

Actually, aggregating species according to trophic level doesn't seem like such a useful concept after reading this book.

The final chapter presents arguments for the research centers and makes a plea for collaboration. One has to ask if lumping the diversity of species interactions (trophic dynamics, size efficiency hypothesis, key-stone predator concept, optimal foraging theory, and so on) under the single rubric "complex interactions" has produced a useful conceptual framework for funding future research. There is at least a danger of rejection of research ideas because they cannot cover the range of time and space scales necessary to understand the full range of interactions. The goal of achieving the mechanistic understanding required for adequate prediction is admirable, as is the suggestion that we need to have four sets of research lakes (comparable to oceanographic vessels!) to cover the range of gradients. But we must be aware of the possibility that only one research site will be supported. Given that more restricted situation, certain paradigms could be emphasized at the expense of originality. The artificial and counterproductive concept of top-down vs. bottom-up is but one example.

The workshop was designed to set a future research agenda for aquatic ecology. Therefore I feel driven to comment on the fact that only one woman was included among the 40 invited participants. We should consider the full range of diversity not only in our research but in our colleagues as well.

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Monitoring Brightness

High Speed Astronomical Photometry. BRIAN WARNER. Cambridge University Press, New York, 1988. xii, 291 pp., illus. \$59.50. Cambridge Astrophysics Series.

With the advent of large telescopes and the accompanying sophisticated instrumentation for optical spectroscopic work and infrared technology, the concept of photometry is too often currently labeled as "old-fashioned" or "not important." There are a few private institutions and individuals who have persevered in this field, developing and using instrumentation specifically designed to provide the best measurements of the brightness of rapidly varying sources and accomplishing important scientific results with this technique. Brian Warner is one such individual. Being fortunate to have

access to large amounts of time on small and medium-sized telescopes, he (with his students) has provided the astronomical literature with a wealth of photometric data and interpretation of them. His book is a testimonial to the power and value of high-speed photometry and its wide-ranging applications in astronomy. Throughout, the emphasis is on the astrophysics that has emerged from the data that have been acquired. Warner clearly states the value and uses of the data and comments when they have not been used to full potential (as in the high-time-resolution studies on flare stars and the interpretation of the flickering and quasi-periodic oscillations in cataclysmic variables).

The discussion ranges from good coverage of planetary science (occultations) to a very small section on extragalactic astronomy, with the major emphasis on stars (flare stars, cataclysmic variables, pulsars, and pulsating white dwarfs and non-degenerates). The order is based on the chronology of discoveries, which leads to an easy transition to the direct results following from technical developments. It also results in interesting reading including or excluding the astrophysics involved. For example, the path leading from naked-eye measurements of lunar occultations during the time of Copernicus to the determination of the diameter of Alpha Leo from a 1980 trace obtained with the Kitt Peak 4-meter telescope gives a very clear picture of how far we have come in technique and knowledge. Embedded in this description is a good discussion of the physics behind the fringe patterns and their interpretation.

This same concise but in-depth coverage of the physics involved permeates all the discussion of the interpretation of light variability, starting with effects from the atmosphere (scintillation) and telescope (drive errors) through the determination of the correct periodicities in a data string, including effects of possible biases from the sampling frequency and of beat periods and Doppler shift complications in work on binary stars. The inclusion of the equations based on first principles and the numerous well-done plots of light curves, power spectra, and diagrams will make this book very useful for graduate students or astronomers from other disciplines who want to learn about the techniques, problems, and applications of high-speed photometry. The book will also be a good handbook for established photometrists—I found it useful to be able to compare the flickering in cataclysmic variables with that in x-ray binaries and extragalactic objects with the aid of the detailed light curves given for each system.

The references and discussion are some-

what biased toward work accomplished at the University of Texas, but this can be attributed to the large contributions of astronomers there to the study of occultations and of variable stars following their development of innovative photoelectric systems in the late '60s. The references as a whole provide a good overview of the important work being accomplished in each field.

