

THE TAXONOMIC VALUE OF THE TONGUE IN BIRDS.

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A RECENT paper of mine on the tongues of Woodpeckers concluded with the statement that "altogether the evidence favors the view that (external) modifications of the tongue are directly related to the character of the food, and are not of value for classification." Dr. Allen, in noticing this paper in 'The Auk' for October, 1895, says: "Granting that the facts are as stated, we are reluctant to agree with Mr. Lucas's conclusions, for on the same grounds we should have to rule out of the list of taxonomic characters any structural feature adaptively modified to special modes of life, and these involve, in a more or less marked degree, every part of the organism."

In writing thus, Dr. Allen has drawn attention to what is perhaps the greatest of the many difficulties which beset the ambitious taxonomist who would venture upon the classification of birds, since, as Dr. Allen says, every part of a bird's organism, whether external or internal, bears marks of modification for some purpose.

Consequently it is practically impossible to use in classification those characters alone which are due to morphological variations, but it is a truism that those characters which rest on a good morphologic basis should have precedence over those which are solely due to adaptation to some particular purpose. Now it is by no means easy to certainly discriminate between these two things for a physiological adaptation may be of such long standing as to have taken on the guise of structural modification. Thus the absence of a keel to the sternum, the openness of the angle formed by the scapula and coracoid, and the fusion of these last two bones are all secondary characters, and yet they have been accorded a high, if not the highest, rank in classification.

To illustrate the extent to which adaptive features may obscure the relationships of a bird, it may be worth while, for the benefit of the younger readers of 'The Auk,' to recall that on the evidence of the tibia Owen put *Cnemidornis* with the Moas, while Parker, guided by the sternum, assigned it a place near the Rails. Each of these eminent anatomists was led astray by purely adaptive

characters, the development of the legs of this great goose being due to its terrestrial habits, while the abandonment of flight had led to the degeneration of the shoulder girdle and the consequent cutting away and smoothing down of its various prominences, causing an appearance of relationship where none existed.

If habit can thus influence the deeper and more substantial parts of the body, it is only natural to expect that more superficial, softer structures would yield still more readily to external influences and adapt themselves to the requirements of daily life. Among such parts is the tongue, which in the majority of birds is so intimately concerned either in the getting of food or in its subsequent manipulation. Just here it will perhaps be best, in sporting parlance, 'to hedge' a little and to say that I have made only a beginning, and a small one at that, in the study of the tongue of birds, and that I am quite ready to retract my statements in the face of better evidence. At the same time the testimony so far is so completely on one side that it does not seem probable that evidence in rebuttal will be forthcoming. Let it be recalled, too, that it was the *external* modifications of the tongue which were considered to be due to adaptations to food or feeding. As for the hyoid, its modifications, slight though they are, appear to be partly adaptive and partly morphological. For example, while the tongues of Woodpeckers vary immensely in length, and in the extent and character of their barbs and horny papillæ, their underlying hyoids agree in the fusion of the cerato-hyals, the complete absence of a basi-branchial, and the fact that the basi-hyal does not extend to the cerato-branchials¹ which abut squarely upon it. This last might appear a good morphological character were it not apparent that this mode of attaching the cerato-branchials to the basi-hyal is the best possible in a tongue which is used as a spear or probe. And yet we find the same condition in the short tongue of the Rhea, and it is hard to see the adaptation in this case. Also there are many birds, obviously not closely related, whose hyoids are similar, so that we are forced to the conclusion that the value of the hyoid for classification is not very great, and that it must be used with caution.

¹ "These be hard words, my masters," but unavoidable.

Coming finally to the tongue¹ we would expect, if my conclusion were correct, to find a pretty constant relation between the shape of the tongue and the nature of the food, to find the same general style of tongue in birds belonging to different groups but eating the same kind of food, and, conversely, to find that birds undeniably closely related might have quite different tongues.

