This book mirrors the immense experience that Hughes, a leading scientist at Brookhaven National Laboratory, has had in presenting this subject in lectures to a wide variety of lay groups all over the world, both on this side of the iron curtain and behind it. Therefore his discussions on "The international atom" and on "Safety, security, and the AEC" are stimulating to the reader who is also interested in the impact of atomic energy on the social structure of our time.

The radiation biologist and the health physicist will be gratified to find in a book of this kind, written for the public and for lay groups, a competent discussion of the hazards of atomic radiation, of the genetic effects, and of the radiation safety limits.

A. T. KREBS
U.S. Army Medical Research Laboratory, Fort Knox, Kentucky, and *Biology Department, University of Louisville*

Progress in Nuclear Physics. vol. 6. O. R. Frisch, Ed. Pergamon Press, London, 1957. vii + 285 pp. Illus. $14.

Annual Review of Nuclear Science. vol. 7. J. G. Beckerley, Ed. Annual Reviews, Palo Alto, Calif., 1957. viii + 478 pp. Illus. $7.

In these days, when the *Physical Review* alone prints more than 6000 pages per year, the need for periodical reviews is clearly evident. No one can, without help, keep up with the developments even in his immediate area. The volumes under review are the compilations for 1957 of two series of annual reviews for the nuclear scientist. Both series have been able over the last few years to attract competent reviewers—the obvious prime requisite for success—and both have maintained high standards. Otherwise the two series, though covering much of the same ground, have quite different purposes.

The British compilation seeks to provide not-too-detailed and easily read general representations of the selected topics, with just enough references to the basic papers and current literature to guide the reader in further studies. The most valuable papers are probably those on the atomic masses, by J. Mattauch and F. Everling (A less than 40) and H. E. Duckworth (A more than 40), which provide a thorough and up-to-date discussion of the accuracies of current mass determination, a comparison of data obtained from nuclear reactions and from mass spectroscopy, and tables of the best values. The most enjoyable articles are those by G. N. Walton (on fission physics, with discussion of the fission process, the slowing down of the fragments, the effects on surrounding materials, and the chemical properties of the products) and by R. J. Eden, who gives a short guide to the variety of nuclear models that have been introduced for various purposes. There are two articles on isotope separation, by T. F. Johns (on multistage methods) and by M. L. Smith (on electromagnetic separation). K. F. Smith gives a useful discussion on nuclear moments and spins, with a survey of methods of measurement and an up-to-date table. M. B. Stearns gives a rather dry compilation of work done in the field of mesonic atoms. The book is brought to a fitting close by a short but lively discussion of nonconservation of parity, by O. R. Frisch and T. H. R. Skyrme. Altogether this volume is pleasant to read, useful, and of ephemeral value. The price is high.

The American counterpart, *Annual Review of Nuclear Science,* represents a much more ambitious undertaking: It seeks to provide authoritative and detailed technical coverage of its topics, with complete literature references up to specified dates. The present volume includes three quite outstanding articles. F. Villars gives a searching discussion of the collective model. He brings out very clearly that the simplicity of collective dynamics, as demonstrated by the possibility of describing with high accuracy, and in terms of very few parameters, many data, such as energy levels and moments, is not yet accounted for by the presently available mathematical methods. He emphasizes the inadequacy of the hydrodynamic approximation, but he holds out the hope that the method of "redundant variables" may ultimately achieve the goal of giving a unified description of single-particle and of collective motion.

R. Hofstadter, in his report on "Nuclear and nucleon scattering of high energy electrons," succeeds admirably in his goals—to get across the fundamental ideas of scattering theory and to give an up-to-date report on experimental and theoretical results. M. Gell-Mann and A. H. Rosenfeld give a lucid and authoritative representation of the field of hyperons and heavy mesons and their decay properties. The "strangeness" systematics is fully discussed, as are the consequences of parity nonconservation in weak interactions. Three other physics topics ("Mu-meson physics," by J. Rainwater; "Collisions of $\leq$ 1 Bev particles with nuclei," by S. J. Lindenbaum; "Spins and static moments of radioactive isotopes," by W. A. Nierenberg) are all very competently handled, with emphasis on basic understanding of the physics situation.

