Book Reviews

Lotic Biology

The Ecology of Running Waters. H. B. N. HYNES. University of Toronto Press, Toronto, 1970. xxiv, 556 pp. + plates. $25.

In the past, the textbook material on the ecology of running waters has usually been relegated to a single chapter in limnology texts, to superficial treatment in sewage engineering texts, and to a few volumes on the biology of polluted waters. Now for the first time the greatly scattered information on stream ecology has been brought together by a stream biologist with long and varied experience. Specific college and university courses in stream biology and ecology are now offered at perhaps no more than three or four campuses in the United States, but unquestionably the appearance of this book will produce a burgeoning of such courses, especially at senior and graduate levels. It is a companion volume to Hynes's *Biology of Polluted Waters.*

Since this is a new kind of book, readers and reviewers will impulsively and deliberately contrast it with counterpart volumes on limnology. For example, except for a concise review of longitudinal zonation of stream organisms, one finds no discussion of stream classification systems, in marked contrast to the emphasis on lake classification systems in limnology texts. Further, Hynes has given the chemical and physical aspects of lotic ecology only passing consideration (25 pages).

If this book has a special "theme" or emphasis, it is undoubtedly in the area of behavior and adaptation, notably in the seven chapters on composition, behavior, feeding, life histories, and ecological factors controlling benthic invertebrate populations. The chapter "Quantitative study of benthic invertebrates" contains a thorough critique of stream bottom sampling methods—a subject of considerable disagreement among stream ecologists. In general, Hynes is skeptical about correlations between standing crops, species occurrence, and water chemistry. He is also pessimistic about the recovery of bottom faunas after spates—a further point of disagreement with some other investigators. An abundant recent international literature is critically reviewed in the chapter "Effects of downstream movements of organisms on the benthos." Chapters on the biology of attached algae, higher plants, and plankton are well balanced and of equal length; there are no long taxonomic lists.

Fishes are treated in four chapters on fishes of running waters, ecological factors affecting fishes, movements and breeding, and feeding habits. These chapters are a general consideration of worldwide literature, however, and there is no special emphasis or reliance on the extensive North American literature.

Two unexpected but welcome chapters are "Effects of man on watercourses" (not including pollution) and "Special habitats" (springs, intermittent streams, very cold streams, hyporheic zone, psammon, and the madicolous habitat).

A summarizing chapter, "The ecosystem," resembles a long essay in which the fragmentary material on trophic relationships in streams is brought together. The emphasis clearly departs from some of the unintentional implied correlations between standing crop and productivity scattered throughout some of the other chapters.

In view of the abundance of generic and species names in this book, the author has attained added polish by the rarity of typographical errors. The bibliography of 1500 entries is especially useful because each entry is followed by the number of the page or pages in the text where the item is cited.

We would wish for more tables, figures, and quantitative data, as well as material on natural eutrophication and shoreline development and microzoans of the substrate, greater emphasis on trout streams, and a realistic discussion of the *Eichhornia* and *Trapa* problems in the southern and eastern states.

Libraries and aquatic ecologists should quickly exhaust the first printing of this essential reference and textbook.

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Two Research Strategies

The Community as an Epidemiologic Laboratory. A Casebook of Community Studies. IRVING I. KESSLER and MORTON L. LEVIN, Eds. Johns Hopkins Press, Baltimore, 1970. xiv, 326 pp., illus. $10.

Studying the distribution of diseases in human populations leads to insights into the ways in which man can reduce disease frequency by modifying his interactions with the social, biological, and physical environment. This, in brief, is the task of the epidemiologists. For example, a series of *ad hoc* epidemiological studies during the last two decades in various populations have shown beyond any reasonable doubt that cigarette smokers have a higher risk of dying of coronary heart disease and an enormously higher risk of dying of lung cancer than do other people. Epidemiologists and biostatisticians have developed the art and theory of conducting such "hit and run" studies to so high a level that a great deal of their training focuses on the transmission of that art and theory. Many questions have been answered by studies of that kind.

But another set of questions requires longitudinal community studies, a different relationship of the investigators to the population under study. If one is interested in understanding the interrelations between living conditions and disease prevalence as they affect the distribution of medical care, one is more inclined to seek out a sample population in which these three sets of phenomena can be repeatedly studied and where the investigators can examine their interrelations in an entire community. Because of such interests, Edgar Sydenstricker settled into Hagerstown, Maryland, and developed what might be called the first "population laboratory" for studies of disease ecology (see E. Sydenstricker, *Environment and Disease,* McGraw-Hill, 1933). This community-laboratory approach led to the technology of morbidity surveys that produced the first national health surveys of the Commit-

tee on the Cost of Medical Care and the present ongoing National Health Surveys of the country's health problems conducted by the National Office of Vital Statistics.

