His initial interest in the subject "was prompted by a growing concern about the destructive tendencies of modern technology." At this point "even a turning away from the nuclear road requires intensive work toward achieving satisfactory solutions to the problem of radwaste," he writes, and "recognition of this fact provided the main motivation for the writing of the present book."

The book first reviews the nature and sources of radwastes, from conventional, once-through plants to reprocessing plants and other future sources. It is stressed that the health hazards associated with well-contained radwastes are far below those for some other substances routinely in use (for example, ammonia, chlorine, and arsenic). One thing is certain: radioactive materials are easy to detect, and at very low levels.

Chapter 2 reviews the general features of major disposal methods, including deep-well injection, grout injection, shallow land burial, ocean dumping, deep-mine emplacement, immobilization, underground melting, and sub-seabed emplacement. Milnes correctly stresses the importance of managing the large-volume uranium mine wastes. He emphasizes that the sub-seabed environment is at least as viable as the land-based options that are given top priority at present. I would very much agree.

Part 2 of the book is devoted to a summary of present knowledge of those processes that modify the outer few kilometers of the earth on a relevant time scale. For the chemist or engineer associated with disposal problems, the summary is adequate. It is stressed that major changes, a 1-kilometer meteorite crater, a San Francisco earthquake, an ice age, a major submarine slump, are not infrequent on million-year time scales. It is with respect to such processes that the seabed environment is perhaps the most predictable of the disposal sites. Milnes also stresses the complexity of predictive hydrogeology and fluid geochemistry, particularly when organic species are considered. Attention is also given to the behavior and stability of natural vitreous materials, a much neglected topic given the present trend to the use of glass in reprocessing. As nuclear wastes produce energy, the complex problem of describing coupled thermomechanical, hydrogeological, and hydromechanical processes is stressed, and it is suggested that field experiments may be the only way of dealing with such complexity. The problems associated with a glacial event are considered, particularly the possibility of localized deep erosion.

The final part of the book is devoted to the problem of finding the most favorable repository sites and to the relation between geology and public policy. Milnes concludes that because work on the seabed is the most free from public pressure it is perhaps the most honest. Case histories from Sweden and Switzerland are critically discussed, and Milnes concludes that "it is fair to say that involvement in the site selection process presents the geological profession with a strong challenge to the maintenance of scientific integrity."

I think Milnes has achieved his goal of providing a reasonable overview of the subject. The book provides an excellent basis on which to build a discussion of the options and problems of radwaste disposal.

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Rocky Shores Revisited

The Ecology of Rocky Coasts. Essays Presented to J. R. Lewis. P. G. MOORE and R. SEED, Eds. Columbia University Press, New York, 1986. xiv, 467 pp., illus. $45.

Rocky coasts are among the most intensively studied habitats in the world. This is because patterns in the distribution of organisms are obvious, physical gradients are compressed, processes such as recruitment, competition, and predation are conspicuous, and the size and longevity of dominant organisms are often scaled down to manageable dimensions. Ecologists of rocky coasts, like the communities they study, are a diverse lot who are often isolated, occasionally provincial, and commonly influenced by a few dominant individuals. All of this is reflected in the collection of essays entitled *The Ecology of Rocky Coasts*.

This volume is a tribute to J. R. Lewis, who is best known for *The Ecology of Rocky Shores,* published in 1964. The essays are by former students and colleagues of Lewis's, several of whom are among the most distinguished and prolific researchers in benthic ecology today. Although the essays focus on rocky coasts in nontropical (primarily North Atlantic) regions and are largely limited to a few dominant groups of organisms, they vary widely in approach, scope, scale, and objectives. Such diversity provides a rich international overview of the discipline. For that reason and for several of its superb essays, this volume is a worthwhile addition to the library of anyone interested in the contemporary natural history and ecology of temperate rocky coasts.

