BOOK REVIEWS

Molecular Errata

Correcting the Blueprint of Life. An Historical Account of the Discovery of DNA Repair Mechanisms. ERROL C. FRIEDBERG. Cold Spring Harbor Laboratory Press, Cold Spring Harbor, NY, 1997. xiv, 210 pp., illus. $49. ISBN 0-87969-507-2.

What a catchy title to introduce the history of DNA repair! Until *Science* christened DNA repair "the molecule of the year" this field had escaped the ravages of the competition that has plagued the mainstreams of molecular biology. Errol Friedberg's book tells how this fortress was protected, first by confusing observations and later by exemplary collegiality. The book is a personal interpretative essay that melds science and historical scholarship. Friedberg has made significant contributions to the study of DNA repair. He now demonstrates other facets of his scholarship: interest in preserving scientific history and love of writing.

It is uplifting, indeed, to be treated to repetitive examples of scientific collegiality: postponing publication so that others might receive equal and well-deserved credit; acknowledging contributions of competitors; and even ferreting out past contributions from Japanese and Russian scientists. In addition, the book is studded with inspiring quotations. Consider the beauty of Evelyn Witkin's statement, "Every generation of biologists lives through thrilling discoveries that instantly transform their view of life, like sudden shifts in the pattern of a kaleidoscope." Research on DNA repair was not dominated by the contribution of single individuals or groups of scientists working together. Instead, as Dulbecco observed, it reflects a wonderfully innocent period in the history of biology, where insights in small labs could determine future directions in science. *Correcting the Blueprint of Life* contrasts with recent books on the history of molecular biology and cancer research that portray scientific battlefields, excessive competition, extreme secretiveness, and even fraudulent claims.

Friedberg hints at how pervasive misconceptions may have both sheltered and hindered progress in understanding DNA repair. First, DNA was considered an undamageable molecule. Even Delbrück stated that genes were composed of extraordinarily stable molecules, perhaps constituting some hitherto unrecognized state of matter. Second, DNA—even in somatic tissues—was protected against damage by reactive cellular metabolites. Third, DNA synthesis was assumed to be error-free. Finally, once DNA repair was recognized as an enzymatic process, it was believed that the same mechanisms were operative in cells from all species. Friedberg demonstrates how each of these misconceptions was negated by decisive experiments. He opens the book with the history of photoreactivation, a powerful mechanism for reversal of DNA damage but one that apparently has been ignored during the evolution of mammalian species. Radiation damage to DNA provided an exacting approach for the quantitation of DNA damage. However, as Cairns concluded, the survival curves employed by countless scientists were castles built in the air. These curves did not lead to mechanistic insights. T4 endonuclease provided the first evidence for enzymatic removal of ultraviolet-dimers, an area of investigation that was Friedberg's own major entrée into DNA repair. Again, this mechanism was not utilized by mammals. In fact, the early experiments demonstrating specialized mechanisms for DNA repair may have delayed the discoveries of more universal mechanisms, including base excision repair by DNA glycosylases, nucleotide excision repair, and mismatch repair.

While this book is a delight for the "repairologist," it is not for the novice. It requires a general knowledge of molecular biology as well as an interest in documenting the history of science. If more of the scientific explanations in the book were bolstered by the use of diagrams and illustrations, similar to those that Friedberg has used so effectively in his textbook on DNA repair, it could have appeal to a wider scientific readership. Friedberg documented his views on the history of DNA repair by solicitation of documents, letters, and recollections. This approach has an inherent bias in that it emphasizes the accomplishments of the contributors. There are areas of investigation that had great impact on the understanding of DNA repair yet are omitted: for example, studies of mutagenesis, oxygen free radicals, and cancer. These are minor complaints that do not detract from the fact that Friedberg has written an informative and authoritative book, providing a personal glimpse into the history of DNA repair before it became a scientific discipline. Since only the epilog considers how deficits in DNA repair contribute to the cause of many human diseases, Friedberg leaves room for a sequel, a book documenting the impact of DNA repair on cancer and associated diseases.

Lawrence A. Loeb
Department of Pathology, University of Washington, Seattle, WA 98195–7705, USA

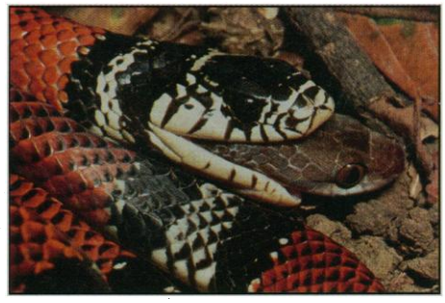
■

The Serpent World

Snakes. The Evolution of Mystery in Nature. HARRY W. GREENE. Photographs by Michael and Patricia Fogden. University of California Press, Berkeley, 1997. xiv, 351 pp., illus. $45 or £35. ISBN 0-520-20014-4.

Few animals engender passion to the same degree as the snake. That passion has traditionally involved aversion rather than affection, but the minority view has been gaining ground. Recent years have seen a dramatic shift in public attitudes toward these animals, with the older biblical image (the evil, cunning, loathsome serpent) being superseded by a far more realistic view of snakes as animals. Indeed, they probably qualify (albeit on a fairly low rung) as charismatic megafauna. One cause—and consequence—of the changing public perception has been an extraordinary explosion in scientific research directed toward these mysterious creatures. The increasing miniaturization of radio transmitters through the 1970s was the key event, because field studies of these cryptic animals suddenly became feasible. Harry Greene was among the pioneers in this work, and he has now produced a remarkable volume to celebrate his lifelong love affair with snakes.

