The Problem of Patchiness

Spatial Pattern in Plankton Communities. Proceedings of a conference, Erice, Italy, Nov. 1977. JOHN H. STEELE, Ed. Plenum, New York, 1978. x, 470 pp., illus. $42.50. NATO Conference Series IV, vol. 3.

There are few water-column ecologists today who fail to recognize that the complex and confounding problem of discontinuous distribution of animal communities affects every aspect of their investigations, from sampling, systematics, and interpretation of experimental results to modeling and the development of ecological theory. This volume, the product of a conference organized by John Steele, goes some way toward establishing a basis for a set of approaches to dealing with the problem. In so doing, and perhaps more important, it elevates the all-pervasive irritant to the level of a structured subdiscipline of biological oceanography.

In the first sentence in his introduction, Steele expands the scope of the symposium from the spatial patterns indicated in the title to include the various facets of food chains and life cycles that interact to produce temporal patterns, spatial patterns being, after all, simply single frames in the temporal sequence. The spatial pattern of the book itself is to begin by concentrating on predominantly physical factors, such as advection, shear, and turbulence, as mechanisms that can create patchy distributions of inert particles starting from homogeneous initial conditions. Then come a series of papers on phytoplankton distributions and a variety of numerical methods for analyzing them, including fluorescence or particle-counter techniques, which can provide something close to the real-time and continuous records that are obtainable for physical oceanographic parameters. From here the contributions work their way rapidly up the food chain, with zooplankton and larval and older fish being represented by single contributions, this reflecting the lack of processed field data as organisms get larger and more dilute. The volume is rounded out by contributions that compare freshwater and terrestrial systems for the benefit of the marine scientist and finally a chapter that, beginning from the position that the "basic issues [of spatial pattern] are fundamental ones in all ecosystems," sets the marine water column in a more general ecological context.

I was impressed by the effort that seems to have been put forth by all the contributors both to provide reviews of how their particular areas of research have arrived at their present state and to make meaningful reference to the work of the other authors. They manage to bring cohesion to a subject so broad that a book on it could very easily become a series of hopelessly disjointed reports. I suspect that the limitation of the conference to some 60 participants helped in this respect.

To my mind there are a few striking omissions, rectification of which would have helped round out the treatment of higher trophic levels, particularly with regard to temporal patchiness. For instance, there is no contribution devoted to the long-time-scale records of the Hardy Recorder surveys or to the records of changing fish stocks. But then the title of the volume does not promise such coverage.

For marine ecologists, this is a very useful collection of papers, more so in some ways for the treatment of subjects outside this immediate area of expertise. It surprised me to find, for instance, that patchiness problems are not much different in other ecosystems. Besides this, there are many interesting insights and useful bits of information buried in the fine print.

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Surface Phenomena

Topics in Surface Chemistry. Proceedings of a symposium, Bad Neuenahr, Germany, Sept. 1977. ERIC KAY and PAUL S. BAGUS, Eds. Plenum, New York, 1978. viii, 408 pp., illus. $42.50. IBM Research Symposia Series.

This symposium volume contains 15 papers on various aspects of surface chemistry and physics. Five topics are treated: surface studies in electrochemical systems, ordered arrays of organic molecules at surfaces and interfaces, atomic and molecular scattering from surfaces, aspects of surface chemical bonding, and optical excitations at surfaces. The selection of topics is both imaginative and knowledgeable, and the quality of the papers is high.

One of the recurrent themes is photochemistry at interfaces. R. Memming reviews the energy-band model used to predict charge transfer between a semiconductor electrode and a redox system and considers the conditions for the successful use of semiconductor-electrolyte combinations for light (solar) energy conversion. It is of course the surface region that provides the electric potential difference necessary for charge separation. A quite different type of interface with the same capability exists in the aqueous micellar solutions discussed by M. Grätzel. The micelles are spherical agglomerates formed by radially oriented surfactant molecules that have the polar group facing the surrounding aqueous phase. Solutions can be prepared with a sufficiently large potential drop across the boundary to effect a separation of positive and negative charges produced inside the micelles by radiation. Yet a third type of interface with special photochemical properties is described by D. Möbius. Techniques have been developed for the assembly of ordered monolayers of selected organic molecules, such as fatty acids and dyes. These layers can then be stacked into units that perform such functions as light-induced electron transfer and energy transfer. B. Tiecke and G. Wegner report on other attempts at two-dimensional molecular engineering, by ultraviolet-induced polymerization of diacetylenes.

