sented and is an excellent guide for any beginner to the field. Craig describes in depth many of the objectives and problems associated with the thermal modeling of solar flare loops. The chapter by Birn and Schindler reviews quite successfully the current theoretical approach to pre-flare evolution of magnetic structures in the solar atmosphere.

Pneuman's chapter is a mixed blessing. He successfully reviews the present observations concerning post-flare loops. However, his presentation of theoretical models for the formation of these loops, though quite lucid, gives the impression that the issue is settled even though it is still highly controversial. Nevertheless the chapter is educational.

The chapter by Heyvaerts is a masterly review of many of the most complex flare problems. It is highly recommended. The only proviso is that many of Heyvaerts' comments represent his views of a subject about which agreement has not yet been reached.

In summary, the book can be useful for the experienced researcher in solar physics, but not as an introduction to the subject of solar flare theory.

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Microbiology

Contemporary Microbial Ecology. Proceedings of a symposium, Coventry, England, Sept. 1980. D. C. ELLWOOD, M. J. LATHAM, J. N. HEDGER, J. M. LYNCH, and J. H. SLATER, Eds. Academic Press, New York, 1980. xviii, 438 pp., illus. $41.

Modern microbiology has traditionally been a series of weakly connected disciplines. Less than ten years ago, for example, marine microbiologists had little contact with medical microbiologists. However, within the past decade a process of integration has begun. The term "microbial ecology" is used increasingly to describe the study of the comparative activities of microorganisms in a wide range of natural habitats. Concepts are discussed that are equally applicable to soils and salt marshes.

It is not surprising that the development of this active new field would spawn international symposiums. The first of these was held in New Zealand in 1977. The proceedings (*Microbial Ecology*, M. W. Loutit and J. A. R. Miles, Eds., Springer-Verlag, 1978) emphasized the individual disciplines contributing to microbial ecology. There were, for example, sections devoted to freshwater and marine ecosystems as well as to animal and plant microbiology.

Contemporary Microbial Ecology is a set of 19 papers based on keynote lectures given at the second international symposium. The conference marked an important turning point in the field. The first generation of microbial ecologists were primarily microbiologists trained in general microbiology or physiology. The new generation has a broader base. In addition to microbiology and biochemistry, they are well versed in genetics, population biology, and evolutionary theory.

The papers in this book reflect this new sophistication. There is a perceptive paper on microbial adaptation and selection by Slater and Godwin in which the complex kinetic, biochemical, and genetic factors controlling microbial community structure are discussed. Konings and Veldkamp consider the difficult subject of phenotypic responses of microbial cells to environmental change. In a fascinating paper on form and function in prokaryotes, Dow and Whittenbury attempt to define functional relationships between bacteria in biochemical and physiological terms.

The book also provides analyses of the extraordinarily wide range of survival strategies available to microorganisms. There are papers on aerial dispersal (Lacey and Gregory), symbiosis (Gooday and Doonan), and antagonism (Baker). A paper by Carlile explains the ecological implications of microbial chemotaxis and other sensory responses to environmental stimuli. Williams, in a paper entitled "On understanding predator-prey interactions," attempts to reconcile the approaches to predation of the microbiologist and the ecologist. His perceptive discussion points clearly to the dangers of interlacing microbiological and ecological theory, at least where predator-prey relationships are involved.

Specific habitats are treated in excellent papers on human pathogens (Jones), intestinal microorganisms (Bauchop), and the plant rhizosphere (Bowen). Kushner's paper on the survival strategies of bacteria living in extreme environments provides beautiful examples of the plasticity and resilience of microbial communities in response to stress. Apparently some bacteria can adapt biochemically to survive conditions, such as extreme heat, cold, saline environments, or pressure, that are lethal to most organisms. Recent work on interfaces as microbial habitats is reviewed by Marshall.

Extensive treatment is given to microbial transformations in soil and water. There are papers on nutrient and energy flow through soil (Paul and Voroney) and marine sediments (Jørgensen) as well as on bacterial energy conservation (Jones) and biodegradation of organic compounds (Bull).

