awards and biographies. Also, the reader who picks up one volume to read, say, Pauling's elucidation of the chemical bond may also be attracted to a parallel reading of Hemingway's remarks on writing as a lonely life, as a writer tries for something that has never been done and that may be beyond attainment.

Statistical Mechanics of Charged Particles By R. Balescu. 477 pp. Interscience, New York, 1963. $15.00.
Reviewed by J. E. Mansfield, Harvard University.

The intention of the author is to provide an introduction to plasma physics that avoids some of the limitations of the standard treatments. Existing monographs stress classical magnetohydrodynamics or special topics, while the quantum statistical mechanics of charged particles is handled mostly in general statistical mechanics textbooks. Here we have a unified and rigorous statistical-mechanical development of the fundamental equations of plasma physics using the Prigogine methods of nonequilibrium statistical mechanics. A diagrammatic technique is used, and the long-range difficulties of the Coulomb force can be handled rather simply.

Chapters 1-13, the first two-thirds of the book, are an introduction to the nonequilibrium statistical mechanics of classical systems. This supplements Prigogine's volume in the same series, "Monographs in Statistical Physics". The diagrammatic technique is developed for the classical gas. In the treatment of the short-time behavior of classical plasmas, the Vlassov equations are developed and solved by the resolvent method and by the van Kampen—Case method. Collective effects and long-time behavior are studied, and the Fokker-Planck approximation is developed. This leads to the ring fragment approximation, by which the kinetic equation and correlation functions are studied. The theory of the equilibrium plasma is given as an asymptotic limit; and by way of contrast, the cluster expansion development of the Mayer theory of electrolyte solutions and of the perfect Lorentz gas are given.

In general, the methods developed for the classical case are so chosen as to be generalizable to the quantum-mechanical case, which forms the second part of the book, Chapters 14-18. The diagram technique is developed with Wigner distribution functions, and the quantum Vlassov equation is developed and solved. The quantum analog of the summation of cycle diagrams used in developing the Fokker-Planck equation is used to study the long-time behavior of the reduced one-particle Wigner function. The quantum ring approximation is developed, and binary correlations in an electron gas are studied.

Much of the basic mathematics is relegated to eighty pages of appendixes, as are several unrelated calculations added after the book was set. These treat of kinetic equations for stable and unstable classical plasmas. The past-history dependence in the short-time kinetic equation is well shown. Recent developments in the theory of plasmas in strong external fields are discussed briefly. Symbol, Author, and Subject Indices are provided.

Man-Made Transuranium Elements. By Glenn T. Seaborg. 120 pp. Prentice-Hall, Englewood Cliffs, N.J., 1963. Paper, $1.50; cloth, $3.95.
Reviewed by Norman Feather, University of Edinburgh.

In the beginning—or fairly soon thereafter—there were three fissile species, uranium 233, uranium 235, and plutonium 239. But that was five thousand million years ago, and when North Atlantic Man came on the scene, in the twentieth century of our present era, that most desirable state of affairs no longer obtained. Indeed, had homo sapiens but delayed his appearance on this planet for just twice as long as he did, his chance of warming his hands at the nuclear fire (on earth) might well have passed beyond possible recall. There would have been no uranium 233 nor plutonium 239 (there was none in A.D. 1940, anyway), and, instead of 0.7 percent of uranium 235, ordinary uranium would have provided him with no more than 0.01 percent of that valuable isotope. However, that was not to be: "by the grace of an odd combination of unusual circumstances", according to Dr. Seaborg (p. 99)—even the half-life of uranium 235 is some ten times longer than it might well have been—all things worked together for good (in that the excitement of winning new knowledge was not denied to the scientist), and the world's original unspoiled state has at last been partially restored. Now "the 'Big Three' fissionable nuclides" (p. 97) are all available again—to those with sufficient funds and good credentials. (The "Three", of course, are "Big" in barns, in respect of thermal neutrons.)

