constitute the organism. This is beautifully illustrated in a description in this volume of the fate of the diapausing pupa of the silkworm when given an overdose of molting hormone. Metamorphosis is accelerated and cuticle deposition outstrips other processes until the reorganizing elements which should form the adult moth are frozen in place and a nonviable monster is produced. Elsewhere in the volume we are entertained with fact and theory about the emergence of order from a prebiotic soup, the coordinated synthesis of macromolecules during bacterial growth, interplay between domains in single plant and animal cells, chemical communication between cells by means of all types of chemical messengers, and finally environmental cues eliciting developmental responses.

There are several lessons to be extracted. One is that although differential gene action may set the direction and boundary conditions for developmental processes, many or most of the steps involved in coordination of these processes operate at other levels. Several of the contributors dwell upon the immediate steps in communication, particularly reception and primary processing of messages. Another lesson is that the messenger (word, hormone) can often be arbitrarily chosen, the meaning of the message being determined by the rules of syntax of the language, and we can understand the choice of messenger only by considering the history of the language. The history of biological communication is a part of evolution. Thus we must imagine "phylogenetic trees" for communications systems. From this point of view we might expect important differences between *E. coli* and elephants.

This volume will be useful to teachers and graduate students and to developmental biologists who want to know the gist of what is happening in other sectors of their multidisciplinary field. It might even serve as the foundation for a graduate seminar course, but as such it would have its shortcomings. Coverage of this broad a subject is unavoidably spotty. Furthermore, unifying principles of communication phenomena do not spring from the individual contributions. Although the editor supplies some interpretation and overview in an epilogue, the volume begs for more. Thus, to create a coherent seminar course would require judicious supplementation and a great deal of thinking. (One might argue that this is a hidden asset.) On the positive side, the volume offers a refreshing perspective on development and leaves the notion that a deeper understanding of developmental processes will issue from this line of thought.

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Marine Techniques

In-Water Photography. Theory and Practice. LAWRENCE E. MERTENS. Wiley-Interscience, New York, 1970. xviii, 392 pp. + plates. $19.95. Series on Photographic Science and Technology and the Graphic Arts.

Advanced techniques in most professions are a mix of art and science. Although several excellent books are available on the art and purpose of photography in the water, this book is unique and welcome because it emphasizes theoretical and practical aspects. The author's technically correct choice of "in-water photography" as the title rather than the more familiar but inexact "underwater photography" properly sets the analytical tone of the book.

The nearly 400 pages of this book contain a well-balanced combination of text, equations, curves, pictures, and references. It should therefore be readable and useful both to serious amateurs and to professionals, whether users or designers. Chapters are devoted to light transmission, contrast, filters, supplemental lighting, lenses and optical ports, cameras and housing, films and image tubes, biological effects, systems and application, new photographic techniques, and diving techniques. The individual chapters, with their somewhat textbook-like format, have considerable breadth and provide considerable information in each of the subfields. The legibility of print, of the line drawings, and of most of the figures is excellent.

This reviewer was impressed by the compilation of so much pertinent information between two covers. Reading this book, and particularly those chapters that deal quantitatively with the optical problems, should upgrade the understanding and work of "in-water" photographers and designers.

In sections devoted to equipment and suggested field techniques different readers might choose somewhat different examples or procedures, but such points are debatable, and criticisms that might be made are certainly minor in relation to the overall presentation of typical problems and a rationale for their solution. The author is on his firmest ground when dealing with optical problems, which he does well indeed. The price of the book may seem high for an individual photographer but is commensurate with the cost of specialized photography.

Photography in the water has long needed a comprehensive book devoted to the technical and optical aspects of the problem. This is such a book and should be a welcome addition to the libraries of all who are seriously interested in the subject.

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Extending the pH Scale

Acidity Functions. COLIN H. ROCHESTER. Academic Press, New York, 1970. x, 300 pp., illus. $13. Organic Chemistry, No. 13.

Since the original work by L. P. Hammett and A. J. Deyrup in 1932, acidity functions have been used with ever-increasing sophistication to extend the aqueous *p*H scale empirically well beyond the limits set by dilute aqueous solutions. It has thus been possible to measure the strength of very weak acids and bases, to interpret the kinetics of catalyzed reactions in super-acid or super-basic media, and to infer reaction mechanisms and modes of proton transfer. The literature on acidity functions is vast, and there have been important changes in point of view since the publication, in 1957, of the classic review by F. A. Long and M. A. Paul.

The present book by Colin H. Rochester is a well-organized, comprehensive, up-to-date review of the subject. It begins with a brief chapter on the theory of *p*H and acidity functions. Then there are two chapters, unique in their completeness, and with many tables of data, about the Hammett acidity function and about acidity functions for solutes other than neutral Hammett bases. These are followed by lucid chapters on acidity functions in acid-catalyzed reactions, in nonaqueous and mixed solvents, and for concentrated solutions of bases. Throughout the book, the discussion is essentially impartial: Where different laboratories