the latter acted as the front man and undoubtedly was the one in the limelight, Juday kept the research program organized and functioning, forming key liaisons with students, which seems to have been difficult for Birge, perhaps because he was a full two generations older than most of them. Yet Juday was a prodigious scientist in his own right. Years ago, I was shocked to find that his "annual energy budget for an inland lake," published in 1940, was superior to most of the energetics studies done under the International Biological Program 30 years later. The paper also avoids the mathematical and conceptual errors found in R. Lindemann's much more famous theoretical paper on energetics, which was published two years after it. A glimpse of the rivalry between the extremely empirical Wisconsin school and the more theoretically based Yale limnologists under G. E. Hutchinson is also provided in the discussion of Birge's and Juday's views of Lindemann's work.

The depression and Second World War seem to have taken a temporary toll on Wisconsin's limnological activities, particularly since both Birge and Juday were in their final years. But the legacy was strong enough to survive until it could be revitalized by Arthur Hasler. What is unusual about Hasler's direction is that he did not simply retool Wisconsin's aquatic science to reflect the strength of his own specialties but kept alive the strong tradition of multidisciplinary research that Birge had begun. Hasler brought the Trout Lake Station back from near-extinction to become one of the world's most thriving aquatic science establishments. He also recognized the tremendous value of the records of old but carefully performed analyses of chemistry and biology in northern Wisconsin. I have visited both Trout Lake and Madison laboratories recently, and it is clear that Hasler has had the foresight to ensure that limnology at Wisconsin would remain strong after his retirement—a consideration most famous scientists ignore.

The book is well illustrated with pictures of apparatus, individuals, and field sites from early in the century. It is a pleasure to read—I picked it up late one evening and finished it just as the first birds were beginning to call.

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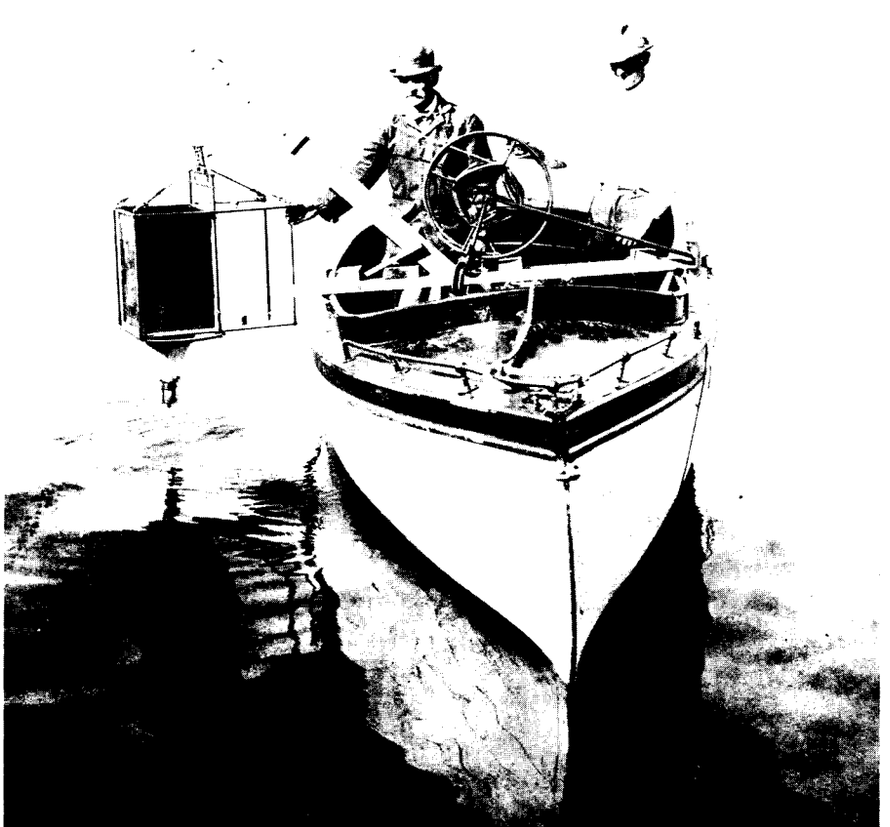

"E. A. Birge and C. Juday with plankton trap on Lake Mendota, about 1917." [From *Breaking New Waters*; State Historical Society of Wisconsin]

Anoxic Life

Biology of Anaerobic Microorganisms. ALEXANDER J. B. ZEHNDER, Ed. Wiley-Interscience, New York, 1988. xiv, 872 pp., illus. $89.95. Wiley Series in Ecological and Applied Microbiology.

