Book Reviews

Titanium. A. D. McQuillan and M. K. McQuillan. Academic Press, New York; Butterworths, London, 1956. 466 pp. Illus. $10.

The industrial development of titanium metal and alloys made therefrom has suffered in the past from a lack of fundamental information on many aspects of titanium metallurgy. The urgency to produce a satisfactory metal as a basic product, to melt or alloy it into useful combinations, and to fabricate it into useful shapes for a wide variety of applications has led us into measures and procedures that have often handicapped, rather than aided, industrial development in this most recent chapter of industrial technology.

The present volume on *Titanium* by the McQuillans sets out to correct this situation. In the preface to the volume, the authors state that "although the present industrial techniques may be expected to be rapidly superseded, the greater part of the material included in the book will retain its validity." They present, for the first time, a summary of the fundamental facts on which all titanium metallurgy must eventually be based.

The chapters on the production of titanium metal are naturally of special interest, since the future applications of titanium to industries other than those that are government-supported depends on a more economical method of production than the magnesium reduction processes now in common use. The reduction of the halides and subhalides of titanium by sodium, attributed by the authors to Quinn, has interesting possibilities for future production. The reduction of titanium oxide by calcium would be of great importance but this development "awaits the appearance of plentiful supplies of cheap high purity calcium." Electrolytic methods and thermal decomposition of titanium iodide have not yet arrived at the point of large-scale operation.

The engineering features used in the production of end-products in titanium metallurgy are covered in the sections on melting and casting of titanium and its subsequent fabrication into finished parts.

The melting of titanium into ingot form is still one of the bottlenecks of the industry. Consumable and nonconsumable electrodes, double and triple melting—skull melting or melting in graphite—vacuum or argon atmospheres, are problems that are calling for more adequate solutions.

The summaries on the physical properties of titanium and the constitutional diagrams of the known binary titanium alloys provide a brief compendium of information in these fields. The sections on heat treatment and mechanical properties review the extensive literature on these subjects which has been presented in the last 10 years.

As a contribution to the scientific and engineering features of titanium metallurgy, this present volume, I think, is among the best.

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Water. The yearbook of agriculture, 1955. U.S. Department of Agriculture, Washington, D.C., 1955 (order from Supt. of Documents, GPO, Washington 25). xiii + 751 pp. Illus. $2.

This is a very important book. Two presidential commissions and now a proposed national program have dramatized the urgent need for us to face up to the implications of present water problems and a demand that is expected to double by 1975. This volume provides a means by which the technical specialist, the scientist, the farm and civic leader, and the thoughtful citizen can obtain the comprehensive background that is necessary to place their endeavors and their local problems into broad perspective.

In the words of the Yearbook Committee, "our main emphasis is on the facts and basic principles that will help people in reaching the best decisions." This book is centered about the problems of agriculture, but only in the broadest sense. Thus, it reaches far beyond the farm to the factors involved in the making and prediction of weather, runoff, erosion, sedimentation, infiltration, and surface- and ground-water flow. It considers watershed, forest and range management, recreational, wildlife, domestic and irrigation needs, conservation, flood control, legal and legislative implications, and fundamental scientific research. There are 96 topics and a considerably greater number of authors. All things considered, the volume is remarkably well aranged, well integrated, and well written. The reader will find this book valuable, whether he desires to read it as a whole or to select separate papers according to his interests.

The great majority of the authors come from within the Agricultural Research Service, the Forest Service, and the Soil Conservation Service. Where necessary to the continuity and coverage, the editors wisely went beyond this talented group within the U.S. Department of Agriculture and obtained participation from experts from other agencies, such as the U.S. Geological Survey, the Weather Bureau, the Bureau of Reclamation, the U.S. Public Health Service, the Fish and Wildlife Service, and the Saline Water Conversion Program, from university and state experiment stations, from professional associations like the American Waterworks Association, and from private organizations. The quality of the individual efforts is quite uniformly good.

In a book that attempts this coverage, every reader will discover some topic that he feels may have been overlooked or undervalued. I am no exception, and I would have welcomed an article on the possibilities for developing plants with greater drouth resistance and lower water requirements and one on the possibilities for reducing evaporation. In the preface, the editors explain that the agricultural scope of the book precluded much emphasis on hydroelectric power, navigation, pollution, and industrial use. To this I might add engineering structures, large dams, and river diversion projects. Jurisdiction for many of these fields lies within the U.S. Department of the Interior, and it can be hoped that it may someday see fit to publish a companion volume covering these subjects.

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Advances in Geophysics. vol. 2. H. E. Landsberg, Ed. Academic Press, New York, 1955. x + 286 pp. Illus. $7.50.

This volume of extensive review papers, assembled under the competent editorship of Helmut Landsberg, covers diverse and important aspects of geophysics in which there have been substantial developments in the last few years. In addition to being review articles, most of these papers include some new mate-

rial or at least material of which I was not previously aware.

This volume contains five review papers, the first of which, on "Advances in radar weather," is by the McGill University group, which is headed by J. S. Marshall and includes Walter Hitschfeld and K. L. S. Gunn. In this paper, the authors review recent work in a very effective manner and point out that radar analyses are still quite crude and are largely qualitative rather than quantitative, but that partially successful attempts are being made to correlate the radar signal intensity to rainfall intensity. It is possible to distinguish the ice or snow phase from the liquid phase, and thus the observations are helpful in establishing the freezing level. This article, comprising some 50 pages, includes 130 references that would be more valuable if they had been placed in alphabetical sequence rather than in serial sequence.