Catalysis is considered by many of the authors. A. Bewick and M. Fleischmann conclude their paper on the electrochemical investigation of surface compound formation with some examples of in situ deposition of the catalyst. The paper by M. Cavallini is devoted to a discussion of the catalytic oxidation of carbon monoxide on palladium and platinum, studied by molecular beam techniques. In a very readable paper, T. Edmonds and J. J. McCarroll examine some cases in which catalytic processes have been developed or improved with the aid of modern surface techniques such as LEED (low-energy electron diffraction spectroscopy) and XPS (x-ray photoemission spectroscopy). The authors make the point, however, that industrial catalysis used to be a secretive art and may now become a secretive science.

Surface scattering of atoms and molecules is reviewed by H. Wilsch, and U. Gerlach-Meyer and E. Hulpke give a progress report on low-energy (5 to 25 electron volts) ion scattering. J. K. Sass describes work on photoelectron emission into electrolytes, A. M. Bradshaw and D. Menzel review photoelectron spectroscopic (UPS [ultraviolet photoemission spectroscopy] and XPS) studies of adsorbed layers, and S. Andersson discusses results for surface vibrations obtained by electron energy-loss spectroscopy. The section on optical ex-

citations has papers by H. Lüth (on photovoltage spectroscopy), by M. R. Philpott (a very good review of surface excitons and polaritons in organic crystals), and by P. J. Hendra and M. Fleischmann (on Raman spectroscopy).

Surface chemistry is a very active research field at the present time. Even in a subfield such as the physical chemistry of solid surfaces one would have to read on the order of ten articles a day to follow the detailed developments at first hand. There is therefore an acute need for concise reviews of familiar topics, surveys of related areas, and accessible introductions to new ideas and techniques. The present volume is an admirable example of how this need may be satisfied.

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High-Energy Atomic Physics

Structure and Collisions of Ions and Atoms. I. A. SELLIN, Ed. Springer-Verlag, New York, 1978. xii, 352 pp., illus. $36. Topics in Current Physics, vol. 5.

The years 1931 and 1932 were exciting ones for nuclear physics. They saw the discovery of the neutron, announcements by R. J. Van de Graaff of a 1.5 million volt electrostatic generator "for the investigation of the atomic nucleus" and by E. O. Lawrence and M. S. Livingston of the principles of the cyclotron, and publication of a paper by J. D. Cockroft and E. T. S. Walton on nuclear experiments with high-velocity positive ions. Except for a few early atomic experiments by Livingston and W. M. Coates, most immediate efforts were understandably directed at the use of the new accelerators for nuclear investigations, and many productive atomic physicists of the period turned to nuclear research, which was then the frontier of physics. Only in recent years has it become widely appreciated that accelerators that produce beams of ions with energies of 0.1 and 10 MeV per atomic mass unit are ideally suited for the study of dynamical detail in ion-atom collisions, since projectiles with velocities comparable to the velocities of some of the more tightly bound atomic and molecular electrons serve as effective probes of atomic structure.

One of the most active users of particle accelerators in atomic physics, I. A. Sellin, has brought together in this book seven reviews by ten authors, all of whom report on the productive period of the last ten years in high-energy atomic physics, as atomic physics done with accelerators is sometimes called. (In this context, "high energy" means MeV energies, not GeV energies as is the case for elementary particles.)

The swiftness of progress in this field is underlined by the fact that this volume, which had an editorial deadline in 1976, has missed several major advances: the experimental demonstration of positron production in heavy ion-atom collisions (at the GSI accelerator in Darmstadt), for which the fine chapter by S. J. Brodsky and P. J. Mohr provides the theoretical background; the discovery of resonant coherent excitation of channeled ions by an Oak Ridge team with S. Datz, whose chapter on atomic collisions in solids sets the stage for this beautiful observation; and the detailed experimental investigations by Sellin and his collaborators of electrons emitted in ion-atom collisions as companions to the emerging projectile. Mention of this mode of electron emission in energetic ion-atom collisions is made briefly in the chapter by N. Stolterfoht.