The simplest tongues are naturally found in those birds which use them least. In the big-throated Pelicans and Cormorants which bolt their food whole, they are rudimentary, while in fish-eating or flesh-eating birds, they are quite simple. The various groups of Ducks which differ as to their diet possess corresponding differences in the pattern of their tongues. The Canada Goose has a rather simple, flattened tongue, slightly barbed along the edge, while the fish-eating Red-breasted Merganser has the serrations on its slender beak matched by a series of sharp, reverted, horny barbs on the slender tongue, whose obvious purpose is to help in holding and swallowing slippery prey. The Teal and other species of more varied diet, which eat a multiplicity of little things, such as seeds, snails and worms, have a thick, fleshy tongue with several series of slender projections of various degrees of fineness, serving the double purpose of a rake and a sieve. The Honey-eaters have tubular and truly suctorial tongues, formed by the upturning of the edges until they lap, being so closely pressed together that it is a difficult matter to part them. The Meliphagidæ, the Drepanididæ and members of the genus *Cæreba* (formerly *Certhiola*) have a brushy tongue which probably serves to collect pollen, nectar and small insects from the bottom of flowers, and the flower-frequenting Parrots of the genus *Trichoglossus* also have a brushy tongue. In the Ducks then we have a variation in the tongue keeping pace with a variation in the bill of fare, while in the brush-tongued birds just noted we have a similarity of tongue correlated with similarity of food or method of obtaining it. A still better instance of similarity of tongues in widely separated birds, and one in which

¹I would like here to express my indebtedness to my friend, Mr. William Palmer, for his kindness in supplying me not only with much material, but information on many points regarding the food and habits of birds.

there seems to be no call for any special adaptation, is that shown by the Swifts and Swallows. Structurally these birds are very dissimilar¹; the pterylosis, skeleton, muscles and digestive tract of each group has its own distinctive features, and yet their tongues are almost identical, as a glance at the figures (p. 114), where the tongues speak for themselves, will show. More than this, the only Trogon's tongue I have examined is also much like that of the Swallows,² and those of *Sayornis* and *Ampelis* are not far removed, so that were birds classified by their tongues all these would be placed near one another. Surely the similarity of all these can scarcely be due to kinship.

On the other hand, the species of the genus *Melospiza* exhibit very considerable differences in their tongues, that of Lincoln's Sparrow being perfectly plain and that of the Song Sparrow the most elaborately fimbriated I have yet met with among thick-tongued birds. The tongue of the Swamp Sparrow is intermediate between the two, though most resembling that of the Song Sparrow. Two specimens of *Melospiza georgiana* are shown, the simpler being from a fresh specimen with a much worn tongue, the other from an alcoholic with a very perfect tongue, and the difference between them is striking, though probably entirely due to wear. I hardly venture the suggestion that the covering of the tongue is regularly moulted, although such may be the case, but it is certainly subject to great changes caused by use. The Woodpeckers have been treated at some length elsewhere, and it is only necessary to repeat that among them the relation between food and tongue seems obvious.

¹ I do not know whether or not Dr. Sharpe is quite serious when he expresses a wish that some competent anatomist would point out the differences between the Swifts and Swallows, but although I might hesitate to call myself a "competent anatomist," I can readily point out these differences, and would do so most willingly.

