reader is left with the strong impression that our understanding of this complex subject must await the systematic application of more powerful analytical techniques. The last chapter of volume 2, on the hydrochemistry of landlocked basins and fjords, is somewhat anomalous in that it is specific to an area. Nevertheless, Grasshoff has produced a carefully documented and complete account of salinity, temperature, nutrient, and oxygen distributions in the Baltic Sea, the Oslo and Flensburg fjords, the Black Sea, and the Red Sea. He includes, particularly for the Baltic, an extensive discussion of the conditions leading to, and the results of, the development of anoxic waters.

As with most multiauthored volumes, its quality is not consistent, but *Chemical Oceanography* has been revitalized and is even more firmly entrenched as the leading reference work in its field. The editors are to be congratulated for the organization of the book and their selection of authors but should take a mild rebuke for allowing the authors too much freedom in the presentation of units. For example, it is irritating for chemists and bewildering for nonchemists to find data reported haphazardly in moles, grams, and gram-atoms not only within one book but within a single chapter.

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Lipids in Plants

Recent Advances in the Chemistry and Biochemistry of Plant Lipids. Proceedings of a symposium, Norwich, England, Apr. 1974. T. GALLIARD and E. I. MERCER, Eds. Academic Press, New York, 1975. xvi, 398 pp., illus. $28. Proceedings of the Phytochemical Society, No. 12.

By judicious selection of participants and topics, the editors have assembled a volume that is both broad and timely. It is not bogged down with attempts to reconcile conflicts but is replete with efforts to provide both good reading and the critical bibliography essential to further research.

Plant lipid biochemistry has led its mammalian counterpart on several notable occasions. The discovery of the alpha-oxidation pathway for fatty acid metabolism in peanut cotyledons by P. K. Stumpf and co-workers elicited enthusiasm for the relevance of plant lipid metabolism to mammalian studies. This pathway, which involves flavoprotein-mediated production of the α-D-hydroperoxy acid and its decarboxylation or, alternatively, its reduction to the α-D-hydroxy acid, was subsequently recognized in mammalian brain and is involved in its requirement for degradation of phytanic acid derived from chlorophyll.

In its 12 chapters the book covers fatty acid structure, methodology, biosynthesis, and their roles in plant lipid function. The intimate relation of acetyl coenzyme A carboxylase to the chloroplast lamellar membrane is represented in a chart of synthesis, elongation, and desaturation systems for the plant cell. The role of lipids in plant structure is introduced in a chapter entitled "Biosynthesis of phosphoglycerides in plants," where pathways and in vivo conditions are outlined and appropriate references to bacterial and mammalian systems are given. Recent studies have led to the assignment of intracellular sites for the synthesis, translocation, and function of these glycerolphosphatides in membranes. Lipid exchange processes are particularly discernible in plant membranes: their study integrates much of the content of the volume.

The physical role of the glycoproteins of mammalian cell membranes appears to be assumed by the glycolipids of plant membranes. Besides the cerebrosides, which in plants include an extensive spectrum of sphingosine analogs, plant membranes contain galactosyl diglycerides, sulfoquinovosyl diglycerides, and a number of complex polyglycolipids. Their biochemistry and that of the related steryl glucosides is reviewed in an elegant chapter that covers their fatty acyl compositions, biosynthesis, and subcellular distribution. The plant sulfolipid, a glycolipid of 6-sulfo-6-deoxyglucose (quinovose) unique to green plants, has been studied for 15 years and yet no pathways for biosynthesis of its $-SO_3H$ group have been demonstrated.

The lipid composition of plant cutin, the essential water barrier of plant surfaces, is ably reviewed by P. E. Kolattukudy, who emphasizes both chemical and microstructural aspects of these remarkable materials. The very-long-chain wax esters and hydrocarbons, being components of the cuticular lipids, are of interest to geologists as well as to biochemists. The polymeric nature of suberin and cutin as delineated by mass spectrometry leads to an elegant molecular picture of the surface of the leaf or apple.

The commercially important oil seeds are examined from biological and enzymological points of view. Metabolic changes that occur in their lipids and structures during development on the plant or during storage in the granary point up the importance of the biochemical reviews by Beevers and by Galliard on contemporary concepts of seed lipid degradation and ultilization.

The influence of the work of P. K. Stumpf and his many distinguished collaborators prevades this volume. Although its cover may not outlive the usefulness of its contents, the book will be a standard reference for a long while.

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Fluviology

River Ecology. B. A. WHITTON, Ed. University of California Press, Berkeley, 1975. x, 726 pp., illus. $40. Studies in Ecology, vol. 2.

