Since the end of the war a number of books published abroad have been sent to the Science office for review. The following reviews cover some of the most recent of these. Future issues will contain reviews of others as they are received.

Synthetische Methoden der organischen Chemie. W. Theilheimer. Basel-New York: S. Karger, 1946. Pp. viii + 224. Fr. s. 25.

This is a unique reference book in synthetic organic chemistry. It does not contain detailed directions for selected preparations as does *Organic syntheses*, nor does it present exhaustive discussions of single reactions after the manner of *Organic reactions*. Instead, the author endeavors to supply information to the chemist who wishes to achieve a certain result. The basic idea is that few really new reactions have been developed in the past 10 years, but much has been done in the way of improving old ones. There is no quick way of gathering from the literature the hopelessly scattered bits of information relating to classical, as well as little-known, procedures, and the author has done much to supply this deficiency. The present volume is the first of a series and covers the years 1942–44.

The arrangement is new and frankly experimental. Reactions are grouped according to the bond formed. In the symbolism used, the new bond is first indicated; this is followed by a device to show the nature of the reaction, such as addition, rearrangement, substitution, or elimination; anP last is the element involved in the reaction. Thus, CH↑↓O means the formation of a CH bond by replacement of oxygen as in the Clemmensen reduction or hydrogenolysis of an alcohol. Elements follow the Beilstein sequence except that carbon comes last, and the rule of last possible placement is followed. The system appears confusing at first, but with a little use its reasonableness is evident. An edition for American students would be more useful if there were an insert containing an English guide to the system, with a few examples.

There is a generous alphabetical index which lists named reactions as well as types of compounds, whether they appear as starting materials or as end-products. Most reactions can be located through the index without use of the system.

The choice of references is satisfactorily broad in spite of wartime difficulties. Fifty, chosen at random, showed the following distribution: German, 21; American, 13; British, 8; Swiss, 6; others, 2. References to Russian literature are rare.

The book will be helpful to the advanced practitioner, as well as to the beginner who is completely lost when faced with the problem of finding how to carry out a strange reaction. It will be a fertile source of ideas, for the unique arrangement brings reactions together according to the end achieved; consequently, in looking up a procedure the reader will often be surprised to find many new ways to accomplish the same result. As a rule, original papers must be consulted, but most of these are in readily available journals.

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Actions of radiations on living cells. D. E. Lea. Cambridge, Engl.: at the Univ. Press; New York: Macmillan, 1946. Pp. xii + 402. (Illustrated.) $4.50

This book deals with a field which is now the center of wide interest from many sides and the object of much work, and which is particularly appealing in that it has appeared to many as a principal pathway for investigating the basic phenomena of life. The book responds to a clear need and should be generally used for study and reference in the field of radiation biology.

The work is aptly described by the author's own words, which appear in the preface: "This book gives an account of certain of the simplest and most fundamental actions of x rays and other ionizing radiations on living cells. It does not survey the whole field but deals chiefly with the mechanism of those actions of radiation which are well enough understood at present to allow a detailed discussion. The relevant physical properties and chemical effects of ionizing radiations are first described, and then the bulk of the book is occupied by the effects of radiations on viruses and on the genes and chromosomes of higher cells. In the concluding chapter the killing of cells by radiation is discussed. Extensive numerical data concerning the dissipation of energy in tissue by various radiations are given. The book is of importance for medical, genetical and biological investigators and for physicists interested in biology."

The reviewer is very sympathetic toward this program and especially appreciates the stress laid on those radiobiological effects which, in a physicist's language, may be termed "elementary." Carrying out this program was an important and laborious task which has been capably and successfully discharged. Quantitative data and literature references are plentiful and well organized. Much space is devoted to a deep and detailed theoretical analysis of the experimental material, including important contributions by the author, some of which are first published here. Therefore, the reading may require considerable effort, but not an unduly great one, as the exposition is remarkably clear.