The Ecology of Rocky Shores focused on qualitative patterns of intertidal zonation along British coasts. Lewis explained most patterns as resulting from largely physical processes such as exposure, topography, and climate. *The Ecology of Rocky Coasts* considers more broadly the system studied by Lewis. The contributions include studies of biological processes, subtidal zones, and regions far beyond British shores. The volume progresses from zonal dominants to population biology to reproduction, recruitment, predation, and community structure. The planning and organization make it relatively cohesive. Cross-referencing is minimal, but there is little subject overlap. The editors added several nice touches such as quotations, poems, whimsical sketches, and a thoughtful preface expressing their gratitude to Lewis.

The volume opens with a brief, affectionate account of the history of Lewis's career and the academic environment of benthic marine ecology during the early post-war years in Britain (Moore and Powell). This is followed by several excellent reviews on the ecology of some dominant organisms of rocky coasts such as algae (Norton), mussels (Suchanek), and limpets (Branch). These provide background and global perspective to current research on each group. Similar reviews on the ecology of barnacles and littorinids would have made the volume more complete.

Todd reviews reproductive strategies for north temperate shore invertebrates. Other essays on this and topics of population biology are in the form of original studies on selected organisms (primarily barnacles and gastropods) that are largely confined to the British coast. These are descriptive and of limited utility beyond the region of study. In contrast, Wethey's contribution stands out as an elegant example of a recruitment study on a single species that is of general significance. He examined the timing of settlement for *Semibalanus balanoides* in New England and Britain using techniques that yield high-resolution spatial and temporal data. At both sites he observed a periodicity in settlement that he concluded would function to minimize the risk of catastrophic early post-settlement mortality.

Predation is the focus of several essays. Hughes presents an excellent overview of several studies on predation in rocky coast environments that have contributed substantively to general ecology. He reviews optimal foraging theory, the role of predation in structuring communities, the intermediate disturbance hypothesis, and biogeographical patterns in predation as it affects prey morphology. Other essays on predation are more limited in scope and overlap those of Hughes or other contributors.

Essays on community organization and structure represent the greatest range of approaches and perspectives. Examples of this range are seen in the essays of Hiscock and Sebens, both of whom describe the ecology of sublittoral communities. Hiscock, however, presents qualitative species lists for regions in the eastern North Atlantic whereas Sebens presents quantitative process-oriented data (that is, data on biological interactions and physical factors) to explain the structure of communities in the western North Atlantic. My bias is that community organization is best understood by examining its structuring processes rather than by quantitative recording of the species composition as called for by Hiscock. Obviously there is no best way to describe community structure.

Scaling in space and time affects what is observed and skews impressions of what is important. A few essays (Lundälv's, for example) reveal the importance of a temporal perspective to discern population fluctuations. Connell suggests that temporal variability and persistence of species should be measured relative to the turnover of the species. Size and spatial scaling of interacting organisms are evident in several essays. Two ends of the size spectrum are represented in essays by Hicks and Sebens. Hicks's excellent review of phytal meiofauna covers the largely unseen world of microcrustaceans and their microalgal food and habitats. He also reviews patterns in their distribution, taxonomy, morphology, and biochemistry. He presents a clear picture of the functional morphology of interacting components as an explanation for widespread convergence among phytal meiofauna. Larger-scale and more apparent interactions were studied by Sebens. His essay integrates long-term quantitative data on patterns, processes, and mechanisms structuring benthic communities. His research indicated that complex interactions of competition, predation, recruitment, and water movement are important to the structure (abundance, dominance, and persistence) of subtidal rock-dwelling communities in the Gulf of Maine. He concluded that many larger-scale patterns are mediated by interactions that occur on small spatial scales. Thus all scales are important.

Several contributors present logical-sounding stories based on considerable quantities of first-hand data with explanations that fit observed patterns. Disturbingly few essays, however, are based on experiments. Throughout the volume, authors indicate the need for experiments to resolve alternative hypotheses. Underwood considers experimentation in ecological studies and warns that care must be taken in the formulation and testing of hypotheses. He shows with several examples from his research that narrowly conceived experimental studies could create erroneous conclusions if simultaneous interactions between biological and physical factors are ignored. His points are well taken, and this chapter should be required reading for all researchers and students in ecology.