Anaerobic microorganisms, which generally cannot grow in the presence of oxygen, abound in nature. Even we humans swarm with them: over 97% of our microflora consists of anaerobic microorganisms, including more than 90% of the bacterial flora on human skin. The diverse metabolic capabilities of anaerobes make them inherently interesting to physiologists and biochemists. Unlike aerobes, whose catabolic metabolism is basically to reduce oxygen to water and oxidize organic compounds to carbon dioxide, anaerobes reduce a variety of organic and inorganic compounds (such as carbon dioxide, sulfate, nitrate, fumarate, even iron and manganese) and produce all sorts of end-products of metabolism, many of which are useful (including acetic acid, propionic acid, lactic acid, ethanol, and methane). Anaerobic microorganisms also play major roles in the global cycling of carbon, nitrogen, and sulfur.

In spite of the importance of the organisms, research into anaerobic life has lagged, primarily because these microorganisms were considered difficult to work with. In the late 1970s, however, the announcement of the discovery of the archaebacteria, of which the major group is the anaerobic, methanogenic bacteria, concomitant with the publication of refined techniques to handle anaerobes, caused a rapid increase in research on anaerobes. The rise of biotechnology provided further impetus. It is pleasing finally to see a book that includes all the important aspects of anaerobic microbiology.

This book contains 14 chapters written by 19 contributors. In addition to the traditional subjects—purple and green phototrophs, nitrate reducers, sulfate reducers, and methanogens—less common topics appear: iron and manganese reduction, anaerobic lignin degradation, and the anaerobic fermentation of lipids. The chapter on acetogenesis, which makes an effective transition between those on lipid fermentation and methanogenesis, brings a fresh outlook to this frequently reviewed process.

The material on the better-known anaerobes (phototrophs, nitrate reducers, sulfate reducers, and methanogens) is usefully organized in pairs of chapters, one on ecology and the other on biochemistry.

Two key themes appear repeatedly throughout this book—geochemistry and

biotechnology. It is difficult to separate the ecology of anaerobes from their geochemical effects, roles in global nutrient cycling, and potential influences on groundwater quality. The first chapter, an introduction to biogeochemistry, addresses these effects. The final chapter explores the potential impact of anaerobes on biotechnology, especially in biodegradation of pollutants. Development of these themes unites the text and broadens its usefulness for readers in disciplines outside microbiology, including those interested in the bioremediation of hazardous wastes.

Biology of Anaerobic Microorganisms was a pleasure to read (even the references). When it arrived at our library, I borrowed it for a six-month term, never believing I'd keep it that long. I kept it for five months, after which students have kept it constantly off the library shelf. This long-awaited book is another indication that anaerobic microbiology has come of age.

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Some Other Books of Interest

A History of Psychology in Autobiography. Vol. 8. GARDNER LINDZEY, Ed. Stanford University Press, Stanford, CA, 1989. xii, 485 pp., illus. $49.50.

The series this volume represents dates back to 1930, having been edited successively by Clark Murchison, E. G. Boring, and (since volume 5, 1967) Gardner Lindzey. Each volume has contained autobiographical memoirs by 13 to 15 eminent psychologists. The present volume is the first to appear since 1980 and the first to be published by Stanford University Press. In his preface the editor reports that "in [his] biased judgment, this is the most interesting set of accounts that has yet appeared in the series. It includes several of the most gifted writers that psychology has (or has had); it includes our first joint autobiography; and . . . our three women contributors exceed the number in any previous volume." One contribution provides a report on "much of what has transpired in Geneva since Piaget's autobiography was published in this series more than 30 years ago." With respect to institutions, the series as a whole has, Lindzey notes, provided an array of perspectives on the development of the field at two of its preeminent institutions, Harvard and Stanford, and with this new volume the Rockefeller Institute and University are now represented. The current set of contributors are Roger G. Barker, Roger Brown, Lee J. Cronbach, William K. Estes, Fritz Heider, Leo M. Hurvich and Dorothea Jameson, Bärbel Inhelder, R. Duncan Luce, Eleanor E. Maccoby, Paul E. Meehl, George A. Miller, Carl Pfaffmann, and Stanley Schachter. Each provides a list of his or her "selected publications," and a name index and a list of contributors to the earlier volumes are appended.—**K.L.**