The volume contains, further, six articles on chemistry and radiobiology: "Radiochemical separations by ion exchange" (K. A. Kraus and F. Nelson); "Equipment for high level radiochemical processes" (N. B. Garden and E. Nielsen); "Cellular radiobiology" (E. L. Powers); "Biochemical effects of ionizing radiation" (B. E. Holmes); "Vertebrate radiobiology (lethal actions and associated effects)" (V. P. Bond and J. S. Robertson); "Vertebrate radiobiology (the pathology of radiation exposure)" (C. C. Lushbaugh). I, as a physicist, have no competence for judgment, though, because of my interest in nuclear energy, I certainly need information in these fields. In spite of my eagerness to learn, I found that all these articles made very dull reading. On the other hand, a radiobiologist, even with very good understanding of the physics required for his work, will find Villar's highly-rated article completely incomprehensible. Thus, while the physics part of this volume is truly excellent, it remains questionable whether it is wise to collect in one volume review articles, dedicated to the experts, covering such a large diversity of topics.

L. W. NORDHEIM
General Atomic, San Diego, California

Handbook of Magnesium-Organic Compounds. vol. I, *Reactions of Magnesium-Organic Compounds Nos. 1–7284*; vol. II, *Reactions of Magnesium-Organic Compounds Nos. 7285–13395*; vol. III, *Indexes of End-Products of Reactions, Magnesium-Organic Compounds, Authors and Co-Authors.* S. T. Yoffe and A. N. Nesmeyanov. Pergamon, London and New York, 1957. 2048 pp. $72.

This monumental work is divided into three volumes, largely for more convenient handling. The first and the second volumes contain tables, of 13,395 entries, which list the empirical formulas (in the order used in *Chemical Abstracts* indexes) and abbreviated structural formulas of reactants; the Grignard reagents used in the respective reactions; the products formed from the particular reactant and Grignard reagent; and literature references to the bibliography contained in the third volume. Volume III also contains an index of end-products arranged in order of empirical formulas, as well as an index of $RMgX$ compounds, excluding the simplest.

There is a foreword by W. Wardlaw. An English translation of the preface and of the introduction, by A. L.Mackay, is admirably suited for helping one make the fullest, most effective use of the volumes.

The preface of the book emphasizes, to an unusual extent, the contributions of Russian chemists to the development

of the Grignard reagent. The Russian chemists have done very significant work in this area, but it is regrettable that no mention is made of workers such as Kohler, McKenzie, Oddo, Ruzicka, and Tiffeneau. For example, Kohler's classical studies not only developed, at an early stage, some fundamental aspects of organomagnesium chemistry but also provided an uncommon and extensive contribution to our knowledge of conjugated systems.

A cursory examination of some of the entries reveals the incorrect spelling of the names of some authors. This is not an overly serious matter when one reflects on the equally inadvertent but much more frequent misspellings or transliterations that are made in the names of Russian chemists by non-Russians. However, the same cursory examination did reveal the omission of some literature references concerned with the broad development of the Grignard reagent and its reactions.

In a sense, this compilation supplements the more critical and readable *Grignard Reactions of Nonmetallic Substances,* by Kharasch and Reinmuth. That one-volume work is more restrictive in its scope (as its name indicates), but it covers two more years of the literature (up to *Chemical Abstracts* of June 1950).

The authors have done a great and splendid service to organic chemistry, and this *Handbook* should be available in libraries, where one can confidently count on its extensive use as a valuable work of reference.

HENRY GILMAN
Department of Chemistry,
Iowa State College

Dynamic Programming. Richard Bellman. Princeton University Press, Princeton, N.J., 1957. xxv + 342 pp. $6.75.

The book under review may be considered to be a mathematics book, since the author is a well-known mathematician. However, it is not a book primarily about mathematics, as all too many mathematics books are apt to be. It is devoted to developing mathematics in response to problems arising in the social, business, military, economic, and political worlds as well as in engineering and the natural sciences.

