other hand, neither can men who have relinquished their birthright of scientific knowledge expect to rule themselves." Aside from the global problems of nuclear war and population growth, we have recent and continuing nonsense episodes like the phoney fears of fish flour, of water fluoridation, and of nuclear power as more mundane examples of misinformed society vs science, and all scientists and engineers would do well to ask themselves "what contributions to education did you make today?"

The final lecture is about the unmasking of the masquerade by Martian oxides of nitrogen as ice caps, vegetation, and dust storms. It is a fascinating story, and Carl Kiess tells it well. It is, of course, a disappointment to us erstwhile fans of Sir Percival Lowell and Edgar Rice Burroughs to find that the atmosphere of Mars is pure smog. (Is that what happened to Martian civilization?)

The book begins and ends in the far reaches of outer space, and the wheel hath turned full cycle. Other than this, there is not much continuity from one essay to the next. More important are the omissions that would have made this collection more deserving of its title, such as science and religion, nuclear weapons and international affairs, food and water supplies, and modern psychology. Surely one misses a discussion of science and religion that might have graced an important lecture series at a Jesuit university. Nevertheless, the book is worth its price, if only for the beautiful essays of its three best-known contributors: Dobzhansky, Morse, and Glass.

David L. Hetrick is Professor of Nuclear Engineering at the University of Arizona in Tucson. He received the BS and MS degrees in physics at Rensselaer Polytechnic Institute and the PhD degree in physics at UCLA. He has been Instructor of Physics at Rensselaer and Associate Professor of Physics at San Fernando Valley State College. He was with Atomics International as a reactor physicist for nine years, and has served as consultant with the Marquardt Corporation, Planning Research Corporation, and Hughes Research Laboratories. For many years he has been concerned with problems of science and society, and he served a term as Chairman of the Los Angeles Branch of the Federation of American Scientists. His main research interest is nuclear reactor dynamics, and he is currently writing an introductory textbook in that field.

AN ADEQUATE SOVIET REVIEW

Title Complex Compounds of Uranium

Editor I. I. Chernyaev

Publisher Daniel Davey and Company, 1966

Pages xiv + 520

Price $21.50

Reviewer H. A. Droll

Complex compounds of Uranium is a translation from the original Russian work by L. Mandel and the staff of the Israel Program for Scientific Translations, Jerusalem. The book, a fairly complete review of the complexes of uranyl, UO_2^{+2} (18 chapters), and U^{+4} (6 chapters) ions, is the product of 13 contributors under the editorship of I. I. Chernyaev from the Kurnakov Institute of General and Inorganic Chemistry, USSR Academy of Sciences. In spite of the large number of contributors, there is no evidence of the disjointed presentation one would expect. The Western as well as the Soviet literature on the subject is reviewed up to 1963. Although there is no index, the nature of the Table of Contents diminishes this deficiency. The order in which the chapters appear is based on the order of decreasing stability of the complexes, which, in turn, reflects the displacement series of the complexing agents (ligands). Thus, for UO_2^{+2}, the order of presentation of complexes by chapters which include annotations ranges from carbonate and peroxide to amines and oxygen-containing ligands.

Chapter one considers briefly the general chemistry of UO_2^{+2} and U^{+4} and introduces the reader to the nomenclature of uranium complexes *à la russe*. This is followed by 14 chapters which describe the properties (thermal, crystallographic, solubility, to name a few) and preparation of over 300 UO_2^{+2} complexes. Chapters 16, 17, and 18 deal with the structure of the UO_2^{+2} unit and with the calculation of bond lengths and bond angles ("geometrical analysis") in UO_2^{+2} complexes. Chapter 16 reports the detailed crystal structures of over 30 UO_2^{+2} complexes, most of which contain inorganic ligands. These structural analyses demonstrate the four-, five-, and six-fold coordination of UO_2^{+2}. The general chemistry of U^{+4} including redox and hydrolytic stability is considered in Chapter 19. Magnetic susceptibility, x-ray diffraction, and electronic spectral data indicate eight-fold coordination and $5f^2$ electronic configuration for U^{+4}. The preparation and properties of 97 U^{+4} complexes are described in the five subsequent chapters. The final chapter reviews the role of complexation reactions in the technology of uranium. Topics dealt with are the dissolution of uranium ores (e.g., carbonate leaching) and of uranium metal, precipitation of uranium complexes in chemical analysis and in purification procedures, and liquid-liquid extraction methods. Two observations of this chapter can be made: ion-exchange methods are ignored and only four references are cited, all from the Soviet literature.

The thought which permeates the book is the utility of coordination theory in the preparation of uranium complexes and in the interpretation of their structures. For example, treatment of crystalline uranates as derivatives of the hypothetical uranic acid is debunked, and the solubility of $U(OH)_4$ in aqueous alkali is interpreted in terms of the formation of an hydroxo complex $U(OH)_5^-$ rather than of a salt of a polyprotic acid, $H_3UO_4^-$. The UO_2^{+2} moiety is shown to resemble a simple dipositive ion, its enormous stability being observed from chemical, infrared spectral, refractivity, and x-ray data and its existence being justified in terms of molecular-orbital theory.

