

interactions with cells to the widespread uses of tracers in many fields and the related problems of radiation safety. Very extensive lists of references, running at times to several hundred items, appear at the ends of the chapters.

The volumes *Uranium Ore Processing* and *Thorium Production Technology* are also edited collections of technical reports, written by many experts. Although the second is more heavily edited, they both are at a high technical level, well organized, and should be of great value to workers in the field of fuel production. The material in both is presented in somewhat condensed form, but the ample reference material, although primarily in the form of government reports, should serve as valuable supplements.

Physical Metallurgy of Uranium is not an edited collection of reports but more in the nature of a basic textbook, having been written by Holden during a period of several years. It gives a clear description of the basic properties of uranium, at a more elementary level than the three preceding volumes. Many recent data on the physical properties of uranium are presented, usually in the form of carefully prepared graphs. Included also are many beautiful photographs of various metallurgical features of uranium.

The last five volumes summarize the results of the nuclear power program in the United States over the past decade. Prepared by experts in the field and published with record speed, the volumes were made available by the U.S. Atomic Energy Commission to foreign delegates at the second Geneva Conference of September 1958. Together, they constituted a technical tour-de-force that could be matched by no other nation.

All of the power reactors under development in the United States are discussed in these volumes, including current favorites such as the boiling water reactor and the organic moderated reactor, which were relatively late starters in the race for economic nuclear power. One volume is devoted exclusively to Admiral Hyman Rickover's PWR, or pressurized water reactor, which is now in routine, high-power operation at Shippingport, Pennsylvania, and may eventually feed 100 megawatts of electricity into the grid of the Duquesne Light Company of Pittsburgh.

The volume *Boiling Water Reactors* gives a chronological account of their development from early concepts to the construction and operation of the EBWR at the Argonne National Laboratory. The design of the 180-megawatt Dresden Nuclear Power Station is also discussed, as is that of its 5-megawatt prototype reactor, the VBWR, built and operated by the General Electric Company's Vallecitos Atomic Laboratory at Pleasanton, California. The professional editor, A.

W. Kramer, deserves credit for transforming a motley collection of scientific papers into a highly readable book. However, a considerable amount of gobbledegook remains, particularly in the discussions of the stability of boiling water reactors.

The collection of papers in *Solid Fuel Reactors* has also been improved by the capable work of its editors, J. R. Dietrich and W. H. Zinn. The most important reactor types discussed here are the fast breeder and the organic moderated reactor. The EBR reactors and the Enrico Fermi Atomic Power Plant are explained in considerable detail. Like the Dresden Station, the latter is in an advanced construction stage and involves a large financial investment by private industry. The chapter on organic moderated reactors includes a discussion of the properties of organic liquids under irradiation, a description of the OMR experiment at the National Reactor Testing Station in Idaho, and some studies of possible OMR power applications. Considerable space is allotted to recent paper studies of deuterium oxide power reactors and to gas-cooled reactors with either graphite or deuterium oxide as the moderator. The final chapter describes current research and development work carried out by the Hanford Laboratories on plutonium-enriched fuel elements.

The volume *Sodium Graphite Reactors*, edited by Chauncey Starr and R. W. Dickinson of Atomics International, contains a complete discussion of the sodium reactor experiment (SRE) at Santa Susanna, California. Like the OMRE of the preceding volume, the SRE was designed and is being operated for the AEC by Atomics International of Canoga Park, California. Some large-scale sodium graphite concepts are also described, including the Hallam (Nebraska) reactor currently under development. A chronological record of operations on the SRE (chapter 7-5) gives some indication of the difficulties encountered in bringing any novel reactor concept into sustained operation.

