

and experimental populations with regard to social factors in reproduction. In view of the many variables, the author's organizational feat is impressive. Attention is drawn to experimental studies where uncontrolled variables may be significant and where the experimental conditions may have little relevance to normal social conditions in the wild. His failure to include sample sizes along with percentage comparisons reduces the value of some of the data. A glossary or index of common names would also have been helpful to nonmammalogists.

A book on the ecology of reproduction in mammals will appeal to a wide variety of scientists. Whether they are concerned about proliferating swarms of humans and the effects of their density or are bent on breeding beef or reducing the growth of rodent populations, this compendium of research will be useful. Its pages are filled with tables and figures. Obviously, the subject is complicated and only a beginning has been made, but Sadleir has pointed clearly to the gaps. A comparison with similar, recent studies of birds will be fruitful.

Our ignorance of the control of reproduction in wild ungulates is quite astounding in view of their importance as converters of plants into high-quality protein. Recent experiments on African ungulates have demonstrated their higher reproductive rate as well as superior physiological and behavioral adaptations under tropical conditions as compared with domestic cattle. The livestock at present used by Western man were chosen some 6000 years ago. Are these the most appropriate for all of man's varied ecosystems?

BARRIE K. GILBERT  
*Zoology Department, Duke University,  
Durham, North Carolina*

## Hosts and Pathogens

**Disease Resistance in Plants.** J. E. VAN DER PLANK. Academic Press, New York, 1968. xiv + 210 pp., illus. \$9.50.

**Plant Diseases and Their Chemical Control.** E. EVANS. Blackwell Scientific Publications, Oxford, 1968 (U.S. distributor, Davis, Philadelphia). xvi + 288 pp., illus. \$12.25.

In *Disease Resistance in Plants* Van der Plank presents many original ideas in a precise, lucid, and readable style, and in a well-organized and logical se-

quence. In 1963, the author published a book on epidemics of plant disease and their control. The present volume flows naturally from that work. The maintenance of disease-resistant crops is a continuing process. Fungal and bacterial pathogens, when exposed to resistant hosts, evolve races that can overcome the resistance. Van der Plank contrasts two kinds of resistance: vertical, which is based on a few specific genes, and horizontal, which is based on many, the action of which may be indirect. When a vertically resistant variety is attacked in nature, the appearance of disease in the crop is delayed, but, once disease is evident, the pace of attack is not diminished. Characteristically, when horizontal resistance is involved, the pace of the epidemic is reduced. The author illustrates how different varieties of host plants may possess both types of resistance, only one, or neither and discusses how the characteristics of an epidemic differ in each situation. In overcoming host resistance, an evolving pathogen must simultaneously develop contrasting characteristics of aggressiveness toward a susceptible host, depending upon whether the resistance of a host evoking this response is of the vertical or horizontal type. Van der Plank argues that control of obligate parasites, such as the rusts, by vertical resistance requires at least two genotypes of the host in the area under the influence of the pathogen.

Of the two types, vertical resistance is the better known, but the useful life of vertically resistant varieties has generally been short. Horizontal resistance is less dramatic; such plants are often disease-tolerant, rather than hypersensitive, and crops may successfully survive epidemic-favoring conditions. Because horizontal resistance has been less sought, Van der Plank reasons that potentialities for improvement in this type of resistance may be very great. The useful life of varieties with horizontal resistance is likely to be long.

Considering the book as a whole, one notes that the evidence presented in support of the arguments is drawn from relatively few diseases, but they are ones that have been extensively studied, and as a result the examples of principles are the more convincing. By presenting the argument in terms of epidemics and the potential of pathogens to evolve readily when confronted by resistant hosts the author

always directs the reader's attention to real situations, however much theory is behind the reasoning. The outlook of the book is one of synthesis and is constructive. It will create improved understanding of disease resistance and stimulate research in the area for years to come.

Evans's book covers physical, chemical, and biological aspects of chemical control of plant disease and is intended as a general introduction. The approach is uniquely broad and will serve well to orient the beginning student who wants an overview free of exhaustive detail. The author presents concepts clearly, with a minimum of technical jargon, while citing evidence adequately to support his presentation. Particularly worthwhile are his discussions of potentialities for control in such contrasting situations as treatment of seed, soil, and foliage and of the limitations on control of foliar diseases when fungicidal sprays are serially applied to combat aerial pathogens.

The broad approach he takes requires the author to generalize concepts. The danger in such an approach to a large and detailed subject lies in the resulting oversimplification. As a result the beginner may believe his understanding to be more comprehensive than is warranted. The experienced worker will be stimulated by this book. He will want to qualify some of the statements, contest others, and introduce a few concepts. He may even be moved to test some of the ideas experimentally. To paraphrase Alice—what is the use of a book that is not stimulating?

A. E. DIMOND  
*Connecticut Agricultural Experiment  
Station, New Haven*

## The Biological Clock

**Rhythmic Phenomena in Plants.** B. M. SWEENEY. Academic Press, New York, 1969. x + 148 pp., illus. \$7. Experimental Botany, vol. 3.

