Mechanics of feeding in the Mallard (*Anas platyrhynchos* L.; Aves, Anseriformes).—G. A. Zweers, A. F. C. Gerritsen, and P. J. van Kranenburg-Voogd. 1977. Contributions to Vertebrate Evolution, vol. 3. vii + 109 pp., 20 figures. Paper $19.75.—For many years, primarily since the 1920's and 1930's, avian morphology has progressively become less descriptive and more functional in its approach. Emphasis has shifted from asking what structure is present and the form it may take to discovering how that structure works. An attempt to construct a general historical overview of this change might recognize three main phases. First, there was an extension of the older descriptive work in which function was inferred from gross structure. In bone-muscle systems this procedure focused on the origins and insertions of muscles and the general configuration of joints. Statements were expressed in terms of the probable role that individual muscles played in moving bones from one position to another. This "phase" has continued up to the present and many published papers, Ph.D. theses, and the like have adopted this approach, although this type of analysis has lost its significance in the eyes of most functional morphologists.

The second "phase," although present in some early papers, is basically a child of the 1960's. Investigators began to incorporate evidence from physiological studies in their analyses. The latter were not themselves physiological in approach; instead, muscles were analysed in more detail, their fiber architecture was noted, as was relative muscle weight and in some cases their fiber types, and then these data were interpreted using known (or surmised) physiological information to yield more precise functional statements about the movements of bone-muscle systems. This second phase allowed for a sense of increased understanding of these systems since one could now make inferences about relative muscle force, speed of contraction, length of shortening or stretching, and perhaps some statement about fatiguability. Yet the specimens being observed were quite dead, sometimes for years, and thus functional inferences remained conjectural.

Finally, a third phase has begun to develop in the 1970's. It has now become fashionable within vertebrate functional morphology to perform physiological experiments on living organisms in order to discover what "really" is happening: inference, some workers would have us believe, has been virtually eliminated. Clearly, the third phase represents an advance in our knowledge and does not merely serve only as a showcase for elegant experimentation. Within avian functional morphology—excluding much fine work by physiologists themselves—this approach is uncommon, especially as it is applied to bone-muscle systems. Unquestionably, the finest work of its kind—perhaps in all the vertebrate literature—has been performed recently by G. A. Zweers and his colleagues in Leiden.

Two studies have been published, both on the Mallard. The first (1974. Structure, movement, and myography of the feeding apparatus of the Mallard (*Anas platyrhynchos* L.). Netherlands J. Zool. 24: 323–467) was concerned primarily with a functional analysis of the jaw and tongue apparatus. The second, under review here, was a follow-up study and details the role of the beak and tongue during feeding. In order to convey fully the importance of these studies it is necessary to consider both of them in this review.

The first study included detailed descriptions of the osteology, the important joints of the kinetic mechanism, ligaments, jaw musculature, and the tongue apparatus (osteology, extrinsic and intrinsic musculature). These descriptive sections were followed by a discussion of the jaw movements using cinematography (64 frames per second). Finally, the most important portion of the study treated the functional analysis of the muscles during drinking and straining fine-grained food in water using electromyographic analysis. The latter was accomplished with the placement of fine wire electrodes surgically implanted in the muscles and the resultant signals synchronized with the concurrent cinematography.

The subsequent analysis of the experimental results is extremely complex and probably will be of interest only to the specialist—indeed, it could only be understood by a specialist, maybe. This is, perhaps, the major shortcoming of the study. It would have been extremely helpful if the analysis had been simplified or at least summarized in an understandable manner. As it is, a reader must wade through pages of complicated data and graphs—one simply drowns in detail. But, in fairness, the feeding mechanism is so intricate, it may have been impossible for Zweers to accomplish this simplification, particularly given the detail level his view was focused at. And here also lies one of the important aspects of the study: the feeding mechanism is demonstrated to be much more complex than previous analyses would seem to suggest.

