extensive bibliographies. The book contains an ample number of good illustrations and an adequate index.

In this age when scientific information multiplies so rapidly (a fact fully reflected in this book), one may justifiably ask whether the publication of a symposium of this type serves as a good method for rapid and wide communication to students and scientists. Because of the tenuous organization of the subject matter, the answer is not an unequivocal yes, but the papers are excellent and the book provides invaluable information on a number of current topics.

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**Free Radicals.** An introduction. A. F. Trotman-Dickenson. Methuen, London; Wiley, New York, 1959. 142 pp. $2.50.

When I reviewed Trotman-Dickenson's book *Gas Kinetics* [*Science*, **123**, 639 (1956)], I praised it because it gave "a useful summary of working equations . . . a critical review and tabular summaries of experimental results . . . a detailed description and evaluation of several recently developed experimental methods." *Gas Kinetics* is a useful monograph on a technical corner of the field of chemical reactions; the present book, *Free Radicals*, is a highly personal exposition in the broad area of physical and organic chemistry where, in either gaseous or liquid systems, one encounters free radicals. The treatment is so personal that I need to heed *"de gustibus non disputandum est,"* and any statements I make are necessarily a comparison of my tastes with those of the author.

The book consists of three short introductory chapters (24 pages) on the general aspects, history, production, and properties of free radicals; a long chapter (94 pages) on the reactions of monoradicals; a short chapter (13 pages) on biradicals; a very short list (37 references) of books and review articles; and a short subject index. A bibliography is not given, although a few names and dates and a few references are given at various points in the book.

Because it is a personal account of the broad field, this book has the same purpose and follows the same pattern as Semenov's *Some Problems in Chemical Kinetics* (translated by M. Boudart; Princeton University Press, 1958); yet the treatments differ as much as the personalities of the authors. Of the two books, Semenov's is more original. Surprisingly enough, in the list of references given in Trotman-Dickenson's book, (Chapter 6), no mention is made of Semenov's.

In *Gas Kinetics*, the exposition of theories of reaction rates was very weak. This weakness is carried over into the present book, and many specific examples could be pointed out. One example occurs in the discussion of the rate of radical recombinations (pages 38–39) where we are told ". . . the rate constants . . . approach the collision rate . . . and are two or three orders of magnitude above the value predicted by transition state theory." Using transition state theory, E. Gorin predicted the rate constant for recombination of methyl radicals to be $1.5 \times 10^{13}$ cm$^3$/mole-sec [*J. Chem. Phys.* **7**, 643 (1939)]; the observed value is $2.2 \times 10^{13}$ cm$^3$/mole-sec [A. Shepp, *J. Chem. Phys.* **24**, 639 (1956)]. For recombination of trifluoromethyl radicals, transition state theory predicts $1.7 \times 10^{13}$; the observed rate is $2.3 \times 10^{13}$ [P. Ayscough, *J. Chem. Phys.* **24**, 944 (1956)]. Obviously Trotman-Dickenson has not taken the pains to follow the literature or to understand the methods of activated complex theory. Of course, he is not the only one who has erred in this respect. The physical chemists' education usually includes too little mathematics and theoretical physics for understanding the main current of theoretical developments. Too often chemists, frustrated because they do not understand a theory, misapply the theory and then proclaim its "failure."

The unique advantage of this book is the author's conscious attempt to unify and cover two or three fields which are usually treated separately. Who might profitably read this book? Certainly not novices in chemical kinetics (one should disregard the subtitle, "an introduction"). However, the portions based on gas phase photochemistry could profitably be read by solution kineticists; and gas phase kineticists could well review the items on the chemistry of reactions in solution. The role of this book, then, is to widen the horizon of narrow specialists in chemical reaction kinetics.

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**Fallacies in Mathematics.** E. A. Maxwell. Cambridge University Press, New York, 1959. 95 pp. $2.95.

Almost everyone who has studied high-school mathematics has been confronted with proofs that $0 = 1$ and that every triangle is isosceles. This book is concerned with these and many more fallacies, defined by the author as proofs which lead by guile and plausible reasoning to a wrong conclusion. Some of the fallacies are of a trivial nature; others lead to a deeper understanding of the mathematics involved. Examples of both kinds are given, but much more emphasis is placed on the nontrivial fallacies, most of which come from the domain of geometry.

Maxwell first gives a number of fallacious proofs from some discipline of mathematics such as geometry, algebra, differentiation, or integration, and asks the reader to discover the fallacious step in the argument. Then he provides a commentary on each fallacy; this may consist of a few words or a long discussion. Several of the discussions on the geometrical fallacies presuppose a sound knowledge of geometry, which an English college freshman may already have but which an American student acquires only if he takes college geometry.

The book ends with a series of howlers which are almost the opposite of fallacies; here we find solutions of problems by incorrect methods that lead to correct results. These howlers were taken from real life and provide a certain amount of amusement. However, much more enjoyment as well as enlightenment is provided by trying to detect the fallacies, or at least by reading the solutions given by the author of this lovely little work.

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**The Thirteen Steps to the Atom.** Charles-Noël Martin. Franklin Watts, New York 1959 (translation of *Horizons de France*, 1958). 256 pp. Illus. + plates. $4.95.

The thirteen steps of the title are the thirteen successive divisions by ten from 1 centimeter to $1^{-13}$ centimeter. The best part of the book is a collection of 118 superb photographs of such small objects as snowflakes, through such very

small ones as cells, viruses, and molecules, to the ultrasmall atomic level. An accompanying text explains the size range involved and describes the instruments used to see within this range. The text then builds up, in logical order, the nature of matter from particles to atoms, to molecules and macromolecules, to bacteria and crystals and corpuscles, to diatoms and protozoa, and, finally, to snowflakes. The text is simple and requires no scientific sophistication to be understood.