The final volume of the series, *Fluid Fuel Reactors*, discusses various approaches to this novel reactor type. The major concepts under development are the aqueous homogeneous reactor and the molten salt reactor at the Oak Ridge National Laboratory and the liquid metal fuel reactor at the Brookhaven National Laboratory. As noted by A. M. Weinberg in his foreword to the book, the solid fuel reactor is primarily a mechanical engineering device while the liquid reactor is a chemical plant. Which will win out is still a moot question. Technical feasibility has already been demonstrated for solid fuel reactors, but there are few who expect these reactors to compete in the near future against large, fossil fuel power plants in the

United States. On the other hand, the technical feasibility of liquid fuel reactors still remains to be demonstrated.

The technical achievements of the United States in the nuclear power field are well represented by these five volumes. The feasibility of several reactor concepts has been established by progressing from small-scale experimentation through large-scale research and development and finally to one or more reactor experiments. A few medium power plants are actually in various stages of construction. It has been a slow and expensive process, but a great deal has been learned about the technology of such novel materials as hafnium-free zirconium, liquid sodium, organic liquids, and uranium solutions at high temperatures, and of the physical limitations and compatibility of reactor components in a strong radiation field.

The volumes also attempt a connected history of each reactor concept. However, the key efforts by many scientists and administrators have been dimmed by time, and a number of important contributions are no longer recalled. Again, what do not appear in these five volumes are the negative aspects of the United States' nuclear power program, the doldrums of the immediate postwar years, the continued struggle for support of the existing programs and the fact that we are lagging behind other nations in the planned construction of large-scale nuclear power plants. The lack of firm commitments between government and industry is seen in the recent withdrawal by industry from the PAR project, an aqueous homogeneous reactor discussed in the volume on fluid fuel reactors.

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Physiological Bases of Psychiatry. Part 1, *From Pavlovian Laboratory.* Part 2, *From Behavior Laboratory.* W. Horsley Gantt, Ed. Thomas, Springfield, Ill., 1958. xiii + 344 pp. \$10.50.

Part 1 of this monograph consists of 18 widely varying papers on various aspects of psychophysiology presented at the 25th anniversary of the establishment of the Pavlovian Laboratory, Johns Hopkins University. Part 2 consists of five papers on the same general subject presented later at the Behavior Laboratory, Cornell University. Part 3 is a list of publications from the Pavlovian Laboratory.

The two laboratories are the only ones in the United States in which the Pavlovian psychophysiological approaches to the study of normal and abnormal behavior are actively employed [see the recent review by G. Razran on "Soviet psychology and psychophysiology," *Sci-*

ence 128, 1187 (1958), in which the scope of psychophysiology in Russia is emphasized]. The contributions in the present monograph show clearly how flexible and useful the conditional reflex method is when properly applied to the study of behavior. It is a true physiological method, one which requires a logical and skillful experimental approach. Perhaps this is why the method is not so popular among behaviorists who do not belong to the Pavlovian group.

Of particular interest are the studies of visceral responses and their role in altered behavior. The cardiac conditional reflex, for example, is readily established. But it is resistant to extinction, and an increased heart rate may persist for several years without reinforcement, representing an inertness to modification that is inappropriate to existing circumstances (schizokinesis).

The individual papers vary widely in subject and quality. Some read very clearly and smoothly—for example, the paper by Moore on "Conditioning and stress in the newborn lamb and kid." The clarity of this paper is accentuated by its freedom from the abbreviations that clutter up many of the other papers.

In spite of the diversity of the individual contributions and the rather haphazard organization, this is a valuable and most interesting monograph.

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Theory and Methods of Scaling. Warren S. Torgerson. Wiley, New York; Chapman and Hall, London, 1958. xiii + 460 pp. Illus. \$9.50.

This book should be within arm's reach of all students, teachers, and researchers in the social sciences who are concerned with problems of measurement. It appears to cover all the important contributions to date in scaling theory and techniques. The skill and competence with which the author has organized the extensive contributions to scaling are indeed impressive.

Because of the clear perspective given by the book on the current status of scaling methodology, it is relatively easy to evaluate critically the developments to date. In fact, I would have liked a somewhat more critical evaluation in view of the great variety and diversity of methods. This was not, however, the primary task assigned the author by the committee under whose direction the book was prepared.

