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In the Light of Evolution: Essays from the Laboratory and Field

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resource management exacerbate environmental insecurities on islands.

The topics considered in the second half of the book are laid out in a more engaging manner, especially where the authors trace unique settlement histories and the sociopolitical and economic forces that have altered the natural processes on these islands. Their discussions of the settlements of Tonga, Hawaii, and New Zealand include a current and impressive set of facts about the peopling of those islands by the Polynesians and an explanation of the environmental impacts created by their canoe cargo of rats, pigs, dogs, and assorted food plants, as well as those created by their cultural practices. Overall, their treatment of the environmental consequences of rapid population growth and global capitalism, viewed over sequential time periods, is expertly evaluated.

Walker and Bellingham stop just short of a complete picture of the environmental transformation of islands as one of irreversible damage, in which readers conjure images of an Easter Island-type of outcome, where almost all of the island's native life is now extinct (Hunt and Lipo 2011). Instead, they call attention to the examples of Japan and Puerto Rico, where ecological restoration efforts are succeeding. They note that corrective responses to positive feedback are occurring in all of the island groups, with the possible exceptions of Tonga and Jamaica, where poverty and low average per capita income (below $10,000, compared with over $40,000 for Japan, Hawaii, the British Isles, and Iceland) may limit environmental restoration initiatives. The hope of improving the environmental security and the sustainability of resources on these two islands may be further compromised when the repercussions of poverty undermine a competitive advantage (e.g., the slow growth of tourism revenue in Jamaica as a result of real or perceived threats to the personal safety of tourists).

In general terms, the authors are successful in reinforcing awareness of the environmental and economic vulnerabilities of islands, especially in their discussion that raises a red flag regarding the future sustainability of island resources. However, most of the photographs are of such poor quality that they detract from the weight of the book's intended message. I also found minor errors of fact, such as the statement that Iceland originated from the geologic process of subduction (p. 22), and, in my opinion, an example of stereotyping with regard to Hawaiians, who have migrated in large numbers to Las Vegas to seek employment. Hawaiians are not led to the city—or call the city their "ninth island"—because of a "high degree of self-assurance" among islanders.

Island Environments in a Changing World provides a handy summary of the natural history and environmental impacts of the development of each of the nine groups of islands discussed therein. Although the book does not present any new insights into scale-related environmental issues (e.g., the relative resilience to environmental degradation associated with size of landmass, topography, or climate), it does contain useful, descriptive comparisons and an impressive list of facts about these islands. Despite the social and environmental remedies spelled out in the final chapter, the sobering question remains whether islanders can shift their human–nature interactions onto a path of ecological sustainability.

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A FULL SPECTRUM OF BIOLOGY AS SEEN THROUGH THE LIGHT OF EVOLUTION

In the Light of Evolution: Essays from the Laboratory and Field. Jonathan B. Losos, ed. Roberts and Company, 336 pp., illus. $30.00 (ISBN 9780981519494 cloth).

The book *In the Light of Evolution: Essays from the Laboratory and Field* takes its title from a famous line by the great evolutionary biologist Theodosius Dobzhansky: "Nothing in biology makes sense except in the light of evolution," which was part of a speech given to the American Society of Zoologists in August 1964 and published three months later in *American Zoologist*. In 1973, Dobzhansky used this same line as the title of his article published in the journal *American Biology Teacher*. Dobzhansky was concerned that the impact of the discovery of the structure of DNA and the subsequent rapid growth of molecular biology was pushing the traditional focus on organismal biology, ecology, and evolutionary biology to the periphery. His concern was instantiated by the creation of new departments of molecular biology in universities and the fragmentation of the life sciences. His point was that sense could be made of what Ernst Mayr called "the biology of proximate causality" (relating to, e.g., biochemistry, physiology, and cell biology) only through the evolutionary context (termed the *ultimate causality* by Mayr) in which these fields arose. Dobzhansky called for a synthesis of the molecular and organismic or evolutionary approaches in order to synergistically gain a deeper understanding of life phenomena.

This collection of 16 essays seeks to achieve Dobzhansky's goals of synthesizing molecular and organismal

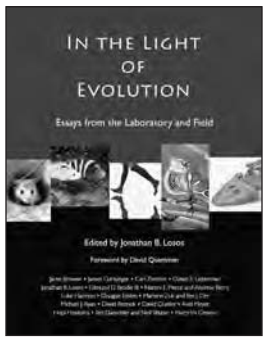
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approaches to better understand both evolution and biology. These essays are the results of current field and laboratory research on biological evolution (one is on the history of Darwin's thought), and their content is aimed at university-level classes in general and evolutionary biology. However, the book is also quite accessible to the interested general reader concerned about evolutionary issues. The contributors include prominent biologists, a historian of biology (Janet Browne), a distinguished science journalist (Carl Zimmer), and a well-known science writer (David Quammen). Editor Jonathan B. Losos, curator of herpetology at the Museum of Comparative Zoology at Harvard University, as well as a professor of organismic and evolutionary biology, also contributes an essay on his research on lizard evolution in the West Indies.

