rized in a series of seven courses, given by Dennis Downes, George Herbig, James Lequeux, Peter Mezger, Jean-Loup Puget, Stephen Ridgway, and Gareth Wynn-Williams. A course given by J. Mayo Greenberg interprets the observational data available on interstellar grains, discusses laboratory experiments that simulate some of the observed physical conditions of interstellar space, and ends with a discussion of the growth and evolution of dust grains in star-forming regions.

Since stars appear to be forming in giant molecular clouds—clouds sufficiently cool to permit the existence of molecules—one may ask how these clouds themselves originate. Bruce Elmegreen discusses that question and examines the currently popular view he first helped to propose, that star formation during the contemporary era may be a self-propagating process in which the formation of stars in one portion of a cloud produces a compression of gas in neighboring regions, thus triggering a further collapse resulting in additional star formation. In a further course Elmegreen examines cluster formation—for stars are seldom found in isolation. As a general rule they appear to form in associations or clusters of stars with varying masses. The mass distribution among these stars may be an important clue to the processes active during collapse.

In recent years, radio and infrared observations have provided us with spectral information about the physical conditions deep inside molecular clouds and about the chemical and isotopic composition of matter there. William Langer, in his course, discusses chemical reactions at play under these circumstances and the chemical evolution of cloud material to be expected. Again, we may have a tracer here of events taking place during protostellar collapse.

At this point in the volume, the stage is set for Joseph Silk, Werner Tscharnuter, and Harold Yorke each to take the bull by the horns and see whether a magnetohydrodynamic approach, which comprises (i) competing cooling and heating mechanisms, (ii) the transfer of radiative energy, (iii) various types of instabilities, (iv) fragmentation into cloudlets, (v) the initiation of star formation, and (vi) the onset of countervailing influences unleashed by stellar winds, which are the outflow of material observed in all young stars, can lead to a self-consistent model of star formation. The three courses provide somewhat different perspectives but overlap reasonably well. The arguments are well presented and permit the reader to perform similar calculations for himself or herself. A final course, by Gregor Morfill, turns the subject of star formation upside down by asking what we can conclude about the formation of stars by working backward in time from the present appearance of the solar system—the sun, the planets, the asteroids, and the comets believed to still contain pristine matter, hardly processed by the evolution that the sun and planets have undergone. In this type of analysis, mineralogical evidence—gathered from meteorites that occasionally arrive from interplanetary space and fall on earth to be picked up and analyzed—plays a central role. Morfill shows how evidence of this kind can be used to construct a coherent picture of the protoplanetary disk out of which the earth and other planets must have condensed.

Completing the volume are short summaries of 12 relevant seminars that were given during the summer school session.

This is a wonderful book. I am planning to teach an undergraduate course during the coming semester that concentrates on the astrophysics of star formation. I know that the material in the volume will greatly help me in clarifying the subject of star formation for my students.

MARTIN HARWIT
Department of Astronomy,
Cornell University,
Ithaca, NY 14850

Aquatic Chemistry

Chemical Processes in Lakes. WERNER STUMM, Ed. Wiley-Interscience, New York, 1985. xx, 435 pp., illus. $59.95. Environmental Science and Technology.

Aquatic chemistry has its origins in a variety of applied disciplines: limnology, oceanography, geochemistry, and water-quality engineering. Until recently, chemistry played a subservient role in the development of these disciplines. For example, the chemistry of lake waters has been studied at least since Birge and co-workers began their pioneering work on Wisconsin lakes in the early 1900's, but for most of this century limnological chemistry focused on routine analyses performed primarily by or for biologists to answer questions of biological interest. Only in the past few decades has aquatic chemistry been recognized as a discipline worthy of academic pursuit in its own right. This change in status was stimulated by concern about the behavior of chemical pollutants that enter natural waters in society's wastes. Realization that the scientific issues about pollutant transformation and fate are complicated far beyond the scope of conventional chemical analysis led to the development of graduate-level academic programs in aquatic chemistry.

The 1970 book *Aquatic Chemistry* by Werner Stumm and James J. Morgan was the first modern treatment of the "new discipline" of natural water chemistry, and it has served as the standard reference ever since. Its paradigm is that of the equilibrium model, and it emphasizes thermodynamic and ionic equilibrium approaches to describing the chemistry of natural waters. These are satisfactory for some inorganic constituents and indeed often are an essential first step in developing a quantitative understanding of such systems. Nonetheless, aquatic chemists soon recognized that equilibrium descriptions are not adequate for many substances of great interest (such as organic pollutants) and that lakes must be treated as the open systems that they really are. This implies greater emphasis on the processes, mechanisms, and kinetics of solute behavior than on the static (equilibrium) states toward which the systems tend (but which they seldom reach).

