

During September we are visited by various birds of prey. Every autumn brings one or two Hawk Owls to perch upon the top of the flag-staff or wind-vane, while young Goshawks and Gyrfalcons circle about, frequently alighting for a short time upon the fence or any convenient post. More rarely, a Pigeon Hawk appears for a moment, only to vanish as quickly. Several times during the evening, I have surprised a Short-eared Owl perched upon the fence or hovering over the yard, probably attracted by the mice which gather about the buildings at this season. One fall, in October, a Great Horned Owl for several successive evenings converted the woodpile into a lookout station, but was careful to decamp before a gun could be brought into requisition.

As winter sets in a small party of Black-capped Titmice may appear for a day or two and, less often, the Hudsonian Titmouse may be seen. Both climb about the old log houses or examine the weed patches, all the while cheerily uttering their familiar *dee-dee-dee*, and, in the end hurrying off as though they had not a moment to spare. Then follows a long blank, broken only by a stray party of Redpolls from their winter quarters in the interior; or, as may happen, a Ptarmigan perches upon the roof of one of the buildings for a few moments, gazing with astonishment on the mixture of dogs and men below; then, probably remembering a pressing engagement elsewhere, it precipitately departs. Once a Ptarmigan, more philosophically inclined or more foolish than the average, came whirring along and dropped into the centre of the yard amidst forty or fifty Eskimo dogs. Several persons who saw the performance stated that, as the birds feet touched the ground, there was a wild rush of dogs, a few feathers floated upward, and the dogs walked innocently away casting back regretful glances to make sure the gods were not to provide another heaven-sent gift for their delectation.

ON THE FINGERS OF BIRDS.

BY J. A. JEFFRIES.

THE anterior limb or wing of birds is homologous with the anterior limb of reptiles, batrachians and mammals. Hence it is

but natural to compare it part for part with the limbs of these animals.

If we take an adult bird we find two ossicles at the distal end of the forearm; these are called the ulno-carpal and radio-carpal bones. Next we have a compound bone made up of shafts, representing as many metacarpals. These in turn are capped by finger points, of the formulas 1, 2, 1, (e. g., *Passeres*), 2, 3, 1 (e. g., Ducks), or 2, 2, 1 (e. g., Coot).

The two carpal bones have, as a rule, been simply referred to the first row; while those of the second were considered to be ankylos with the metacarpals. Whether the metacarpals are the I-III or the II-IV has been a mooted question, Rolleston, Huxley, and Gegenbaur holding the first view and Owen, Wyman, Morse, and Coues holding the second view.

The first study of the development of the carpus was made by Gegenbaur, who showed that the carpals were joined to the metacarpals, and that the three metacarpals were at first separate. Next Dr. Morse studied the carpus and tarsus of small birds in their normal condition. By this means he demonstrated the existence in the embryo of the radiale, ulnare, and 2d, 3d, and 4th carpals of his determination, also in some cases the intermedium (*Dendræca æstiva*), and the centrale (*Tyrannus carolinensis*).

About the same time Rosenberg studied the carpus of the chick in a systematic way, longitudinal and transverse sections being made of the wing in various stages of development. The result is that he has shown that the carpus is represented by the radiale, intermedio-ulnare, and two carpal bones supposed to be the 1st-2nd and 3rd-4th. Also that the metacarpus is represented by four long bones, the fourth one being on the ulnar side. These he considers to be the first four.*

Very good sections can be obtained by soaking the wing in a 2%-5% solution of chromic acid and then in alcohol of increasing density till 95% is reached. The wing thus treated should be imbedded in paraffine or some similar substance, then cut in the thinnest possible sections and mounted in balsam or a glycerine compound. It is not necessary to stain the object, though this is an advantage. A wing can be made perfectly transparent for

* I, however, find what seems to be a discrete 1st carpal in the Redstart; Morse has done the same of other birds.

gross examination by soaking in a solution of glycerine and ammonia carmine. By this means I have obtained specimens that have shown all the bones distinctly.

With this knowledge of the carpus and the light thrown by the new specimen of the *Archæopteryx* it would seem possible to decide the homologies of the fingers in the class of birds. The questions to be solved are: (1) Are the fingers homologous throughout the class? (2) Are they the I-IV or the II-V?

The only author known to me who considers that the fingers among living birds are not homologous is Dr. Coues. This distinguished ornithologist says (Key, p. 30): "The forefinger hand-bone sticks out a little from the side of the principal one, and bears on its end one finger-bone (sometimes two), which is commonly, but wrongly, called the bird's 'thumb'. For although on the extreme border of the hand, it is *homological* with the forefinger; birds have no thumb (exc. *Archæopteryx*, *Struthio*, *Rhea*); and no little finger." The mistake concerning the *Archæopteryx* was natural and is merely taken from Owen's memoir on the first fossil found. It has since, however, been shown that it had only three fingers. But why the Ostrich and Rhea should be included is hard to understand, since these have hand bones like all flying birds.*

Among the birds with undeveloped hands the "index" finger is the most constant, those on either side aborting before this. The genus *Dromæus* is a good example of this.

When the hand is developed it is of precisely the same form in all birds.

On the second question, which is virtually whether the first finger of birds is the first of the series or the second, much has been written; all, however, with the idea that two were lost.

Owen, Coues, and Morse have at separate times held that birds have no thumb, while Nitzsch, Meckel, Huxley, Gegenbaur and Rosenberg claim that birds have a thumb.

The arguments used against the existence of the thumb are as follows: (1) The first fossil remains of *Archæopteryx longicauda* show the remains of a detached finger, which Owen supposed to be a first digit placed on the radial side of the "thumb." Of this, however, he expresses some doubt.† (2) In Todd's

* See Selenka, Bronn's Thier-Reichs, Vögel, p. 75; D'Alton, Die Skelete d. Straussartigen Vögel, p. 17; Owen, Anat. of the Vertebrates, Vol. II., p. 73.