Browne's essay provides a historical and biographical introduction to Darwin—as a theorist who proposed the theory of natural selection to explain the inferred phenomenon of common descent and as an experimental biologist who explored a number of issues empirically. Several other contributors, while describing their own current research, provide historical perspectives of the growth of evolutionary thinking. For example, Luke Harmon describes the work of the codiscoverer of natural selection, Alfred Russel Wallace, who created the field of island biogeography, thus providing a laboratory for the study of natural selection. Marlene Zuk and Terri Orr analyze Darwin's other big idea—that of sexual selection—and how both of his theories were developed and viewed in the twentieth century, leading to the promulgation of the modern evolutionary synthesis based on population genetics. Zuk and Orr also raise issues relating to the role of social attitudes influencing the path of investigative inquiry. James Curtsinger follows the insights of J. B. S. Haldane and Sir Peter Medawar (i.e., that the force of natural selection lessens with the age of organisms) to understand senescence through the study of fruit flies at the genetic and molecular levels.

Research on natural selection is the focus of several of the essays. Carl Zimmer reviews experimental work by Richard Lenski and others on bacterial evolution. Such studies are quantitative and easily replicated, which allows many generations of variation and selection to be observed. Samples taken from a population of bacteria to be frozen serve as "fossils" and function as the control variable for environmental changes, as well as for the opening of new niches (such as making citrate available as a nutrient), which reveals, for example, that there are many genetic changes that solve an environmental challenge. Indeed, Zimmer argues that these types of experiments lend support to the notion of Stephen Jay Gould that contingency plays an important role in evolutionary phenomena.



Losos's essay on island lizards reveals the power of integrative studies of evolution and how islands provide a natural laboratory for studying the basis of diversity. He has found evidence, from field and DNA work, of multiple pathways to get to adaptive radiation; therefore, there can be convergent evolutionary paths to solve particular ecological problems presented to populations of organisms. Furthermore, he has been able to conduct experiments to test various hypotheses about the mechanism of adaptive radiation, and he found that phenotypic plasticity plays an important role. Indeed, he argues for a selective advantage of the evolution of such plasticity that allows a jump-start for adaptive radiation.

Losos's goal in his research, as well as in this volume, is to unite genomics with community ecology, behavior, and macroevolution. This approach is also used by Hopi Hoekstra, who combines the work of natural populations and DNA sequencing to study color polymorphism in mice. Edmund Brodie III combines biogeography, physiology, neurobiology, and DNA studies to gain insight into the coevolution of garter snakes and newts resulting from a variable resistance of the snakes to a toxin of the newts. David Reznick combines life history and DNA studies to understand adaptations of guppies to differential predation. Others, such as Daniel Lieberman, seek unification of paleontology with comparative DNA studies in order to understand an evolutionary phenomenon like the evolution of human bipedalism, which made for more effective hunting and, therefore, a larger source of energy to facilitate the emergence of larger brains. However, there is also value in the traditional paleontological studies, as is shown by the work of Ted Daeschler and Neil Shubin on the emergence of tetrapods.

From natural selection, the reader moves to the essays on sexual selection. Douglas Emlen describes his research on the horn evolution of dung beetles that shows a large variation in the size and location of the weapons and that is amenable to extensive experimentation, which reveals that the variety is caused by sexual selection rather than by natural selection. Additional examples of sexual selection are explored in the book, including color polymorphism in chiclid fish studied by Axel Meyer, some of which is due to natural selection (ecological selection or allopatric speciation) but most of which is due to sexual selection (sympatric speciation). Meyer argues that sympatric speciation is rapid—especially in the crater lakes in Nicaragua—which allows speciation events within 1200–1800 years.

Broader issues are addressed in the book concerning symbiotic evolution,

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such as those explored by Naomi Pierce and Andrew Berry with regard to a nitrogen shortage in the diets of caterpillars. Ants harbor bacteria, including ones that provide nitrogen fixation, which supplements the diet of caterpillars. The caterpillars, in turn, provide amino acids and sugars to ants while also protecting them from parasites. David Queller discusses the evolution of altruism in social insects and addresses the issue of how natural selection could reward altruistic actions.

My only reservation with this volume is that it does not address issues that have arisen in studies of molecular evolution, such as neutral mutations or gene duplication; nor does it focus on mutations in genetic regulatory systems or on the integration of developmental processes in evolution (i.e., evo-devo). Finally, efforts have been made to utilize the resources of complex-systems dynamics in order to model and understand evolutionary phenomena, especially those of emergence, but these efforts are not mentioned by any of the contributors.

In the Light of Evolution is a handsomely produced volume with copious, apt, and informative color illustrations to supplement a text that has a personal and informal style. The book's strength lies in its range of specific biological studies that illuminate Dobzhansky's quotation and exemplify the integration of molecular with organismal and ecological data.

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