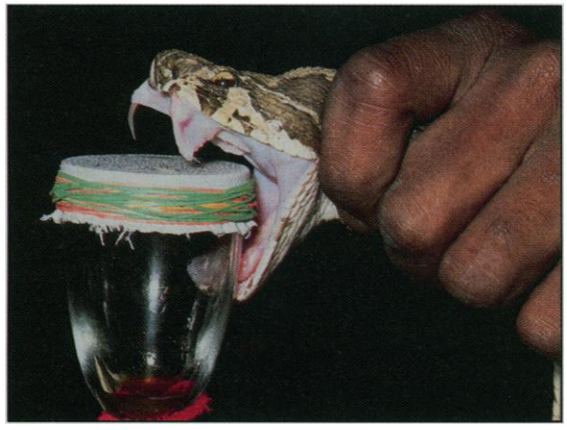
The book covers the same topics as sev-



"Double-banded Coralsnake Mimic (*Erythrolamprus bizonus*), Costa Rica, swallowing a Northern Cat-eyed Snake (*Leptodeira septentrionalis*) tail-first." [From *Snakes*]

eral other snake books that have appeared in recent years, with a primary emphasis on general biology (especially ecology and behavior) and diversity (a phylogenetically organized exploration of living snakes), but its approach and general themes are very different. First, Greene writes from an intensely personal perspective. Each chapter begins with an anecdote in which he integrates some snake-related experience with other parts of his life. One chapter, for example, begins with Greene wandering through the desert pondering the recent death of his father and exploring the symbolism of his own fascination with deserts and the snakes that inhabit them. Those who advocate the view that professional scientists should be impersonal, disinterested, and objective will be appalled. The reality, though, is that most professional reptile biologists are passionate about their study organisms, and the directions of that passion often determine which kinds of studies are undertaken. Greene's boyish enthusiasms erupt spontaneously in the most unlikely places (who else could wax lyrical about the attributes of the "Central American goo-eaters"?), but the result is a pleasing blend of scientific rigor with unbounded joy at biological diversity.

"Central American Dwarf Boa (*Ungaliophis panamensis*), Costa Rica." [From *Snakes*]



"Russell's Viper (*Daboia russelli*), India, during venom extraction." [From *Snakes*]

The book is also unusual in two other ways. Greene is a powerful advocate of historical (that is, phylogenetically based) approaches to the study of adaptation, and this view permeates the book. Although the "comparative method" has revolutionized the ways in which evolutionary biologists ask questions, Greene's book is one of the first "semi-popular" tomes to blend phylogeny so thoroughly with natural history. The other distinctive feature is visual. Michael and Patricia Fogden traveled the world to photograph snakes for this book, and the result is stunning. The photographs are as notable for their aesthetic impact as for their scientific informativeness. Most of the pictures are "portraits" of attractive or bizarre snake species, often from surprising angles, but always remarkably sharp. My own favorites involve snakes doing things—an eyelash viper lunging at a hummingbird, two male black mambas in a ritualized combat "dance," assorted serpents swallowing assorted prey or adopting threatening stances against a predator. The impact of such images should not be underestimated. The spectacular growth in the popularity of bats among the general public dates from the advent of close-up photography of these strange and wonderful beasts; perhaps the Fogdens' photography can help do the same for serpents.

Inevitably, because the book is very much Greene's view of the snake world, the geographic and phylogenetic coverage is uneven. Greene's passion for large pit-vipers is often evident, and many of his anecdotes involve his two main field studies—of rattlesnakes in the Arizona desert and of bushmasters and the terciopelo in the Costa Rican rainforest. An encyclopedic work such as this also brings into strong focus the grossly uneven distribution of available information. We now know a great deal about the biology of a few species of snakes (such as adders and grass snakes in Europe and rattlesnakes and gartersnakes in North America), but entire lineages remain unstudied. Particularly for tropical snakes and for "basal groups" such as blindsnakes and pythons, our ignorance is overwhelming. Similarly, the broader-level phylogenetic relationships among snake clades remain controversial, a significant problem for an author of Greene's orientation, who needs to identify where a trait arose in phylogeny before he can speculate on its adaptive significance. Unfortunately, Lee and Caldwell's work on the fabulous missing link (*Pachyrhachis*, "the snake with legs") was published too recently for inclusion in the book.

In summary, Greene and the Fogdens have produced a luscious visual feast—a celebration of snake diversity—with extensive factual information intermingled with current concepts in evolutionary biology. Some parts of the book will not be easy to read for the uninitiated—Greene's text is often interspersed with technical terms—but most readers should have little real difficulty. For those of us who share Greene's passion for these mysterious and poorly known animals, this book is undoubtedly a landmark publication.

Richard Shine
School of Biological Sciences,
University of Sydney,
Sydney, NSW 2006, Australia

■

NMR Perspectives

Spin Choreography. Basic Steps in High Resolution NMR. RAY FREEMAN. Spektrum, Oxford, UK, and University Science Books, Sausalito, CA, 1997. xii, 391 pp., illus. $58.50 or £30. ISBN 0-935702-95-4.

Virtually every nuclear magnetic resonance spectroscopist's list of the "greats" in the field would include Ray Freeman, now at Oxford University. Freeman thinks about problems differently from most of his colleagues, and his presentation style and his ability to find simple solutions for complex problems have earned him tremendous respect. This reviewer will always remember the first time he heard Freeman speak, in 1979—introducing the concept of "composite pulses," back-to-back radiofrequency pulses with phase shifts, which create a more uniform rotation than any single pulse could. He made the idea look so simple that we wondered why it hadn't been discovered years earlier. The answer, of course, is that sometimes it takes a special kind of insight to take the first few steps.

Freeman's *Spin Choreography* is worth reading precisely because of such insight. Modern NMR pulse sequences often involve many spin rotations (hence the title) and can appear hopelessly complicat-