The dearth of results from two-dimensional detectors is ascribed by Warner to the newness of the technique. I expect that the charged-coupled device detectors will affect photometry in the '90s as photoelectric photometers changed the field in the '70s. This will be especially true for small telescopes (CCD photometry of 20th-magnitude stars can now be accomplished on 36-inch telescopes) and for extragalactic sources. Knowledge of photometric variations at timescales of less than seconds will probably change more slowly pending further improvements. I am confident that Warner's celebration of high-speed photometry will continue into the future. Readers of his book will be motivated to join in the fun of making observations of rapidly varying sources.

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Earth Science and History

The Behavior of the Earth. Continental and Seafloor Mobility. CLAUDE ALLÈGRE. Harvard University Press, Cambridge, MA, 1988. xiv, 272 pp., illus. \$35. Translated from the French by Deborah Kurmes van Dam.

"Scientific theories are like talented artists: once recognized their merits seem so obvious that their success is assumed to be due only to their excellence." So Claude Allègre begins his breezy account of mobility theory and its transformation of the geological sciences. He goes on to note that his "attempt to trace in an uncomplicated manner the evolution of the ideas connected with continental mobility . . . is combined inextricably with the goal of explaining mobilist geology and its essential concepts" and that he has "purposely simplified the work to give it a manageable size, make it accessible to the general reader, and place it in its proper sociological context."

Like most books recounting the history of plate tectonics, this one spans the years from Wegener's original proposal of 1911 through the early 1970s, by which time it was obvious to most that a revolution had occurred. In addition to following the well-

established tracks (Wegener, rejection, specialization, paleomagnetism in two roles, sea-floor spreading, continental drift, plate tectonics, the evolution of ocean basins, geology at plate boundaries, and mountain building), Allègre carries the scientific developments arising from the revolution into more recent times, with discussion of topics that I have not seen covered in other popular historical treatments.

The essence of the sociology is contained in the preface and epilogue. The writing is flavorful throughout. An example is this passage on Harry H. Hess, who introduced the theory of sea-floor spreading, and J. Tuzo Wilson, who supported it:

The scientific community tends to distrust anyone who changes his opinions too often or who appears to be attracted by novelty above all else. . . . Like Wilson, Hess had often entertained daring theories. . . . The agreement between these two scientific adventurers did nothing to reassure the conservative scientific community. After years of wandering in the wilderness, however, the two had finally stumbled upon a promising path and were moving in the right direction [p. 63].

The historical treatment is exciting but uneven. It was planned that way: "Certain chapters are very personalized, while others mention few names" (p. 245). One of the detailed sections covers the familiar events of 1966–68—events that led to the formulation of the theory of plate tectonics in conversations, public lectures, and published abstracts or articles—with considerable attention to the topic of priority.

In 1986 in his Crafoord Lecture on isotope geodynamics Allègre discussed in technical detail the work done by him and his group, noting that "mathematically, the earth's behavior can be described as a set of distributions of chemical elements constantly modified by a set of operators which characterize the principal geological functions." Readers will not find language like this in *The Behavior of the Earth*, but some of Allègre's far-reaching conclusions about convection in the earth's interior, the formation of the oceanic crust, the extraction of the continents, and the degassing of the earth and formation of the fluid envelopes are embedded in the historical developments described in the last two chapters on the continental crust and the dynamics of plate movement, which present earth sciences as a global system.

Readers exposed to this story for the first time will find it fascinating. Those who are more knowledgeable will find statements about history that differ from those in other published accounts. Some may question who really did pronounce "for the first time" the expression "plate tectonics" (p. 108), and others may wonder what happened to

the eclogite sinker in figure 35 (p. 89), derived from Holmes's 1944–45 textbook without reference to the original ideas and figure from the Glasgow Proceedings of 1928–29, which Holmes reproduced in his 1965 revised edition. Such subtleties will not matter to the general reader to whom the book is addressed—who may, however, find too much of the vocabulary of traditional geology that Allègre says was "as barbarous as it was esoteric" (p. viii). There is a nicely written glossary, but many of the esoteric words in the text are not listed. Despite this, I am sure that the general reader can enjoy the story.

