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.

ERNEST M. GRUENBERG
College of Physicians and Surgeons,
Columbia University,
New York City

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

standards of deductive rigor that appeal to most phage workers. However, one might hope that in subsequent editions of this book Drake will bring his talent for crisp analysis and clear exposition to the difficult problems of mutagenesis and its control in eucaryotes.

R. H. HAYNES
Department of Biology,
York University, Toronto, Ontario

Blood Cell Formation

Regulation of Hematopoiesis. ALBERT S. GORDON, Ed. Appleton-Century-Crofts, New York, 1970. Vol. 1, Red Cell Production, xx pp. + pp. 1–766, illus., + index. $44. Vol. 2, White Cell and Platelet Production, xx pp. + pp. 767–1658, illus. $46. The set, $78.50.

These two volumes provide a comprehensive account of current views of hematopoiesis. The chapters vary considerably; some are excellent critical reviews, some are primarily reports emphasizing the authors' own work and views, a few are simply research papers, and a few are so brief that they are of little value. Even in these, the consultation of the literature cited would give pertinent up-to-date information. The references for the various chapters are uniform and complete. The physiology, morphology, chemistry, and clinical findings relevant to hematology are well correlated, and a concerted effort has been made to emphasize the subject as a general biological problem.

The range of hematological problems discussed is wide, and although the emphasis is on mammalian hematopoiesis, a brief discussion of the relatively neglected field of hematopoiesis in nonmammalian vertebrates, as well as an excellent review of insect hematopoiesis, is included.

Several chapters are devoted to the stem cell problem, using primarily data accumulated during the last few years by the spleen colony technique and the growth of bone marrow cells in soft agar. These papers, as well as the more theoretical papers by Hirschfeld and Hodgson, should be stimulating to all investigators interested in the current status of this fundamental hematological problem. The field is in such a state of flux, however, that some of the conclusions may warrant modification in the future. The full potential of these relatively simple yet highly reproducible techniques is only beginning to be realized and their use, together with already available mouse strains having gene mutations affecting specific stages of hematopoiesis (discussed in a chapter by Russell), will give greater insight into the processes regulating hematopoiesis, possibly at the molecular level.

A number of excellent chapters are devoted to the many problems of normal, fetal, and abnormal erythropoiesis. An excellent critique of the in vivo assay of erythropoietin using the plethoric mouse is provided. A similar evaluation of the in vitro assay of the hormone, frequently used in studies of mechanism of action of erythropoietin, would be of value. Some attention is given to erythropoietin physiology, with perhaps too much emphasis on the role of the renal erythropoietic factor in the genesis of erythropoietin. These chapters, read in conjunction with the recent book by Krantz and Jacobson (*Erythropoietin and the Regulation of Erythropoiesis*, University of Chicago Press, 1970), provide a balanced account of current knowledge of the erythroid system.

The second volume contains 25 chapters on the normal and abnormal morphology, physiology, chemistry, and kinetics of proliferation of the granulocytes, lymphocytes, monocytes, macrophages, and platelets. The overall coverage is as impressive as in the previous volume, and is well balanced.

Excellent chapters on the fine structure of blood cells are included. The chapter by Wetzel on granulocyte fine structure and his discussion of the technical and interpretative problems of electron microscopy should be read by all hematologists. Regrettably, many of the fine electron micrographs and photomicrographs have suffered a loss of detail during reproduction.

Any hematologist reading these volumes could point out topics that have not been covered, but certainly most of those that have been covered are presented comprehensively. A more thorough indexing of the work would have greatly increased its value.

The price of this work precludes individual purchase, but the volumes should be available in all laboratories interested in hematological problems. Biologists interested in differentiation and cellular interactions should also find this book of interest, since the hematopoietic system provides an excellent model for such studies.

JOHN C. SCHOOLEY
Lawrence Radiation Laboratory,
University of California, Berkeley

Chemistry and Entomology

Chemicals Controlling Insect Behavior. MORTON BEROZA, Ed. Academic Press, New York, 1970. xiv, 170 pp., illus. $10.

Control of Insect Behavior by Natural Products. DAVID L. WOOD, ROBERT M. SILVERSTEIN, and MINORU NAKAJIMA, Eds. Academic Press, New York, 1970. x, 346 pp., illus. $11.

These two volumes, containing contributions from 38 authors, including 15 from Japan, are largely complementary. Together they probably constitute the most complete and up-to-date reviews available of the various aspects of chemical control of insect behavior by pheromones and substances produced by host plants. As such they will be invaluable background reading and sources of reference for all those who are interested in the isolation, identification, synthesis, biological function, and possible practical use of such naturally occurring organic compounds.

It was an excellent idea for biologists and chemists who are currently working on these problems to consider together plant attractants and the various types of pheromones of both solitary and social insects, and to discuss many of the chemical, physiological, and ethological methods of studying them. The results are very rewarding.

The difficulties of the biologist in devising quick and reliable laboratory bioassay techniques that bear some relationships to natural field conditions are recognized, as are the extremely difficult problems of the chemist, even with the most sophisticated equipment, in isolating and identifying minute traces of biologically potent, and sometimes fugitive, compounds. These problems are well illustrated by the fact that even though more of the so-called "alarm" pheromones, which are not only present in relatively large amounts but are also fairly easily assayed biologically, have been identified than pheromones of any other group, they present biological difficulties in that, as no doubt happens with other pheromones, they elicit at small and great concentrations quite distinct but equally important responses from recipient insects. Furthermore, as work has proceeded during the last decade, the problems have been seen to be more, rather than less, complex than was first thought, as many pheromones are being found to be mixtures of several compounds, sometimes acting synergically. In other cases a series of stimuli are necessary. For instance, an insect that has found a potential mate, or