The general physical scientist who wants an orientation to atomic physics done with particle accelerators will find particularly rewarding a systematic and careful chapter on the theory of inelastic atom-atom collisions by J. S. Briggs and K. Taulbjerg, a comprehensive report on x-ray production in heavy ion-atom collisions by P. H. Mokler and F. Folkmann, and the chapter by Brodsky and Mohr, although it is on a subject, quantum electrodynamics in strong and supercritical fields, that lies partly outside the scope of the title of the book.

The chapter by Stolterfoht, though especially rich in physical insights, is relatively narrow. It is complemented by Sellin's chapter on the information gained from beam-foil experiments about the spectroscopy of highly charged and highly excited ions, with emphasis on radiationless (Auger) transitions, which strongly compete with the more familiar radiative deexcitation of atoms. A chapter by L. Armstrong, Jr., on relativistic effects in highly ionized atoms, is both too technical in content and too casual in presentation. More than the rest of the chapters, this one suffers from not having been linked even superficially to the other pieces in the collection.

A volume like this, containing several contributions to which one may wish to refer during the next few years, would be much more useful if it included an author index, especially since the references accompanying the chapters are not alphabetically ordered and in some instances are not even sequential with respect to the text. A glossary of acronyms, such as FPES, PWBA, TIRS, and REC, would also have been handy even for the initiated reader. Few of these terms are mentioned in the subject index. These are more than matters of convenience, for the 753 references supplement the reviews in the book and direct attention to many still open questions.

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Books Received

Adults and Their Parents in Family Therapy. A New Direction in Treatment. Lee Headley. Plenum, New York, 1978. 194 pp. $14.95.

Advances in Archaeological Method and Theory. Vol. 1. Michael B. Schiffer, Ed. Academic Press, New York, 1978. xvi, 426 pp., illus. $24.50.

Avian RNA Tumor Viruses. Proceedings of a workshop, Pavia, Italy, Sept. 1977. Sergio Barlati and Carlo de Giuli-Morghen, Eds. Piccin Medical Books, Padua, Italy, 1978. xviii, 356 pp., illus. $30.

Benefit Financing in Unemployment Insurance. A Problem of Balancing Responsibilities. Paul J. Mackin. W. E. Upjohn Institute for Employment Research, Kalamazoo, Mich., 1978. xii, 124 pp. Paper, $3. Studies in Unemployment Insurance and Related Problems.

The Biology of Aging. John A. Behnke, Caleb E. Finch, and Gairdner B. Moment, Eds. Plenum, New York, 1978. xii, 388 pp., illus. $18.95. A Publication of the American Institute of Biological Sciences.

Current Trends in Programming Methodology. Vol. 3, Software Modeling. K. Mani Chandy and Raymond T. Yeh, Eds. Prentice-Hall, Englewood Cliffs, N.J., 1978. xiv, 380 pp., illus. $19.95.

Current Trends in Programming Methodology. Vol. 4, Data Structuring. Raymond T. Yeh, Ed. Prentice-Hall, Englewood Cliffs, N.J., 1978. xiv, 322 pp., illus. $19.95.

The Death of the Asylum. A Critical Study of State Hospital Management, Services, and Care. John A. Talbott. Grune and Stratton, New York, 1978. xvi, 186 pp. $22.50.

Design of Reinforced Concrete. Jack C. McCormac. Crowell (Harper and Row), New York, 1978. xx, 508 pp., illus. $20.95.

Explanatory Structures. A Study of Concepts of Explanation in Early Physics and Philosophy. Stephen Gaukroger. Humanities Press, Atlantic Highlands, N.J., 1978. viii, 262 pp. $21.

Exploring with Martin and Osa Johnson. Kenhelm W. Stott, Jr. Martin and Osa Johnson Safari Museum Press, Chanute, Kans., 1978. 134 pp., illus. Paper, $5.

Farmers and Towns. Rural-Urban Relations in Highland Bolivia. David A. Preston. Geo Abstracts, University of East Anglia, Norwich, England, 1978 xii, 196 pp., illus. Cloth, $13; paper, $9.90.

Future Directions in Health Care. A New

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