models that often characterizes poor biological theory. There is a converse moral well illustrated by the monograph under review: physicists who wish to do useful biology should not try it on their own. The real future of systems like the Volterra one lies in painstaking, time-consuming, and sometimes dull attacks on the problem of independent estimation of the parameters, with the aim of eventually being able to synthesize ecological processes out of the physiology, behavior, and other performance characteristics of individual species members. The resulting body of theory should be free of the "knife-edge" instabilities which plague results in the specific Volterra formalism. Moreover, the theory should de-emphasize random contributions from unknown forces, which probably do more to highlight the poverty of our theories than the final state of our knowledge. In their introduction, the present authors express the hope that a Volterra model "might play the same role that the harmonic oscillator or the Ising model plays in theoretical physics." They apparently do not realize that the harmonic oscillator's importance derives from fundamental physical principles which have no connection with its formalism. The corresponding biology remains to be done.

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Applied Microbial Ecology

Water Pollution Microbiology. RALPH MITCHELL, Ed. Wiley-Interscience, New York, 1972. xii, 416 pp., illus. $19.50.

Biochemical Ecology of Water Pollution. PATRICK R. DUGAN. Plenum, New York, 1972. x, 160 pp., illus. $14.50.

Ralph Mitchell's primary goal in *Water Pollution Microbiology* was to produce a text for advanced students that would show how modern microbiological concepts have been applied to the analysis of water pollution problems. In accomplishing his objective he has assembled an impressive group of environmental microbiologists, chemists, and engineers who have, for the most part, carefully and critically summarized the current state of our knowledge of many topics in this field.

Following an introductory chapter in which the editor attempts to tie together the disparate subject material contained in the volume, he presents the chapters grouped into several parts. The first part contains three chapters on inorganic pollutant materials, namely phosphorus, nitrogen, and acid mine drainage. The second part contains four chapters on the degradation of organic substances. A single chapter on water-borne pathogens constitutes the third part, and this is followed by a consideration of the effect of pollution on the structure of microbial communities in the fourth part. In the fifth part various procedures used in assaying biomass and activity as well as techniques employed for the enumeration of viruses and coliform bacteria are compared and discussed. The final part includes one article that critically and musingly reviews waste-water treatment processes and another that discusses the practice of destratification of impoundments. Altogether there are 17 chapters and 24 authors.

As might be expected, the treatment of the subject material is somewhat discipline-oriented. Perhaps the most notable example of this is the chapter on acid mine drainage by Lundgren, Vestal, and Tabita. Though this is an excellent article on the biology of the thiobacilli that cause the perplexing problem of acid mine waters, it would have been appropriate to discusss, in addition, the substantial, albeit inconclusive, research undertaken to control this problem. All in all, however, the authors have done a commendable job in bridging the interdisciplinary gap.

The book is to be especially recommended to prospective applied microbial ecologists. They will surely heed the "call" when they read some of the enticing comments of la Rivière, such as "microorganisms promise to be excellent tools for model laboratory studies in ecology, just as they are already in biochemistry and genetics."

Bravo for Mitchell! This book has been needed.

P. R. Dugan's book is aimed at a much wider audience including "engineers, economists, biologists, public servants, and others." Assuming that the nonbiologist reader is not intimidated by the title, he will find the first portion of the book highly readable and informative. It presents an overview of the significance, types, and causes of water pollution. In this section Dugan coins the terms "first-order pollution," which refers to the biological excreta of humanity, and "second-order pollution," as nonbiological human excrement, that is, technological pollution (it would not be fair to consider the book as an example of this!).

The second part of biochemistry begins benignly enough, but the chapter on the chemistry and biochemistry of water and those on degradation are, as the author himself suspected, too technical for most of the audience.

This book also has a chapter on acid mine drainage. Unquestionably it is, for the biologist, the best chapter in the book.

The appearance of these books is further evidence that the recently emerging interest of microbiologists in ecology is gaining momentum that will remain sustained for some time to come.

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Faunal Remains

The Study of Animal Bones from Archaeological Sites. RAYMOND E. CHAPLIN. Seminar, New York, 1971. x, 170 pp., illus. $5.75. International Series of Monographs on Science in Archaeology, No. 1.

Clearly the age of the specialist is in full swing in archeology. No expedition worthy of the name will take to the field without having available the expertise of those from a wide variety of disciplines. In many of these fields the degree of sophistication in techniques and analysis has increased remarkably in the years since World War II, and such is the case in the study of animal bones. This book, the first of a forthcoming series by specialists in disciplines pertaining to archeology, is a comprehensive study of most of the current aspects of faunal analysis, and should be read not only by the zoologist studying archeological material but by the archeologist as well. It includes valuable information on the collection, study, and treatment of bones and discusses the three most common methods of quantifying animal remains. There is an important chapter on bone measurements in which Chaplin rightly points out that they should be used with caution: "A dimension should be measured only when it is hoped or known that it will provide information relevant to the problem in hand such as size, weight or sex of the animal." I heartily agree, and wish that all our colleages in faunal studies would take this advice to heart.