The second review paper on "Methods of objective weather forecasting" was written by Irving L. Gringorten of the Air Force Cambridge Research Center. The author mentions, as have many other meteorologists, that weather forecasting is still an art and that objective forecasting is not at the moment preeminently successful as compared with older techniques that are based on synoptic observations combined with tables and charts, experience, and a sense of the weather. He notes that "atmospheric motions and conditions are far too . . . complex to be reduced to a simple mathematical model or unified by a system of equations. . . ." Electronic computers aid greatly, but simplifying assumptions must still be made. If the problem can be limited to one or two forecast features, such as winter rainfall in the given locality, a high degree of forecast accuracy may be attained. But if the answer is simply "rain" or "no rain," then other questions, such as visibility and cloud development, remain to be answered subjectively. On the other hand, objective forecasts also involve the quantitative idea, which is not usually involved in subjective forecasts. The author sets up a detailed classification of objective studies and discusses each in turn. His 40 pages of text are followed by a list of 124 references, which, like those in the previous paper, are listed serially rather than alphabetically.

The longest paper in this group is the one by Willard J. Pierson, Jr., of the department of meteorology and oceanography, New York University, and is entitled "Wind generated gravity waves." Pierson has done a splendid job in drawing together the extensive recent work in this field, but at the same time he has gone back and outlined basic theory. He develops a stationary Gaussian process in one dimension and in three dimensions in some detail, discusses the ergodic theorem briefly, and outlines the principles of energy spectra and the propagation and growth of waves. He closes with an outline of practical methods for observing and forecasting ocean waves and a list of unsolved problems. There are 66 items in the references, also in serial order.

The fourth review paper is a 35-page paper entitled "Geological chronometry by radioactive methods," by J. Laurence Kulp of Lamont Geological Observatory, Columbia University. This review covers lead methods, the carbon-14 method, the strontium method, the potassium methods, the helium method, the ionium method, and other potential methods, with the largest section of the paper devoted to the lead methods, including an extensive table of published results and some of the errors involved or possibly involved in the techniques. In the carbon-14 method, he also considers the situation if the cosmic ray flux had been half of its present value during the Ice Age. The other methods are discussed only briefly; however, references to more extensive material are given. The list of 74 references at the end is an important compilation.

The final review paper is on "Earthquake seismographs and associated instruments," by Hugo Benioff of the Seismological Laboratory, California Institute of Technology, himself an important developer of seismographs. Benioff discusses the principles and merits of the various types of seismographs, including torsion seismographs of various subtypes, carrier-current transducer seismographs, linear-strain seismographs, and various appurtenances. He discusses these various types with respect to components measured and the response characteristics. It is a splendid 50-odd page summary of the instrumentation for earthquake measurement. At the end there is a list of 27 references.

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Essentials of Biological and Medical Physics. Ralph W. Stacy, David T. Williams, Ralph E. Worden, Rex O. McMorris. McGraw-Hill, New York–London, 1955. xiv + 586 pp. Illus. $8.50.

This volume undertakes to include generally all the physical aspects of biology and medicine. It is intended to serve as a textbook in biophysics for "senior undergraduates and graduates in the biological sciences and for graduates in physics." Although both fundamental and applied types of material are included, the dominant viewpoint is that "biophysics is a form of applied physics" and includes any field in which physical instruments may be used.

With such a vast domain of unquestionably interesting material, the authors face the necessity of limiting the scope in some fashion. Thus they say: "Since this text is not to be used as an advanced reference, we have not given complete explanation of all phenomena falling within its scope." In fact, more often than not, mathematical formulations in terms of the calculus or differential equations appear without the supporting logic or derivation. This imparts something of a handbook character to the text. References are offered with each chapter where more thorough treatments can be found.

That the major value of biophysics might lie in power of analysis and conceptual contribution to fundamental biology is certainly not the impression one gains from this textbook. There is even a hint that biology is regarded as an inexact science, and hence that rigor cannot be expected.

Granting that conceptual and logical development have not been stressed, one must still be impressed by the colossal task that has been accomplished in bringing so much material together. It would be futile to enumerate the many fields covered. Practically anything that involves physical technology may be found in this volume. No doubt many will find this a valuable source of information and a possible introduction to various fields of research.

This treatment brings into sharp relief a number of serious questions concerning biophysics. What should be included? What should be stressed? How should its students be trained? There is a growing demand for physical technologists to assist in clinical operations and biologists' research. This leads to courses in applied physics, sometimes referred to as health physics.

At the other extreme are those who aspire to mature thinking in fields of biology and biochemistry, which demands disciplined clarity in the study of biophysical mechanism. It matters little what the original training of such a person may have been, since many more years must be devoted to securing both a greater mastery of more advanced mathematical and physical conceptions and a penetrating grasp of biological ideas.

Educators faced with the impossible task of collapsing both a Ph.D. training in physics and one in biology into the usual span of graduate study are making desperate compromises. Some omit mechanics entirely—the very cornerstone of conceptual physics, both classical and modern.

The election that these authors have