Book Reviews

Some Problems in Chemical Kinetics and Reactivity. vol. 1 (revised and expanded edition). N. N. Semenov. Translated by Michel Boudart. Princeton University Press, Princeton, N.J., 1958. 239 pp. Paper, $4.50.

The aroma of the laboratory is very strong in this book. The author is steeped in a wide range of experimental results, and there is a complete lack of interest in theories which solve problems "in principle." The field covered is very broad: a wide range of atoms and radicals is considered, and the reactions of these with a wide range of molecules are given. In addition to the usual subjects of decomposition, recombination, and atom-transfer reactions, difficult topics such as oxidation, polymerization, free radical reactions in solution, and surface reactions are included. Extensive tables of data are given; documentation is thorough, especially for Soviet articles; and there is a substantial amount of correlation and interpretation.

The unifying theme of the book is the almost universal importance of free radical chain reactions. A free radical is defined (not abstractly, as a molecule with an odd electron) in accordance with the logically tenuous but practical and chemical criteria of great reactivity, tendency to dimerize, and so forth; a diradical is taken to have two highly reactive unsatisfied valences. In the author's pioneering book *Chain Reactions* (written 20 years earlier) there were many instances of the use of elaborate algebra to express the build-up and decay of abstract chain entities; here there is introduced a simple and powerful arithmetic of free radical reactions. The numbers represent the radicals—0 for a molecule, 1 for a radical, 2 for a diradical, and so forth. Chain initiation becomes $0 \longrightarrow 1 + 1$; chain propagation steps are of the form $1 \longrightarrow 1$; chain branching is typically $1 \longrightarrow 1 + 2$. It is highly instructive to apply this simple, chemical arithmetic to each step of any chain reaction.

To give the broad picture of the entire field, Semenov has not hesitated to use principles which are known to be incorrect or imperfect upon close inspection—for example, the constancy of Arrhenius A-factors or the Polanyi relation between activation energy and heat of reaction. In the last chapter, on the mechanism of the production of free radicals on surfaces, we find stimulating suggestions rather than established ideas.

In all, the book gives a mature, critical, personal survey of the field. A large amount of material is intelligently and originally presented in a small volume.

HAROLD S. JOHNSTON
Department of Chemistry,
University of California, Berkeley

Some Problems of Chemical Kinetics and Reactivity. vol. 1 (revised and enlarged edition). N. N. Semenov. Translated by J. E. S. Bradley. Pergamon, New York and London, 1958. x + 305 pp. $12.50.

The author tells us that an all-union conference on chemical kinetics and reactivity was arranged by the chemistry department of the Academy of Sciences of the U.S.S.R. and held in 1955. This book is an expansion of the opening paper for this conference, published in 1954. The conference, at which 69 papers in addition to that of Semenov were presented, was held in June 1955.

The first edition of this work was soon sold out; this is a revised and expanded edition which has been translated into English and German. This book is a sequel to *Chain Reactions,* written 20 years earlier. It is a thoughtful, systematic account of the various types of chain reactions, written from the experimentalist's point of view. Semenov has neglected quantum mechanical and statistical mechanical considerations, except for a ten-page appendix on the activated complex, contributed by M. I. Temkin, and a second ten-page appendix written by N. O. Sokolov, on the quantum-mechanical calculation of activation energies.

It is particularly useful to have this well-written account of chemical reaction rates since it calls attention to many interesting Russian papers which, because of language difficulties, are not sufficiently well known to English-speaking chemists. Reaction-rate theory poses many as yet unanswered questions. This complexity arises from the fact that reactions proceed by every imaginable mechanism and the important one is that one which, under the particular set of circumstances, contributes most to the rate. Thus qualitative reasoning is insufficient. To be successful one requires a quantitative theory. Further, even though from experiment we know the concentration dependence of a chain reaction, this may involve many alternative elementary reactions, each with its particular activated complex.

In this book Semenov steers us surprisingly well through the chemical maze. He offers mechanisms, supported by evidence, for very many chain reactions and emphasizes that these chains often compete on nearly equal terms with radical-free reactions.

HENRY EYRING
Department of Chemistry,
University of Utah

Digging into History. Popular series, Anthropology, No. 38. Paul S. Martin. Chicago Natural History Museum Press, Chicago, Ill., 1959. 157 pp. Illus. $1.50.

All too frequently, at the conclusion of a protracted and concentrated study of the archeology of a region, archeologists are content to let their labors come to rest with the publication of the technical reports, designed for the specialist. *Digging into History* is an exception to this trend because Martin, after having concluded 15 years of excavation in the ruins of west-central New Mexico, sets out to share his experiences by distilling the development of a 5000-year record of human progress in language designed for the lay reader.

Martin first sketches the background of Southwestern culture history, wrestling with such problems as shifts in the continuity of economic dependency, from the big-game hunters of late glacial times to the emergence of sedentary village life based on agriculture. The four tribal, or cultural, units, as now recognized by Southwesternists, are reviewed in understandable terms; this leads to discussion of the Mogollon people, whose history Martin and his colleagues have done so much to elucidate.

How the archeologist works and what he seeks to accomplish by digging is clearly stated. Explanations of such principles as stratigraphy, culture change, and the meaning of periods and phases add further to the clarity of the booklet.

The 5000-year story of man's tenure of this part of New Mexico is described under "way of life" rubrics such as "The time of limited wandering," "Emergence

of small sedentary communities," and "The beginnings of town life." In considering the later part of the record attributable to the Mogollon people, Martin looks beyond the usual cultural residue of archeology to seek inferences of a more sociological nature.

