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.

FRED COOKE
Department of Biology, Queen's University, Kingston, Ontario K7L 3N6 Canada

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

have been extensively studied, one example being the adhesions of *Escherichia coli* and gonococcal pili, as befits the medical significance of these bacteria. For others we are presented with more modest but just as intriguing studies, as in the case of lectin-like substances from nitrogen-fixing bacteria. Wisely, Mirelman has included systems in which the strict definition of lectins may not in fact be met, such as sugar-binding bacterial toxins. A novel and surely beneficial feature of the chapter on lectins from the protozoan *Entamoeba histolytica* is the joint authorship by individuals (one of them the editor) who have apparently worked independently, which shifts the burden of explaining inconsistencies from the reader to the experimenters themselves.

Those of us who study lectins can take heart in the material presented here. Not only are we provided with appropriate data, we are allowed to see the frustrations that confront investigators in this area. We learn that, under physiologic conditions, certain lectins from slime molds may bind to phospholipids rather than to the sugars with which they react in more conventional laboratory conditions and that a substance derived from the etiologic agent of cholera may achieve hemagglutination by proteolysis rather than by its lectin-like activity. Indeed, a recurring theme in this book is that, if lectins do play a role in establishing or maintaining a physiologic or pathologic association involving microorganisms, they do so in concert with other mechanisms, and not alone.

In general, the chapters are well written and extensively referenced. An unfortunate exception is the chapter on the protozoan *Giardia lamblia*, which seems particularly plagued with editorial problems. Throughout the book there is a problem with incomplete or inappropriate figure legends: the autoradiograph on p. 161 and the accompanying legend are incompatible. On a more conceptual level, I was surprised that some contributors apparently overlooked the possibility that the cells interacting with microorganisms may themselves bear lectins, thereby contributing to the associative process.

The inherent interest of the material, the unique compilation of topics, the general format, and the fact that a significant amount of the information presented has not been previously published are all factors that make this volume worthwhile reading for anyone interested in the mechanisms of microbial adherence and its consequences.

T. G. PISTOLE
Department of Microbiology, University of New Hampshire, Durham, NH 03824

Solar Physics

Progress in Solar Physics. Review Papers Invited to Celebrate the Centennial Volume of *Solar Physics*. C. DE JAGER and Z. ŠVESTKA, Eds. Reidel, Dordrecht, 1986 (U.S. distributor, Kluwer, Hingham, MA). xii, 621 pp., illus. $99.50. Reprinted from *Solar Physics*, vol. 100, nos. 1–2.

Plans for a new journal to be entitled *Solar Physics* were initiated in 1965 with Cornelis de Jager (Utrecht) as the founding editor. De Jager was joined early in the endeavor by Zdeněk Švestka, and the two have served as coeditors of the journal since its first issue appeared in early 1967. The journal enjoyed explosive growth in its early years and is now a monthly publication, presenting over 200 articles a year in some 2000 pages.

Progress in Solar Physics reprints a collection of review papers commissioned for the 100th volume of the journal. The collection includes 30 contributions by 31 contributors—16 from the United States, three from the Netherlands, two each from the Soviet Union, England, and the Federal Republic of Germany, and one each from France, Denmark, Japan, Italy, Switzerland, and Czechoslovakia.

The subjects treated encompass solar interior processes (oscillations, dynamo, convection), chromospheric and coronal physics, prominences, flares, solar rotation, stellar activity and analogs, radio observations, solar wind and interplanetary observations, high-resolution observations, and future directions of the discipline. Thus, virtually all aspects of solar studies, both observational and theoretical, are represented.

As might be expected with such a collection, the contributions are uneven. Three papers, by Roxburgh, Bahcall, and Gough, explore solar interior oscillations and neutrino generation in some detail. Together they offer the reader an excellent overview, with appropriate quantitative backing, of this important subject. A paper by Nordlund is a superior description, in physical terms, of solar convection. However, the paper by Ruzmaikin on the solar dynamo is brief to a fault and, in addition to placing excessive mathematical emphasis on the nonlinear nature of equations, hardly represents the body of effort in this area broadly, or well. Fortunately, Belevedere compensates for this lack with a good survey of dynamo theory in the context of solar and stellar activity. Some of the unevenness arises from differences in the intended breadth of reviews, as evidenced by the contrast between titles such as "The solar wind" and "Imaging of coronal mass ejections by the Helios spacecraft." Additional unevenness results from inevitable differences in authors' treatment of their subjects; for example, contrast the contribution by Zirker entitled "Progress in coronal physics"—actually only a brief outline of the subject area—with the aforementioned effort by Nordlund.

On the other hand, this unevenness results in a pleasant mixture of research surveys and retrospective summaries with a dash of detail about current efforts. Howard offers a look at eight decades of research at the Mount Wilson solar observatory; Dunn surveys the problems and current efforts in the development of high-resolution solar telescopes; and Parker closes the volume with a ringing advocacy of the study of physical processes on, in, and around the sun within the context of progress in stellar physics.

Is the volume worthwhile? Emphatically, yes. The contributions are less deep and uniformly broad than those included in the recent massive survey *Physics of the Sun*, edited by Sturrock and also published by Reidel (in three volumes), but they are no less valuable, for *Progress in Solar Physics* provides a more recent, fresh mixture of efforts—current and past—in the broad field of solar science. With its diverse approach, the present work will be useful to both the specialist and the interested observer.

R. M. MACQUEEN
High Altitude Observatory, National Center for Atmospheric Research, Boulder, CO 80307

Riverine Mammals

Otters. Ecology and Conservation. C. F. MASON and S. M. MACDONALD. Cambridge University Press, New York, 1986. viii, 236 pp., illus. $34.50.

Mason and Macdonald have written an authoritative and readable book on otters that is the best available general account of the group. It will be a useful source to all who are interested in these poorly known animals.

The title suggests a comprehensive treatment of various otter species, but the book actually is devoted largely to European otters, *Lutra lutra*. Three-quarters of the text specifically concerns this species, and only in the final chapter are the other 12 or so species discussed. This imbalance probably reflects the authors' history of research and personal involvement with European otters, as well as their apparent concern for the species' shrinking range, dwindling numbers, and bleak future, rather than a disparity of available information about different otter species.