Perhaps it is a criticism of the mission assigned the author rather than of the book itself that it may tend to perpetuate the schism between testing and

scaling theory, whereas there is mounting evidence that an integration of the two is not only feasible but highly desirable. Along the same line, those dedicated to the operational point of view may regard the rather extensive philosophical development of measurement concepts as a proliferation of semantic red herrings.

The construction of a fundamental framework within which one develops a presentation is necessarily somewhat arbitrary. The notions of *object*, *attribute*, and *magnitude* seem, however, most happily chosen and serve as a solid and well-anchored set of coordinates from which the more detailed framework proceeds. The utility of the additional concept of *quantity* as distinguished from *magnitude* is not so compelling, however, unless it was meant to include the concept of replication. The definition given seems to preclude this, and its function in the more detailed superstructure is not highlighted, even though it might be implied.

Although the mission of the book is essentially reportorial rather than critical in nature, two distinctly different fundamental points might appropriately have been emphasized. One of these is the vast amount of covariant information in the experimental data ignored by both the paired comparisons and successive intervals models. The other is the flagrant violation of one of the basic principles of scientific methodology—that is, the principle of parsimony, by the deterministic techniques.

In general, the material seems to be extremely well structured and well organized. However, I was surprised to find a discussion of the Horst and Guttman principal components models included in the chapter on deterministic models. These would seem to belong in the chapter on multidimensional techniques and are nothing if not probabilistic. Perhaps one of the reasons for this apparent displacement is that Guttman himself has failed either to recognize or to emphasize the true nature and importance of his contribution in the principal components approach.

A minor detail is the crediting of Horst with the least squares solution of the missing data problem for the paired comparison model rather than for the successive interval type model. Another detail which applies to all books dealing with multivariate analysis techniques concerns mathematical notation. The obvious notation for such techniques is that of matrix algebra. Although the book employs matrix notation in a few of the developments, it clings for the most part to the clumsy and untidy summation notation of scalar algebra. In this respect it merely follows an unfortunate tradition, and perhaps there is no par-

ticular reason why this book should have been the first to break with it.

The type and format are in the excellent tradition of the publisher. The only obvious improvement would have been to carry the chapter number along with the title at the head of each page. With so many back references, rapid referral to preceding relevant equations and passages would have been greatly facilitated by this device.

Although the lack of exercises and extensive numerical examples limits the usefulness of the book as a text on scaling theory and methods, its value as a ready reference for students, instructors, and researchers, striving toward greater precision in all the social sciences, cannot be overemphasized.

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Science and the Detection of Crime. C. R. M. Cuthbert. Philosophical Library, New York, 1958. 244 pp. Illus. \$10.

As stated in the preface, the purpose of this book "is to provide the reader with an accurate and authoritative account of the work undertaken in the Forensic Science Laboratory at New Scotland Yard and to illustrate how a small group of scientific workers can render valuable service to the detective force in its constant war against crime. The work is not intended as a scientific text book, but it is hoped that, in addition to being of interest to the ordinary reader, it may be of some value to young detective officers and others whose work makes it necessary to know the extent to which science can assist in the investigation of crime."

On the whole, the book accomplishes the purpose for which it was designed. It is especially suitable for the lay reader who has a limited understanding of scientific crime investigation, and it will prove attractive to those who enjoy "whodunits." It is of more doubtful value to the professional policeman (unless he, too, enjoys "whodunits"), who should have a more thorough indoctrination into the facilities, operation, and investigative usefulness of a modern crime laboratory than is provided by this book.

Seven of the chapters deal with the work of laboratory specialists: the forensic pathologist, the serologist, the forensic chemist and biologist, the physicist, the toxicologist, the document examiner, and the ballistics expert, respectively. Six chapters deal with criminal specialties: stolen articles and fraud, fire and sabotage, breaking offenses, abortion, drug trafficking, and alcohol and motor accidents, respectively.