

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.

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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 devel-

opment 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.

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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 imma-

terial 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 Wigner-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.

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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-

diate neighborhood, as listed in the classical Shapley-Ames *Catalogue* of 1932. One chapter, reprinted from an article published by Shapley in the *American Scientist* in 1956, reviews rather briefly the Harvard studies of the Clouds of Magellan.

Two chapters dealing with the diameters of the Galaxy and the distance to its center are, perhaps, not very relevant to the subject matter but are of more general interest and in line with the purpose of the book: to present a well-rounded account of all Shapley's main "galactic and extragalactic" studies. The final chapter deals with miscellaneous subjects related to the orientation and evolution of galaxies and tests for possible intergalactic absorption.

The line illustrations are adequate, but the plates are disappointing. This, however, is a rather minor defect, since this is not a "picture book." All students of the extragalactic field will be grateful to Shapley for this very valuable compendium of three decades of "trail blazing work," carried out under his direction at the Harvard Observatory.

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Russian-English Glossary of Nuclear Physics and Engineering. Russian-English Glossary of Solid State Physics. Russian-English Glossary of Electronics and Physics. Consultants Bureau, New York, 1957-58. 195 pp.; 90 pp.; 343 pp. \$10 each (series rate available).

These volumes represent a first step in the development of a complete Russian physics dictionary. A number of other specialized glossaries are still to be issued; ultimate publication of a single revised dictionary is envisaged. The present issues, then, are to be judged in the light of their rather transient character.

Within their defined scope, the glossaries appear to be first class. The compilers have avoided the common mistake of presuming that there is a one-to-one correspondence between Russian terms and English equivalents; often two, and occasionally three or more English terms are listed. The translations are realistic, and current terminology is used effectively.

Nevertheless, I was somewhat shaken by the enormous number of terms. These three volumes furnish more than 30,000; the completed text will probably have 100,000. That would make a rather large book to thumb through. Is such a large number necessary? My opinion is negative on this point. For example, *edinitsa* means "unit," and is so listed. It then is

followed by ten other phrases (such as length unit, mass unit, energy unit) each one of which is a literal translation of a pair of Russian words (*edinitsa dliny*, *edinitsa massy*, *edinitsa energii*, and so on). This practice adds nothing but length to the volume. One should take it as a fundamental rule that no phrase should be inserted in the glossary whose precise meaning can be found by a literal translation of its individual members.

One of the outstanding features of the *Electronics* glossary is a listing of American equivalents of Soviet vacuum-tube designations. This inclusion and that of a series of Russian abbreviations are exceedingly valuable features.

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Radiological Physics. M. E. J. Young. Academic Press, New York, 1957. x + 365 pp. Illus. \$7.50.

This book is intended for the use of candidates for diplomas in radiology from the Royal College of Physicians of London or the Royal College of Surgeons of England or of candidates for membership in the Society of Radiographers. The text is thus designed around the requirements for these examinations, but it should, nevertheless, be of value to the many workers who want a ready reference or who wish to review the status of medical physics.

The text is a well-written basic review of the field. Mathematical treatments of the subject matter are avoided for the most part. A useful feature is the group of examination questions at the end of each chapter.

Two introductory chapters review the fundamentals of nuclear physics, thermionic emission, vacuum tubes, and electronic circuits. The production of x-rays is reviewed in two chapters, which separate the subject into the energy region above and that below 400 kev. Chapters on the naturally occurring radioactive substances and the interaction of radiations then set the stage for subsequent chapters on diagnostic radiography, the chemical and biological effects of ionizing radiations, the therapeutic use of gamma radiations, and the production and medical use of artificial isotopes. The text concludes with a chapter on health hazards and radiological protection.

The volume should be well received by those who wish a nonmathematical introduction to the subject of radiological physics.

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Social Sciences

Pleistocene Man at San Diego. George F. Carter. Johns Hopkins Press, Baltimore, Md., 1957. xvi + 400 pp. Illus. \$8.

The dogmas that "early man" in the Americas dates back 10,000 to 15,000 years and that the American culture is an isolated tradition have been giving ground. The thesis of this provocative book is that man has lived in the San Diego region of California for some 30,000 years and perhaps 80,000 years and that he witnessed the changes in climate and sea-level of the Wisconsin glaciation. Evidence is developed from studies of geologic, geomorphic, and climatic phenomena and from 17 archeologic site areas, which are then placed within the suggested geochronologic framework.

Among the basic concepts considered are the eustatic theory of sea-level changes; stability of the area, particularly during the Upper Pleistocene; a time-sequence of soils and soil profiles; and correlation of the 25-foot subaerial terrace with the last interglacial of the Wisconsin, on the theory that there has been no sea stand higher since that time. The thesis is supported by data from other areas of California, from other parts of North America, and from other countries, and there is a variety of evidence.

The archeologic sequence is developed on the basis of early work of M. J. Rogers, one of the first systematic investigators in the area. Carter has reinterpreted the archeology on the basis of recent field work and of his knowledge of the region and adjacent areas; he has defined an older tradition and has greatly expanded the time scale of the occupation. Many details are presented, but archeologists generally will not be satisfied with the methodology. Detailed site reports and further analysis of the implements are still needed—a situation of which Carter is fully aware. It is regrettable that reports and artifacts from previous work were not accessible, so that details and comparative data on earlier finds could have been presented.

Stone-working techniques, as indicated by the artifacts and tool-manufacturing debris from the older horizons, are considered, and the need for more research is noted. Many archeologists have reserved judgment or have questioned the view that the workmanship is that of man, but the presence of associated hearths, charcoal, fire-broken rock, burned bone, and marine shells supports the view that the presence of the material in the valley fill and elsewhere is more than fortuitous.

The book is well illustrated with photographs, maps, charts, diagrams, and