

GENERAL NOTES

Leg-muscle formulae and systematics.—Nearly 90 years have passed since Alfred H. Garrod described differences in the thigh muscles which he thought would aid in determining the relationships among birds. His muscle formulae have become an integral part of the technical diagnoses of the families and orders of birds. Garrod's contribution in this regard was, indeed, a most significant one, but Hudson (1937. *Amer. Midl. Nat.*, 18:1-108) demonstrated over 20 years ago that Garrod's formulae may be misleading because they often do not report adequately the similarities or dissimilarities in the thigh musculature, that is, the formulae are incomplete. Nevertheless, many contemporary writers continue to use Beddard's (1898) *The Structure and Classification of Birds* (or equally outdated references) as their source for myological data in order to support a thesis or to enlarge a technical diagnosis. In certain instances the addition of such formulae is merely padding; it has no real significance.

The opportunities for further work on avian myology are unlimited. For example, in addition to all of the genera that have never been studied at all, we need to have data on the complete appendicular myology of most of the genera that were studied in the past, in order that we may know more about the similarities and dissimilarities in their myology, including especially the muscles that Hudson proposed be added to the leg-muscle formulae.

I believe that muscle formulae can continue to be a useful part of the technical diagnosis *but only if the formulae are enlarged*. Hudson's excellent suggestions for expanding Garrod's original formulae were based on a study of representatives of North American bird families. If we think in terms of world birds, however, I believe that the addition of several other muscles would make the formulae even more meaningful. I would like to emphasize, however, that a muscle formula is only a substitute for knowing the complete appendicular myology. Perhaps the chief value in expanding the formulae is to call attention to those muscles that seem to exhibit the greatest variability among birds, and thereby to insure that authors will comment specifically on the presence or absence of those muscles when describing the anatomy of a given genus or species. When the author of an anatomical paper does not mention a particular muscle, one cannot be sure whether the muscle is absent or whether the author did not feel that it was important to refer to the muscle, simply because it is not one of the formulae muscles.

I have discussed *M. iliacus* at some length in a paper still to be published. I propose that *M. iliacus* be added to muscle formulae and that the presence of the muscle be indicated by adding "E" to the formula. I propose, further, that two other muscles be added. *M. plantaris* ("F") is absent in the Accipitridae, Pteroclididae, Psittacidae, Strigidae, Apodidae, and Bucerotidae. *M. popliteus* ("G") is absent in the Psittacidae, Apodidae, *Aceros undulatus*, Picidae, and in all passerine birds thus far studied. So little has been published on the total myology of the pelvic appendage, however, that it hardly seems necessary to say that we have no idea whether or not these two muscles are absent in all members of the Apodidae, for example, or in how many additional families or genera the muscles may be absent.

Mitchell (1913. *Proc. Zool. Soc. London*: 1039-1072) described *M. peroneus longus* and *M. peroneus brevis* in representatives of many families of birds. Either muscle may be absent in some birds. Hudson did not feel that it would be worthwhile to add these muscles to the formulae, and I agree with him, but probably for different reasons. There are several other muscles about which so little is known that we have no way of predicting whether or not it would be advantageous to add them to the formulae. For example, *M. flexor hallucis brevis* is absent in *Gavia*, *Uria*, and in some, but not all, passerines. *M.*

extensor hallucis longus is absent in *Gavia*, *Podiceps*, and *Uria*. *M. extensor proprius digiti III* is absent in such distantly related birds as *Fregata*, *Grus*, *Tyrannus*, *Corvus*, and *Sturnus*. *M. adductor digiti II* is absent in *Pediocetes*, some cuckoos, *Colaptes*, *Dendrocopos*, *Tyrannus*, *Paradisaea*, *Corvus*, *Fregilupus*, *Sturnus*, *Aplonis*, *Artamella*, *Vireo*, *Junco*, etc. Is *M. extensor brevis digiti IV* absent in all woodpeckers and passerines?

The full muscle formula as found in a galliform bird, for example, would be ABCDEFGXYAmV. We may tabulate these as follows:

Code Letter	Name of Muscle
A	Piriformis, pars caudofemoralis (= femorocaudal)
B	Piriformis, pars iliofemoralis (= accessory femorocaudal)
C	Iliotrochantericus medius
D	Gluteus medius et minimus (= "piriformis" of Fisher)
E	Iliacus (= "psoas" of Fisher) ¹
F	Plantaris
G	Popliteus
X	Semitendinosus (= "flexor cruris lateralis" of Fisher)
Y	Accessorius semitendinosi
Am	Ambiens
V	Vinculum between the tendons of Mm. flexor perforatus digiti III and flexor perforans et perforatus digiti III ²

¹ *M. iliacus* of Fisher equals *M. iliotrochantericus anterior* of Hudson and Berger.

² It should be noted that the vinculum mentioned by Garrod, Forbes, Beddard, and Gadow usually pertains to the band that connects the tendons of Mm. flexor hallucis longus and flexor digitorum longus and which is found in most non-passerine birds. The vinculum of the formula above is far more variable among birds.

When the information above is available for all families of birds, we shall have a much better understanding of the significance of muscle formulae in determining the relationships among birds. I grant that this is a sizable list of symbols, and that the skeptic might counter with the statement that anatomists soon will propose that the entire alphabet be used in muscle formulae. However, I submit that systematists might better ignore muscle formulae entirely than to continue to use only Garrod's abbreviated formulae of AXYAm and ABXYAm.—ANDREW J. BERGER, *University of Michigan Medical School, Ann Arbor, Michigan, November 8, 1958.*

Tufted Titmouse feeding on a shrew.—On February 20, 1958, in the backyard of my parents' home in Van Buren County, Michigan, I watched a Tufted Titmouse (*Parus bicolor*) eating bits of flesh which it picked from a Masked Shrew (*Sorex cinereus*) during a heavy snowfall. The bird had lodged the little mammal in a forked branch of a small shrub just above the ground and was holding it there by one foot while clinging to the branch with the other. As I approached to a distance of about 10 feet the bird flew to a nearby apple tree with the shrew in its bill and continued feeding. I was not able to determine whether the titmouse had captured the mammal alive or found it dead.

An examination of pertinent literature failed to disclose any mention of this species including small mammals as part of its diet. Perhaps the greater than average snowfall had created a decline in the availability of the regular food supply and caused the bird to turn to such an unusual meal.—RICHARD C. FLEMING, 136 E. Battle Creek Street, Galesburg, Michigan, May 15, 1958.