aspect of the topic of malnutrition, and it is the portion of greater value. At this point, the work becomes a handbook for action through its discussion of nutrient requirements and of the assessment of nutritional status, a description of nutrition programs and services, and a discussion of the determinants of food habits.

The authors have attempted to gain recognition for the breadth of the problem of malnutrition, and in doing so have directed attention to several questions which they state thus: "What are the manifestations of malnutrition, what is the setting? What is normal nutrition and what nutrients does the body require to maintain health? How do we know if adequate nutrition has been achieved? How do we promote better nutrition and relieve existing malnutrition?" A mere casual reading of these volumes will not be sufficient to discern whether or not the goals have been achieved. The authors have avoided following a systematic approach to the study of individual nutritional diseases, in order to further illustrate interrelationships. The casual reader may not grasp this purpose, either.

FREDRICK J. STARE
JELIA C. WITSCHI
Department of Nutrition,
Harvard School of Public Health,
Boston, Massachusetts

Animal Biosystematics

Evolution in the Genus Bufo. W. FRANK BLAIR, Ed. University of Texas Press, Austin, 1972. viii, 460 pp. + plates. $17.50.

To many people toads (genus *Bufo*) are grotesque or ugly creatures of the night that bespeak witches, hobgoblins, black cats, and the imperfect dark side of man, especially revealed in warts. To Shakespeare they were nocturnal creatures of wonder, containing in their heads a jewel, which scientists identify as eyes reflecting back light from lantern or flashlight at night, but which in medieval symbolism represented the hidden beauty of life visible to those who see beyond appearances through the ugliness of day-to-day "reality." In this book, the last theme reappears as the editor and contributors regard the genus as an evolutionary treasure to be mined for new insights into life processes.

The book itself is based upon an intensive though somewhat uneven analysis of the biological characteristics, distribution, relationship, and probable evolutionary history of toads. The work is a major effort to bring together the diverse approaches of morphology, karyology, comparative biochemistry, bioacoustics, experimental hybridization studies, and biogeography to elucidate the evolution of a speciose and complex biological group. Although this approach, especially correlating karyology and hybridization experiments with morphologic data, has become almost standard practice in studies of higher plants (the "biosystematics" of most authors), *Evolution in the Genus Bufo* represents the first major attempt at a biosystematic analysis of a genus of vertebrates, if not the first for any animal group. The book is the culmination of 15 years of effort by Blair, who provided the initial impetus and the leadership for the study, who combed the world for living materials, and who assembled a battery of students and colleagues to work on the project. Blair's previous achievements include the virtual invention, in the early 1950's, of discriminant sonographic analysis of the breeding calls of frogs and toads as a basic technique for study of their systematic, ecologic, and evolutionary relationships and the use of refined experimental hybridization techniques, once used only by a few experimental embryologists, for genetic evaluation of the evolutionary status of related anuran species. These approaches set the stage for the investigation summarized in the present book.

The objectives of the study were essentially to establish the geographic and evolutionary origin of toads, the relationships among the approximately 200 recognized species, and the most probable evolutionary history explaining distribution patterns. Some 16 papers deal with various approaches and interpretations of data pertaining to these matters. Particularly outstanding is the paper by Tandy and Keith on African *Bufo*, including a wealth of biological and bioacoustical data, and the study of the mechanisms of vocalization by W. F. Martin, although Martin's evolutionary interpretations seem questionable. Only somewhat less excellent are the accounts of karyology by J. P. Bogart and the data from paper chromatographic analysis of the toxic parotoid gland secretions by Low. A wealth of data on hybridization experiments is provided in a paper by Blair himself, but I found the paper difficult to follow and many of its statements arguable.

Unfortunately almost all the authors attempt to relate their data to the morphology-based groupings of broad-skulled and narrow-skulled toads established in R. F. Martin's contribution on osteology. This paper is rather weak and does not seem to take full advantage of the evidence of osteology. Review of the osteological data seriously weakens the argument for the recognition of two major divisions on the basis of skull form, since of the 20 defined species groups, 2 in the broad-headed division have intermediate- or narrow-skulled species and 6 in the narrow-headed division have intermediate- to broad-headed representatives. A more interesting approach might have been to construct separate evolutionary interpretations based on each line of evidence and to compare these phylogenies for congruence.

One regrets that no account of the features of the eggs and larvae is included, since these must have been available in numbers during the hybridization studies and are known to provide useful data for systematic studies.

There can be no question but that the work stands as a first major effort toward understanding the genus as a biological and evolutionary entity. Any such effort requires refinement. As a herpetologist who knows something about *Bufo*, I find many points on which reevaluation is in order. From the viewpoint of an evolutionist, I find the objectives of the study still unfulfilled. The explanations in the summary by Blair fail to be convincing because of conflict among the various data used and because of his difficulty in relating present patterns to chronology and paleogeography. Nevertheless, the attempt should stimulate others to utilize the data in this book for the construction of alternative hypotheses.

The book is best regarded as a prototype of what can be done through this kind of multidisciplinary approach to problems of animal evolution. For this reason, if for no other, it will have an influence on future studies far out of proportion to the intrinsic value of any knowledge of *Bufo* per se. Anyone interested in evolutionary theory and the potential for biosystematic study of other vertebrates will find this book the best available prospector's guide.

JAY M. SAVAGE
Allan Hancock Foundation and
Department of Biology,
University of Southern California,
Los Angeles