The booklet is handsomely illustrated. Martin has used well-selected pictures taken in the field, photographs of specimens, and drawings that show the function of what otherwise would be only curiosities.

EMIL W. HAURY
Department of Anthropology, University of Arizona

Tools for Machine Literature Searching. Semantic code dictionary, equipment, procedures. J. W. Perry and Allen Kent, Eds. Interscience, New York, 1958. xviii + 972 pp. Illus. $27.50.

In the words of its authors, "This book presents the . . . status of a research program initiated over ten years ago with the purpose of formulating methods to apply existing—or anticipated—developments in electronics to providing ready access to information stored in extensive collections of documents." Although bound in a single volume, *Tools for Machine Literature Searching* is not one but two books. The first 600 pages are textual in nature. They are in effect a compilation of reports on the activities of personnel at the Western Reserve University Center for Documentation and Communication Research in the field of information storage and retrieval.

Among these discussions is an extremely lucid and interesting chapter by John L. Melton, entitled "The semantic code." The purpose of this chapter is to explain the purpose and workings of semantic codes as a form of standardized language which can be used for the definite and consistent identification of concepts that is necessary in information storage and retrieval systems which utilize machines with limited logical capabilities. The chapter is followed by three tables of "semantic factors," which are the building blocks upon which semantic coding is based. In Melton's chapter and the tables that follow it, the reader is given a very fine (perhaps the best extant) explanation of the rationale that led to the development of the semantic code. The reader can also grasp quite easily from Melton's contribution the detailed workings of semantic codes and semantic factors. The chapter does not settle the very basic question of whether a universal machine language is really possible, or desirable if possible; but it does at least show the reader what one example of such a language looks like and how it works.

This being the case, one is led to wonder about the purpose of the second half (or section) of the book, which is a semantic code dictionary occupying 364 pages. Can it be that the authors assume that everyone who buys the book will want to make use of the semantic code dictionary? This would seem very unlikely at the present stage of mechanical storage and retrieval of information. Presumably most readers of the book will use it as a source of background information on machine codes and coding. The Melton chapter would seem to serve this background function nobly.

In view of this, the inclusion of the entire semantic code dictionary seems a rather unfair "tie-in" sale. It makes the book needlessly bulky and expensive. The authors themselves seem to argue against the inclusion of the semantic code dictionary in the present volume: "For those readers who plan to make extensive use of the code dictionary . . . it is suggested that arrangements be made with the Center for Documentation and Communication Research . . . to use the latest edition of the . . . dictionary. *It should be kept in mind that the code dictionary is being continually expanded by inclusion of new terms*" (italics mine). In view of this, it seems unfortunate that the authors did not see fit to issue the code dictionary as a separate publication in a readily expansible (perhaps loose-leaf) form.

Another source of bulk and annoyance is the fact that, although "this book was not written for the novice in the documentation field," chapter after chapter is given to relatively elementary considerations, and much of the material in these chapters is reprinted from common documentation periodicals which any advanced worker in the field is bound to read regularly. Is this publishing and republishing of essentially the same thing not glutting the literature with sources of the information that the authors seek to codify? The authors have contributed many profound and important writings to the literature of documentation, but the repetition of these writings before the same audience will not increase their usefulness. It will merely frustrate this audience by forcing it to wade through more and more literature in the vain hope that something new has been added.

There are, happily, parts of the present book that have not been published before, to my knowledge. These come mainly from the pens of John L. Melton and Jessica Melton, who, in my opinion, "carry" the book. In addition to the very fine chapter by John Melton on semantic codes, there is a well-written, informative chapter by Jessica Melton, entitled, "Procedures for preparation of abstracts for encoding." This chapter takes the reader quickly and clearly through the basic problems and procedures involved in the process of converting the conventional prose of the scientific and technical abstract into the specialized language of the machine. The author wisely limits herself to abstracts in a single field, metallurgy. By doing so, she is able to present her exposition in the form of a case study—an excellent means of conveying relatively complex ideas. It would perhaps have been better from the viewpoint of the reader if the chapter by John Melton which lays the groundwork of codes and coding had preceded rather than followed the chapter by Jessica Melton, which constitutes a specific example. But, in any event, both chapters are well worth reading.

Similarly, there are a number of new and worth-while chapters dealing with other phases of machine processing of information. Notable among these is one entitled, "Automatic encoding for machine searching," in which procedures by which machines are made to recognize conventional words and convert them into machine language are outlined. This discussion is extended (again by the Meltons) in a chapter dealing with, first, the conversion by machine of foreign words into machine words and, second, the reconstitution of these machine words into English words. In view of the expanding interest in the use of foreign-language information, this chapter is very timely and useful.

From the foregoing sampling, it should be clear that there is a good deal of worth-while material in *Tools for Machine Literature Searching*. Much of this material is perhaps the most definitive in its field to date. It is unfortunate that the impact of this material is dulled somewhat by its surroundings.

SAUL HERNER
Herner and Company, Washington, D.C.

Voice across the Sea. Arthur C. Clarke. Harper, New York, 1958. xiii + 208 pp. Illus. $3.75.

The problem of communicating by electricity has been relatively well solved in the past hundred years. How this was done is a fascinating story to those who are acquainted with the technical details, but it is a difficult one to narrate because of the rather specialized problems involved. Arthur C. Clarke, however, has not only told the story accurately, as those familiar with it can testify, but has made it intelligible and interesting, as those unacquainted with it will discover.

This is not to say that *Voice Across the Sea* is a scholarly monograph in the history of technology. The author himself points out that his purpose is to en-