Demonstrating Natural Selection

Natural Selection in the Wild. JOHN A. ENDLER. Princeton University Press, Princeton, NJ, 1986. xiv, 337 pp., illus. $40; paper, $13.95. Monographs in Population Biology, no. 21.

Many evolutionary biologists are in favor of natural selection regardless of what it actually means. John Endler in *Natural Selection in the Wild* focuses our attention on the multifarious ways in which the term has been used and the phenomenon investigated by biologists and provides us with a valuable synthesis. At the outset he provides us with a definition that is both useful and sufficient: Natural selection is a process in which, if with respect to a particular trait a population has (a) variation, (b) fitness differences, and (c) a heritable component, then the frequency distribution of the trait will differ among life history stages and, if the population is not in equilibrium, the trait distribution will differ between parents and offspring more than would be expected from conditions a and c. By focusing on these three conditions Endler gives a framework whereby natural selection can be and has been investigated in the field. He contrasts his definition with some alternative definitions that confuse the evolutionary biology literature. These include cases where natural selection is considered to be a phenotypic rather than a genetic response and where natural selection is considered to contrast with sexual selection. Endler rightly regards sexual selection as just one of the components of fitness that occur in most life cycles. Another value of the definition used is that it effectively eliminates the charge that natural selection is a tautology.

This book is clear, well written, and essential reading for evolutionary biologists. It provides a lucid account of natural selection theory, an explanation of the various methods of investigating selection, a review of the effective demonstrations of natural selection in field conditions, a review of the generalizations that can be drawn from those examples, a section on methods for quantifying selection, and a series of suggestions for future research.

As a biologist who attempts to measure selection under field conditions, I found Endler's chapter on methodology particularly valuable. In it he summarizes ten different approaches that have been used, describing the logic on which they are based, the null hypotheses they test, their strengths and weaknesses, and their effectiveness for demonstrating selection. Some of the methods are indirect and cannot provide evidence of selection at all, although it is often claimed that they do. The methods are grouped according to the effectiveness with which they demonstrate selection in the wild. Clearly methods requiring considerable fieldwork and detailed family histories, such as those involving genetic demography or cohort analysis, are the most effective, but they are employed relatively infrequently. It is clear that Endler feels that the time for "quick and dirty" demonstrations of natural selection is past and that we should concentrate on the detailed fieldwork necessary to understand a population in sufficient biological detail that we can not only demonstrate natural selection but also understand why it occurs and what predictions can be made about the evolution of the population.

Another important chapter in the book deals with examples of natural selection in the wild. Here Endler tabulates more than 160 cases in which in his opinion the existence of natural selection has been clearly demonstrated in field conditions. The examples include only direct and unambiguous cases and only those where variance in trait, variance in fitness, and a heritable component, either polymorphic or quantitative, to the variation had been demonstrated. In some cases evidence for a heritable component is indirect. If one reduces Endler's examples to include only those with unambiguous evidence for a genetic component to the variation and data collected by the most direct method (cohort analysis), then the number of cases is reduced to around 60. Endler has had to eliminate some of the "classical" examples of selection under these criteria.

From the examples tabulated Endler then tries to generalize. Selection is much more frequently documented for morphological than for biochemical traits, and this may account for the fact that biologists working with enzyme variability tend to be "neutralists" whereas those studying morphological variation are more likely to be "selectionists." Part of the reason for the greater number of morphological examples of selection may in Endler's opinion be that it is more difficult to detect selection for biochemical traits because it is more difficult to identify the selective agent. This seems to me to be a weak argument since fitness differences can be documented by cohort analysis without the selective agents being recognizable.

Another important generalization is that polymorphic variation showing selective differences can be found throughout the spectrum of values for the selection coefficient apart from a deficiency of studies showing very weak or zero selective difference between favored and unfavored genotypes. Endler concludes that natural selection is not necessarily weak as many theoretical models have assumed. There is one major problem with such a generalization, which he in part recognizes. This is the bias on the part of journal editors and scientists themselves against the publication of data showing no or marginal selective difference. This attitude probably has led to a vast underrepresentation of low or zero selective differences and makes one wonder if the positive cases documented by Endler are significantly more frequent than would be expected by chance considering that so many biologists are interested in natural selection.

Reservations notwithstanding, Endler has documented the case for natural selection as a potent evolutionary process convincingly and eloquently. This book should have an important influence on the direction of future field studies.

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Lectins

Microbial Lectins and Agglutinins. Properties and Biological Activity. DAVID MIRELMAN, Ed. Wiley-Interscience, New York, 1986. xviii, 443 pp., illus. $57.50. Wiley Series in Ecological and Applied Microbiology.

It has been more than 30 years since Boyd used the term "lectin" to describe substances that we now operationally define as sugar-binding proteins capable of agglutinating cells or precipitating glycoconjugates, yet many of the contributors to this volume would no doubt agree that we are not significantly nearer to an understanding of why these substances, ubiquitous in the biosphere, exist. That their natural functions remain a puzzle is certainly not due to a lack of interest in or research on them, as this volume well attests. Since their original description in plant seeds lectins have been recognized in representatives of every major life-form; those derived from viruses, bacteria, protozoans, and fungi are the subject of this 20-chapter volume. In his preface, Mirelman admits having reservations about compiling a book on a subject in its early stages of development. Fortunately he had second thoughts, and the result is an interesting and useful book.

As expected, some topics in this book