Although rhythmic phenomena have been studied for many years, it is only within the past two decades that rhythmicity has been explicitly viewed as a biological regulatory system. The notion that this regulation involves time, that is, that the temporal order and magnitude of biochemical and physiological processes are controlled by an endogenous and rather accurate bio-

logical clock, is now abundantly clear. Sweeney takes this as a point of departure in her short but authoritative monograph. The book is more explicative than encyclopedic, covering all the basic concepts in the field. Although it deals primarily with plant material, the author does not hesitate to refer to results with animals where it is appropriate. The emphasis throughout is on the mechanism and biological function of clock systems.

The chapters not only cover daily or circadian rhythms but also include tidal, semilunar, lunar, and annual cycles. There is also a valuable chapter on the cell division cycle and its relation to endogenous rhythms.

A final chapter on mechanism, on the "clock" and its "hands," serves to set in good perspective the present knowledge and the speculations. Unfortunately, no good theories are currently available concerning the cellular and biochemical identity of the clock or its functional nature. Sweeney's book provides an uncluttered descriptive background, especially for "the students of the future who will reveal the balance wheel of the biological clock."

J. W. HASTINGS

*Biological Laboratories, Harvard University, Cambridge, Massachusetts*

## Degenerate Materials

**Heavily Doped Semiconductors.** VIKTOR I. FISTUL'. Translated from the Russian edition (Moscow, 1967) by Albin Tybulewicz. Plenum, New York, 1969. xii + 420 pp., illus. \$25. Monographs in Semiconductor Physics, vol. 1.

In 1965 (when this book was written) it was still common to equate heavily doped semiconductors with those that are electronically degenerate. Thus they are treated as "poorly conducting metals" throughout this volume. Other topics of recent interest in heavily doped semiconductors—energy band tails and the properties of disordered systems—are barely mentioned.

Within this context, the book is a detailed compilation of relevant formulas and properties for these materials. It is not a textbook so much as a reference for those who are familiar with solid state and semiconductor phenomena. The reader should, in fact, treat with care the first chapter, which

is intended as a summary of semiconductor physics but which is in several places misleading and sometimes simply wrong. The remainder of the book, though short on explanations, contains probably the most extensive treatment of degenerate semiconductors now available. Germanium and silicon get the lion's share of space to such a degree that most of the theoretical relations are extended to include the explicit details of their individual energy-band structures.

One-third of the book consists of the chapter on transport phenomena, which is, in itself, a tour de force. The preceding chapter on semiconductor statistics is also quite detailed and adds to the standard material some not-so-familiar graphical techniques for Fermi-level determination. Optical absorption is given a fair treatment, but other optical effects are somewhat slighted. In addition to a chapter on the preparation of heavily doped semiconductors (written by M. G. Mil'vidskii), the author includes a short chapter on solubility relations for impurities which is evidently largely his own work. A chapter on applications of these materials and a large set of tables of Fermi integrals and transport integrals complete the volume.

The references are very comprehensive through 1963; thereafter, the author's own works appear to outnumber all the rest. The translation reads very fluently. In conclusion, this is a unique book which can be of value to the knowledgeable workers in this field.

DAVID REDFIELD

*RCA Laboratories, Princeton, New Jersey*

## The Magnetosphere

**Magnetospheric Physics.** Proceedings of a symposium, Washington, D.C., Sept. 1968. DONALD J. WILLIAMS and GILBERT D. MEAD, Eds. American Geophysical Union, Washington, D.C., 1969. iv + 460 pp., illus. Cloth, \$10. Paper, Vol. 7, Nos. 1 and 2, of *Reviews of Geophysics*, available by subscription only.

This book differs from the usual symposium proceedings in that it is very well done. One has become accustomed to the publication of symposium proceedings in expensive volumes with long production times and containing many papers that either advertise work pub-

lished elsewhere or are not good enough to survive the refereeing process of a reputable journal. This book was produced relatively quickly and at a cost of less than half that of the usual symposium proceedings. The symposium was restricted to a single topic: the magnetosphere. The volume contains only the 15 invited review papers presented at the symposium, and these papers, as a collection, constitute good reviews.

The contents of this book have also been published as the first half of volume 7 (1969) of *Reviews of Geophysics*, the interdisciplinary review journal of the American Geophysical Union. This last point has led to some difficulties for the journal. It has been questioned whether an interdisciplinary review journal such as *Reviews of Geophysics* should devote half a year's output to such a narrow topic. This question may have been largely responsible for the motion made in the spring meeting of the Council of the AGU that *Reviews of Geophysics* "be discontinued at the earliest possible date." [See *E&S* 15, No. 6, 465 (1969). It appears that this matter has since been resolved.]

Although this collection may be criticized from the point of view of its publication in *Reviews of Geophysics*, it is a model of what a good symposium proceedings should be. The authors were carefully chosen to cover a wide range of topics and subdisciplines within the general discipline of magnetospheric physics. There is not much overlap among the various papers. What overlap does exist is useful in that it sometimes results in the presentation of divergent views of the same topic. For example, four of the contributions are by Soviet authors. The areas of overlap between these papers and the U.S. papers indicate to me that the Soviet program of magnetospheric research is not operating at the same dynamic level as the U.S. program. Most discoveries and innovative new ideas have come from U.S. research.

The book contains some minor flaws that detract slightly from its overall excellence. The lack of an index is annoying. Some topics of importance are treated lightly; for example, the production of ELF and VLF emissions by trapped radiation and the existence of field-aligned currents in magnetosphere are mentioned only casually.

This conference proceedings provides an excellent benchmark for progress in magnetospheric physics. (The conference was held in observance of the tenth