Chemical Processes in Lakes is an outgrowth of the gradually increasing focus on dynamic aspects of aquatic chemistry, and it reflects a quantum jump in the sophistication of the discipline. Its paradigm is the process-oriented box model, but insofar as most chapters strive to describe lake processes mechanistically, the boxes are not "black." The book has a strong chemical-engineering flavor, but in spite of the emphasis in the book on models, the level of mathematics is not overwhelming. The book reflects the current research approaches and interests of many aquatic chemists, and it probably will influence the tone of the next generation of aquatic chemistry textbooks. Because of its many authors, the style of writing in it, and the "case-study" approach of some of its chapters, the book would not be practical as a textbook itself, except perhaps in advanced seminar and reading courses. It should be widely read, however, not only within the relatively small community of chemists interested in lakes but among aquatic scientists in general. As the editor points out in his preface, lakes are convenient experimental systems with which to study processes occurring in other aquatic systems. Most lakes are rather small and can be sampled with simple and inexpensive equipment (compared with that required for oceanographic work). Lakes also have much greater chemical and biological diversity than oceans. In some cases, lakes can be manipulated experimentally, but even passive studies, when appropriately designed, can lead to a mechanistic understanding of fundamental aquatic processes.

The first and last chapters probably are the broadest, most general, and most didactic treatments in the book. Imboden and Schwarzenbach introduce the concepts of

time and length scales for mass transport in lakes as a prelude to a general development of simple box models. These concepts are used to good advantage to describe the behavior of hydrophobic organic pollutants in several Swiss lakes. Morgan and Stone summarize a large quantity of chemical kinetics succinctly and relate theory to a practical understanding of reaction dynamics in aquatic systems. In between these two chapters, which emphasize fundamental concepts, are 15 chapters on topics ranging from the chemistry of bogs to the use of carbon isotopes to measure paleoproductivity. More than a third of the chapters treat some aspect of trace-metal aqueous geochemistry; topics range from strategies of microorganisms to resist metal toxicity to the importance of sorption and particle settling in removal of trace metals from lakes. Several chapters deal with important topics of lake pollution: eutrophication, acidification, and heavy metal and organic pollution. In each case, the chapter takes a fresh approach and focuses on understanding the chemical processes involved by means of compartment models.

This is an important and well-written book, and the editor has done a fine job of assembling a group of interesting topics and capable authors. The book is packaged nicely, and I found few typographical errors. It should be in the library of all who are interested in the chemistry of lakes.

PATRICK L. BREZONIK
Department of Civil and Mineral Engineering, University of Minnesota, Minneapolis 55455

Some Other Books of Interest

Ecology of Mosquitoes. Proceedings of a Workshop (Welaka, FL, Jan. 1984). L. P. LOUNIBOS, J. R. REY, and J. H. FRANK, Eds. Florida Medical Entomology Laboratory, Vero Beach, 1985. xxii, 579 pp., illus. $15.

The editors of this proceedings volume begin their preface by commenting that since the publication of M. W. Service's *Mosquito Ecology* in 1976 medical and applied entomologists concerned with mosquitoes have come to utilize ideas and methods from basic ecology and basic ecologists have come to recognize mosquitoes as fruitful subjects for research. They present this volume as providing an overview of current research interests in the field. The volume consists of 35 papers by 43 authors, about a third of them from outside North America. The papers, which include general considerations of such issues as host selection and life history genetics as well as reports of individual research projects, are arranged under the headings Communities and Interactions, Population Dynamics, Forecasting and the Environment, Ecology and Epidemiology, Ecology and Genetics, and Strategies and Patterns, the last described by the editors as a catchall. Each group is followed by an edited transcript of the discussion that occurred at the workshop from which the volume derives. The volume has taxonomic and subject indexes and a combined reference list containing over 700 entries.
—K.L.

Search for the Universal Ancestors. H. HARTMAN, J. G. LAWLESS, and P. MORRISON, Eds. National Aeronautics and Space Administration, Washington, DC, 1985 (available from Superintendent of Documents, Washington, DC). xvi, 129 pp., illus. Paper, $3.75. NASA SP-477.