In sum the volume provides an interesting mix of approaches, perspectives, and philosophies. Despite this diversity, several topics of current interest are absent or underrepresented. For example, clonal and colonial organisms are largely ignored. Reproductive strategies or variations and persistence of species using turnover (as discussed by Todd and Connell, respectively) should be considered for organisms with no known senescence. Relatively little is presented on the demography, reproduction, and recruitment of sessile organisms (particularly algae). The volume would have been better balanced had there been fewer essays on the population biology of inconspicuous gastropods and at least one on competition. Thus, it appears that 20 years after Lewis's original work the rocky shores are worth revisiting but far from being understood.

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Some Other Books of Interest

Mathematical Physics. ROBERT GEROCH. University of Chicago Press, Chicago, IL, 1985. vi, 351 pp., illus. $30; paper, $15. Chicago Lectures in Physics.

Though "it is often the case that the essential physical ideas of a discussion are smothered by mathematics through excessive definitions, concern over irrelevant generality," and the like, writes Geroch, one can nonetheless "make a case that mathematics as mathematics, if used thoughtfully, is almost always useful—and occasionally essential—to progress in theoretical physics." The familiar role of mathematics in physics is "that of solving specific physical problems which have already been formulated mathematically," and this role has come to dominate in university curricula. The role Geroch sees for mathematics in physics is a "broad and largely shallow" one in which "the idea is to isolate mathematical structures, one at a time, to learn what they are and what they can do. Such a body of knowledge, once established, can then be called upon whenever it makes contact with the physics." The book is intended as "a brief walking tour through various areas of mathematics, providing, where appropriate and available, examples in which this mathematics provides a framework for the formulation of physical ideas." The book contains 56 chapters ranging in length from two to 13 pages. Twenty-three chapters "deal with things algebraic" and 17 "with things topological." Eight chapters discuss such "special topics" as structures that combine algebra and topology, Lebesgue integrals, and Hilbert spaces. "Lest the impression be left that no difficult mathematics can ever be useful in physics," five chapters deal with the spectral theorem. Geroch notes that although strictly speaking the only prerequisites are a little elementary set theory, algebra, and some elementary calculus, some informal contact with groups, vector spaces, and topological spaces "would be most helpful."—L.H.

Fundamental Neuroanatomy. WALLE J. H. NAUTA and MICHAEL FEIRTAG. Freeman, New York, 1986. xii, 340 pp., illus. $39.95; paper, $26.95.

This book is intended for "anyone seeking familiarity with the tissues inside the skull and at the center of the vertebral column," although the authors caution that it is "far from encyclopedic" in that it "slights the molecular basis of neural activity and the intricate local patterns in which nerve cells are organized." The book is divided into three parts. Part 1 is a set of preliminaries. It deals with early phylogeny, the nerve cell and the cells that support its activity, the anatomical divisions of the brain, and the techniques for tracing the connections a nerve cell makes with other nerve cells. Part 2 is a topological overview of the mammalian brain and spinal cord. In it the authors construct "a broad-scale mammalian wiring diagram." Part 3 is an account of the anatomy of the brain. It concludes with a chapter, entitled "Prospects," that discusses some issues having to do with understanding the brain. The book has a bibliography and a subject index.—L.H.

Motivational Systems. FREDERICK TOATES. Cambridge University Press, New York, 1986. xii, 188 pp., illus. $37.50; paper, $11.95. Problems in the Behavioural Sciences, 4.

Toates writes that in this book he has set himself "a tough task: to breathe some life into the theory of motivation." He considers "the divorce between motivation theory and learning theory to be to everyone's disadvantage," and in this book he hopes to bring together the traditional theoretical domain