Biotechnology and the Research Enterprise. A Guide to the Literature. WILLIAM F. WOODMAN, MACK G. SHELLEY II, and BRIAN J. REICHEL. Iowa State University Press, Ames, 1989. xviii, 358 pp. $49.95.

This is a guide to works not on biotechnological techniques, results, and applications but on biotechnology—most specifically, agricultural biotechnology—in its social and economic ramifications. Compiled at Iowa State University with funds appropriated by the Iowa legislature for examination of the broader issues raised by biotechnology, the volume lists, summarizes, or describes publications ranging in length from editorials to full books and including reports prepared by or for government agencies, universities, foundations, associations, and other institutions. The entries are arranged according to theme: federal research policy generally, university-industry relations, conflict of interest, university research, the biotechnology industry, international biotechnology, and "related issues" (including public perceptions and ethical implications). Each set has an introduction, and the volume also includes a directory of biotechnology organizations, commercial and otherwise, a list of periodicals that regularly cover biotechnology, and a glossary of terms relating to biotechnology. It lacks a general index, and there is no cross-referencing between sections.—**K.L.**

Books Received

Acoustical Imaging. Vol. 16. Lawrence W. Kessler, Ed. Plenum, New York, 1988. xii, 658 pp., illus. $115. From a symposium, Chicago, IL, June 1987.

Additive Gene Systems. An Explanation for Problems in Evolution and Selection. Roy G. Silson. Greenfield, Tring, U.K., 1988 (distributed by the author, Near Station, Tring, Herts., U.K. HP23 5QX). 312 pp., illus. $35; paper, $20.

Advanced Ceramics. Shinroku Saito, Ed. Oxford University Press, New York, and Ohmsha, Tokyo, 1988. viii, 278 pp., illus. $65. Reprint, 1987 ed.

Advanced Research on Animal Cell Technology. Alain O. A. Miller, Ed. Kluwer, Norwell, MA, 1988. x, 421 pp., illus. $119. NATO Advanced Science Institutes Series E, vol. 156. From a workshop, Brussels, Belgium, Sept. 1987.

An Ancient Air. A Biography of John Stringfellow of Chard, the Victorian Aeronautical Pioneer. Harald Penrose. Smithsonian Institution Press, Washington, DC, 1988. 183 pp. + plates. $22.50.

Biotechnology and the New Agricultural Revolution. Joseph J. Molnar and Henry Kinnucan, Eds. Published for the American Association for the Advancement of Science by Westview, Boulder, CO, 1989. xvi, 288 pp., illus. Paper, $27.50; to AAAS members, $22. AAAS Selected Symposia Series, vol. 108. Based on a symposium, Philadelphia, PA, May 1986.

Biting off the Bracelet. A Study of Children in Hospitals. Ann Hill Beuf. 2nd ed. University of Pennsylvania Press, Philadelphia, 1989. xii, 206 pp. Paper, $14.95.

Board Games Round the World. A Resource Book for Mathematical Investigations. Robbie Bell and Michael Cornelius. Cambridge University Press, New York, 1989. iv, 124 pp., illus. Paper, $9.95.

C Tools for Scientists and Engineers. Louis Baker. McGraw-Hill, New York, 1989. xii, 321 pp. Paper, $29.95.

CAD/CAM of Dies. J. S. Gunasekera. Horwood, Chichester, U.K., and Halsted (Wiley), New York, 1989. x, 194 pp., illus. $64.95. Ellis Horwood Series in Mechanical Engineering.

