



Review

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REVIEWS AND COMMENTS

THE ORIGIN OF TERRESTRIAL VERTEBRATES. By I. I. Schmalhausen. Translated from the Russian edition (Moscow, 1964) by Leon Kelso. K. S. Thomson, Editor. Academic Press, New York. 1968. xxii + 314 pp., Illus. \$15.—Schmalhausen was a remarkable Russian biologist, an active, productive scientist for over 50 years. In his early career he was a descriptive and comparative embryologist, but he soon entered experimental embryology. His most common experimental subjects were fish, ranid frogs and hynobiid salamanders. He became increasingly concerned with problems of evolutionary biology and phylogenesis, and gained much attention with his theory of stabilizing selection. Toward the end of his career he attempted to treat phylogenetic questions by combining renewed studies of comparative embryology with paleontological data. This book is the culmination of his work, although his methodologies are being used by several of his students.

Most of Schmalhausen's studies were conducted in an atmosphere of isolation, and his work is extremely interesting in that it frequently provides fresh views of topics long treated dogmatically by workers in western Europe and America. His research animals also differ from those most familiar to most of us, and the generalizations that result from his studies are often surprising and unexpected. The present account is a posthumous work that is incomplete in several regards. Nevertheless, sufficient detail is provided for some groups (e.g. salamanders) to elucidate Schmalhausen's methodology.

The book is organized into twenty chapters, most of which are brief and frequently uninteresting. The chapters have a peculiar arrangement which results in great redundancy; perhaps this is simply indicative of the fact that the manuscript was not polished by the author. Yet, despite annoyances, the reader is compelled to continue, for there are new ideas, often dogmatically presented, on nearly every page. One learns that "paired fins obviously arose repeatedly . . .," that labyrinthodonts had large poison glands in their mouths, that development of salaman-

der vertebrae gives "obvious proof" of origin from the vertebrae characteristic of microsaurs. Assertions abound, with sweeping generalizations and speculative theories commonplace. But there are hard facts as well, and one data-rich chapter on salamander development and evolution occupies 131 pages, nearly one-half of the text.

A detailed and rather complete argument concerning the origin of terrestrial vertebrates is developed. Schmalhausen thinks that tetrapods are basically monophyletic, and his ideas stem in large part from his interpretations of the physiological significance of morphological and paleontological evidence. He argues strongly and effectively that salamanders are remarkably like labyrinthodonts in many respects, and that studies of their life history, development and morphology are instructive in understanding the biology of early tetrapods. He was fortunate in having studied hynobiids, the most generalized of living salamanders. Most European and American biologists and paleontologists have studied more specialized groups, and they have generally emphasized the rather isolated position of salamanders relative to ancient amphibians. However, while he exploits his salamander studies in interesting and imaginative ways, his arguments suffer from his ignorance of current paleontological data. As a result, knowledgeable readers will spot immediately the archaic nature of his paleontology and some will be led to reject his arguments out of hand. This would be most unfortunate, for there is much of value and significance in this work. Often the theories proposed are unorthodox, occasionally they are bizarre, but they are without exception thought provoking. One comes away from this book with a healthy respect for the creative and synthetic abilities of this imaginative, dedicated scientist.

Some examples of the author's methodology can be presented to illustrate his heavy reliance on data and interpretations from modern amphibians. Much emphasis is placed on the evolution of respiratory mechanisms. Many novel suggestions are made. For example, features of the jaws usually

associated with increased feeding efficiency are interpreted as specializations permitting respiration by a hunting predator without producing conspicuous movement. Further, as ancient amphibians became increasingly predatory, external gills are said to have evolved to facilitate continuous respiration. He argues that this was tied to accelerated development, with small eggs (large clutches) and small amounts of yolk, which led to reduced vitelline vessels serving respiratory functions. Thus there was selection for increased gill size, and finally their externalization.

The speculations concerning fishes are either uninteresting or outdated as the result of recent research. Respiratory mechanisms play a large role in his treatment, but so does anatomy. He fearlessly enters the battle on frontal bone homologies, but contributes little that is new. Based on structural features, *Polypterus* and its relatives are placed in a separate major group, the Brachyopterygii, following Stensiö. Attempts to reconstruct the biology of crossopterygian fishes produce some interesting results (e.g. *Eusthenopteron* crawled partly on to the shore to expose the anterior part of the body and permit dermal respiration).

An example of Schmalhausen's rather uncritical reliance on old paleontological literature is his discussion of the origin of the living amphibians. Watson's out of date work on *Amphibamus* and Gadow's discredited views on vertebral evolution play important roles in his arguments concerning anurans.

Much excellent information is presented concerning salamander development (the gills and their transformation, the formation of the vascular system of the head, the lateral line system, the development of the chondrocranium) and always functional and evolutionary implications are emphasized. This section is well illustrated. Organs of hearing are treated in great detail, and an implausible theory concerning sound reception through the venous system of the head is developed.

The Gadovian system of vertebral terminology is used in development of an argument of major importance on the evolution of vertebrae. Williams' important paper of 1959 is cited, but essentially ignored. Yet, the account is of some interest. Schmalhausen thought that vertebrae of caecilians, salamanders and some Paleozoic lepospon-

dyls evolved from a vertebral state rather similar to that of some embolomeroous labyrinthodonts. The centrum is thought to have consisted of two essentially equal parts. The arguments derive in part from embryological evidence of dubious value, but in general they are logical. Unfortunately some premises are wrong. For example, we now know that embolomeroous vertebrae were not the primitive labyrinthodont state, and that some rhipidistians had vertebrae having only a single centrum. Despite this, the information presented on salamander vertebral development is valuable and important in itself. Some of it is original, and the remainder is taken from Schmalhausen's work of the late 1950's, which has been available only in the original Russian.