A look at the list of contributors to this book is enough to give the potential reader a sense of anticipation. In general, he or she will not be disappointed. Some of the chapters are almost at the level of definitive works on their topics. Especially noteworthy are the treatment of river zonation and classification by H. A. Hawkes and the imaginative framework and rationale for quality control systems presented by J. Cairns, Jr.

Overlap between chapters is minimal and, with a few exceptions, coverage is comprehensive insofar as present knowledge permits. Most of the obvious omissions, for example, Asian, Southeast Asian, and Arctic rivers, reflect lack of investigation rather than oversight. Subjects which could profitably have been emphasized but which receive only cursory treatment or are omitted altogether include waterborne viruses, disease vectors, problems presented by large-scale removal of water resulting in the entrainment of immature fish, and riverine fisheries. Although the treatment of impoundments by J. E. Ridley and J. A. Steel is an excellent summary of their work on those of the relatively small, pumped-storage variety, the important topic of large, run-of-the-river impoundments, especially in tropical rivers, is addressed only superficially. The chapters on thermal streams and estuarine fauna, although interesting in themselves, could have been omitted with little prejudice to the comprehensiveness of the coverage of river ecology.

The technical editing and production

of this book are generally excellent. The extensive list of references alone will make it a worthwhile acquisition for many readers. Organisms, rivers, and subject matter are all indexed, some (but unfortunately not all) chapters are cross-referenced, and a guide to the literature on particular rivers is included in an appendix. Typographical errors and awkward wording are frequent enough to be mildly annoying.

The book nicely complements the few others available on river ecology. New material and original insights are provided in a few of the chapters, and others concisely summarize present knowledge. *River Ecology* will be a welcome addition to the bookshelf of any student of those fascinating, complex, highly variable, vital sources of water, sites of waste disposal, and subjects of contemplation and enjoyment we call rivers.

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Space Physics

International Conference on X-Rays in Space. (Cosmic, Solar and Auroral X-Rays.) Calgary, Alberta, Canada, Aug. 1974. Published by Dr. D. Venkatesan, University of Calgary Department of Physics, Calgary, Canada, 1975. Two volumes. xx, 1236 pp., illus. + appendices. Paper, $40.

These two volumes are the result of a week-long conference on x-rays in space. The purpose of the meeting was to bring about an exchange of ideas among researchers in cosmic, solar, and auroral x-rays, three currently active and fascinating fields. After the conference the participants submitted manuscripts, and this proceedings consists of 33 invited talks (mostly reviews), 16 contributed papers (many of which have since appeared in journals in essentially identical form), and eight panel discussions.

The nature and depth of these papers vary considerably. A few are very broad discussions of large fields of research. The inaugural lecture on high energy astronomy by H. Friedman and a review of high energy plasmas by C. de Jager are two examples of this genre. Both are lucid expositions that do not go into much detail. The majority of the papers, however, treat more specific topics in greater depth. H. S. Hudson's review of the solar x-ray continuum and S. R. Kane's discussion of solar flare x-rays and cosmic gamma-ray bursts are particularly noteworthy in that they present clear summaries of a large mass of observational data as well as some of the conclusions that can be drawn about these phenomena. These qualities do not, however, justify the inclusion of the identical paper by Kane twice, almost a thousand pages apart.

There are a number of reviews of observational techniques. R. Novick's paper on the emerging field of x-ray polarimetry is quite readable; positive results have already been obtained for solar flares and the Crab nebula, confirming the synchrotron nature of its x-ray emission. A few of the observational papers on x-rays from electron precipitation in the magnetosphere require some familiarity with the field to be understandable. Purely theoretical papers are in the minority. Reviews on x-ray binaries by R. M. McCray and by F. K. Lamb and on solar corona models by A. B. C. Walker, Jr., are all reasonably current and yet provide good background material.

Overall, there is little attempt to provide systematic coverage of various fields. For example, there is no single critical review of the evidence that Cygnus X-1 is a black hole, although there are extensive and understandable discussions of binary mass determinations by J. N. Bahcall, of the radio and x-ray emission of Cygnus X-1 by R. M. Hjellming and by M. P. Ulmer, and of its x-ray time variability by M. Oda and the Goddard x-ray group, as well as a somewhat too specialized compendium of black hole theory by R. Ruffini. As a result, the book is not suitable for students unfamiliar with the subject, but it is a useful collection for active researchers.

The attempt to find a common ground for cosmic, solar, and terrestrial x-ray scientists is particularly valuable. As F. D. Seward points out in one of the concluding summaries, the earth, if it were viewed in x-rays by a distant observer, would appear as a binary x-ray source whose emission is produced by particles accreted from a stellar wind and funneled through the magnetosphere. This emission would then appear to pulse with the rotation frequency of the earth, in a manner very similar to that of cosmic x-ray sources—the main difference being 20 orders of magnitude in luminosity.

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