more than that, an outline for even more work on atomic power and its economic effects. The reader will find that it presents a first picture of the potential usefulness of this aspect of the nuclear engineer's work. No book of equal stature on the subject has yet appeared.

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The James River Basin: Past, Present and Future. Compiled by the James River Project Committee, Virginia Academy of Science, 1950. 843 pp. Order through Foley F. Smith, Box 1395, Richmond 11, Va. $6.00.

The concept of surveying natural resources within physiographic rather than political boundaries has been aptly exploited by the James River Project Committee. The results are highly satisfactory; in fact, the completeness and generally high caliber of the coverage of each division leave little to be desired. Considering the immense difficulties of consummating the survey, it can boast of few competitors in the United States.

The James River basin is a triangular area extending through the central part of the states from the West Virginia border to Norfolk and the mouth of the Chesapeake Bay. It drains important parts of all the Virginia physiographic subdivisions from mountains to tidewater. Most of the transportation systems, educational institutions, industrial centers, and important cities are found in the basin. Such regions, as a portion of the Dismal Swamp, Allegheny Mountains, fresh and tide waters, are still rich in natural resources despite the inroads of civilization that began in 1607. Prominent scientists, educators, and industrial and social leaders have participated in the compilation of the monograph. Specific chapters, or sections, have been the responsibility of one or two individuals, and their work is accurate and factual. Since the survey has been prepared for laymen and scientists alike, the style in general attempts to be popular, but much of the writing will require more than a cursory examination. The monograph is divided into five major subject headings: Conservation, Recreation, Education; Biological Sciences; Earth Sciences; Mathematical and Applied Sciences; and Industry and Transportation.

I. N. Gabrielson's essay on conservation points out that, in general, all the elements necessary to sound resources management are now present and active in the valley of the James. The recreational aspects of the river, surveyed by R. F. Nelson, are concerned with hunting and fishing, the George Washington National Forest, the Jefferson Forest development, and miscellaneous needs.

Over one third of the huge volume is devoted to the biological sciences. "Botany of the James River Basin," by A. B. Massey, and "Plant Pathology," by S. A. Wingard, are, of necessity, rather general, but are well summarized and have useful bibliographies. The entomological essay, by G. T. French, is devoted almost wholly to history and control of economic pests, with little reference to the actual rich insect fauna of the basin. In addition to the references cited in the text, a bibliography covering insect studies made in Virginia should have been added. The check list and bibliography of the 145 species and subspecies of mollusks, by P. R. Burch, is one of the worth-while contributions from the viewpoint of a zoologist.

E. C. Raney recorded more than 74 kinds of freshwater fishes from the James River system. His account is one of the better faunal presentations, with a distributional discussion and complete bibliography. It should prove useful not only to Virginians, but to ichthyologists elsewhere. The section on marine fishes and invertebrates of tidewater, by N. Marshall, covers their economic role and is, unfortunately, too general to be an adequate report on such an important subject. The herpetological section of R. P. Carroll lists the Virginian herpetologists and indigenous amphibians and reptiles. An interesting photographic reproduction of an albino pilot blacksnake is given. A scholarly history of Virginia ornithology with an exhaustive bibliography was prepared by J. J. Murray, and the mammals are well covered by C. O. Handley, Jr., and C. O. Handley, Sr. The survey of medical sciences by M. P. Rucker consists of abundant historical and bibliographic evidence that Virginia's role in American medical science has been outstanding.

The section on earth sciences is divided into: (1) Agriculture, by A. W. Drinkard, Jr.; (2) Forests and Forestry, by C. Jones and associates; (3) Geology, by Marcellus Stow, J. K. Roberts, and associates. The treatment of mathematical and applied sciences consists of essays on the history of astronomy, mathematics, chemistry, engineering, and related subjects, by distinguished scientists of Virginia universities. The section on highway engineering and transportation deals with the industry, and with highway, air, and railroad transportation, emphasizing the established commercial companies. Officials and industrial authorities from these companies have provided the necessary data for this section, often with interesting historical documentation and illustration.

One cannot help but feel that the committee has completed a prodigious task, and they will be admired and envied for their results for years to come. The volume represents "the initial phase of research on the James River basin;" hence we may expect continued studies from the group. Although in the various essays emphasis was to be placed on the *human habitat*, this is not entirely successful. The committee is to be commended, however, for allowing each author to use his own discretion in organizing and writing his paper. They deserve sympathy, on the other hand, when one considers the difficulties involved in arbitrarily selecting subjects to be included and deciding on the amount of space each was to receive. Admittedly, some subjects benefited at the expense of others, and a more uniform treatment of biological subjects would have definite advantages. It is easy to comprehend why such biological forms as algae, fungi, protozoans,

sponges, coelenterates, annelids, arthropods (excluding insects), and nematodes, are hardly mentioned, but lists of these would have served a practical purpose.

