawed fingers, to the ordinary birds of to-day, the more that very few of the intermediate stages have been brought to light. Fortunately, however, there is a bird still living, and not uncommon, in parts of South America, which goes some distance toward bridging over the gap between gallinule and *Archæopteryx*. This bird, which on account of its many peculiarities, stands quite alone among modern birds, and is looked upon as the survivor of a great group of birds which has become extinct, is *Opisthocomus cristatus*. From the unpleasant odor of its flesh, acquired from its food of wild arum leaves, the bird is more commonly known as the stink bird, or stinking pheasant, while what Dr. Coues would term its "book" name is Hoactzin or Hoatzin.†

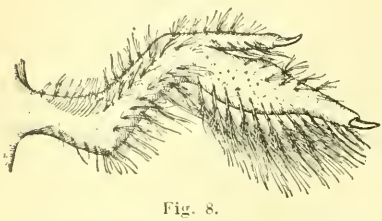

Fig. 8.

WING OF YOUNG HOACTZIN, OPISTHOCOMUS CRISTATUS.

Natural size.

Cat. No. 18523, U. S. N. M.

The adult birds not only have no claws upon their wings, but their thumbs, even, are so poorly developed that one would hardly suspect that in the nestlings we have the nearest approach to a quadruped found among existing birds. Mr. J. J. Quelch, who studied them in British Guiana,‡ tells us that soon after the hatching of the eggs the nestlings begin to crawl about by means of their wings and legs, the well-developed claws on the pollex and index being constantly in use for holding and hooking to the surrounding objects (fig. 8). If they are drawn from the nest by means of their legs, they hold on firmly to the twigs both with their bill and wings; and if the nest be upset by means of a rod pushed up from below, they hold on to all objects with which they come in contact by means of bill, feet, and wings, making considerable use of the bill, not only to reach objects above them, but also, with the help of the clawed wings, to raise themselves to a higher level. When the parent bird is driven from the nest, owing to the close approach of a boat, then the young birds, unless they be only quite recently hatched, crawl out of the nests on all fours, and rapidly try to hide in the thicker bush behind.

*Biological Theories, VII. The Digits in a Bird's Wing: A Study of the Origin and Multiplication of Errors, by C. Herbert Hurst, *Ph. D.* Natural Science, October, 1893, pp. 275–281. Also, The Wing of Archæopteryx. W. P. Pycraft, M. B. O. U. Natural Science, November and December, 1894, pp. 353–360, 437–448.

†Given to the bird by Buffon, who considered it to be the bird mentioned under that name by the Spanish writer Hernandez.

‡The Ibis for 1890, pp. 327–335.

YOUNG HOACTZINS.
Slightly reduced in size.
Cat. No. 18523, U. S. N. M.

One curious feature noticed with a nestling which had been upset into the river was its power of rapid swimming and diving when pursued. As soon as the hand was placed close to it, it rapidly dived into the dark water, in which it was impossible to see it, and would rise at distances of more than a yard away. Owing to this power, the little creature managed to evade all attempts to seize it, taking refuge eventually far under the bushy growth where it was impossible to pursue it. The prolonged immersion which a nestling will thus instinctively and voluntarily undergo, or which an adult bird will bear in an attempt to drown it, seems quite remarkable.

The nestlings, even when quite small, are frequently found far away from any nest, climbing by the help of their clawed wings, after the parent birds during their feeding time.

Not the least of the many interesting features of the Hoactzin is the rapid change which takes place in the fore limb during the growth of the bird by which the hand of the nestling with its well-developed, well-clawed fingers, becomes the clawless wing of the old bird with its abortive outer finger. It gives us, as it were, an epitome of the past history of birds, and as the events of a century are summed up in a page of history so the slow progress of birds from the Jurassic *Archæopteryx* to the thrush of to-day is represented by a few weeks in the life of the Hoactzin.