† Owen, "On the *Archæopteryx*." Phil. Trans., 1864, Vol. CLIII.

Cyclopedia Owen cites Nitzsch as authority when stating that the claws at the radial side of the wing are supported by phalanges. (3) The argument from analogy to the foot is brought forward in the following words by Morse: "If we compare the leg and wing of *Spizella* we shall see that in this early stage there are but three metatarsals and three metacarpals, and it seems reasonable to compare them together.

"As the first toe appears much later and is reduced to two phalanges, and has its two metatarsals also greatly reduced, and as at the stage just cited the first toe is represented only by a few granules, it seems natural to infer that in the wing the first finger never makes its appearance." Again Morse refers to the law of the reduction of digits. According to this law first the first and then the fifth digits are lost.

If we examine these arguments it will be found that they can not now be held. First, the last remains of an *Archæopteryx* described by Vogt show no traces of the supposed thumb of Owen, though the specimen was very much better than Owen's. The second argument, like the first, is without ground, and is not mentioned in Owen's Anatomy. The spurs found on the radial edge of the wings of certain birds are just like those found on the tarsus of the cock and others of the same order. The bone within, if any, is a special development for support. These spurs are not to be confounded with the claws developed on the last phalanges of the first and second fingers of many birds.

In following the analogy of the hand to the foot among birds we must not forget the great diversity in their formations. Again, if we force the analogy at all, it becomes an argument in favor of the existence of I digit. In the hand we have four metacarpals developed, in the foot we have four, or more probably five; the last, however, very rudimentary (a mere spot), even in the embryo. Thus it seems more natural to omit the development of the little finger than the thumb.

In considering the law of progressive reduction it must be borne in mind that this is the law as worked out among walking limbs, principally mammalian. Hence, with our present knowledge of the action of physical forces on life, it is a doubtful question whether the same laws would hold true for an organ used for such an utterly different purpose as the wing of a bird. In a walking limb the objects to be gained are: (1) The strongest

possible means of support down its long axis, i. e., a post. (2) Ease of flexion combined with rigidity when extended. This problem has been successfully worked out by the horse and other Ruminants. In the wing of a bird the object is very different; here no direct support is required but the power to resist a force applied along the whole of the hæmal surface. With this is combined the requisite that the wing should close in such a way as to oppose little resistance to the air in the advance of a bird through it.

Again this law is an absolute failure when applied to the leg of a bird, since the little toe is aborted but not the thumb. It may not be out of place here to mention the greater tendency of the radial side to produce digits, as shown by the extra toes in dogs, cats and hens. On the other hand the anatomists who consider the first digit of a bird to be the first of the series have not brought forward any particular argument, but have taken it to be a matter of course. Yet there are facts that seem to point this way. (1) There are no signs of any metacarpals developed radial of the "thumb." This, of course, is of value only in so far as it seems to imply that there never was any. (2) If we study the myology of the hand we find several long muscles to the I and II fingers. These are the extensor metacarpi radialis longus, * and extensor carpi radialis to the first metacarpal, the extensor pollicis longus and the extensor indicis proprius. The last two muscles are so named from their similarity to these muscles in man. At all events, long, separate muscles to the digits are characteristic of the I, II, and V digits. Thus finding them in birds seems to imply that the first and second fingers are the I, II of the series.

Very marked characteristics of a bird's arm are that the flexor muscles are numerous, the pronators and supinators performing this function, and that all the long finger muscles are brought up to the radial sides of the fingers so as to act as adductors. This means a strong application of force to the radial side of the wing, hence correspondingly strong bones. Now, unless the thumb was lost before the modifications for flight were brought about, this application of force to the radial side points to the development of the thumb and index.

* Rödingen considers this to be a muscle of the thumb, not the carpus. Nat. Verhand. v. d. Hollandsche Maatschappij d. Wetenschappen te Haarlem. II. Verzameling, 25 deel, 1868.

The only other parts, of any constancy, in the limbs besides the bones and muscles are the nerves. And here again we find facts that point towards the existence of the thumb. In man and some mammals the I, II and radial side of the III fingers are supplied by the radial nerve while the ulnal supplies the rest. This also is the case in birds, a small branch from the ulnal running down the posterior face of the pinion to the III finger.

Thus, since the arguments drawn from the *Archæopteryx* must be discarded, none remain to prove the non-existence of the thumb. On the other hand, all the facts of myology point to its existence, while the nerves, though not so constant, point the same way. Analogy to the foot also points this way, there being two joints in the thumb and three in the index; the same number that are the rule in the foot for the first and second toes. Also where there are two and three joints respectively in the finger there are often claws on the end, thus pointing to unguis phalanges.

So it seems safe to say that the structural evidence of the forearm and hand points to the existence of the I, II, III, and IV fingers in the class of birds.

NOTES ON A FEW BIRDS OBSERVED AT FORT HAMILTON, LONG ISLAND, N. Y.

BY DE L. BERRIER.

ABOUT the 20th of September, 1877, great numbers of the Red-headed Woodpecker (*Melanerpes erythrocephalus*), made their appearance about Fort Hamilton. They outnumbered the "High-holes," usually so common at that time of the year, and attracted the attention of the local gunners. Up to this time I had looked upon the Red-head as a scarce bird with us, having seen it only a few times before. As long ago as 1844, Giraud noticed that this bird had become much less abundant in the Eastern States than formerly. Dr. Coues, in "Birds of the North West," says it is now rare in New England. The conclusion is that either the bird is becoming extirpated in these regions, or else it is taking the advice