Calculus. Vol. 1, One-Variable Calculus, With an Introduction to Linear Algebra. Tom M. Apostol. 2nd ed. Wiley, New York, 1988. xxii, 666 pp., illus. Paper, $49.

The Cassandra Architecture. Distributed Control in a Blackboard System. Iain D. Craig. Horwood, Chichester, U.K., and Halsted (Wiley), New York, 1989. viii, 310 pp., illus. $75. Ellis Horwood Books in Information Technology.

Dispersed Systems. K. Hummel and J. Schurz, Eds. Steinkopff, Darmstadt, and Springer-Verlag, New York, 1988. viii, 244 pp., illus. $89. Progress in Colloid and Polymer Science, vol. 77. From a meeting, Graz, Austria, Sept. 1987.

DNA-Protein Interactions in Transcription. Jay D. Gralla, Ed. Liss, New York, 1988. xviii, 333 pp., illus. $72. UCLA Symposia on Molecular and Cellular Biology, vol. 95. From a symposium, Keystone, CO, April 1988.

An Essay on Fevers. John Huxham. Science History Publications, Canton, MA, 1989. xxxii, 191 pp. $15.95. Resources in Medical History. Reprint, 1757 ed.

Ethics in Engineering. Mike W. Martin and Roland Schinzinger. 2nd ed. McGraw-Hill, New York, 1988. xx, 404 pp., illus. Paper, $23.95.

Evolutionary Progress. Matthew H. Nitecki, Ed. University of Chicago Press, Chicago, 1989. viii, 354 pp., illus. $42.50; paper, $16.95. From a symposium, Chicago, IL, May 1987.

The Expanding Role of Folates and Fluoropyrimidines in Cancer Chemotherapy. Youcef Rustum and John J. McGuire, Eds. Plenum, New York, 1988. x, 336 pp., illus. $69.50. Advances in Experimental Medicine and Biology, vol. 244. From a symposium, Buffalo, NY, April 1988.

Experimental Hematology Today—1983. S. J. Baum, *et al.*, Eds. Springer-Verlag, New York, 1989. xvi, 182 pp., illus. $69.50. Based on a meeting, Houston, TX, Aug. 1988.

Expert Systems. Introduction to the Technology and Applications. Dieter Nebendahl, Ed. Siemens Aktiengesellschaft, Berlin, and Wiley, New York, 1988. xii, 210 pp., illus., + appendix. $34.95. Translated from the German edition (Berlin, 1987).

Exploring the Night Sky with Binoculars. Patrick Moore. Cambridge University Press, New York, 1989. 203 pp., illus. Paper, $11.95. Reprint, 1986 ed.

Fallout. An American Nuclear Tragedy. Philip L. Fradkin. University of Arizona Press, Tucson, 1989. xvi, 300 pp. $24.95.

Fiber Optics in Astronomy. Samuel C. Barden, Ed. Astronomical Society of the Pacific, San Francisco, CA, 1988 (distributor, Brigham Young University Print Services, Provo, UT). xviii, 295 pp., illus. $32. A. S. P. Conference Series, vol. 3. From a conference, Tucson, AZ, April 1988.

Finite Element Approximation for Optimal Shape Design. Theory and Applications. J. Haslinger and P. Neittaanmäki. Wiley, New York, 1989. xii, 335 pp., illus. $79.95.

Flavor Chemistry. Trends and Developments. Roy Teranishi, Ron G. Buttery, and Fereidoon Shahidi, Eds. American Chemical Society, Washington, DC 1989. viii, 246 pp., illus. $52.95. ACS Symposium Series, vol. 388. From a symposium, Toronto, Ontario, June 1988.

Flax. Breeding and Utilisation. G. Marshall, Ed. Published for the Commission of the European Communities by Kluwer, Norwell, MA, 1988. viii, 171 pp., illus. $53.50. Advances in Agricultural Biotechnology. From a workshop, Brussels, Belgium, May 1988.

Fluorescent Biomolecules. Methodologies and Applications. David M. Johnson and Gregory D. Reinhart,