In 1983 a group of authors identifying themselves as the Pre-Cambrian Paleobiology Research Group produced a 570-page compendium (*Earth's Earliest Biosphere*, J. W. Schopf, Ed.; Princeton University Press) addressing in detail the biogeochemical evidence bearing on the origins and early evolution of life. Now a (somewhat overlapping) group of 27 scientists concerned from various points of view with the origins of life have produced a brief discussion of the subject at a level suitable for a general audience. The volume opens with a "prologue" by Philip Morrison. In four ensuing chapters the authors collectively discuss the nature of life, give a history of the search for its origins, describe the paleontological and biochemical evidence bearing on the question, outline the relevant aspects of earth and solar system history, and discuss evidence that has been or could be obtained in the laboratory. A final chapter, "Recommendations," identifies some questions in need of further investigation and proposes some organizational steps to facilitate the effort, including establishment of a fellowship program to attract young researchers to the field and a series of occasional awards to encourage efforts at synthesis and evaluation such as the one that gave rise to the 1983 volume.—K.L.

Sixth International Conference on Collective Phenomena. Reports from the Moscow Refusnik Seminar. INGA FISCHER-HJALMARS and JOEL L. LEBOWITZ, Eds. New York Academy of Sciences, New York, 1985. xx, 411 pp., illus. Cloth or paper, $94. Annals of the New York Academy of Sciences, vol. 452. From symposia, Stockholm, Dec. 1983, and Tel Aviv, May 1984.

The collective phenomena to which the majority of papers in this volume are devoted are not, as the subtitle might suggest, social or political but physical and biological. As is explained in preliminary papers by the editors, the series of conferences the volume represents had its origins in the Sunday seminars held in Moscow by Soviet Jewish scientists who had been deprived of ordinary professional contacts. Several of the planned conferences in the series were not permitted to take place. The set that is designated the sixth was held with the support of various Western organizations and individuals and included papers by both Western and refusnik scientists, though the contributions of many of the latter had to be presented in absentia. Of the principal papers in the volume the first three, all by D. I. Golenko, deal with optimization in scheduling theory. There follow 28 other technical papers, mostly in various fields of physical science, concerning for example solar wind–magnetosphere interactions, adhesive friction of elastomers, and diffeomorphisms in the physics of particles, gravity, and fluids. The volume concludes with 13 poster papers, about half of them on biological subjects, and an index of the 62 contributors.—K.L.

Books Received

Acoustical Imaging. Vol. 14. A. J. Berkhout, J. Ridder, and L. F. van der Wal, Eds. Plenum, New York, 1985. xvi, 801 pp., illus. $110. From a symposium, The Hague, April 1985.

Adenosine Deaminase in Disorders of Purine Metabolism and in Immune Deficiency. George L. Tritsch, Ed. New York Academy of Sciences, New York, 1985. xii, 345 pp., illus. Paper, $80. Annals of the New York Academy of Sciences, vol. 451.

Adolescence. Margaret A. Lloyd. Harper and Row, New York, 1985. xvi, 445 pp., illus. $25.95.

Applications of Plasma Processes to VLSI Technology. Takuo Sugano and Hyo-Gun Kim, Eds. Wiley-Interscience, New York, 1985. xvi, 394 pp., illus. $44.95.

Arthritis and the Elderly. Roland W. Moskowitz and Marie R. Haug, Eds. Springer, New York, 1986. xii, 195 pp. $21.95.

Artificial Intelligence and Psychiatry. D. J. Hand. Cambridge University Press, New York, 1985. x, 266 pp., illus. $39.50.

Aspects of Symmetry. Selected Erice Lectures. Sidney Coleman. Cambridge University Press, New York, 1985. xiv, 402 pp., illus. $69.50.

Atherosclerosis. K. T. Lee, Ed. New York Academy of Sciences, New York, 1985. x, 327 pp., illus. Paper, $75. Annals of the New York Academy of Sciences, vol. 454. From a symposium, Saratoga Springs, NY, Aug. 1984.

The Atmosphere of Venus. Recent Findings. G. M. Keating, A. J. Kliore, and V. I. Moroz, Eds. Published for the Committee on Space Research by Pergamon, New York, 1985. vi, 201 pp., illus. Paper, $49.50. Advances in Space Research, vol. 5, no. 9. From a workshop, Graz, Austria, June 1984.

Behavioral Case Formulation. Ira Daniel Turkat, Ed. Plenum, New York, 1985. xvi, 321 pp. $35.

Beyond Busing. Inside the Challenge to Urban Segregation. Paul R. Dimond. University of Michigan Press, Ann Arbor, 1985. xii, 411 pp. $29.95.

Beyond the Helix. DNA and the Quest for Longevity. Carol Kahn. Times Books, New York, 1985. xii, 285 pp. $17.95.

Briefbook. Biotechnology and Genetic Diversity. Steven C. Witt. California Agricultural Lands Project, San Francisco, 1985. 145 pp., illus. Spiral bound, $12.50.

The Bunker Climate Atlas of the North At-