series," Seaborg; "Crystal chemistry of the 5f elements," Zachariasen; "Optical properties of some compounds of uranium, plutonium, and related elements," Staritzky and Truitt; and "Slow-neutron and spontaneous-fission properties of heavy nuclei," Huizenga, Manning, and Seaborg.

In general, the book is well written; much of it is, however, detailed listings of preparations and properties. Since most of these data are available only in declassified reports and have not heretofore been subject to critical review, this attention to detail is both necessary and desirable. Considerable care must have been taken in the writing, editing, and printing because only four errors were noted. There is a subject index, but unfortunately no author index.

The title of this book, *The Actinide Elements,* presumably stems from Seaborg's theory that these elements form an Actinide Series akin to the well-known Lanthanide Series. Since some chemists do not agree with this concept, Seaborg presents strong arguments in support of his views. An alternative point of view —that this is a Thoride Series—is ably discussed by Zachariasen in his chapter. Other chapters that were found particularly interesting are those by Connick and Hindman on plutonium chemistry.

These authoritative chapters are a fitting "record" of the quality and quantity of the work done on the Plutonium Project. This book is highly recommended to those interested in the chemical and nuclear properties of these heavy elements.

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Calculations of Analytical Chemistry. Leicester F. Hamilton and Stephen G. Simpson. McGraw-Hill, New York–London, ed. 5, 1954. xii + 340 pp. Illus. $5.

The fifth edition of this well-known textbook retains the best features of the previous editions. Through selective editing, rewriting, and additions by the authors, its general usefulness to teachers and to students of elementary analytic chemistry has been significantly improved.

For the student, the value of such a problem book, used in conjunction with a standard analytic textbook, lies in the fact that an organized approach to the whole area of basic analytic calculations is available in compact form. Example problems worked out to illustrate the principles of calculations for each type of analytic stoichiometry, together with an ample number of selected problems with and without answers, provide a source of self-instruction for the student and an opportunity to test his knowledge and understanding of the subject.

For the instructor, the value of such a problem book stems directly from the above. The obvious benefit is that less time needs to be spent in organized lecture or recitation presentation of problem work, but more important is the fact that, with adequate printed instructional material available, more efficient use can be made of the time given to individual instruction. During some years of using this textbook, it has been my experience that student questions relating to the material covered are individual questions and differ from student to student and from problem to problem. This opportunity for individual instruction allows for a probing of the student's attempt at self-instruction, and it has been my uniform experience that the student who honestly attempts to understand the material presented in Hamilton and Simpson's book has no trouble in mastering the solution of any problem in basic analytic chemistry.

The following material has been added: a chapter on colorimetry; a brief treatment of precision measures, rejection of results, and the use of nomographs; sections on decomposition potentials, overvoltage, polarization, and electrolytic separations; potassium bromate and iodate titrations; and reference is made to antimony electrodes and examples are given to illustrate the calculation of potentials during the course of a redox titration. Rewritten sections expand the treatment of polarography as related to amperometry, and the Latimer convention regarding electrode potentials is now employed.

Problems relating to these subjects have naturally been added, but many long, seldom-used problems have been eliminated. The total problems are some 40 fewer than in the fourth edition. Editing has corrected most of the errors in the previous editions.

Future editions could include a brief treatment of the statistical theory of the distribution of errors, together with appropriate curves to make the presently defined precision measurements more meaningful. It is hoped that the Fe^{+2}, Ce^{+4} example of a redox titration can be eliminated. Too often the student is led to believe that all equivalence half-cell potentials are the average of the respective E^{0} values. Reference is made to problem 16.7 which is so mistakenly solved. The derivation of a universal expression for calculating the potentials and the use of an appropriate example would be desirable in all elementary treatments of the subject.

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Animal Breeding. Laurence M. Winters. With additional chapters by William Rempel and John N. Cummings. Wiley, New York, and Chapman & Hall, London, ed. 5. 1954. ix + 420 pp. Illus. $5.75.

Modern concepts of livestock breeding are clearly presented in the fifth edition of this textbook. The author draws freely on his own experiences in animal-breeding research, particularly with swine. Approximately half of the book is devoted to selection, inbreeding, and crossbreeding, including a chapter on "building superior germ plasm." Emphasis is placed on the use of inbreeding as a tool to aid selection in forming lines. These lines are then used in a crossing program to obtain hybrid vigor.