Here, then, one may find direct statements of the applications of the mathematical theories developed, together with the construction of theories to solve specific classes of problems, such as inventory problems, depletion problems, and scheduling problems in general. The title *Dynamic Programming* refers to development of a dynamic optimal policy or program as a guide for the making of time-dependent decisions in complex problems involving many variables. Optimization may refer to maximizing net profit, to minimizing risk probabilities, to minimizing storage space, to minimizing delivery times, and so on.

Dynamic Programming takes its place among the comparatively recent attempts to develop mathematics to meet problems of modern civilization and was undertaken in somewhat the same spirit as were John Von Neumann's study of the theory of games and Abraham Wald's of the theory of sequential analysis.

While the book includes many problems indicating the scope of applications, it is not a book that can be easily read for its philosophical content alone, since the author uses concepts of advanced mathematics with ease and makes comparisons which require mathematical experience on the part of the reader.

The need for some serious attention to higher-dimensional geometry and analysis in the undergraduate curriculum is again seen in this book, which could be read with profit by leaders in a wide variety of fields if they had the capacity to assimilate its contents.

PRESTON C. HAMMER
Department of Mathematics,
University of Wisconsin

Elementary Theory of Angular Momentum. M. E. Rose. Wiley, New York; Chapman & Hall, London, 1957. x + 248 pp. $10.

The student of quantum mechanics is soon introduced to the simplest properties of angular momenta, whereupon he is often inclined to believe that his knowledge of the subject is complete. In later stages of his development he will meet with increasing frequency references to sophisticated general theorems, usually accompanied by the casual remark that they follow from group theory, and his knowledge has not advanced by more than the realization that there is evidently more to the matter than he thought.

At this point he is well advised to turn to the new book of Rose, which neither minimizes the complexity nor introduces an unnecessarily elaborate mathematical apparatus. Thus, the orbital angular momentum of a single particle is used as an illustration and not as a substitute for the general definition which requires the consideration of rotation; on the other hand, there is wise economy insofar as the theory is directly based upon the truly necessary geometrical properties of infinitesimal rotation rather than upon the actual but immaterial fact that one deals with a special case of continuous groups. A logical development leads from this start to the coupling of two and three angular momenta, the Wiger-Eckert theorem, Racah coefficients, and other more complex aspects of the general theory treated in part A.

It cannot be expected that the relatively short second part, part B, would deal with more than a fraction of the many applications. In particular, it stresses those relating to angular correlations and nuclear reactions, and it contains an introduction to the properties of static moments. Nevertheless, the reader will be equipped to acquaint himself more thoroughly with some of the special literature, quoted as reference.

F. BLOCH
Department of Physics,
Stanford University

The Inner Metagalaxy. Harlow Shapley. Oxford University Press, London; Yale University Press, New Haven, 1957. xiii + 204 pp. Illus. + plates. $6.75.

This book, by the former director of the Harvard College Observatory, has been awaited with keen interest for several years by all workers in the field of extragalactic astronomy. It covers the region of the extragalactic universe within reach of telescopes of moderate size; this region Shapley calls the "inner" metagalaxy, following a nomenclature introduced some thirty years ago by K. Lundmark of Sweden. The exploration of this domain has been for several decades the special interest of the Harvard College Observatory, and it is essentially a synopsis of this work, carried out by Shapley and his coworkers, that the reader will find described in this volume, on a semipopular level.

After an introduction designed to assist the nonspecialist, Shapley describes the various surveys or censuses of faint galaxies in several strategic locations of the sky and the main conclusions derived from them relative either to the large-scale distribution of galaxies—the evidence for density gradients, for clustering, and so on—or to the distribution of the absorbing material—the cosmic "smog"—in our own Galaxy. This section comprises seven of the 14 chapters of the book and may be the most attractive and useful part, for it gives a clear and well-organized summary of results that, until now, had remained scattered over many publications. The details of the galaxy counts are conveniently summarized in five appendices. There is also a brief discussion (one chapter) of the thousand brightest galaxies in our imme-