The book deserves to be a popular success, and it includes much of interest to the professional as well. I particularly enjoyed the insights it provided into French contributions and reactions to the revolution, as well as the description of subsequent developments in geochemistry and global systems. Finally, this book should spark the interest of potential students of the earth sciences.

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Reprints of Books Previously Reviewed

From Maxwell to Metaphysics. Aspects of Electromagnetic Theory in the Last Quarter of the Nineteenth Century. Jed Z. Buchwald. University of Chicago Press, Chicago, 1988. Paper, \$17.95. *Reviewed* 232, 532 (1986).

The Propagation of Radio Waves. The Theory of Radio Waves of Low Power in the Ionosphere and Magnetosphere. K. G. Budden. Cambridge University Press, New York, 1988. Paper, \$37.50. *Reviewed* 232, 1448 (1986).

The Shaky Game. Einstein, Realism, and the Quantum Theory. Arthur Fine. University of Chicago Press, Chicago, 1988. Paper, \$10.95. *Reviewed* 238, 409 (1987).

Books Received

Activation, Deactivation, and Poisoning of Catalysts. John B. Butt and Eugene E. Petersen. Academic Press, San Diego, CA, 1988. x, 495 pp., illus. \$95.

Advances in Thermal Modeling of Electronic Components and Systems. Vol. 1. Avran Bar-Cohen and Allan D. Kraus. Hemisphere, New York, 1988. x, 469 pp., illus. \$90.

The Alphabet and the Brain. The Lateralization of Writing. Derrick de Kerckhove and Charles J. Lumsden, Eds. Springer-Verlag, New York, 1988. xvi, 455 pp., illus. \$98.50.

Analytic Properties of Automorphic L-Functions. Stephen Gelbart and Freydoon Shahidi. Academic Press, San Diego, CA, 1988. viii, 131 pp. \$18.75. Perspectives in Mathematics, vol. 6.

Antibody-Mediated Delivery Systems. John D. Rodwell, Ed. Dekker, New York, 1988. xiv, 384 pp., illus. \$99.95. Targeted Diagnosis and Therapy, vol. 1.

Applied Information Theory. I. M. Kogan. Gordon and Breach, New York, 1987. x, 466 pp. Paper, \$195. Studies in Cybernetics, vol. 14. Translated from the Russian edition (Moscow, 1979) by K. Mohan Das.

Berelson on Population. John A. Ross and W. Parker Mauldin, Eds. Springer-Verlag, New York, 1988. xiv, 275 pp., illus. \$28.95.

Bibliographic Information on Plant Tissue Culture. The Information Committee on Plant Tissue Culture and The Institute of Physical and Chemical Research (RIKEN), Eds. Japan Scientific Societies Press, Tokyo, 1988 (U.S. distributor, International Specialized Book Services, Portland, OR). 2 vols. xviii, 281 pp., and iv, 142 pp. Paper, \$89.95.

Biological Nitrogen Fixation. Recent Developments. N. S. Subba Rao, Ed. Gordon and Breach, New York, 1988. xii, 337 pp., illus. \$114.

Biological Response Modifiers and Cancer Therapy. J. W. Chiao, Ed. Dekker, New York, 1988. xvi, 444 pp. illus. \$99.75. Immunology Series, vol. 40.

Biology of Growth Factors. Molecular biology, Oncogenes, Signal Transduction, and Clinical Implications. Jeffrey E. Kudlow et al., Eds. Plenum, New York, 1988. viii, 238 pp., illus. \$57.50. Advances in Experimental Medicine and Biology, vol. 234. From a symposium, Toronto, Ontario, June 1987.

Biology of the Leukotrienes. Roberto Levi and Robert D. Krell, Eds. New York Academy of Sciences, New York, 1988. xxvi, 475 pp., illus. \$122. Annals of the New York Academy of Sciences, vol. 524. From a conference, Philadelphia, PA, June–July 1987.