Thus the primary reason for organizing community studies is that some important questions about disease ecology cannot be answered by *ad hoc* studies. In addition, there is a technical advantage, because the investigators can familiarize themselves with the living conditions of a single community and build successive studies on what was learned in previous ones, and so explore the interrelations between different illness distributions in the same population. As Comstock (Sydenstricker's successor in Hagerstown) points out in his contributions to the book under review, "the currently popular application of the word 'laboratory' to a human population seems somewhat inappropriate . . . 'observation' is a more inclusive and felicitous term than 'experiment' and encompasses most community-based epidemiological research."

This book, the product of a series of seminars given in 1968 at the Johns Hopkins School of Hygiene and Public Health by investigators from various centers, is the first "systematic presentation of community studies from an epidemiological viewpoint," and affords the reader an opportunity to review some of the ongoing work of this kind in various parts of the United States and elsewhere in this hemisphere. Because the ecology of disease is bound to be of ever greater future importance, this collection is a landmark in the history of community-based studies. Unfortunately, the editors, from the Division of Chronic Disease of Johns Hopkins University, have placed so much emphasis on studies of the conventional, older *ad hoc* type and on the potentialities of the community-centered study groups to execute that type of study that neither side of the debate comes out clearly. There is some reason to think that an investigative group concentrating the bulk of its work on the population of a single community—what might be termed the "localized" investigative team in contrast to the "hit and run" investigative team—can produce more data of the hit-and-run type per dollar, but that is not the main reason for organizing community studies. The main reason is that there are questions about the ecology of disease that will never be answered by hit-and-run studies alone. The preoccupation of the host group and the editors with hit-and-run techniques apparently kept the guests from emphasizing their motives in starting community studies. The reader may be further confused regarding this point because the editors preempt the term "epidemiology" early in the book and keep coming back to what they choose to call "the epidemiological point of view," namely, "elucidating pathogenic mechanisms: identifying risk factors in disease and, to the extent possible, etiologic agents." This is a definition much narrower than many epidemiologists—including this reviewer and apparently many of their guests—would accept.

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Genetic Mechanisms

The Molecular Basis of Mutation. JOHN W. DRAKE. Holden-Day, San Francisco, 1970. xiv, 274 pp., illus. $13.95.

Every biologist thinks he knows quite well what mutations are. The usual definition is simple enough: mutations are abrupt, heritable changes in the structure of genes; they are the ultimate source of the genetic variability necessary for evolution by natural selection. But even as the structure and function of genes have been revealed by molecular biologists, the familiar idea of mutation has become a shadowy, if not downright slippery, concept. This state of affairs is well illustrated in the final chapter of John Drake's book, in which the "philosophically inclined reader" is challenged to consider the question of whether recombinants are mutants. It is a good question, and this is a good book, really the first of its kind in the field.

The author's major concern is to set forth the ideas and experiments of the past 20 years that have contributed to the truly exquisite insight that we now possess into the mechanisms of viral mutagenesis (particularly in the T-even coliphages). Drake begins with a crisp discussion of the "first principles" of phage genetics and goes on to outline, with many practical admonitions for the naive or uninitiated reader, the experimental procedures and pitfalls that are to be encountered in the field. He includes a useful chapter on the treacherous problems of calculating and comparing mutation frequencies, but still is bold enough to include a table of comparative forward mutation rates in organisms ranging from phage lambda to *Drosophila.* One might wish for a broader and more critical analysis of the significance of quantitative estimates of mutation frequencies, especially in view of the serious practical problems associated with assessment of the hazards of environmental mutagens.

The real heart of the book consists in an exceptionally lucid and well-organized discussion of the various macromolecular processes associated with chemical, radiation, and spontaneous mutagenesis in bacteriophages. The taxonomy of mutational lesions elaborated by Benzer, Freese, Brenner, and Crick, and based upon the linear encoding of genetic information into DNA base sequences, provides Drake, and all modern students of mutation, with a most elegant theoretical framework for experimentation. However, the very beauty of this theoretical structure sometimes causes even experienced workers to overlook the rather meager empirical justification for using the various reversion tests in classifying mutations. Drake is properly critical and cautious in his evaluation of the base-analog and proflavin reversion tests for transitions and frameshift mutations, respectively, although he does seem to exude surprising confidence only a few chapters later in describing his own use of these tests in the classification of ultraviolet induced mutations in bacteriophage T4. Drake concludes his book with brief discussions of mutational heterozygotes, suppression, complementation and polarity, and a number of other genetic phenomena that he lumps together under the heading of "pseudomutations."

The only obvious deficiency of the book is the lack of an adequate discussion of reactivation mechanisms and of the various modes of DNA repair. The former is occasioned probably by the author's predilection for experiments involving phage T4, but the latter is genuinely puzzling in view of his frequent invocation of DNA repair enzymes as possibly essential elements in the mechanisms underlying recombination, deletion and frameshift mutations, and mutational heterozygosity.

Drake does not set his discussion of mutagenic mechanisms in the kind of broad evolutionary context that would make the book even more attractive to the general biologist. By restricting himself to simple genetic systems the author is able to maintain the high