waves are introduced, and this relates to the introduction of new concepts of plasma frequency and fast and slow waves. Nonelementary cases are also considered, e.g., the double-beam tube, space-charge waves with transverse motion, etc. In the next section the Llewellyn diode equations, which are of particular interest for investigations in the cathode and beam-forming region, are dealt with. In Chapter 6 Pierce's method of traveling waves is treated. In a very short section, backward-wave interactions are taken up, and the start-oscillation condition of backward-wave oscillators is also considered. Up to Chapter 8, in most cases, electron motion in only one direction is considered. Here this assumption is dropped and electron motion in two-dimensional systems is discussed. In Chapter 9, on coupled-mode analysis, the approach to a more precise description of beam problems is driven further by considering the kinetic-energy flow and its change both in the energy content of the traveling electromagnetic wave and in the energy of the beam. In the last chapter, crossed-field interactions are considered. If one doubted that the model method, instead of the boundary-problem approach, gave a good picture of the topics, one would be cured by considering crossed-field interactions. Here one has to make approximations and simplifications to obtain an insight into the problems involved. The picture drawn by the authors is a clear and very good one. Two appendices, on hydrodynamic flow and on induced currents, as well as an index of subjects, are included. References to papers are given in the text.

This book is an excellent treatise on the fundamentals of microwave electronics. One easily follows the path the authors are tracing. The mathematical and physical background required to understand the content of the chapters can be assumed to be that required for a first-year graduate course. The book can be highly recommended to students interested in microwave-tube problems, but one must consider the fact that noise problems are not dealt with. People working in the field will also find it very helpful because of the clear coverage. An expert in the field will also appreciate the book, even if he gains only some ideas on how to describe these phenomena to other people. We have to thank the authors for a book which will certainly very soon find wide use by people working in the field of microwave tubes.

Nuclei and Radioactivity. By Gregory R. Choppin. 150 pp. Benjamin, New York, 1964. Cloth $4.95, paper $1.95.

Reviewed by Norman Feather, University of Edinburgh.

In 1903, a young chemist wrote (or helped to write) "The law of radioactive change . . . is also the law of monomolecular chemical reaction. Radioactive change, therefore, must be of such a kind as to involve one system only . . . the changing system must be the chemical atom. . . ." It is perhaps a pity that in 1964 the author of a volume on *Nuclei and Radioactivity* in a General Chemistry Monograph Series (a series which already includes a volume entitled *How Chemical Reactions Occur*) should have disregarded this historical lead into his subject, and that all the space that he has been able to devote to the classical experiments of the pioneers is encompassed by the half-sentence "Rutherford and Soddy were the first to suggest that radioactivity was due to spontaneous transformations of one element into another. . . ." (page 17).

However, let us forget the past and concentrate attention on the present ("Emphasis . . . is on those areas of experimental and theoretical research of most concern to nuclear chemists today"—author's preface). I would suggest that this term "nuclear chemist," which recurs throughout the book, itself breeds confusion rather than enlightenment. We cannot easily escape from "nuclear reaction" (though why not "transformation" or "transmutation"?), but what reply are we to give to the chemistry student who inquires what is the order of the reaction? Dr. Choppin shows no sign of anxiety lest such a question should be asked. Instead, his glossary adds to the confusion: "Threshold energy: The minimum energy thermodynamically necessary for a reaction to occur." The chemistry student, puzzled to interpret the precise meaning of the adverb in this definition, is unlikely to find much help, even in *Elementary Chemical Thermodynamics*, a companion volume in the series.

It is admittedly difficult to write for the beginning student in a first-year university course in a way which satisfies the pundits. But Dr. Choppin cannot, I would imagine, satisfy the first-year student for long by confusing force with energy. This he does, consistently. From page 13 ["the total attractive force (binding energy)"] to page 68 ("when 5 to 6 MeV extra energy is added to the disruptive coulomb force"), whenever he discusses the stability of nuclei, he mixes these concepts with utter abandon. It will not do—not even for the beginning student of chemistry.

This is a short book which may serve some sort of purpose in widening the scientific horizon of the undergraduate freshman. He may well learn a lot from it (if his instinct for truth is sufficiently good for him to neglect what is misleading or plainly wrong), but it will do little, I fear, to further his education in the basic principles of his science.

The Structure and Properties of Biomolecules and Biological Systems. J. Duchesne, ed. 754 pp. Interscience, New York, 1964. $27.50.

Reviewed by Joseph G. Hoffman, State University of New York at Buffalo.

The 18 papers by 27 contributors are reviews of biomolecular topics, constituting volume seven of the series: "Advances in Chemical Physics". Part I is devoted to four theoretical papers, and Part II is experimental material in four sections as follows: Influence of Physical Agents on Proteins and Nucleic Acid, Electrical and Magnetic Properties of Organic Molecular Solids, Proteins and Nucleic Acids, Applications of Spectroscopic Methods, and Physico-chemical Mechanisms in Biological Systems.

