recognition phenomena in the operation of incompatibility systems. He admits, however, that the book is biased toward his own research interests and that another book (by another author) is needed to deal with the theory and mathematical modeling that he covers less thoroughly. One-fifth of the text is devoted to Richards's interests: heterostyly (51 pages) and agamospermy (53 pages).

The introductory chapter makes some statements easily subject to misinterpretation; for example that "hermaphrodites can self-fertilize whereas unisexuals cannot" (p. 2) could be read to mean that plants with perfect flowers *do* self-fertilize (thus excluding the important role of incompatibility or other mechanisms that prevent this in many species). This statement also does not distinguish two kinds of hermaphroditic individuals: plants with perfect flowers and monoecious ones with unisexual flowers. This confusion is compounded in the glossary, which refers to monoecious flowers as well as to monoecious individuals; the term correctly refers to plants and not flowers. Likewise that "self-fertilization tends to reduce genetic variability" (p. 2) surely is not what the author intended to say; the distribution of variability may differ in xenogamous and autogamous breeding systems, but the level of variability is dependent on selection and is not an artifact of the breeding system alone. "Self-incompatibility will lead to more outbreeding and greater genetic variability than will self-compatibility" (p. 3) is a statement that is true only if accompanied by qualifications concerning levels both of outbreeding and of genetic variability. An "interesting feature" of monoecious species is "that they can change sex" (p. 4); the sentences that follow this puzzling assertion explain what the author means, but it is a showstopper for an informed reader and probably an uninformed one as well. The glossary poses additional problems. The term "breeding system" does not appear there. A monocarpic plant is one that "only flowers once." A carpel is "the segment of an ovary." Definitions of the Darwinian terms "legitimate" and "illegitimate" for classes of pollination of heterostylous plants exclude tristylous species.

Richards is to be commended for dispelling the common notion that agamospermy (the production of seeds without syngamy) is an evolutionary dead end. Indeed, anyone who has attempted to maintain a lawn free of dandelions will have an intuitive suspicion of this assertion. Most agamospermous species that have been studied appear to be facultatively so, and retain some level of sexual reproduction combined with asexuality. The balance between relative levels of sexuality and asexuality in successive reproductive phases may vary and seems to be under environmental control, though the specifics of this control are scarcely understood. Richards contrasts the "real world" of agamospermy with the "hopelessly naive" mathematical models that assess its long-term success in a given evolutionary line. His own work with the dandelion genus *Taraxacum* has gone a long way toward providing an understanding of the mechanics and significance of sexuality and asexuality combined in the same organism.

Botanists, in particular, do not always distinguish clearly between inbreeding as a term of population genetics and the various factors, such as levels of selfing and of assortative mating or population size, that contribute to levels of inbreeding. Indeed, one commonly finds the term "inbreeding" used interchangeably with "selfing." Richards, however, keeps the distinctions clear and realizes that the mechanics of reproduction must be distinguished from the genetic consequences of different reproductive modes.

The flaws mentioned above may diminish the value of this book as a textbook, but a seasoned reader will doubtless recognize most of the infelicities as such and benefit from the book's many positive qualities. The book is wide-ranging in coverage, provides an excellent review of many interrelated topics, and lacks the doctrinaire quality and sketchy literature reviews of some recent volumes that cover some of the same territory. It also points to many general topics that require investigation; the "explosive expansion" of research that Richards refers to will doubtless continue.

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Petrology

Fluid-Rock Interactions during Metamorphism. JOHN V. WALTHER AND BERNARD J. WOOD, Eds. Springer-Verlag, New York, 1986. x, 218 pp., illus. $44. Advances in Physical Geochemistry, vol. 5.

In the last few years a lively debate regarding the nature of fluid-rock interactions at depth has been carried on in the geological literature. This debate has centered on the amount of fluid involved in metamorphism (lots vs. almost none), the sources of the fluid phase, and the mechanisms of fluid migration through material with low permeability. A review of current thinking on the mechanical and chemical aspects of fluid-rock interactions has been sorely needed.