Finally, on the basis of all data available to him, Schmalhausen argues that several complex organs which changed radically in the fish-tetrapod transition could not have done so in essentially identical ways had they been modified from different ancestral stocks. Thus he argues for monophyly, and, in sum, his arguments are substantial. As for the modern Amphibia, the salamanders and caecilians are considered to have been derived from a microsauro ancestor, a view increasingly out of vogue among modern workers. The microsaur, and for that matter, all lepospondyls, are seen as originating from "Embolospondylii," which in turn are derived from ichthyostegids. Frogs are seen as independent derivatives, not of rhacitomes but of ichthyostegids.

In terms of production the book is attractive and rather reasonably priced. The translation has resulted in an easily read text and obvious errors are few. As is unfortunately too common in the herpetological literature, the name *Tylotriton* is misspelled (*Typhlotriton*, p. 262; *Tylotriton*, p. 264). Schmalhausen spelled the name correctly both times in the 1964 Russian edition, so this is either translator or editorial error. There are several other such errors. In addition, outdated taxonomy is used on occasion (e.g. *Spelerpes*) for both fossil and recent groups. On the whole, however, the translator and editor are to be commended on their work.

With the publication of this book, two of Schmalhausen's works (the other is *Factors of Evolution*, published by Blakiston-McGraw-Hill in 1949) are now available to the English speaking world. We are for-

tunate to have even such limited acquaintance with the thoughts of this great and gifted man.—DAVID B. WAKE, *Museum of Vertebrate Zoology, University of California, Berkeley, California 94720.*

INVESTIGATIONS ON THE GRAY SNAPPER, *LUTJANUS GRISEUS*. By Walter A. Starck, II and Robert E. Schroeder. "1970" [1971]. Stud. Trop. Oceanogr. Miami 10:224 pp., 44 figs. Clothbound, \$12.00 from Univ. of Miami Press, Drawer 9088, Coral Gables, Florida 33124.—This volume includes the "Biology of the gray snapper, *Lutjanus griseus* (Linnaeus), in the Florida Keys" (pp. 11–150, 32 figs.) by Starck and "Ecology of the intestinal trematodes of the gray snapper, *Lutjanus griseus*, near Lower Matecumbe Key, Florida, with a description of a new species" (pp. 151–221, 12 figs.) by Schroeder.

Starck's paper is based primarily on studies conducted during 1962–63 and contains information on the systematics, geography, ecology, morphology, reproduction, and behavior of the gray snapper. Certain aspects of the biology of seven other species of western Atlantic lutjanids, *L. cyanopterus*, *L. apodus*, *L. jocu*, *L. analis*, *L. synagris*, *L. mahogoni*, and *Ocyurus chrysurus*, are compared with those of *L. griseus*. Starck has provided a great service to all of us interested in the biology of percoid fishes in furnishing a model approach to their study. His extensive experience diving with SCUBA enabled him to gather much data on behavior, habitats, and color patterns that would have escaped a surface-bound investigator and it is on these facets, plus those of age and growth, reproduction, and food and feeding, that he contributes most significantly.

There are several misstatements regarding other genera of lutjanids, e.g. *Pristipomoides* in the Atlantic is not limited to the West Indies region, *Ocyurus* is known from the eastern as well as the western Atlantic, *Rhomboplites* is found at least as far north as North Carolina. *Lutjanus brachypterus*, from the Bahamas, is considered as a close relative of *L. synagris*. It may be, instead, conspecific with *L. synagris*. Starck (p. 17) describes *Apsilus*, *Etelis*, and *Pristipomoides* as epipelagic. Because species of all three genera are largely associated with bottom environments the adjective "epipelagic" is inappropriate. The criticisms above refer to

a short section on relationships which is peripheral to the main body of the paper.

Much useful data on size, body proportions, and dentition are presented in the section on morphology. The table comparing the relative sizes of certain body parts among the eight species studied would have been enhanced by presenting the size ranges of the specimens measured. In the description of the changes in body proportions which occur with growth, there are several statements, such as depth of body "is greatest in young specimens and gradually decreases with increasing size." (p. 70), that should have been avoided. There are a number of other distracting errors such as the use, in several places, of "%" where, presumably, "‰" was intended. As indicated earlier, Starck's paper is a valuable reference, but it would be even more valuable if greater care had been taken in writing and proofreading it.

Schroeder collected specimens of *L. griseus* from four different habitats near Lower Matecumbe Key, Florida, over a nine-month period (June 1963–February 1964) and found nine species of trematodes (one of which, *Metadena obscura*, he describes as new) in the intestine and pyloric caeca. He also collected intermediate hosts and made observations on life cycles of the trematodes. He concludes that the habitat of the gray snapper is more important in determining the trematode populations harbored by it than are season or size and sex of host, and that seasonal changes in populations of trematodes are due to movements of the fish, e.g. migrations related to spawning or to decreasing water temperatures. Speaking as one largely unfamiliar with the parasitology of fishes, I am of the opinion that Schroeder has produced a worthwhile study. He has presented his results in such a manner that he answers some questions, stimulates others, and directs those who will follow into approaches that appear likely to lead to answers for some of the questions developed. The author is to be commended for preparing a paper that is largely free of obvious errors.—WILLIAM D. ANDERSON, JR., *Grice Marine Biological Laboratory, College of Charleston, 205 Fort Johnson, Charleston, South Carolina 29412.*

AUSTRALIAN LIZARDS. By Robert Bustard. 1970. Collins, Sydney, London, 162 pp., 80 pls. (12 colored).—In "The Red Centre,"