ECOLOGY

Reflections on Lizard Diversity

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Lizards
Windows to the Evolution of Diversity
by Eric R. Pianka and Laurie J. Vitt
University of California Press, Berkeley, 2003. 347 pp. $45, £29.95. ISBN 0-520-23401-4. Organisms and the Environment.

Ranging in size from a 0.5-g gecko to the 250-kg Komodo "dragon"; sometimes possessing jewel-like coloration or spectacular ornamentation such as horns and crests; moving by running, gliding, swimming, or crawling; lizards occupy an array of niches in habitats that include snow-capped mountains, Galapagos beaches, deserts, and tropical rainforests. To escape from predators, members of this paraphyletic group (their clade also includes snakes) employ such bizarre strategies as squirting blood from the eyes, leaving patches of skin in the predator's grasp, and shedding the tail, which wriggles rapidly while its owner flees. Lizards epitomize diversity, and thus Eric Pianka and Laurie Vitt's *Lizards: Windows to the Evolution of Diversity* is appropriately titled.

Pianka (a professor at the University of Texas, Austin) and Vitt (a professor at the University of Oklahoma) belong to the breed of field biologists who spend months at a time away from home and e-mail, living out of a tent or field vehicle, in sometimes inhospitable conditions. Their combined experience encompasses research in the rainforests of Central and South America as well as the deserts of North America, southern Africa, and Australia. *Lizards* represents a synthesis of their lives' work, and it provides the rare opportunity for a comparison of independently evolved lizard faunas, particularly in the context of life histories—the area of expertise of both authors.

Trying to impress. Many lizards, such as this Amazonian *Enyalioides palpebralis*, use open-mouth displays to appear more threatening than they actually are.

Divided into three sections (lizard lifestyles, lizard diversity, and a synthesis), the book has an unorthodox format, which I found appealing. Rather than beginning with a traditional detailed evolutionary history and following with lengthy accounts of the major lizard taxonomic groups, the authors keep discussion of taxonomy and phylogenetics to a minimum. The first section of the book focuses on what lizards do rather than what they are. In the second section, Pianka and Vitt explore the biology of the major clades of lizards in six easy reading chapters that often focus on morphological and behavioral innovations (e.g., the toe pads of geckos). The result is a welcome departure from the classic approach of pages of dry taxonomic accounts. Nonetheless, readers would have been better served had the authors offered an explanation of why they favored the classification (portrayed in a cladogram of extant lizards that appears in the first chapter) they use to organize their discussions. In the absence of any reference to an original source or the underlying data, one cannot determine whether this is a well-supported phylogeny or simply the authors' best estimate of lizard relationships. This uncertainty is unfortunate, given that many students may follow the same arrangement simply because the book is current and its authorship authoritative.

A book of this nature can serve as a great source of ideas for graduate student projects. For example, the authors mention that horned lizards (*Phrynosoma*) squirt blood from the suborbital sinus when they are seized by foxes or coyotes. The blood is distasteful and prompts the canid to release the lizard (*1*). However, neither the identity nor the source of the chemical compounds in the blood that cause this response are known. Given findings from studies of other taxa, such as frogs that obtain toxic skin chemicals from the ants they eat, an obvious avenue of inquiry is the lizard's diet—horned lizards are, after all, ant specialists, and ants are famous for their production of chemical cocktails. Other questions worthy of further investigation abound in the authors' discussions.

As one expects of any book that attempts to provide a comprehensive yet concise account for a broad audience, readers immersed in particular aspects of lizard biology are likely to identify points of disagreement. For example, Pianka and Vitt state that chameleons are capable of catching flies in midair. I may be putting my head on the chopping block, but I have great difficulty believing this claim. In my experience, chameleons take several seconds to both focus on a prey item and obtain just the right body posture before flinging out their tongue. The authors also state that "sperm competition has yet to be explored in any lizard"; although it is true that sperm competition in lizards is largely unstudied, Pianka and Vitt have inadvertently ignored several important studies by Mats Olsson and co-workers that examine multiple matings in sand lizards (*2*, *3*). One such study demonstrated that female sand lizards select sperm from more distantly related individuals (*4*). Such selection can be particularly important in systems in which matings with close relatives are likely (sand lizard females are promiscuous).

Wide-ranging books such as this are also handicapped by spatial constraints in that the coverage of any given topic must necessarily be limited. The authors mention that lizards have been deemed model organisms for a number of questions in biology (and particularly in ecology), but they do not discuss some of the really important studies that would have bolstered this statement. For example, Barry Sinervo's team used an allometric engineering analysis of side-blotched lizards (*Uta stansburiana*) to test basic tenets of life history evolution, including the relation between the size and number of eggs (*5*). In this same species, the mating behavior of males conforms to a paper-rock-scissors game in which no single throat form dominates all strategies (throat forms correlate with fixed strategies such as territory defense, mate guarding, and sneaking copulations) (*6*). Several recent papers by Sinervo and Kelly Zamudio—some too recent to have been included in the book—underscore the importance of lizards in contributing to our understanding of sexual selection (*7*). And, to offer one more example, recent work by Manuel Leal and Leo Fleishman (*8*) identifies an additional resource axis for ecologists to consider, that of the light environment. The spatial separation of two anole species seems to be based on properties of their visual systems and the

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amount of ultraviolet reflectance in their dewlaps (throat fans used for signaling); the conspicuousness of the dewlaps is tied to the levels of ultraviolet radiation in the anoles' respective microhabitats.