This special volume has a noteworthy introduction of fewer than four pages by A. Szent-Gyorgyi. He points out that "molecular biology is still harvesting the most wonderful suc-

cesses, such as 'breaking the code' of DNA but . . . the basic phenomena of life . . . we still do not understand." Further on, talking about biology he says: " . . . we have hardly scratched the surface of its central problems. . . ."

The very first paper, on electronic structures by J. I. Fernandez-Alonso, is a remarkable summary of methods for computing molecular energy levels and properties. As far as I know it is the only concise description of the various initialled methods such as SCF, MO, LCAO, HLSP, and VB. The 80 pages provide a cursory review of the difficulties attending the approximations of quantum theory in molecular orbitals (MO's). On page 23 it is stated that a diagram of procedure in MO theory is presented "to make it more readily understood by chemists and biologists." A wide variety of biomolecules is described and discussed competently.

The editors have made a broadly representative selection of experimental methods applied to getting information about living systems. These include, for example, electron spin resonance in plants, paramagnetic species in seeds, photo-protection from ultraviolet, nuclear magnetic resonance in specific molecular reactions, infrared spectra of nucleic acids, and thermal effects on proteins, etc.

The format includes heavy paper, large print, good mathematical notation, numerous tables and figures, subject and name indices, and a table of contents. It is a highly commendable, durable, and timely book for students in basic life sciences.

Group Theoretical Concepts and Methods in Elementary Particle Physics. Summer School Lectures (Istanbul, July-Aug. 1962) Feza Gürsey, ed. 425 pp. Gordon & Breach, New York, 1964. Regular edition $19.50; professional edition $12.50.
Reviewed by John G. Taylor, Rutgers University.

Group theory plays a basic role in elementary-particle physics, and there have been important advances very recently, based on certain symmetries which the strongly interacting particles are found to possess. The book under review is a collection of lectures on the various aspects of group theory which are concerned with these and other symmetries of the elementary particles.

Let me first describe the area covered by the lectures. They may be roughly separated into two classes: the first class discussed certain mathematical problems in group theory of physical interest, and the second class discussed more directly physical problems using standard group-theoretic tools. The first class of lectures consisted of a discussion of the Hopf method for the global consideration of compact Lie groups (both classification and representation theory) and some applications (D. Speiser); the local classification and representation of Lie groups (G. Racah); a survey of the inhomogeneous Lorentz group and its unitary representations, including space and time reversal (E. Wigner); group invariance in quantum mechanics and the group extension problem (L. Michel); contraction of Lie groups and their representations (E. Inönu). The second class consisted of derivation of the *PCT* theorem and the relation between spin and statistics (N. Burgoyne); topics in high energy scattering theory (O. Greenberg); the unitary symmetry model, and generalized gauge invariance (S. Glashow); chiral symmetries in strong and weak interactions (Y. Nambu); broken symmetries (A. Salam); introduction to the de Sitter group (F. Gürsey); axiomatization of parastatistics (dell'Antonio, Greenberg, Sudarshan); and a review of the renormalization group (E. Caianello).

The articles vary greatly in length. Taken as a whole they will be of great value to the graduate or other nonexpert student wishing to gain familiarity with the way groups are being used in elementary-particle physics. Most of the articles are readable and have good bibliographies. Further, they cover a broad range. The reviewer thought two of the articles to be too condensed to be really helpful, but eleven out of thirteen is a good percentage. The book contains few minor errors and is very clearly printed. Evidently great care has been taken in publishing. This care may be the reason for the long delay (over two years) between the summer school and the appearance of the book. This delay means that most of the physical lectures of class two have lost some of their topicality or are out of date. Indeed the later successes of SU_3 and SU_6 should have meant much more emphasis on these groups than allowed in a single lecture by Glashow. Even so, the book should be a very valuable introduction to students trying to learn something about groups and elementary particles.

Direct Use of the Sun's Energy. By Farington Daniels. 374 pp. Yale University Press, New Haven, Conn., 1964. Cloth $7.50, paper $2.45.
Reviewed by Robert L. Weber, The Pennsylvania State University.

In this attractively styled book (in sunbeam-yellow binding), Professor Daniels alerts his readers to the rapid depletion of the earth's conventional sources of energy and to the promise that direct use of sunlight holds in supplying the energy of primary importance to man's continued survival on earth.

This felicitous account is popular science at its best. The unsolved problem concerns us all. The account of efforts to solve the problem can be skimmed by a reader chiefly attracted by the historical sketches, illustrations, anecdotes, and foreign ventures. But for the reader who wants to know the cost of solar heat compared with oil heat for a home in Princeton, engineering data are there. And for the serious student who may want to embark on his own research, many tables summarize findings to date, and there is a good bibliography of work in a field in which surprisingly little was published before 1940.

Professor Daniels' humanitarian interest in securing improved water, food, and energy supplies for peoples in areas with very limited resources is apparent throughout this book. So also is the scientist's disciplined imagination and an engineer's willingness to plan beneficial projects feasible with use of local materials.

Solar heating and the distillation of water receive major attention. But there is also discussion of selective radiation surfaces; refrigeration; heat engines; and thermoelectric, thermionic, photovoltaic, and photochemical