My only criticism of this excellent book concerns its omissions. The vitality of the symposium reflects the input of young microbiologists, and the volume might have included more of the papers presented by younger, less established researchers.

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Paleobotanical Progress

Paleobotany, Paleoecology, and Evolution. Papers from a symposium, Ithaca, N.Y., Nov. 1979. KARL J. NIKLAS, Ed. Praeger, New York, 1981. In two volumes. Vol. 1, xxii, 298 pp., illus. $37.50. Vol. 2, 280 pp., illus. $36.

This is a timely book in that it brings together significant contributions from fields of evolutionary biology between which there has traditionally been too little interaction. Although the emphasis is on paleobotany and plant paleoecology, with chapters spanning geological time from the Precambrian to the Neogene, there are also contributions dealing with liverwort evolution by reference to comparative morphology and phytogeography, molecular genetics in the context of species durations, and biochemical evolution in early land plants. The book is published in honor of Harlan Banks, recently retired from Cornell University, who is remarkable not only for his outstanding work in paleobotany but also for his infectious enthusiasm and his generous and warm personality both as a teacher and as a colleague. In view of the dedication, it is perhaps surprising that there is not a greater representation of paleobotanists and others who have been among Banks's numerous students and collaborators. The book is an entirely American production in that all the authors are either American or have accomplished most of their scientific work in the United States. The reason for this is probably simply that the papers were presented first at a symposium held in the United States, but it seems a little unfortunate in view of Banks's international acclaim.

Paleobotany has had until recently and

indeed unfortunately continues to have among some biologists an image of conservatism if not of irrelevance. However, recent developments, in which some of the contributors to this book have played a leading role, have done much to restore respect. Many of these developments are due to the application of new techniques. Tom Taylor, in his chapter on pollen and pollen-organ evolution in early seed plants, demonstrates the importance of electron microscopical studies in enabling paleobotanists to adopt a more biological and functional approach to their material, which may be of great significance in evolutionary studies. Only a few years ago biochemical analysis of fossil plants would have been considered futile. Although biochemical studies in paleobotany to date have been few, their results encourage the prediction that this too will appreciably broaden the pool of data available for the tracing of evolutionary relationships and, as Tony Swain and Gillian Cooper-Driver here suggest, will assist toward a better understanding of the relations between ancient plants and their environments.

Paleobotanists have perhaps been rather slow to appreciate the importance of the ecological dimension by comparison with many animal paleontologists, but in recent years much has been done in pre-Quaternary plant paleoecology to make up for the slow start. Greg Retallack's review of work on fossil soils demonstrates the potential importance of this rather neglected source of information about past vegetation and environments, though many readers will wish that he had presented it so that those with less experience than he in this area might have read it with greater understanding.

Another and already very fruitful approach to paleoecology is represented by the work of Tom Phillips and William DiMichele on coal-ball analysis. The Pennsylvanian coal-swamp plants are probably better known morphologically and anatomically than those of any other fossil flora. Many attempts have been made to reconstruct the communities to which they belonged, but few have been based, as Phillips and DiMichele's are, on analytical methods.

The impact of plate tectonics is reflected in a discussion by Alfred Ziegler and others of the implications of land-mass disposition during the Paleozoic, not only in relation to the creation and breakdown of breeding barriers but also in influencing climatic patterns.

Some of the most outstanding advances in paleobotany over the past two decades relate to the origins and early evolution of gymnosperms and angiosperms. Charles Beck's work and that of Banks and his associates on the progymnosperms provide a superb example, the evolutionary implications of which are admirably discussed by Beck here. Similarly, although it stresses one particular paleoecological theory, the contribution by Retallack and David Dilcher on the rise of the angiosperms provides reason to hope that paleobotany is making significant progress toward a solution of this traditional evolutionary mystery.

The book, which is divided presumably only for handling ease into two volumes, each with the same appreciation of Harlan Banks, portrait, and editorial preface, will be valuable to advanced students as well as to those actively involved in relevant areas of research. For the general biologist it provides a useful microcosm of much of what is exciting in modern paleobotany.

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