Interest in this general subject continues to expand rapidly. One consequence is that many significant developments have taken place since this book (which has many 1980 references and a few 1981 ones) went to press. For example, Briand has provided an excellent catalogue of 40 food webs (and a later study of 62 webs is circulating among the Invisible College); Yodzis has argued that food chain lengths can indeed be explained on energetic rather than dynamical grounds; it has been shown by Nunney and by Abrams and Allison that extensions of the simple Lotka-Volterra models to include realistic refinements (such as time lags or nonlinearities in the functional and numerical responses of predators to prey densities) can significantly modify the dynamical properties; and so on. These developments were well covered at a recent conference, the proceedings of which are available as an Oak Ridge Technical Report (D. L. DeAngelis, W. M. Post, G. Sugihara, Eds., *Current Trends in Food Web Theory*, ORNL/TM-8643 [1983]; for an overview of the issues covered in this report, see R. M. May, *Nature* **301**, 566 [1983]). None of this, however, diminishes the value of Pimm's book as the best introduction to the subject that is currently available.

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Limulus

Physiology and Biology of Horseshoe Crabs. Studies on Normal and Environmentally Stressed Animals. JOSEPH BONAVENTURA, CELIA BONAVENTURA, and SHIRLEY TESH, Eds. Liss, New York, 1982. xviii, 316 pp., illus. $48. Progress in Clinical and Biological Research, vol. 81.

In the summer of 1980 a *Limulus* expedition was organized, not aboard the *Alpha Helix* but at Duke University's Marine Biomedical Center. The editors of the resulting volume indicate that the spirit of the intellectual expedition cannot be adequately reflected in the published papers. The book is nevertheless an enthusiastic example of a multidisciplinary account of a non-mammalian species.

The 18 papers, a somewhat haphazard collection of reviews and research reports, vary greatly in length and purpose. A grand review of the natural history of horseshoe crabs and a substantial description of their developmental stages with figures and diagrams form the two opening papers. These are followed by a set of brief notes and longer research reports on osmotic, respiratory, and circulatory physiology, including a concise review of the anatomy and physiology of the *Limulus* heart and blood circulation. This set leads via a paper on coxal gland function—a paper that mixes primary data with a review and a comparison with other crustaceans—to a set of papers on blood physiology and biochemistry. The focus of these papers is on the structure and function of hemocyanin, of which they provide a state-of-the-art review.

The current surge of interest in *Limulus* blood for medical and pharmaceutical purposes is only a peripheral issue here (the subject is covered in *Biomedical Applications of the Horseshoe Crab*, E. Cohen, Ed., Liss, 1979), although it is mentioned in the context of invertebrate disease studies in a short paper by the late Frederik Bang, to whose memory the book is dedicated, and Betsy Bang. These authors emphasize the importance of invertebrate studies to human health problems, a fact not generally recognized by the public or in funding policies. In a brief note, Anne Rudloe makes a plea for environmental health and laws protecting *Limulus* from human plunder. The final paper, by Sidney Galler and Bernard Zahuranec, deals with biological policy matters in general. The authors advocate stronger representation of biologists in national policy decisions and urge biologists to take an active role rather than staying at the bench or the beach exclusively. One wonders why such pleas are hidden in the tail section of a book on *Limulus*. The message of these papers deserves attention.

Conferences—or expeditions—focusing on one or a few related species serve eminently the function of disseminating diverse facts and theoretical models among different scientific disciplines. They also serve to remind us that we deal, even in the laboratory, with animals that evolve as physiological entities both in harmony and in competition with their environments; in turn, these animals are part and parcel of our own environment. Thus I applaud the multidisciplinary principle upon which the present book is founded. However, I regret that more of the outstanding *Limulus* physiologists—for instance in photoreception and vision—were not included. The book's title promises more than is actually included. May other expeditions follow!

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Tempestites

Cyclic and Event Stratification. Papers from a workshop, Tübingen, Germany, April 1980. G. EINSELE and A. SEILACHER, Eds. Springer-Verlag, New York, 1982. xiv, 536 pp., illus. Paper, $29.50.