The book's abundant high-quality color photographs (which show lizards in their natural habitats and depict various behaviors) highlight the spectacular diversity of lizards. Readers will also enjoy the authors' anecdotes from their field experiences, presented in a series of sidebars that add a more personal dimension to the book. Momentarily transporting one to far-flung places, these stories offer snapshots of such moments as gecko hunting at night in Kalahari dunes where hungry lions roam. Besides providing interesting reading, these accounts may inspire future biology students to spend sufficient time in the field to come to grips with the systems on which they work.

Field biologists unable to get out of the office or lab will find that Pianka and Vitt provide them a welcome reminder of the value and pleasures of managing such an escape. All readers will find *Lizards* an excellent introduction to the ecology of an interesting and scientifically rewarding group of animals.

References

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MOLECULAR BIOLOGY

Impressions of Watson Through 50 Years

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I have never seen Jim Watson in a boring mood. *Inspiring Science: Jim Watson and the Age of DNA* explains why. It isn't that Jim is the most witty conversationalist or the most eloquent lecturer. It's because he always is interested in some new, grandiose project—one usually ahead of its time. Considered premature by conventional minds, his projects require eloquent explanations and Watson can deliver. His excellent scientific logic and peremptory dismissal of objections help overcome initial skepticism and inertia. Edited by John Inglis, Joseph Sambrook, and Jan Witkowski (past or current colleagues of Watson at Cold Spring Harbor), *Inspiring Science* does a splendid job of describing Watson's roles as a leader of DNA research, administrator, mentor, and writer as well as his visionary, and sometimes controversial, personality.

The book combines several features. Much of it is filled with personal essays from Watson's colleagues, students, predecessors, and followers. These articulate and interesting chapters cover different aspects of Watson's life and endeavors. All of the accounts display admiration, although the one from E. O. Wilson—an excerpt from his *Naturalist* (Island Press, Washington, DC, 1994)—reluctantly so. The volume includes facsimiles of a number of key scientific papers (e.g., four articles by Watson and Crick from 1953–1954 that announce the double-helical structure of DNA and consider its genetic implications) and Watson's Nobel Banquet speech. A timeline charts the events of Watson's life and selected landmarks in the history of molecular biology. The combination of personal perspectives, original documents, and timeline enhances the volume's interest and authenticity. The chapters that record responses to the epochal DNA news, such as Avrion Michison's "Jim's Cool Reception among the British Geneticists" and an assortment of impressions of the 1953 Cold Spring Harbor Symposium, offer an understanding of the atmosphere of the times. Nonetheless, the volume is, as its subtitle indicates, about Watson and his era rather than a comprehensive history of DNA research.

Inspiring Science
Jim Watson and the Age of DNA
John R. Inglis, Joseph Sambrook, and Jan A. Witkowski, Eds.
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It has been said that "every institution is the lengthened shadow of one man." The volume documents the long shadow Jim Watson has cast on the Cold Spring Harbor Laboratory as well as his influences on the Human Genome Project, the writing of textbooks, the approach to scientific autobiography, and the role of DNA in science. The book offers an inspiring and enjoyable adventure not only because the subject is important but also because the protagonists have interesting things to say, and say them well.

Sydney Brenner recalls Watson's accurate prediction of the size and cost of the genome project early in its infancy, when neither the knowledge nor the technology the project required were available. I remember asking Jim around the same time why he had projected a 15-year timetable to completion. "Because," he replied, "people who have to work long and hard are more motivated if they know they will be around to observe the finish." Examples of this typically astute analysis of human nature are scattered throughout the volume: Brenner comments that Jim understood the need to "reach the hearts and minds of people before you go for their pockets." Bruce Stillman explains how Watson swept him off balance to induce him to become the next director of Cold Spring Harbor Laboratory. Norton Zinder describes his role on the Board of Trustees as "to defuse Jim's resignations." E. O. Wilson and Paul Doty attribute Watson's ability to get his way at Harvard on policy matters to a combination of vision and personality.

Along with his shrewd assessment of human behavior, Watson possesses excellent vision of future goals. He not only saw the need for a good textbook on the topic of molecular biology, he was unafraid to write it in an unconventional style. He translated his peremptory conclusions, typical of his personal style, into textbook subheadings. Similarly, his vision of the future helped propel the Human Genome Project (described by James Wyngaarden, Robert Cook-Deegan, and Kenichi Matsubara) when many of his peers thought it was a boondoggle of the type NIH had averted in the past. Now that the genome's biological and medical implications are apparent, it is "obvious" that the project should have been done. Watson's ability to predict the future has been particularly useful in his mentoring of students and postdocs, as Joan Steitz, Lionel Crawford, Thomas Maniatis, and David Botstein gratefully note in their chapters.

That the volume is such a good read probably reflects the capabilities of Watson's friends as well as the efforts of the three editors. From the excellent foreword by Matt Ridley to the final explanatory notes on puzzling details (including descriptions of quiz kids, Delbrück's principle of limited sloppiness, and Benzer's lunchtime diet of crocodile tail), *Inspiring Science* is a delight, a ride in a convertible through history. The editors deserve accolades for their excellent selections and documentation. Watson himself deserves credit for doing such important work with such panache.

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