preface, which tells why the book was written and what is in it. And they should also glance at the bibliography which includes some 400 titles, each with brief annotation or quotation.

All of us will admire, if not completely share, the authors' enthusiasm for geologic self-analysis.

LINCOLN DRYDEN
Department of Geology, Bryn Mawr College

Oppenheimer's Lectures

The Flying Trapeze: Three Crises for Physicists. J. Robert Oppenheimer. Oxford University Press, New York, 1964. x + 65 pp. Illus. $2.75.

This slim volume, scarcely larger than a paperback and half as thick, contains the transcript of a recording of the three Whidden lectures of 1962 at McMaster University in Toronto. They were delivered by Oppenheimer from rough notes without manuscript, and they have been edited by M. A. Preston, with some slight rearrangement and the disclaimer that "all the significant words are Oppenheimer's." The lectures are entitled "Space and Time," "Atom and Field," and "War and the Nations."

Those who know the author or have heard him lecture will recognize the flavor of this book as authentic, vintage Oppenheimer. Although the method used to get the book into print gives the words the advantage of spontaneity, it does not always permit easy comprehension: the voice of the lecturer always carries much by intonation and emphasis that does not get through to the printed page without careful rewriting.

The body of the text (pp. 8 to 57) is concerned with making the current concepts of relativity, gravity, nuclear structure, light waves, and the quantum theory—a large order—clear to a general audience, while using an absolute minimum of mathematics and no demonstrations. To do this adequately is a problem that every physicist has met socially, if not professionally, a problem that is always challenging and very rarely met successfully. Surely it was met successfully here, though to state this categorically involves deciding just what is meant by "making things clear" to a nontechnical audience.

The first eight pages are introductory reflections on the history of physical theory and of scientific knowledge in general, a discussion of the tenacity of error, and of the nature of scientific progress. In sharp contrast to them and to the body of the lectures, and of very great historical interest because they are based on the author's own recollection, the last nine pages are the author's "synoptic history" of the developments in nuclear physics that led to the production of atom bombs for use against Japan. Here is also the author's balanced and final judgment in the controversy as to the necessity for using them at Hiroshima and Nagasaki. His concluding paragraph deals with the duty of scientists in relation to the making of a world which will be, hopefully, "varied and cherishes variety, which is free and cherishes freedom, and which is freely changing to adapt to the inevitable needs for change in the 20th century and all centuries to come; but a world which with all its variety, freedom, and change, is without nation states armed for war and above all, a world without war."

MALCOLM C. HENDERSON
Department of Physics, Catholic University, Washington, D.C.

Mathematics

Theory of Difference Schemes: An Introduction. S. K. Godunov and V. S. Ryabenki. Translated by E. Godfredsen. North-Holland, Amsterdam; Interscience (Wiley), New York, 1964. xii + 289 pp. Illus. $9.75.

This volume is an interesting and well-written introduction to the problem of solving ordinary and partial differential equations by replacing the derivatives by difference quotients and approximating the solutions of the resulting difference equations. The authors have written a self-contained volume, avoiding as much as possible systems of references to literature without the book in developing the ideas. A bibliography is given at the end of the book, along with comments on the literature.

No previous preparation in the subject is expected of the reader other than a knowledge of basic concepts such as limits, derivatives, and differential equations, but the ideas involved are by no means simple. All the concepts are developed from elementary notions, and the authors use simple examples to illustrate the points in question.

The first two chapters play an introductory rôle. Here the authors develop the elementary theory of one-dimensional difference equations of the first and second order with constant coefficients, and give precise definitions of approximation and stability. Some of the most commonly used integration schemes, such as the methods of Adams, Stormer, and Runge-Kulta, are bypassed for a single method developed by one of the authors.

In the third chapter, concepts of approximation and stability are discussed for difference schemes for partial differential equations and a scheme for the proof of existence theorems by the method of finite differences given. Some simple procedures for solution of the equation of thermal conductivity are developed in chapter 4.

The last two chapters are devoted to methods that can be used for the study of stability of schemes for the solution of equations which describe nonstationary processes. A method for the study of stability proposed by Gelfand and Babenko is presented; this is combined with the idea of quasi-eigenfunctions leading to the concept of a spectrum of a sequence of operators.

There are a number of appendices that provide an introduction to the literature on various difference methods, including the following papers: "On difference schemes for solution of the equation of thermal conductivity," by Gelfand and Lokutsievski and, by the same authors, a substantial paper entitled "The double sweep method for solution of difference equations"; "The scope of the energy method" by Peter D. Lax; "On the estimate of the amount of computational labor necessary in approximate solutions" by N. S. Bakvalov; and "Difference schemes for parabolic equations and continuous integrals" by V. Y. Krylov.

Although many examples are given in the development of the concepts, the authors provide no problems. This would, of course, be a drawback to the use of the book as a text. Otherwise the book is an admirable one.

NATHAN SCHWID
Department of Mathematics, University of Wyoming