Sedimentologists have commonly been subdivided into catastrophists and non-catastrophists, depending upon the importance they attach to rare catastrophic events in molding sedimentary sequences. The early 1960's were dominated by proponents of non-catastrophic or cyclic sedimentation—the explanation that repetitive alternations or sequences of sedimentary layers represent periodic, gradual changes in the paleoenvironment. In the mid-1960's, cyclicity enthusiasts received a setback, as many modern and ancient basins were finally recognized to be filled with turbidites, centimeter- to meter-thick packages of sediment that episodically swept in as gravity-driven turbidity currents. A second setback occurred in the late 1960's, as many finely laminated limestone and dolomite sequences were reinterpreted to be not quiet-water basinal deposits but algal-influenced storm deposits of tidal flats. A rather quiescent decade followed.

Now, here come the tempestites.

Tempestites, a vivid term for sedimentary stratification produced by episodic storm events, have gained wide recognition in European rocks and are gradually taking hold in America. This book's greatest excitement (and bulk) lies in the presentation by Seilacher and colleagues of the concepts of and evidence for sedimentation by "rare episodic events" (the term "catastrophic" has fallen into disfavor).

Most pleasing is the rigorous evidence provided by many of the authors that layering in the sediment sequences documented is indeed of storm origin. Evidence for storm stratification is drawn from an intriguing, but logical, integration of sedimentological characteristics, early diagenetic fabrics, paleoecological attributes, and post-event biological responses.

Tempestites are documented from ancient shallow marine, shelf, and epeiric sea settings, as well as from areas slightly below wave base, where storm-generated bottom flow is thought to carry sediments seaward for some distance. Twenty papers and one abstract focus on tempestites and four papers on turbidites.

Cyclic and Event Stratification, however, attempts to cover more than event stratification. There are also sections on

cyclic sedimentation (focusing on limestone-marl and limestone-shale rhythms) and black shales (evaluating the interplay of cyclic and event stratification on poorly oxygenated bottoms).

The section on cyclic sedimentation leaves the reader wanting. G. Einsele presents the concepts for cyclic sedimentation of various types and time scales, but neither he nor the other authors (seven papers and two abstracts) adequately present the evidence from their rocks that cyclic sedimentation is, in fact, the cause for the centimeter- to decimeter-thick limestone-marl or -shale alternations focused on here. Most of the effort is spent in attempting to explain the role (if any) of early- and late-stage diagenesis in creating the bedding partings, shaly interbeds, and limestone layers or in evaluating the significance of stable isotope data. Perhaps this is to be expected from a research symposium on a concept that has been embedded in the literature for over 20 years. However, one leaves this section with the feeling that while the enthusiasts of cyclic sedimentation are refining and quibbling over fascinating details others are going to restudy the same rocks and remove them from the category of cyclic deposits. The paper by P. J. Barrett is such a restudy of layered radiolarian chert of Triassic age from the Italian Apennines, in which he offers evidence that the layers are of turbidite origin in a deep basin.

W. H. Berger provides a breath of fresh air at the end of the section on cyclic sedimentation by summarizing recent evidence from the Deep Sea Drilling Project on the role of long-term climatic steps through the Cenozoic and the resultant positive and negative feedbacks (especially albedo and carbon) on deep sea sedimentation.

The section of the book on black shales is a rather commendable attempt to reevaluate the role of episodic events on stratification in poorly oxygenated bottoms—an environment in which annual and longer-term cyclic sedimentation seems to be well preserved. Following an overview of the concepts and evidence for black shale formation by A. Wetzel, ten papers struggle with the origin of black shale sequences. These papers draw on a variety of sedimentologic, paleontologic, paleoecologic, geochemical, and stable-isotope characteristics of the rock sequences.