Such a review is now available in the present volume. The editors have assembled eight clear and concise papers by some of the leaders in the study of metamorphic fluids that present a well-balanced variety of viewpoints; as the editors state in the preface, "A cursory examination of the volume will reveal that there are widely divergent opinions on the compositions of metamorphic fluids and on the ways in which they interact . . . with the rocks through which they pass. . . . We leave the reader to determine his own brand of 'truth.' "

Three main topics are covered by the papers in this book: fluid compositions (M. L. Crawford and L. S. Hollister; B. Newton), evidence for fluid flow and techniques for calculating fluid-rock ratios (J. M. Ferry; B. J. Wood and J. V. Walther; B. W. D. Yardley; R. T. Gregory), and mineral-fluid reaction mechanisms and rates (J. Ridley and A. B. Thompson; J. V. Walther and B. J. Wood). Each of the papers begins with development of the necessary theory and ends with case studies or insightful back-of-the-envelope type calculations; the papers are uniformly well written.

Some of the highlights of the book include a lengthy discussion by Crawford and Hollister on fluid immiscibility and the different physical properties of coexisting CO_2- and H_2O-rich fluids; continuing debate between Ferry on the one hand and Wood and Walther on the other over the meaning of calculated, time-integrated fluid-rock ratios; and discussions by Wood and Walther and by Yardley on mechanisms of fluid flow in regions where fluid pressure is much greater than hydrostatic pressure. The chapters that are least successful, to my mind, are those by Gregory and by Ridley and Thompson. In the former case, I found the chapter, which deals with evidence from Precambrian iron formations, to be *too* concise and hence somewhat difficult to follow, despite some interesting conclusions. The latter paper contains an excellent discussion of mineral kinetics, but any correlation between kinetics and the role of a fluid phase is left to the reader's imagination. These were only minor disappointments, however.

Overall, this book is a fine and up-to-date (references through 1985) review of research on fluid-rock interactions. Although the focus is on the role of fluids in metamorphic processes, I would recommend it to anyone concerned with understanding the physical and chemical processes of fluid flow and fluid-rock interactions.

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Some Other Books of Interest

Thermophiles. General, Molecular, and Applied Microbiology. THOMAS D. BROCK, Ed. Wiley-Interscience, New York, 1986. xii, 316 pp., illus. $47.50. Wiley Series in Ecological and Applied Microbiology.

Thermophilic microorganisms, the editor of this volume writes in his preface, are of interest both because of their potential biotechnological applications and for the basic biological questions their tolerance for high temperatures poses. The purpose of the present book is to "present the current status and future direction" of fundamental and applied research on these microorganisms. An introductory chapter in which Brock presents a taxonomic and ecological overview of thermophiles is followed by a chapter on methods for their isolation and study by Wiegel. Stetter then provides a genus-by-genus summary of archaebacterial extreme thermophiles from volcanic areas. Physiology and growth (Sundaram) and membranes and lipids (Langworthy and Pond) of thermophiles are then reviewed. Next, Oshima presents a selective review of biochemical studies of the genetic apparatus of extreme thermophiles, which is followed by accounts of the applied genetics of aerobic (Imanaka and Aiba) and anaerobic (Béguin and Millet) thermophiles. The volume concludes with chapters on industrial applications of thermostable enzymes (Ng and Kenealy) and on the use of thermophiles in the production of fuels and chemicals (Weimer), in wastewater treatment (Zinder), and in recovery of metal from ore and mineral waste (Brierley and Brierley). A subject index is appended.—K.L.

Evolution of Animal Behavior. Paleontological and Field Approaches. MATTHEW H. NITECKI and JENNIFER A. KITCHELL, Eds. Oxford University Press, New York, 1986. viii, 184 pp., illus. $35. From a symposium, Chicago, May 1984.

This volume consists of papers originally presented at the Field Museum's seventh Spring Systematics Symposium. The opening section, headed Historical Approaches to the Evolution of Behavior, begins with a consideration by George Lauder of the concepts of homology and analogy as applied to behavior that includes by way of example a case study of motor patterns of feeding behavior in the sunfish. There follow two papers concerned with evidence from the fossil record bearing on possible social behavior in dinosaurs (John Ostrom) and on feeding behavior in sediment-dwelling marine invertebrates (Adolf Seilacher). In a fourth paper Jennifer Kitchell considers factors affecting the evolution of the behavior of naticid gastropods and their molluscan prey. A second section, Field and Experimental Approaches to the Evolution of Behavior, consists of papers on parental investment in offspring as related to sexual selection (Randy Thornhill), cooperative breeding in New World jays (John W. Fitzpatrick and Glen E. Woolfenden), and parent-offspring interactions in anthropoid primates (Jeanne Altmann). The contributions are preceded by a general introduction by the editors, and an index concludes the volume.—K.L.

