And if past experience is any basis for judging, most of these efforts are destined to a quick and merciful oblivion.

It is therefore refreshing to read this unusual book by N. J. Berrill, who is Strathcona Professor of Zoology at McGill University and the author of a number of books and articles. In this volume Berrill's ostensible purpose is to extrapolate to other worlds what is known about life on earth and to speculate about the possible existence and nature of extraterrestrial life. In a kind of rambling discursive style, which has some of the attributes of free association, the author examines some of the components of the solar system, the nature and diversity of life from the viewpoint of a classical biologist, and finally the problems and prospects of space communication and travel.

The real intent of the writer, however, soon reveals itself, if the reader has not already guessed it by scanning the table of contents. The titles of some of the chapters are "Moonstruck"; "Out of their minds"; "Landed gentry"; and "Is sex necessary?" The overall impression left with the reader is that of a tongue-in-cheek discussion of "exobiology." By far the best part of the book is that which deals with the subject that the author knows best—the overwhelming variety of the earth's ecology and the questions raised about the nature of life itself. There is, however, some implied teleology in certain involved sentences—for example, "So what we see when we look at a horse is what a horse has to be if it is to be as big as it is and run as well as a dog" (p. 98). The author makes no significant reference to the key discoveries of modern genetics.

The book is also marred by a number of inaccuracies; for example, in describing the Martian dark areas Berrill says: "Often the colors become brownish, reddish, black, or even a moss green" (p. 55). But there exists substantial evidence suggesting that these colors are the result of an optical illusion arising from the contrast against the bright areas of the planet. Certain sweeping statements—for example, "Taken altogether, the evidence makes the existence of life on Mars almost a certainty" (p. 57) and the statement denying that relativistic time dilation applies to biological systems (p. 217)—are, to say the least, unwarranted. Anthropomorphisms of the type found on page 71—"Jupiter . . . turns on its axis in less than ten hours, blowing and rumbling as it spins around"—whether intentional or not, seem flippant rather than witty.

Perhaps the author's main contribution has been to provide an enjoyable and quite readable alternative to the plethora of space books that suffer from exaggerated optimism and labored enthusiasm.

ELIE A. SHNEOUR
Department of Genetics,
Stanford University

Organic Chemistry Series

Carbene Chemistry. Wolfgang Kirmse. With a chapter by H. M. Frey and one by P. P. Gaspar and G. S. Hammond. Academic Press, New York, 1964. vii + 302 pp. $9.50.

During the last decade or so, at least four areas of organic chemistry have emerged from a position of relative obscurity to one of permanent importance in the field. One of these areas is the subject of this monograph, the first in a new series edited by Alfred T. Blomquist of Cornell University.

The chemistry of carbenes covers a rapidly growing class of highly reactive divalent derivatives of carbon, the central significance of which lies in its relevance to the fundamentally organic chemical problem of transforming one covalent bond into another. During the past 50 years it has been found that the great bulk of organic chemical reactions involve three classes of highly reactive trivalent intermediates—the positively charged carbonium ions, the neutral free radicals, and the negatively charged carbanions. Divalent carbon, which has now been established as a fourth class of reactive intermediates, has given rise to a host of novel chemical transformations.

The story of these intermediates is told simply and clearly by Kirmse in an orderly sequence, beginning with the parent unsubstituted methylene and proceeding chapter by chapter through carbenes substituted by alkyl groups, double and triple bonds, aromatic rings, the ester grouping, ketones, halogens, and miscellaneous types. Within each chapter emphasis is placed on methods of preparation of the divalent intermediates and on the chemical reactions to which they give rise. The presentation of these more classical aspects represents an impressively successful effort to cover a rapidly growing literature in complete form.

The fascinating mechanistic aspects of the field are woven into the formal development skillfully and with a fine sense of relevance. It is particularly in these sections that Kirmse's long experience as an imaginative contributor to the chemistry of carbenes, his command of the current theory of organic chemistry, and his inately critical and analytical mind have combined to lift this monograph far above the level of the customary review.

Two features in the chemistry of carbenes are of particular interest to physical organic chemists. One involves the behavior of the so-called "hot" molecules that are formed with abnormally high energies as the initial product of gas-phase reactions of methylene; the other concerns the calculation and establishment of the electronic spin states of carbenes. These subjects are expertly handled by Frey (University of Southampton) and Hammond (California Institute of Technology) and Gaspar (Washington University, St. Louis).

Because it was mainly written by one good man, this book achieves a coherence that is a most welcome change from the more customary collection of chapters written by several authors of disparate points of view and abilities. It is well indexed and free of serious errors; I recommend it highly for those whose background permits them to indulge their interest in the exciting events at the frontier of organic chemistry.

WILLIAM VON E. DOERING
Department of Chemistry,
Yale University

Plasma Physics

Dynamics of Charged Particles. Bo Lehnert. North-Holland, Amsterdam; Interscience (Wiley), New York, 1964. 310 pp. Illus. $11.50.

The subject of plasma physics is studied by scientists in a variety of disciplines, partly because of its intrinsic complexity and partly because of its appeal in diverse applied areas. A division exists between the particle approach and the gas dynamic approach; the present text follows the former choice. In this plan, it becomes a major addition to the field. A basic