Scientist or layman, adult or juvenile will enjoy the photographs. The author selected them from many sources, and chose each in terms of three criteria, "intrinsic beauty, technical perfection, and the power to stir the imagination." They cover a wide variety of subjects, including (in approximate order of increasing magnification) snowflakes, sections of a flower, the structure of wood, diatoms, human bone affected by radium, particles of latex, melting iron oxide powder, the lashes of spirochaetae of recurrent fever, new and used engine grease, polypeptide fibers, the skin of a microbe, striated muscle, diffraction fringes in an electron microscope, several examples of molecular structure, and the spiraling track of an electron caught in a magnetic field.

The device of starting with objects of familiar size and proceeding by successive steps to the very much larger or very much smaller has been used before, but never, in my memory, with such a magnificent collection of photographs. One of them is reproduced on the cover of this issue of *Science*.

The book would make a fine present for a youngster beginning to be interested in science, if he can get it away from his elders long enough to see it.

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**The Science of Mechanics in the Middle Ages.** Marshall Clagett. University of Wisconsin Press, Madison; Oxford University Press, London, 1959, xxix + 711 pp. Illus. $8.

In the good old order of the history of science, the physicist teaching the elements of mechanics could point to a laughably incorrect "Aristotelian" view of motion. He could then dismiss the Middle Ages, bring Galileo on the scene with a cry of triumph for the experimental method and offer, as evidence for this triumph, the famous Tower of Pisa experiment. Thanks to the efforts of 20th century historians of science, concerned in a more professional manner with the publication and analysis of the rich medieval sources, vast change has been wrought in this crucial area. This work is second only to that in the neighboring field of mathematical astronomy in shedding light on the true antecedents of the more familiar Renaissance activity and in revealing the Middle Ages as being more than a period of simple transmission and stagnation. It is a period, rather, in which many of the basic issues of later mathematical physics were discussed and brought to fruition and which lead in a reasonably continuous way, to the work of Galileo—work that we now realize could not possibly be truly estimated without this knowledge.

For many years, Marshall Clagett has inspired a whole school of collaborators and students to work on medieval mechanical texts and to bring to fruition the labor started by Pierre Duhem, Annaliese Maier, and Alexandre Koyré. This volume represents a definitive and culminating achievement in that study. It collects all the chief medieval texts on statics and dynamics, supplies English translations, and extends, for completeness, from the Hellenistic sources at one end of the time scale to Galileo and Copernicus at the other. Needless to say (for those who know the author) the job is carried out with exemplary and meticulous scholarship, and this volume will clearly stand as the definitive achievement in this field for many years. Now that students have so readily available the texts and good critical commentaries on each, we are happily out of that stage in the historiography of medieval science when it sufficed to know only the names of the authors and the titles of their works.

It is particularly important that we now have an established rationale of the content of medieval mechanical texts, for this volume includes the work of the peculiarly active and unexpectedly original school of theoreticians who worked at Merton College in Oxford during the 14th century. In mechanics, they developed the rich concept of instantaneous velocity and used it in discussions of motion under uniform acceleration. Later, when this grew (probably due to Nicole Oresme in Paris) to include the use of a two-dimensional graphing method as a model for the variation of instantaneous velocity, an important and new part of the mathematical analysis of nature had been achieved. Thus, one must not look upon this book as merely an antiquarian treatment of the medieval origin of one small piece of modern, elementary mechanics. Rather, it is one of the first (and most exemplary) treatments to discuss a vital process in the hard fight that men had to make during the Middle Ages to extend the realm of validity of mathematical treatment from celestial to terrestrial phenomena.

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## New Books

*The Performance of Lubricating Oils.* H. H. Zuidema. Reinhold, New York; Chapman and Hall, London, ed. 2, 1959. 216 pp. $7.

*The Politics of Mass Society.* William Kornhauser. Free Press, Glencoe, Ill., 1959. 256 pp. $5.

*Reading German for Scientists.* Hans Eichner and Hans Hein. Wiley, New York, 1959. 218 pp. $5.25.

*Sechzig Jahre Medizinische Radiologie.* Probleme und empirie. Hans R. Schinz. Thieme, Stuttgart, Germany, 1959 (order from Intercontinental Medical Book Corp., New York 16). 275 pp. $4.65.

*Science and Technology in Contemporary War.* G. I. Pokrovsky. Translated by Raymond L. Garthoff. Praeger, New York, 1959. 191 pp. $4.

*Sociology.* The study of social systems. G. Duncan Mitchell. University Tutorial Press, London, 1959. 183 pp. 11s. 6d.

*Spectrum.* The world of science. Ray Ginger, Ed. Holt, New York, 1959. 115 pp. $3.95. This volume is intended to present many of the basic ideas of modern science to nonscientific readers—readers who have little knowledge of science and who are aware only of its complexities. Contributors include Glenn T. Seaborg, Herbert Robbins, Melvin Calvin, Bobb Schaeffer, Philip Siekevitz, and D. B. Steinman. Consulting editors are Harold C. Urey, Chauncey D. Leake, Otto Struve, George G. Simpson, William Feller, David Krech, Carl D. Anderson, and Richard S. Crutchfield. Among the more than 100 photographs and drawings are illustrations of the Gulf of California from 140 miles above the earth, the appearance and evaporation of atoms in a piece of platinum, and a crystal of pyrite magnified 2.2 million times.

*Systems of Units.* National and international aspects. A symposium. Publ. No. 57. Carl F. Kayan, Ed. American Assoc. for the Advancement of Science, Washington 5, 1959. 303 pp. Prepaid to members, $5.75; others, $6.75.

*Too Many Asians.* John Robbins. Doubleday, New York, 1959. 215 pp. $3.95.