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.

J. A. WHATLEY, JR.
Animal Husbandry Department,
Oklahoma A & M College

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.

The nontechnical reader, for whom this book is intended, should indeed be interested and enlightened by it, and for that purpose the work is a worthwhile endeavor. The book may also clarify some thoughts for more specialized investigators along certain lines of activity in this general field and indicate to them the nature and magnitude of the problems in competing potential methods for sea-water demineralization.

GEORGE O. G. LOF

Denver, Colorado

Titanium and Titanium Alloys. John L. Everhart. Reinhold, New York, 1954. v + 184 pp. Illus. $3.

This book is published as a "pilot" book, and it contains 184 pages in small-book form, 4½ by 6½ in. It represents a well-selected coverage of the published literature on various phases of the technology of the metal that has appeared in recent technical magazines and in company publications. Everhart summarizes recent literature on forming and fabrication, joining, machining and grinding, and applications, as well as on physical and mechanical properties.

The book should prove useful to those not familiar with developments in titanium but whose diversified interests require a general understanding of the progress being made with this metal. Unfortunately the author lacks working contact with the metal, and he offers only information appearing in the literature, some of which is conflicting and left unresolved.

The many references cited allow easy access to original articles and offer the reader the source of significant information on work accomplished in the various fields covered.

BENJAMIN S. MESICK

Ordnance Corps, Watertown Arsenal, Watertown, Massachusetts

Biological Effects of External X and Gamma Radiation. Part I. Raymond E. Zirkle, Ed. McGraw-Hill, New York–London, 1954. xxvi + 530 pp. Illus. $7.25.

The work reported in this volume was part of a large radiobiological program pursued during World War II at the Metallurgical Laboratory, University of Chicago, and the National Cancer Institute. Although the range of topics is quite wide, all the investigations were primarily directed toward an understanding of radiobiological actions on mammals and on man in particular. This book brings together in one volume many scattered reports that have not been previously available to many. It presents the reports with much detail as to methods and results.

The effects of long-continued total-body irradiation on mice, guinea pigs, and rabbits are reported by Lorenz, Heston, Jacobson, Shimkin, Eschenbrenner, M. K. Deringer and J. Doniger, Schweisthal, Miller, Hagen, and Sacher. Hematological effects are covered more specifically in chapters by Jacobson, Marks, Simmons, Hagen, Zirkle, Sacher, Pearlman, Gaston, Block, Allen, Sanderson, Milham, and Kirshon. Biochemical studies of irradiated animals are reported in chapters by Barron, Muntz, Dickman, Singer, Wolkowitz, Wattenberg, and Schwartz.

The effects of x-rays on immunity are discussed by W. H. and L. G. Taliaferro. There is also a chapter by Simmons, Jacobson, Pearlman, and Prosser on the effectiveness of drugs in preventing or alleviating x-ray damage. The final chapter is on the methods of exposing animals to x-rays by Hagen and Zirkle.

Among other reasons, the book is of value since it represents the type of data on which much of our "acceptable exposure" concepts are based.

TITUS C. EVANS

Radiation Research Laboratory, College of Medicine, State University of Iowa

Advances in Cancer Research. vol. II. Jesse P. Greenstein and Alexander Haddow, Eds. Academic Press, New York, 1954. xi + 530 pp. Illus. $11.

This volume is of considerable interest to the biochemist and to the geneticist, as well as to the physician.

Alexander elaborates on the reaction of carcinogenic substances with macromolecules, and Badger elaborates on the relationship between the chemical constitution of carcinogens and their tumorigenic activity. In my opinion the terms "carcinogen" and "carcinogenic" are often inadequate, and they should be replaced by "cancerogen" and "cancerogenic." The geneticist will find a great deal of information in Law's chapter, and the physician will find the other contributions helpful.

Berenblum sees in cancer pathogenesis a two-stage-mechanism. The first stage (initiation) is sudden and probably due to cell mutation, while the second stage (promotion) is gradual, converting a dormant cancer cell into a tumor. The cancer cell is hidden among the great multitude of nonneoplastic cells of which the precancerous lesion consists.

Brues develops the role of ionizing radiations in cancerogenesis as well as in therapy. Two chapters are devoted to chemotherapy—a comprehensive one by Stock, and a chapter on nitrogen mustards by Klopp and Bateman. In a very informative chapter, Oberling and Guering deal with the virus problem; in another chapter, Fenninger and Mider deal with metabolism in cancer. Craigie covers many details on the survival of tumors in the frozen state.

To each chapter a comprehensive bibliography is appended. The volume is an excellent reference book; it shows the development of experimental cancer knowledge and points to some problems that are to be tackled in the near future.

SIGISMUND PELLER

New York, New York