Since 1940, not only plutonium 239, but also some hundred other transuranium species have been produced and characterized by the nuclear scientists of the world, thereby adding eleven new elements to the Periodic Table. In truth, this most exciting chapter in the history of science has been written almost exclusively in USA, and Dr. Seaborg, more than any other single person, has been its author. Having received, in full measure, the unstinted acclaim of his brother scientists of all nationalities for his discoveries, he has now put the college freshmen of his own country in his debt—and every person with an intelligent interest in the new elements, also. This slender book is intended to supplement Chapter 23 of the CHEM Study textbook, *Chemistry—An Experimental Science*, but it will do much more than that. It will provide exciting reading for the scientific layman (not all of it, perhaps, but enough to repay his attention), tabloid instruction for the undergraduate, and it will serve as a handy data-book for the nonspecialist researcher. It might be said that to have attempted all these things was to have attempted too much, but that is a churlish objection. It is very unlikely that Dr. Seaborg took deliberate aim at three targets: more probable that he had only to press the trigger, steadily and without fuss, to score three bulls in a single burst. Of course, he can be faulted by the pedant in matters of detail. This reviewer, being somewhat pedantic himself, finds him over addicted to the adjectival phrase "ever-increasing" (or "decreasing"): "elements of ever-increasing atomic number" (pp. 5,

57) may populate the dream-world of the scientist, but in the cold light of day they are linguistic monstrosities. The only scientific faulting to be recorded relates to Fig. 32. There, some isotopes of elements 100-102 are shown which are not referred to at all in the text, and for the production of which it would appear that, at present, there is no reasonable likelihood. But these are matters of minute detail, indeed.

Variation Methods for the Study of Nonlinear Operations. By M. M. Vainberg. With a Chapter on Newton's Method, by L. V. Kantorovich and G. P. Akilov. Transl. from Russian by Amiel Feinstein. 323 pp. Holden-Day, San Francisco, 1964. $12.95.
Reviewed by T. Teichmann, General Dynamics Corporation.

Nonlinear operators have been receiving an increasing amount of attention in the pure and applied mathematical literature, because of their vastly greater (potential) generality, and, in many cases, because of some highly desirable practical characteristics. Unfortunately general techniques for dealing with them are rare, and expositions of those that exist even rarer. Vainberg's book fills an important gap by providing a precise but readable description of the mathematical framework needed to treat nonlinear operators in a general way, as well as a relatively extended discussion of the most general method (Newton's) available for such problems.

After a description of some of the basic ideas of functional analysis (supplemented by an appendix on Banach spaces), the author gives an illuminating discussion of the notions of Gateaux and Frechet differentials of operators, and the corresponding derivatives. The Gateaux (or weak) differential of an operator F is defined as

$$VF(x,h) = \lim_{\epsilon\to 0} \frac{1}{\epsilon}[F(x+\epsilon h) - F(x)],$$

where x, h belong to E, the domain of F, provided of course the quantity cited exists. The Frechet differential is slightly stronger. The properties of these operators are discussed, and on them are built the notions of potential vector fields in infinitely dimensional spaces, extreme and critical points of functionals, and proper functions and branch points of nonlinear operators. A number of special operators and functionals are introduced (in particular relating to square roots of operators), which are then applied to variational proof of the existence and uniqueness of solutions of various nonlinear integral equations. In the final chapter (due to L. Kantorovich and G. Akilov) many of the concepts introduced are applied to the solution of nonlinear operator equations using the analog of Newton's method. This is done both in general and in a number of special cases.

Although there is, of necessity, much abstract discussion, the language, notation, and logical presentation tend to follow that of ordinary vector spaces, and as a result it is relatively easy to follow and illuminates the underlying concepts very well.

Progress in Solid Mechanics, Volume 3. I. N. Sneddon and R. Hill, eds. 256 pp. (North-Holland, Amsterdam) Interscience Publishers, Inc., New York, 1963.
Reviewed by E. H. Dill, University of Washington.

This volume contains one article, "Dynamical Problems in Elasticity", by V. D. Kupradze of the USSR. The intellectual level is of a monograph for the research specialist, and it is a very important work. It is not only a rigorous mathematical treatment of great interest to the theorist but, in view of the current advances in digital computers, the basis for numerical calculations will prove of great practical value.

The equations of the classical linear theory of elasticity are considered: In the case of the static equilibrium and steady-state harmonic motion, the equations of motion subject to certain boundary conditions form a boundary-value problem. The author shows how the problem can be treated by the method of potentials, based on the theory of singular integral equations. Uniqueness and existence theorems, and methods of solution by reduction to sets of linear algebraic equations are treated in a rigorous mathematical manner. New re-