The James River Basin is an impressive thick octavo. The text is easily read, and is printed on heavy, high-grade paper; the photographs and maps are reproduced on strong bond paper. The book is bound in heavy blue cloth and is handsomely stamped. The Virginia Academy of Science is to be congratulated on such an excellent contribution to the ever-expanding culture of the South.

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Physics and Mathematics

Introductory Nuclear Physics. David Halliday. New York: Wiley; London: Chapman & Hall, 1950. 558 pp. $6.50.

College texts notoriously suffer from a tendency to conservatism and overemphasis on "classical" developments of historical importance. Too often an author also tries to force a whole field into the mold of a personal point of view. Professor Halliday's book is entirely free from both these faults. It takes the student directly into the spirit of our great new laboratories: up to date in every respect and not unduly concerned with broad unifying principles. A large number of the most modern experimental and theoretical results is presented, on the whole accurately and clearly. Some sections (e.g., chap. 2, sec. 18, and chap. 8, sec. 17) consist of a review of a recent paper in the *Physical Review,* briefly presenting the fundamental knowledge required for its understanding.

The book is divided into 13 chapters and two appendices: an introductory chapter, two on radioactive processes, one each on interaction of radiations with matter, on detecting equipment, on neutrons, on nuclear masses and abundances, on nuclear forces, on accelerating equipment, on nuclear reactions, a separate chapter on fission, one on cosmic rays, and, finally, one on nuclear moments. One appendix is a table of physical constants, the other reviews 6 papers on experimental results which appeared during 1950. Each chapter is divided into about 20 sections and is provided with well-selected and stimulating problems. There are almost 300 illustrations, many of them helpful and relevant. Format, type selection, and paper are unusually pleasing. It would be useful if future editions would list section headings as well as chapters in the table of contents, since some topics do not appear in the most obvious places.

The treatment is weakest in the exposition of basic principles. For example, in the discussion of mass-energy equivalence (chap. 1, sec. 9): "If 1000 cal of heat is added to a block of copper, its mass . . . should increase by 1000 cal divided by the square of the velocity of light." For the beginner this may obscure the significance of c^2 as a factor connecting the units of mass and energy. Similar lapses occur in the discussion of the range of nuclear forces (chap. 8, sec. 5, and elsewhere).

In the presentation of techniques the emphasis is on accurate description of specific instruments rather than on general methods. For example, design data of one particular modern magnetic electron spectrometer are given in considerable detail (chap. 3, sec. 4), but the reader is referred to the literature for a systematic discussion of magnetic focusing.

About 70% of the numerous literature references are to publications that appeared during the past 5 years; over 80% are American. This may lead the less experienced reader to overestimate the significance of progress in experimental technique compared with the selection of important problems. For example, the author index contains only two references to Joliot (one in a historical summary, one to the failure to recognize the neutron). Bothe's name does not appear at all, and Heisenberg is mentioned only once, in passing. Neither Schmidt nor Kopfermann is quoted in the sections on nuclear moments. On the other hand, this reviewer finds *his* name in the index eight times.

The approach should prove most stimulating to a graduate student eager to join the main stream of thought and activity in his chosen field of specialization, particularly if his fundamental training was quite thorough and conservative. It will be less valuable to the beginner, still uncertain about the nature of important progress in physics.

As a textbook in a basic course in nuclear physics the volume must be supplemented by lecture notes explaining the fundamental principles. Its main value will be its use as a source book, providing specific illustrations and problems for the general material of the course.

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The Friction and Lubrication of Solids. F. P. Bowden and D. Tabor. New York: Oxford Univ. Press, 1950. 337 pp. $7.00.

Friction between solid bodies is one of the most basic of physical phenomena—one that affects nearly every phase of human activity. If, on some mythical cosmic control panel, one should pull the switch marked "Friction (Earth)," what a shambles would rapidly ensue. There would lie man, sprawled helplessly on the ground, unable to rise, while much of his physical world, both man-made and natural, would come sliding down about his ears. If, on the other hand, by a simple twist of the wrist one should flip the cosmic rheostat marked "Friction Intensity (Earth)" to "HIGH," the results would be almost equally grim. Civilization would quickly grind to a halt, with much squealing and smoke, and the lubrica-