aging. In some respects, it has even now been superseded by new results. Nevertheless, its main conclusions will stand the test of future research.

Why are the variable stars important in galactic research? The answer to this question is given only by implication in this volume. It has, however, been stated lucidly by B. V. Kukarkin in a Russian book under the title *The Study of the Structure and Evolution of Stellar Systems upon the Basis of our Knowledge of Variable Stars* (Moscow-Leningrad, 1949; this book is now available in a German translation. It is strange that Mrs. Gaposchkin gives no reference to this monograph, which treats the problems of variable stars in much the same manner—except, of course, for some Communist-inspired ideological nonsense that abounds in the introductory and closing pages of the Russian book): (i) The variable stars identify themselves by their light-curves as objects of comparable physical properties. (ii) They can be discovered and investigated with relatively modest instruments; since some groups of variable stars are exceedingly luminous, they can be isolated at great distances from the sun in the Milky Way and in other galaxies. (iii) Their variations—due to pulsations and to explosive processes—provide information regarding the evolutionary processes in all stars. These processes are intimately related to the structure and evolution of galaxies.

A single example (not given in these two books) may suffice to illustrate the third point. Consider the mean density of a star and its evolutionary change. If the evolution proceeds with only a negligible change in mass, as in the case of thermonuclear energy-generation, $\bar{\rho} = \frac{\text{constant}}{R(t)}$. But the radius is very poorly determined from direct observations, and its change with time t cannot be found. But most variable stars obey the universal law of vibrating sysems, $P\sqrt{\bar{\rho}} = \text{constant}$. For many variables the period P is known to a small fraction of 1 sec, and in a few, changes of P amounting to 1 sec/century (when $P \sim 4$ hr) have been definitely established. If these changes in period are systematic in character, they imply a corresponding change in $\bar{\rho}$—with a fantastic degree of precision!

The first chapter, "The galaxy," will be of special interest to nonastronomical readers. It lists all the major "races" of stars, not just those that are characterized by changes of brightness, and it contains estimates of their frequencies relative to the entire disk and halo populations. The second chapter on "The pulsating variable stars" is a summary of our knowledge of the light-curves, radial velocities, and spectral characteristics of the principal groups of intrinsic variables. Mrs. Gaposchkin has omitted the T Tauri stars because "our knowledge of these groups of stars is very fragmentary and permits us to investigate them only in our immediate neighborhood." She does not mention the stars of the β Canis Majoris type. They may turn out to be a particularly valuable tool in the future study of associations of very young stars in the Milky Way and in other galaxies.

The third chapter, "The explosive variables," deals with novae and nova-like stars. The fourth, on "The magnitude scale for variable stars" fixes the scales of intrinsic luminosities for the various sequences of variable stars. It recognizes the change in the distance scale of the galaxies first established by W. Baade in 1952. The fifth chapter, "Distribution of variable stars" contains a cautious discussion of the difficult problem of interstellar absorption.

The sixth chapter is a rather abbreviated treatment of the "Motions of variable stars," and the concluding chapter entitled "Variable stars, galactic structure and evolutionary problems" summarizes the results. It "is an expression of opinion [of the author] and touches upon the important problem of the effective planning of research."

Not all of these chapters will make easy reading for a nonastronomical reader. The text is so concise that many terms that are familiar to every astronomer have not been explained. A physicist may not know what a "Bottlinger diagram" is, and a geologist or chemist may wonder what the 21-cm line of hydrogen is supposed to do for astronomy.

OTTO STRUVE
Berkeley Astronomical Department, University of California

Modern Gas Analysis. Paul W. Mullen. Interscience, New York–London, 1955. ix + 354 pp. Illus. $5.50.

This book on gas analysis is divided into two parts. Part I on "Absorptiometric gas analysis" makes up about 60 percent of the text. Part II on "Instrumental gas analysis" takes the remaining 40 percent.

The book is quite complete; practically all known methods of gas analysis are discussed. It is profusely illustrated, as is shown by the fact that illustrations take up space equivalent to about 15 percent of the total. It is a pocket-size book. These facts indicate that the treatment of topics is necessarily condensed. For example, mass spectrometry is described in some 12 pages of text. In such a condensation, when the field to be covered is very broad, it might have been better to have limited the number of topics rather than to strive for historical and subject completeness.

As a survey of an important field, this work will be useful, but for specific applications the information given in it must be supplemented by other sources.

PAUL FUGASSI
Department of Chemistry, Carnegie Institute of Technology

An Introduction to the Study of Insects. Donald J. Borrer and Dwight M. DeLong. Rinehart, New York, 1954. ix + 1030 pp. Illus. $9.

This volume received one of the most extensive reviews to which a science textbook can be subjected. A panel of entomology professors exhaustively and comparatively discussed it at the December 1954 meetings of the Entomological Society of America's Section A. The authors were present to explain some details of contents and arrangements that were mildly criticized.

The concensus of the panel was that the authors had made a major contribution to entomological education, with a textbook that has a somewhat different approach and is of considerably wider taxonomic coverage than most standard introductory textbooks. The panel's principal criticism related to the type of treatment rather than the quality of the material. Those who contend that ecology, morphology, physiology, and other facets of zoology should be segregated and highlighted, will find this textbook deficient in that respect. What the authors have accomplished so well is to weave information concerning environmental relationships, form, structure, and function of insects in the explanatory matter throughout the chapters related to the individual orders.

The typography is excellent. Its 10-point modern type makes it unusually legible. Illustrations are sharp and clear. Authors of species names are written in full, except the customary abbreviation of Linnaeus. An extensive glossary and an adequate index complete the volume.

Professors of beginners' courses who choose to emphasize the taxonomic end of entomology will find this book ideally suited to their use. It also fits especially well in an undergraduate course in insect taxonomy that emphasizes field collection, identification, and preservation of insects. Professors already using it have reported that the keys are excellent, key characters very well illustrated, and students have little difficulty in determining what is meant by a given character. Students can get a close and intimate acquaintance with each insect family from this book. Students have also expressed much interest in the section on each insect order that describes methods of collecting and preserving insects of that