This book, the outgrowth of a workshop held at the University of Tübingen, is not a textbook, nor is it a balanced review of the causes for stratification. It is, rather, a documentation of the concepts, approaches, and conclusions of a significant group of researchers attempting to understand cyclic and episodic event stratification in the marine environment. Of the contributors 27 are from West Germany (15 from Tübingen), seven from the United States, six from the United Kingdom, and one each from Canada, the Netherlands, and Switzerland. Only two papers and two abstracts focus on American rock sequences.

As the concepts of and evidence for tempestites were evolving in Europe, a parallel recognition of episodic event stratification was evolving in America and has culminated in a recent surge of publications on "hummocky" (referring to an undulatory layering thought to be produced by shallow marine storm erosion, resuspension, and deposition) and allied stratification. This book, however, contains a somewhat more mature development of evidence and concepts for marine storm stratification than is present in American literature. In this it must serve as a cornerstone for future research. Einsele and Seilacher deserve commendation for publishing the proceedings in English so we might more easily learn from and interact with the wealth of sedimentologic research under way in Europe.

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Pteridophytes

Ferns and Allied Plants. With Special Reference to Tropical America. ROLLA M. TRYON and ALICE F. TRYON. Habitat photography by Walter H. Hodge. Springer-Verlag, New York, 1982. xiv, 858 pp. $148.

This handsome volume is the only modern comprehensive treatment of the tropical American pteridophytes and as such will be, as the brochure announces, an important source for years to come. The book contains a wealth of useful information of value to pteridologists and to other botanists. For each genus synonymy, description, classification (often to subgenus or major species group), ecology, and geography are presented and information on spores and chromosome numbers is given. Selective bibliographies and maps showing the American distribution of each genus are also provided.

The format is attractive; wide left-hand margins make the book easy on the eyes and allow space for annotation. Most of the illustrations are outstanding, including excellent habit photographs by W. H. Hodge and many scanning electron photomicrographs of spores.

The introduction is brief. The discussion of fern systematics has a pre-Darwinian ring to it: "The classification presented here is based on character similarities rather than on presumed phyletic relationships." A classification is outlined down to the level of subgenus. (Curiously, the level of tribe is adopted in place of subfamily.) At the family level there is neither extreme splitting nor extreme lumping. The key to families has many exceptions to the leads, however, and the use of trichotomies and the misuse of terms (such as "synangium" in *Ophioglossum* and "joint" for the internode in *Equisetum*) are unfortunate. The remainder of the introduction consists of discussion of biogeography, spores, and chromosome numbers. These subjects are obviously principal concerns of the volume, but although the material provided concerning them is interesting and useful the emphasis on them tends to skew the treatment rather than give a balanced view of fern characters. The high degree of parallelism in spore sculpturing and chromosome number makes the value of such analysis often negligible above the generic level. Sporophyte morphology and anatomy and the gametophyte generation are neglected.

At the genus level the Tryons' taxonomy displays extremes both of lumping and of splitting. *Tectaria* and *Dryopteris* are viewed very broadly to include all closely allied genera, and *Asplenium* swallows up *Phyllitis*, *Ceterachopsis*, and *Antigramma* but curiously not *Holodictyum* or *Camptosorus* (usually the first segregated genus returned to *Asplenium*). By contrast, the cyatheoid tree ferns, Rolla Tryon's specialty, are maintained as six separate genera. The polypodioid (but not grammitid) ferns are split to the extreme, with all the segregate genera recognized except *Phlebodium* (into *Polypodium*) and *Hyalotrichopsis* (into *Campyloneurum*).

The literature citations lack some major papers, notably in cytology one by Lovis (1977) and one by Wagner and Wagner (1980).

The abundant typographical errors, grammatical lapses, and inconsistencies in capitalization of book titles are disappointing in a work of this magnitude. Sentence construction is occasionally awkward and confusing. Careful proofreading would have been helpful.

The danger with any work as large as this, no matter what its quality, is that it tends to give the impression that work on its subject is essentially complete. Bower's three-volume treatise *The Ferns* in