No book of this size can possibly be absolutely free of inconsistencies and faulty interpretations, and Chernyaev's splendid review is no exception. The statement on page 255 concerning the inability of UO_2^{+2} to be complexed by more than five thiocyanate groups is undermined by the appearance of $UO_2(NCS)_6^{-4}$ in a table of synthesized ions on page 266 and the inclusion of $[Co(en)_3]_2[UO_2(NCS)_6](NO_3)_2 \cdot 5H_2O$ in a table of preparable compounds on page 255; the procedure for the preparation of this compound described on page 270 omits the use of a thiocyanate salt! The thermal data on page 428 for a series of sulfate complexes of U^{+4} suggest the formula $3(NH_4)_2SO_4 \cdot (NH_4)_2[U(SO_4)_3(H_2O)_3$ in which all waters are in the coordination sphere of U^{+4}. This suggestion is at variance with the interpretation given in the text.

The number of typographical errors is tolerably small and of minor importance. The reader will have to adjust to several awkward or unfamiliar expressions, e.g., "genetic series," "intraspheric coordination," and "localization" (for "location").

The authors occasionally point out those areas of the chemistry of uranium complexes which either are unexplored or are explored but whose results lend themselves to interpretations which are moot. Very little synthetic work has been done on cyanate complexes; only Pascal's study in 1914 represents this area. Chapter 15 lists over 200 UO_2^{+2} complexes with organic ligands (amines, phenols, hydroxyquinolines, polyprotic acids, and miscellaneous organics including adrenaline). The formulas given by various investigators, most of them from outside of Russia, are based on only chemical analyses. The structures are unknown and can only be guessed within the framework of modern coordination theory.

Complex Compounds of Uranium is an adequate survey which will serve as good background for workers in uranium chemistry and in reactor fuel processing.

H. A. Droll is an associate professor of chemistry at the University of Missouri at Kansas City. He obtained the PhD degree in chemistry at the Pennsylvania State University in 1956. His current specialty is coordination chemistry and chemical equilibrium problems, although his research interests have included fused-salt electrochemical cells, the chemistry of the rare-earth elements, and chemical problems in nuclear reactor technology.

AN EMPTY PROMISE

Title Successful Engineering Management

Author Tyler G. Hicks

Publisher McGraw Hill, 1966

Pages xii + 287

Price $8.50

Reviewer Joseph H. Bach

In 1890, this volume might have passed muster as an elementary description of industrial management techniques. The subtitle, "Modern Techniques for Effective and Profitable Direction of the Engineering Function," appears to be a promise to guide the reader through the new techniques specifically developed to control the ever growing complexity of the engineering manager's job. It is an empty promise. While CPM, PERT, OR, etc. are mentioned, the description and analysis of these and other management techniques is compressed into a few uneven pages. The reader is then advised to read all about it in the references which follow each chapter. The balance of the text is a mish-mash of banalities and generalities, which indicate that the author is unqualified to discuss the subject and that the publisher did not have the fortitude to reject a worthless manuscript.

Written in three parts, the first of these deals with the advantages of becoming a manager (you get two extensions on your phone!) and equally puerile advice on how to get there. This is followed by chapters listing various functions often performed by managers, ranging from technical writing through labor negotiations. With minor exceptions not a single subject is adequately described, nor are alternatives or application critically discussed. Typically, the chapter on proposal writing shows the last 4 of 8 major (sic!) steps as "Typing, Binding, Final Check and Submission." Not a word on proposal organization, what to put in, or how to describe the work program. Twelve pages on contract negotiations can be summed as "be alert, and nice to the customer."

The planning process, although mentioned often is left to the readers' imaginations, as are other major engineering management problems such as Evaluation of Alternatives, R & D Program Selection, etc.

The final part of the book describes some typical management jobs which usually fall to an engineer, and repeats the generalities of the first two parts. Redundancy is not the least of the book's many deficiencies. Whole paragraphs are repeated, often three or four times throughout the text, leading one to suspect that the editor was too bored to read either the manuscript or the proof in its entirety.

The book's high price need not discourage anyone who may wish to own it. This reviewer predicts that it will appear shortly on the shelves marked "Any 3 for 50¢."

Joseph H. Bach obtained his formal education as a metallurgical engineer at Purdue (BS 1942) and the University of Idaho (MS 1951). For the last 20 years, he has worked at Hanford, Sylvania, and Westinghouse in a variety of nuclear energy programs including weapons, naval propulsion, space application, and central power stations. He has held both line and staff engineering management positions and is currently a planning consultant at the Atomic Power Divisions of Westinghouse Electric Corporation.

INTERESTING AND THOROUGH RECAPITULATION

Title Scientific and Managerial Manpower in Nuclear Industry

Author James W. Kuhn

Publisher Columbia University Press, 1966

Pages xv + 209

Price $7.50

Reviewer R. L. Doan

This book represents a study of the role of manpower in the development of nuclear technology, with particular reference to the nuclear power industry. It is part of a