Book Reviews

Project Sherwood. The U.S. program in controlled fusion. Amasa Bishop. 228 pp. $5.75. **The Transuranium Elements.** Glenn T. Seaborg. 354 pp. $7. **U.S. Research Reactor Operation and Use.** Joel W. Chastain, Jr., Ed. 384 pp. $7.50. **Radiation Biology and Medicine.** Selected reviews in the life sciences. Walter D. Claus, Ed. 968 pp. $11.50. **Uranium Ore Processing.** J. W. Clegg and D. D. Foley, Eds. 450 pp. $7.50. **Thorium Production Technology.** F. L. Cuthbert. 320 pp. $6.50. **Physical Metallurgy of Uranium.** A. N. Holden. 272 pp. $5.75. **Physical Metallurgy of Uranium.** A. N. Holden. 272 pp. $5.75. **Solid Fuel Reactors.** J. R. Dietrich and W. H. Zinn. 864 pp. $10.75. **Boiling Water Reactors.** Andrew W. Kramer. 592 pp. $8.50. **Fluid Fuel Reactors.** J. A. Lane, H. G. MacPherson, Frank Maslan. 1008 pp. $11.50. **Sodium Graphite Reactors.** Chauncey Starr and R. W. Dickinson. 304 pp. $6.50. **The Shippingport Pressurized Water Reactor.** Personnel, Naval Reactor Branch, Division of Reactor Development, U.S. Atomic Energy Commission, Westinghouse Electric Corp., Bettis Plant, and Duquesne Light Company. 600 pp. $9.50. Addison-Wesley, Reading, Mass., 1958.

The simultaneous appearance of these twelve volumes, replete with up-to-date information on peacetime nuclear energy development in the United States, calls for a brief explanation. They make up the "presentation set" given by the United States to each of the hundreds of official delegates of the countries represented at the second Geneva Conference on the Peaceful Uses of Atomic Energy, held in September 1958. Written under contract with the Atomic Energy Commission, by many scientists, their purpose was to present a picture of the progress in nuclear energy in the United States in the three years since the first Geneva conference.

There is no doubt that the express purpose of the series was amply fulfilled at Geneva, for these are attractive, well-produced volumes containing an impressive amount of material. In addition to having been distributed at Geneva, however, they are now being sold through normal channels by the publisher and are pleasantly priced, a result of the specific publication arrangements between the AEC and Addison-Wesley. Being written under contract, and in most cases on a tight time schedule, the books might be expected to be hasty compilations of already existing material. However, most of the writing is of high quality, and the technical appearance of all the volumes, including the tables, drawings, and photographs, is excellent.

The nature of the volumes varies widely, from *Project Sherwood,* which is short and non-technical, to *Radiation Biology and Medicine,* with many long, highly technical papers. As a whole, the series represents almost a full coverage of the field of modern nuclear energy for peace in this country, the principal omission being the highly developed mathematical theory of nuclear reactors. In some phases, the series extends beyond the usual definition of the field of nucleonics as "the production of energy from the nucleus and the directly related parts of physics, chemistry, and the biological sciences." For example, the many fields in which tracers are used are thus not part of nucleonics proper, although many of these uses are covered in *Radiation Biology and Medicine.* However, this series of 12 volumes fits the field of nuclear energy rather well, for fully five volumes are devoted specifically to nuclear reactors. The others deal with matters connected directly with the production of nuclear energy, although in the chemistry and biological volumes a fair fraction of the material is further afield.

The short *Project Sherwood* is certainly not at all the result of a hasty compilation of existing reports. Written by one individual, it gives a clear description at the layman's level of the progress thus far in Project Sherwood, the code name of the United States effort to achieve the thermonuclear reaction. The well-written text and the remarkable drawings of "pinch effects," "Perhapsatrons," and "Stellerators" (produced by J. Banks of Addison Wesley) make the reading of this book a pleasure. Actually, the over-all picture of thermonuclear fusion is now much more discouraging than it was when overoptimistic reports were released in January 1958 by the United States and Great Britain. However, Bishop presents an optimistic view of the wide-ranging fusion activities now underway in the United States. The British and Soviet efforts in the field are unfortunately not described, but this is not a crippling omission, for at the second Geneva meeting it was abundantly clear that all three nations are pursuing closely similar approaches.

In *Transuranium Elements,* Seaborg describes the enormous effort of separating plutonium from reactor uranium during the war years, and the later accomplishments in the production of further elements up to the present limit at element 102 (added in the preface). Like the fusion volume, this book has only one author, is highly authoritative, and is carefully written. Actually, it is an extensive expansion of a lecture series given by Seaborg at Yale University. Although not meant to be a highly technical book, it nevertheless contains an enormous amount of information on the chemical, physical, and nuclear properties of the manmade elements. In addition, the actual events in the discovery of each new element have been carefully recreated, by the principal participant, and make stimulating reading indeed. A minor curious matter is the enormous number of names that are listed in the first third of the book, together with opening and closing apologies to those whose names were omitted. But perhaps this cataloging is simply a sign of the team nature of modern research, involving the cooperation of so many individuals to attain a desired goal.

More than the other volumes, *U.S. Research Reactor Operation and Use* bears the characteristics of being written somewhat hurriedly to order. Most of the book does not concern the operation and use of research reactors but is made up of their descriptions, together with many pictures of their various features. There is a short chapter on typical research performed with reactors but the material is much too descriptive and abbreviated to be useful to those engaged in research. The chapters on the operation of research reactors tend to be at the administrative level, with reproductions of organization charts and work schedule sheets. While the book is hardly a handbook for individuals operating research reactors or doing research with them, it would be a good introduction to the general types of research reactors that are available, the number of people required to run them, and their probable cost.

Radiation Biology and Medicine is a large, carefully edited volume containing a wealth of high-level material on the effects of radiation on living material. Although written by more than 50 authors, it is so well organized that there are no sharp discontinuities in treatment. A wide range of material is covered, from the basic mechanisms of radiation

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.

D. J. HUGHES
J. CHERNICK
Brookhaven National Laboratory

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-*