In the second study with Gerritsen and van Kranenburg-Voogd, attention is directed toward the beak and tongue. Included are histological descriptions, a summary of the relevant bones, ligaments, and muscles, and their functional analysis during straining of food using cinematography, cineradiography, and electromyography. The analyses are accomplished by the development of causal models for lingual movements and the transportation of food and water. The models themselves encompass the suction-

pressure pump mechanism of food and water uptake, expulsion of water, filtering of food, and the transport and swallowing of food. As with the previously described paper, this study will probably be of limited value to the nonspecialist. Both, however, should be required reading for anyone interested in vertebrate feeding mechanisms.

To my knowledge these two studies, taken as a whole, represent the finest and most complete analysis of the feeding mechanism of any vertebrate. This includes the most extensively studied species, you and me. It will, of course, be unrealistic to expect many future studies to come close to the level of detail presented in these papers; after all, it took years to produce these results. If such studies are repeated for other species, and they should be, workers will have to address more fundamental problems. What are the purposes of such studies, other than trying to understand how the feeding mechanism of a particular species works? What are the broader questions being investigated? How do these individual, detailed studies relate to answering these broader questions? The investigations of Zweers focus on the narrow and by design do not attempt to deal with broader questions: this was not their purpose. These papers, in a real sense, stand as a monument to experimental functional morphology, and they represent its strengths, but also its weaknesses. This is not to negate the importance of this work. Indeed, congratulations are insufficient: Zweers and his colleagues deserve our respect and admiration for one of the finest studies in all of avian biology.—JOEL CRACRAFT.

OBITUARIES

ELIZABETH SCHLING AUSTIN (23 January 1907–23 May 1977) began her ornithological career both early and late. "Sliver" (an alliterative nickname from her childhood) would give you an argument if you tried to call her an ornithologist; she insisted that she was an ornithologist's *wife*. So in one way, she began her career at the age of 7, when she first met young Oliver L. Austin, Jr. at dancing school. She and Oliver were married some years later—in 1930—while he was a graduate student at Harvard University. For many years after that she devoted her life to her family: making ends meet during the Depression; moving from place to place with Oliver as he began his professional career; bearing two sons, Anthony and Timothy; becoming a wartime Navy wife. After the Japanese surrender, she and the boys joined Oliver in Tokyo where he was serving on General MacArthur's personal staff as a wildlife consultant.

It was not until her children were raised, and particularly after she and Oliver settled in Florida in 1957, that Elizabeth became seriously interested in birds. She had shown early promise as a writer while a student at Saint Elizabeth Academy, Convent Station, New Jersey. Although she had no formal education in ornithology, informal training in the subject came from the many years with her husband. Her writings on birds were always thoroughly discussed with, and read by, Oliver before they were sent for publication, but Sliver did her own work. She was a tireless reader and a skilled library researcher—persistent until she was satisfied that she had ferreted out the last bit of information on a particular subject.

In 1960 she was appointed a Research Associate of the Florida State Museum, a post she held until 1973 when she and Oliver both retired. From 1960 to 1965 she wrote a weekly newspaper column, "Wild Adventure," for the Florida Times Union in Jacksonville. Her main contribution to scholarly ornithology, "Frank M. Chapman in Florida: His Letters and Journals," appeared in 1967. This was followed by several children's books, for which she had a special talent: "Penguins, the Birds with Flippers" (1968), "Birds that Stopped Flying" (1969), and "The Random House Book of Birds" (1970). The latter included Oliver as co-author, but Elizabeth did virtually all the writing. She also contributed the bird articles for "The Golden Book Encyclopedia of Natural Science" (1962).

Born in New York City, Elizabeth was a member of a socially prominent family and raised in an intellectually stimulating environment. Her father was the renowned horticulturist and florist Max Schling, a good friend of botanist Liberty Hyde Bailey. She also spent much time in Europe as a child and was fluent in German. Elizabeth was strongly instilled with an appreciation for excellence and a sense of what was right. She insisted on these in herself, and expected them in others—hence the penetrating and often rapier-like quality of her many reviews in Bird-Banding and The Auk, for which she was well known among ornithologists. Less known were her anonymous and pungent contributions to The Auklet.

Of the several awards and honors received in her lifetime, Sliver perhaps was proudest of her election to the class of Elective Member of the AOU in 1972. This was followed in 1973 by the joint award, with