Biomedical Ethics. An Anglo-American Dialogue. Daniel Callahan and G. R. Dunstan, Eds. New York Academy of Sciences, New York, 1988. viii, 175 pp., illus. Paper, \$46. Annals of the New York Academy of Sciences, vol. 530. From a conference, New York, June 1987.

Biomedical Importance of Marine Organisms. Daphne G. Fautin, Ed. California Academy of Sciences, San Francisco, CA, 1988. viii, 159 pp., illus. Paper, \$20. Memoirs of the California Academy of Sciences, no. 13. From a symposium, San Francisco, CA, April–May 1987.

Biomembranes. Basic and Medical Research. Gh. Benga and J. M. Tager, Eds. Springer-Verlag, New York, 1988. xvi, 224 pp., illus. \$64.50.

Brain Injury and Recovery. Theoretical and Controversial Issues. Stanley Finger et al., Eds. Plenum, New York, 1988. xx, 368 pp., illus. \$69.50.

Building for Tomorrow. Global Enterprise and the U.S. Construction Industry. National Research Council. National Academy Press, Washington, DC, 1988. xvi, 104 pp. Paper, \$11.95.

Calculus on Heisenberg Manifolds. Richard Beals and Peter Greiner. Princeton University Press, Princeton, NJ, 1988. x, 194 pp. \$52.50; paper, \$20. Annals of Mathematics Studies, vol. 119.

The Criminology of Edwin Sutherland. Mark S. Gaylord and John F. Galliher. Transaction, New Brunswick, NJ, 1988. xiv, 183 pp. \$24.95.

Darwin and the Novelists. Patterns of Science in Victorian Fiction. George Levine. Harvard University Press, Cambridge, MA, 1988. xiv, 319 pp. \$27.50.

Descriptive Set Theory and the Structure of Sets of Uniqueness. Alexander S. Kechris and Alain Louveau, Cambridge University Press, New York, 1987. x, 367 pp. Paper, \$34.50. London Mathematical Society Lecture Note Series, vol. 128.

Desorption Induced by Electronic Transitions, DIET III. R. H. Stulen and M. L. Knotek, Eds. Springer-Verlag, New York, 1988. xiv, 295 pp., illus. \$59. Springer Series in Surface Sciences, vol. 13. From a workshop, Shelter Island, NY, May 1987.

Diffusion Processes and Partial Differential Equations. Kazuaki Taira. Academic Press, San Diego, CA, 1988. xviii, 452 pp., illus. \$69.50.

The Diplomacy of Biological Disarmament. Vicissitudes of a Treaty in Force, 1975–85. Nicholas A. Sims. St. Martin's, New York, 1988. xvi, 356 pp. \$49.95.

Discourse and Reference in the Nuclear Age. J. Fisher Solomon. University of Oklahoma Press, Norman, 1988. xvi, 298 pp. \$24.95. Oklahoma Project for Discourse and Theory, vol. 2.

Disorder and Order in the Solid State. Concepts and Devices. Roger W. Pryor, Brian B. Schwartz, and Stanford R. Ovshinsky, Eds. Plenum, New York, 1988. x, 261 pp., illus. \$62.50. Institute of Amorphous Studies Series. Based on a conference, Bloomfield Hills, MI.

Distillation and Absorption 1987. G. G. Haselden et al., Eds. Hemisphere, New York, 1988. 2 vols. Vol. 1, Plenary, vi, 644 pp., illus. Vol. 2, Poster, vi, 540 pp., illus. \$197.50. Institution of Chemical Engineers Symposium Series, no. 104. From a symposium, Brighton, U.K., Sept. 1987.

Divided Opportunities. Minorities, Poverty, and Social Policy. Gary D. Sandefur and Marta Tienda, Eds. Plenum, New York, 1988. xvi, 279 pp., illus. \$34.50. Environment, Development, and Public Policy.