Books Received

The Concise Natural History of New Zealand. Harriet Fleet. Heinemann, Auckland, New Zealand, 1986 (U.S. distributor, ISBS, Portland, OR). xviii, 275 pp., illus., + plates. $19.95.

Contemporary Classics in Clinical Medicine. James T. Barrett, Ed. ISI Press, Philadelphia, 1986. xvi, 390 pp. $39.95. Contemporary Classics in Science.

Contextualism and Understanding in Behavioral Science. Implications for Research and Theory. Ralph L. Rosnow and Marianthi Georgoudi, Eds. Praeger, New York, 1986. xiv, 379 pp. $49.95.

Control Applications of Nonlinear Programming and Optimization. G. Di Pillo, Ed. Published for the International Federation of Automatic Control by Pergamon, New York, 1986. x, 210 pp., illus. $58. From a workshop, Capri, Italy, June 1985.

Culture, Society, and Menstruation. Virginia L. Olesen and Nancy Fugate Woods, Eds. Hemisphere (Harper and Row), New York, 1986. xiv, 186 pp., illus. $29.95. A Health Care for Women International Publication.

Estuarine and Coastal Pollution. Detection, Research and Control. D. S. Moulder and P. Williamson *et al.*, Eds. Pergamon, New York, 1986. xvi, 364 pp., illus. Paper, $95. Water Science and Technology, vol. 18, no. 4/5. From a conference, Plymouth, UK, July 1985.

Evaluation of Pesticides in Ground Water. Willa Y. Garner, Richard C. Honeycutt, and Herbert N. Niggs, Eds. American Chemical Society, Washington, DC, 1986. x, 573 pp., illus. $94.95. ACS Symposium Series, 315. Based on a symposium, Miami Beach, FL, April 1985.

Exploring the Concept of Mind. Richard M. Caplan, Ed. University of Iowa Press, Iowa City, 1986. x, 150 pp., illus. $15.95.

The Facts on File Dictionary of Science. E. B. Uvarov and Alan Isaacs. 6th ed. Facts on File, New York, 1986. viii, 468 pp., illus. $21.95. Hardcover ed. of *The Penguin Dictionary of Science*.

Fast Electrical and Optical Measurements. James E. Thompson and Lawrence H. Luessen *et al.*, Eds. Nijhoff, Dordrecht, 1986 (U.S. distributor, Kluwer, Hingham, MA). 2 vols. Vol. 1, Current and Voltage Measurements. xii pp. + pp. 1–593, illus., + index. $120.50. Vol. 2, Optical Measurements. xii pp. + pp. 594–1060, illus., + index. $98.50. NATO Advanced Science Institutes Series E, vols. 108 and 109. From an institute, Il Ciocco, Castelvecchio Pascoli, Italy, July 1983.

Few-Body Problems. E. Hadjimichael and W. Oelert. World Scientific, Philadelphia, 1986. viii, 399 pp., illus. $51; paper, $33. International Review of Nuclear Physics, vol. 3.

Field Measurement of Dinitrogen Fixation and Denitrification. R. D. Hauck and R. W. Weaver. Soil Science Society of America, Madison, WI, 1986. x, 115 pp., illus. Paper, $18; members' first copy, $15. SSSA Special Publication, no. 18. From a symposium, Washington, DC, Aug. 1983.

Hyperbolic Partial Differential Equations 3. Matthew Witten, Ed. Pergamon, New York, 1986. x pp. + pp. 377–632, illus., + index. $64. International Series in Modern Applied Mathematics and Computer Science, vol. 12. *Computers and Mathematics with Applications*, vol. 12A, nos. 4/5.

The Illustrated Naked Ape. A Zoologist's Study of