I cannot find fault with Chaplin's presentation of field methods and study techniques, which is exemplary if

somewhat idealistic. I am disturbed, however, by what he has called the standard method of interpreting the data. Although the bibliography indicates his acquaintance with the literature from both the Old and the New World (a circumstance all too rare among faunal analysts), he shows a certain temporal and spatial provincialism in his discussion of analytical techniques. It is quite correct that there are basic principles that may be applied to a site of any age, but the statistical approach used on material from a Roman villa or a Saxon farm is hardly applicable to long-term occupation sites such as are found in the Near East. Chaplin makes the dubious assumption that a large sample indicates a high preservation rate of bone (in fact, except in special situations, the preservation rate is very low). This assumption is implicit in his calculation of the grand minimum number of individuals per species (GMT), which he derives from the well-known minimum number of individuals calculation (MNI). The latter is a perfectly valid statistical technique, but it is inapplicable unless the sample is very large. Chaplin makes the error of thinking that the MNI calculation is an approximation of the actual number of individual animals killed, which it is not, and from this he evolves his GMT calculation, which is statistically invalid. He has lost sight of the primary objective of quantifying faunal material, which is not to determine the number of animals killed during the period of occupation (surely a Utopian goal) but to determine the relative frequency of each species and consequently its economic importance. It is high time that those of us in faunal analysis take a close look at our quantification methods (preferably with the help of a statistician) so that such errors will not be repeated.

Although the author emphasizes the necessity of close cooperation with the archeologist, his orientation is essentially that of the zoologist. He is not thinking in cultural terms and, indeed, he never discusses bone as an artifactual material. There are limitations in the "specialist" approach, and nowhere is this more evident than in faunal analysis. Let the archeologist beware: the specialist he hires must be part archeologist himself.

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Effects on Behavior

Pharmacological and Biophysical Agents and Behavior. ERNEST FURCHGOTT, Ed. Academic Press, New York, 1971. xii, 402 pp. $14.50.

This book can be divided into two portions. The first four chapters deal with the behavioral effects of ionizing radiation, nonionizing radiation, anoxia, and ambient temperature. The main concern of these chapters is with the possible behavioral toxicity of these environmental hazards. The last three chapters deal with the effects of stimulants, sympathomimetic agents, and muscarinic blocking agents (atropine and scopolamine) on behavior, but from the point of view of their possible therapeutic use in behavioral disorders. In addition there is an emphasis on the utilization of drugs having known pharmacologic effects in order to elucidate the role of various chemical systems in behavior.

These two sections of the book differ not only in subject matter and approach but also in style and quality. The first is quite disappointing in terms of the title of this volume and its intent. In the introduction, the editor states, "Since some of the original research reports [on the behavioral effects of environmental agents] were not written by psychologists, the terminology and conceptualizations are not compatible with current behavioral science. The literature is, therefore, in need of evaluation. This volume is an attempt to bridge this existing gap." Unfortunately, the gap is not bridged, nor are the terminology and conceptualization compatible with current behavioral science. Much time is spent in defining the physical nature of these environmental factors and describing their biological effects. Such information is easily available from other sources. In contrast less than a third of the first 179 pages deal directly with behavioral effects. The presentation of behavioral effects is moreover totally uncritical, leaving the reader lost in a series of references to experiments that the authors fail to evaluate or place in perspective. Effects on learning are cited without a concern for whether the observed changes are due to associative or performance variables. Furthermore, there is no attempt to abstract general phenomena that have a common feature with other biological manipulations. For example, many of the symptomatic effects of radiation on behavior are also obtained following brain damage or toxic dosages of drugs. Perhaps the authors are simply the victims of the paucity of experimental data within their fields. Certainly the impression gained by the reader is that virtually nothing is known in any systematic way concerning the effects of environmental hazards on behavior. Considering the current interest in the toxic effects of our environment on behavior of all organisms one might hope that systematic studies will be initiated in this area.

In contrast to the first part of the book, the final three chapters are well-written evaluations of effects of drugs on behavior. The chapter by Calhoun on stimulants is a gem of clarity and lucidity. The strengths and shortcomings of experiments are pointed out, problems of research methodology are made understandable, and the general conclusions that can be reached are clearly stated. Great care is taken to lead the reader through the maze of results and provide him with a coherent picture of what we know concerning the behavioral effects of stimulant drugs. The same comments can be made concerning the other two chapters in this section.

This volume could prove useful for those interested in a general handbook for this field. There are over 1200 references in it and a reasonably good index of authors and subjects.

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Acquiring Language

The Ontogenesis of Grammar. A Theoretical Symposium. DAN I. SLOBIN, Ed. Academic Press, New York, 1971. xiv, 248 pp. $14.50. Child Psychology Series.

Transformational generative grammar as developed by N. Chomsky and other linguists, as well as the philosophical orientation of these scholars, has challenged psychologists in the past decade to consider more carefully the structure of individual knowledge and the preconditions for speech and language. Much of this interest has centered on first language mastery. This book includes papers on that subject written in 1965, when the symposium that prompted it was held, additions to those papers, and other, independent papers written in the last five years.

The major characteristics of young