

Introduction to the Symposium: Experimental Approaches to the Analysis of Form and Function¹

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The science of comparative morphology can trace its origins to the era of descriptive morphology in biology that began several centuries ago. Descriptive approaches remain indispensable weapons in the arsenal of the present-day morphologist, but experimental approaches have come to play an increasingly important role, offering a means of answering fundamental questions concerning the relation between form and function that are insoluble by description alone (Homberger, 1988; Müller *et al.*, 1989). Indeed, while a number of factors can be offered as contributing to the current "renaissance" in comparative morphology (Gans, 1985; Liem and Wake, 1985; Wake, 1982), certainly among the most important is the increasing use of experimental approaches—brought about by both conceptual and technical advances—done in the context of explicit functional or evolutionary hypotheses. This symposium was designed to both highlight and evaluate the role that experimental approaches have in modern analyses of comparative morphology.

The eleven papers represent four broad, active disciplines that are making important contributions to our knowledge of form-function relations: developmental morphology (Müller, Burke, Jacobson), functional morphology (Carrier, Swartz, Welsford *et al.*), ecological morphology (Wainwright, James), and evolutionary morphology (Emlet, Block, Lombard).

Authors were asked to evaluate the utility of the experimental approach by illustrating both the kinds of insights that can be gained from it, as well as the limitations. Most chose to do this in the context of a discussion of their own research; in a few instances, a broader treatment was presented. We deliberately have used a broad working definition of the term experimental, to include the variety of manipulative and analytical techniques now available to study morphology, which contrast with the traditional principal approach of anatomical observation and description. Though the role of experimentation is a central topic that unites these proceedings, we emphasize that the primary aim is not simply to promote one or a few specific experimental procedures or techniques. Rather, it is to underscore how a variety of experimental methods may be applied to the analysis of fundamental questions in comparative morphology.

There are three recurring themes in the papers. First is the reciprocal illumination afforded by a combined approach involving both description and experiment. Controlled manipulation may be required to reliably distinguish among alternative hypotheses, but the hypotheses themselves typically emerge from careful observation and description. Experimental results in turn often pinpoint features that require more accurate description or they identify appropriate comparisons to be made. Second, analyses prove most fruitful when the investigation is problem-driven. In other words, fundamental questions should dictate the experimental approach or technique used, not vice versa. There is a tremendous temptation to do otherwise in this age of rapid and abundant technological advance, too

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often resulting in data in great quantity but of little relevance. Third, an integrated approach, combining data from different levels of the biological hierarchy, may provide novel and fundamental insights into longstanding problems in the evolution of, and relation between, form and function.

Despite their obvious benefits, experimental approaches are still not routinely incorporated into morphological studies. By highlighting some of these benefits, we hope to promote more widespread use of these types of approaches in the future.

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