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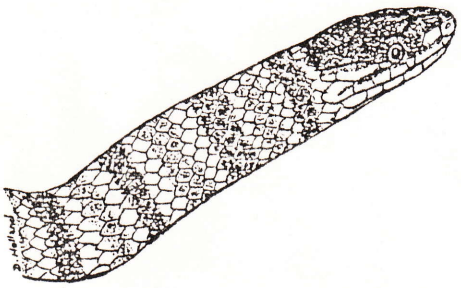

BOOK REVIEWS

Biology of the Reptilia. Vol. 14, Development A, edited by Carl Gans, Frank Billett and Paul F. A. Maderson. 763 pp. Price $60.00, clothbound; Vol. 15, Development B, edited by Carl Gans and Frank Billett. 731 pp. Price $79.95, clothbound. 1985. John Wiley & Sons, New York.

I read these latest two volumes of *Biology of the Reptilia* during Super Bowl month last January. It didn't take me long to realize that the timing was more than mere coincidence. After attempting to tackle these enormous tomes—each one, at around 750 pages, is a Bear of a book—I now know what it must feel like to be a New England Patriot.

Biology of the Reptilia has come to represent an invaluable source of information for many topics of reptilian biology. The latest two contributions, encompassing any and all aspects of reptilian development that have been scientifically investigated, are worthy additions to the series. As stated explicitly in the preface to volume 14, a primary aim of these books is to address the paradox that, despite their morphological, physiological, and ecological diversity, reptiles as a group have been neglected in studies of major features of vertebrate development. Thus, while the editors have sought "to summarize the state of our knowledge of developmental pattern in this diverse group of organisms," and to identify "the major gaps that remain" (v. 14, p. vii), they also have taken on the task of promoting the increased use of reptiles by developmental biologists generally.

We learn early on how serious they are. For example, the introductory chapter to volume 14, authored by editors Billett, Gans, and Maderson, begins with an historical résumé of *Entwicklungsmechanik* and its tendency to ignore reptiles as experimental subjects. It soon focuses, however, on "practical considerations," which includes identification of interesting developmental phenomena that can be studied only in reptiles, such as temperature-dependent sex determination, appropriate species to use and their availability, and even recipes for various histological fixatives. Finally, the chapter closes with two appendices—one listing sources of serial sections, the other listing the literature of normal development. This sets a pattern of comprehensive treatment and careful attention to detail that is generally characteristic of all that follows.

The two-volume set is organized around two themes, one taxonomic, one topical. Each major taxon is treated in at least one chapter that summarizes past developmental studies concerning that group; it also reviews known aspects of reproductive biology. Complementing these general chapters are a number of additional chapters that focus on particular topics that are particularly well studied. Volume 14 includes those chapters dealing primarily with turtles, crocodilians, and *Sphenodon;* volume 15 includes those for squamates, although reference to other reptiles is included at times. The following is a list of the chapter topics and authors. Volume 14: Introduction: Why Study Reptilian Development? (Billett, Gans, Maderson); Oocytes (Hubert); Turtles (Ewert); Marine Turtles (Miller); Crocodilians (Ferguson); The Tuatara (Moffat); Integument (Maderson); Immunity (Cooper, Klempau, Zapata); Pituitary (Pearson); volume 15: Squamata (Hubert); Lepidosaurian Reproduction (Saint Girons); Limbs and Embryonic Limb Reduction (Raynaud); Genital System (Raynaud, Pieau); Autotomy and Regeneration (Bellairs, Bryant); Parthenogenesis (Darevsky, Kupriyanova, Uzzell); Placentation and Gestation (Yaron); Ecological Aspects of Viviparity (Shine).

As would be expected of such a distinguished international array of researchers (and editors), all the treatments are of high quality. What distinguishes several chapters, however, and what makes these books much more than simply a catalogue or even a review of prior studies, is the wealth of significant and valuable data that are published here for the first time. For example, the two accounts of turtle embryology by Ewert and by Miller—which together span an impressive 254 pages—include a tremendous amount of previously unpublished descriptions of organogenesis, egg sizes, incubation periods, embryonic diapause and aestivation, and other subjects. Perhaps of interest to a wider range of biologists is Miller's presentation of an annotated, illustrated table of developmental stages from first cleavage (prior to oviposition) to hatching that is generally applicable to all marine turtles, and an analogous (albeit postoviposition) developmental table for crocodilians by Ferguson. Publication of these data represents a tremendous contribution to the embryology of non-squamates. Similarly, the extensive study of parthenogenesis in Eurasian *Lacerta* by Darevsky and colleagues, much of which is published in Russian journals (and typically written in Russian), is reviewed extensively in his chapter (co-authored by Kuprinova and Uzzell). This should be relished by those with a consuming interest in the general phenomenon of parthenogenesis, but who have been reared largely on a diet of North American *Chemidophorus*.

Finally, these two volumes provide an opportunity to assess at least in a general sense the current state of reptilian developmental biology. Two aspects seem especially prominent. First, most of what is known about even the most fundamental aspects of reptilian development comes from study of only a relative handful of species, and much of this is exclusively descriptive. By the editors' own account, probably fewer than 100 of the 6,000 extant species, or less than 2 percent, have been studied in any respect. And while it is not reasonable to expect that every unstudied species has a novel pattern of gastrulation or limb chondrogenesis that will force revision of textbook descriptions of basic vertebrate development, it is also unfair to assume that no significant features remain to be discovered. The description of a novel pattern of gastrulation in the hylid frog *Gastrotheca* is an example of one such recent discovery in amphibians (del Pino and Elinson 1983). Certainly, consideration of additional species will bring handsome rewards. The fact that most of what has been done is descriptive can be attributed to most experimentalists having fixed on a very few species of typical "laboratory" vertebrates, none of which is a reptile. Admittedly, it is difficult to imagine reptilian subjects for developmental studies that could be more convenient than frogs which can be made to breed almost on cue and chick eggs which can be dialed up from your local hatchery. Nevertheless, the organ culture work of Raynaud, Ferguson, Maderson, and others clearly shows that this valuable procedure is feasible with reptiles, and perhaps easier than analogous methods for mammalian systems.

Second, the diversity of developmental phenomena documented in even the relatively few species studied poses a number of intriguing evolutionary questions that remain to be addressed. Contributing to the timeliness of these volumes is the fact that evolutionary biology in the last few years has witnessed a dominant interest in development, especially in the developmental mechanisms that underlie morphological transformation during phylogenesis. Some of the most dramatic transformations in vertebrates involve reptiles, thus the more that can be known about reptilian development, the better. As revealed by the comprehensive reviews provided in these volumes, a meaningful synergism between these two disciplines as applied to study of the evolution of reptiles remains largely in the future. Thanks to the latest installments of the *Biology of the Reptilia*, however, that day may now be closer at hand.

LITERATURE CITED

Del Pino, E. M., and R. P. Elinson. 1983. A novel developmental pattern for frogs: Gastrulation produces an embryonic disk. Nature 306:589-591.

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