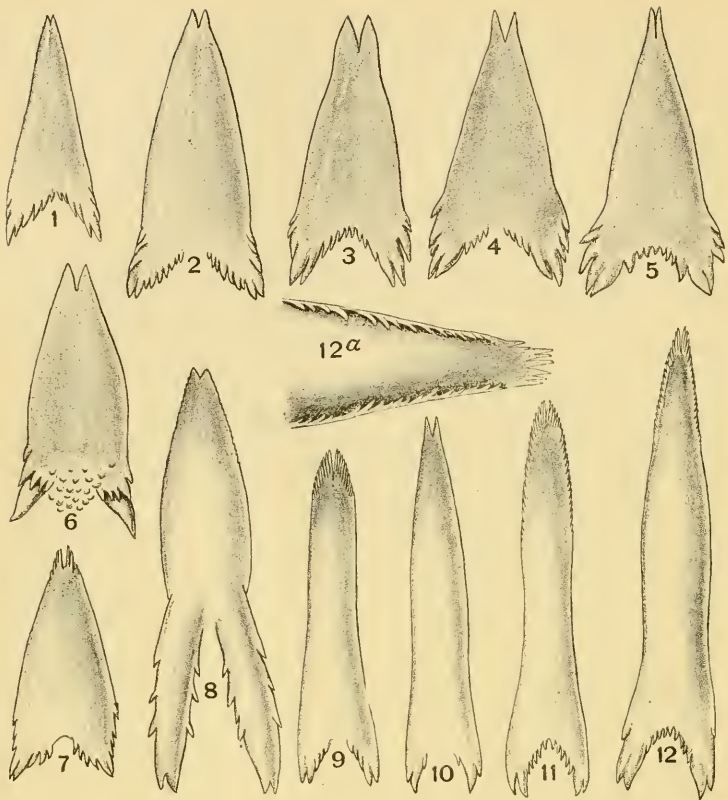
² It would be unfair not to point out that there is a decided difference between the tongue of *Priotelus* and that of the others figured. What may be called the primary lateral barbs of *Priotelus* are single, while in the other birds they are double; moreover, in *Priotelus* the primary barbs are overlaid by a second series of smaller barbs, while in the Swifts and Swallows all barbs start from the same level.

All Hummingbirds examined by me, or those whose tongues have been described by others, have identically the same style of tongue, and the members of this wonderfully homogeneous group, so far as I am aware, feed on the same kind of food and take it in the same manner. If any Hummingbird is known to depart widely from his brethren in the character of his food or method of taking it, I venture to say that his tongue will also be found to have some peculiarity.

The facts herein noted are few in number and our knowledge of the tongues and food of birds is far from complete, but, to sum up, what conclusions do we seem justified in drawing from the evidence so far advanced?

If we were to be guided by the tongues as they are found in our North American Woodpeckers, we might say that while they are clearly modified according to food or habits, yet they have a certain taxonomic value, since, in spite of their varied adaptations, it is still possible to recognize each and every one as the tongue of a Woodpecker. If, on the other hand, we based our conclusions on the Swifts and Swallows we would be justified in saying that the tongue is of no value since birds belonging to totally different orders may have precisely the same kind of tongue. Noting the differences that exist between the tongues of *Spinus tristis*, *Passer domesticus*, *Loxia*, *Habia*, and *Melospiza*, we would be forced to conclude that the tongue gives no hint even of family affinities, while a study of *Melospiza* would cast doubts even on its generic value.

But if we find that differences in the tongues of closely related birds are correlated with differences of food, and that birds widely separated by structure, but of similar habits, have similar tongues, and if we find that many tongues of peculiar form seem to bear a direct relation to the nature of the food, I think we are warranted in concluding that the evidence favors the view that modifications of the tongue are directly related to the character of the food and are not of value for classification.



EXPLANATION OF FIGURES.

1. *Macropteryx coronata*.
2. *Collocalia* sp.
3. *Tachycineta bicolor*.
4. *Tachornis gracilis*.
5. *Hirundo puella*.
6. *Priotelus tenuirus*.
7. *Ampelis cedrorum*.

8. *Passer domesticus*.
9. *Melospiza georgiana*.
10. *Melospiza lincolni*.
11. *Melospiza georgiana*.
12. *Melospiza fasciata*.
- 12 a. *Melospiza fasciata*. Tip of tongue much enlarged.

These figures have been drawn with the camera lucida, all being enlarged to about the same absolute size to facilitate comparison.

[Reference having been made by Mr. Lucas to some remarks of mine on the subject here under discussion, I trust he will pardon me for adding a few words to his excellent paper on the taxonomic value of birds'