For those whose statistics background is limited, the subject of selection is clearly presented without resort to technical statistical terms. Perhaps a brief discussion of gene frequency and how selection changes gene frequency would aid still further in giving the reader a better concept of how selection changes a herd or breed. Dominant, epistatic, and overdominant gene actions as possible explanations of hybrid vigor are clearly discussed. The basic Mendelian principles as related to animal breeding are reviewed briefly as a background for the material on selection and breeding systems. Four chapters are devoted to physiology of reproduction and artificial insemination. A chapter on lethals includes a list of all reported lethals in farm animals.

On the whole, *Animal Breeding* is simply and clearly written and should interest the livestock breeder as well as the student being introduced to this subject.

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Fresh Water from the Ocean. Cecil B. Ellis. Ronald Press, New York, 1954. xi + 217 pp. Illus. $5.

Fresh Water from the Ocean by Cecil B. Ellis is the first book in which the physical forces and the many techniques involved in the separation of salt ions from sea-water molecules have been systematically examined and analyzed. As with many first works in new fields, the author has had to bring together much scattered information as general background for all readers, even those in closely related technical pursuits. The book is informative, useful, and interesting but also, perhaps necessarily, somewhat superficial as a piece of technical writing.

The book is written in informal style, intended to "attract and enlighten those interested persons who otherwise would shun a highly technical treatment." Ellis explains, from an elementary standpoint, the nature of sea-water impurities, the fundamental physical, chemical, and energy factors involved in separating them from water, and classifies the many possible separation methods into those involving (i) the whole volume, (ii) a surface, and (iii) individual ions or molecules. These general methods are further subdivided into "long-range force systems" (pressure, vibration, heat, refrigeration), "sieve processes" (membranous, osmotic, biological), "distillation" (multiple effect, compression distillation, supercritical, solar, and so forth), and "chemical surface methods" (ion exchange, precipitation and so forth). Following a commendably clear but elementary explanation of the basic physical chemistry involved in each separation method, a description of the process and equipment for a very large-scale plant is presented. An economic appraisal of a 1000-million-gallon-per-day plant (about the amount used by New York City) is then outlined for each technically feasible method.

The work is introduced by a considerable amount of useful background material including sea-water composition, purity requirements for potable and irrigation water supplies, average and minimum U.S. energy costs, and some simple thermodynamics leading to statements of maximum heat engine efficiencies and minimum theoretical work requirements in sea-water separation.

The author concludes that, although compression distillation is the least expensive proved method for plants of almost 1-million-gallon daily capacity, multiple-effect evaporation, supercritical distillation, and freezing might be competitive at a 1000-million-gallon-per-day capacity. None of these systems is believed likely to better the 70 ct/1000 gal price forseeable at this time, however. The author predicts that the electric-membrane method (electrodialysis) when fully developed will be less expensive than any other method heretofore proposed, and that in about 10 years it should be possible to obtain fresh water from the ocean at a total cost of about 30 ct/1000 gal, a price not at all out of reach of many large cities and industries. There is little promise, however, in any method thus far suggested, for producing irrigation water at a cost low enough for practical use.

I question the wisdom of aiming the book at the level of the completely nontechnical reader and, by so doing, failing to develop some of the sound technical ideas and economic factors to a fuller extent. If the author's purpose is to encourage and stimulate thought on the problem, I doubt that the layman will be nearly the source of ideas that the reader of some technical background will be. To describe the precipitation of magnesium and sulfate ions from sea water as a "musical chair game of switching partners" seems quite unnecessary and, perhaps, to be the sort of writing that would discourage the reader who has elementary chemistry training.

Prediction of 70-ct-distillation costs and 30-ct-electric-membrane costs per thousand gallons is indeed bold, for not even the manufacturers and developers of these processes and equipment are so optimistic. I believe that $1 is a more realistic figure for distillation methods, and that the 30-ct figure for electric-membrane separation may ultimately be applicable to a saline ground water of perhaps 5000 ppm solutes rather than to sea water with 7 times this concentration.

The consistent use of kilowatt hours for all energy figures including even heat and chemical reaction enthalpy changes is systematic but somewhat inconvenient for those who are more familiar with Btu's and calories. Inclusion of some heat units along with the electric work units would have aided many users.

I found some of the explanations of electrolysis fundamentals exceptionally clear and of material value, even to the technical reader, in understanding the mechanisms and limitations of methods based on these principles. Of somewhat less clarity is the explanation of multiple-effect and compression distillation, where the role of pressure differences might have been more prominently outlined.