The reader still unfamiliar with radiobiology should bear in mind that different authors have frequently held widely different opinions on the significance of whatever evidence was available in this field. Even though such divergencies have become less acute in recent years, the book represents Dr. Lea's personal evaluation of the evidence. Accordingly, it is natural that a number of items in the book may not be acceptable to other workers in the field. Thus, for example, this reviewer is not satisfied with the analysis of the recessive lethals in *Drosophila* (pp. 157 ff.). (This matter will be discussed more fully in a future issue of *Science.*)

The author has wisely intended to keep mathematical detail in the background of his theoretical analysis. However, he might well have gone further in this direction by eliminating the quantitative treatment entirely whenever the experimental evidence warrants only broad qualitative statements. This applies, for example, to the analysis of the dominant lethals in *Drosophila* (pp. 164 ff.), in which a specific working model is treated mathematically in great detail; later remarks show awareness of the difficulties met in applying the model, but the over-all impression conveyed to the reader does not seem quite fair. A similar comment may apply to the recurring unusual practice of presenting numerical data with several

significant figures where errors of the order of 10 per cent or more are expected; the insertion of occasional cautioning statements or the possible convenience for numerical work do not seem adequate justifications.

The book contributes to pure as well as to applied physics through very extensive and laborious new calculations on the distribution of radiation energy throughout matter. The author's emphasis on recognizing and analyzing the role played by secondary electrons in this process represents an important advance. As stated in the appendix, the calculations are based on somewhat tentative theoretical assumptions; the eventual influence of these assumptions should be estimated when utilizing the numerical results. The author emphasizes that the energy of photo- and recoil-electrons released by x rays of 10–100 KeV is far from proportional to the x-ray voltage; however, what is important for application is the apportionment of the total x-ray energy among electrons of different energies rather than the apportionment of all the electrons among different energy ranges. The latter is represented by the "mean energy" given in Table 3 of the book. The former is represented by a "weighted mean energy" calculated by giving each electron a "weight" proportional to its energy and is much more closely related to the x-ray voltage.

This book is timely, useful, and important and is recommended for widest circulation; judgment should be exercised, however, in utilizing its content.

The book was completed in the middle of 1944 and became available in England early in 1946. Commercial arrangements prevented its distribution in America until a year later. While the former delay may be charged to war conditions, the latter is highly regrettable.

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Fisica nucleare: dalla pila di Volta alla pila atomica. Plinius Campi and Aldo Rusconi. Milan: Ulrico Hoepli, 1946. Pp. viii + 215. (Illustrated.) Lire 400.

This book covers more ground than the title suggests, since it represents a general survey of the advances of atomic physics from the advent of relativity and the quantum theory to the utilization of nuclear energy.

Chapter 1 includes a condensed account of the structure of matter, ions and electrons, Bohr's atomic model, isotopes, radioactivity, and Planck's quantum hypothesis. Chapter 2, bearing the title "Space, Time, and Causality," gives an elementary account of restricted relativity and of the failure of the principle of causality in quantum physics as expressed by Heisenberg's uncertainty relations. The authors take the occasion for setting forth certain views of their own on the structure of the geometrical continuum. In the reviewer's opinion, whatever the value of such theories may be, discussion of them should be reserved for papers of a technical character and is rather out of place in a book of this type. Chapter 3 is a discussion of the wave properties of material particles as expressed by Schrödinger's equation. Chapter 4 includes an account of radioactivity, artificial disintegration of nuclei, neutrons, and the conditions which determine nuclear stability. Chapter 5 discusses the fission of heavy elements and the utilization of nuclear energy.

The book does not require from the reader more than a general knowledge of elementary physics and mathematics, and the difficult task of popularizing such a vast amount of material is, for the most part, well done. Perhaps the account of the principles of restricted relativity and of quantum mechanics contains some obscurities that might have been avoided. Inaccuracies are few and unimportant.

This book will be particularly useful to readers of a scientific mind, such as chemists, engineers, biologists, etc., who, not being physicists, are not familiar with the more technical accounts of atomic physics and look for an elementary but accurate résumé of the subject.

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Relaxation methods in theoretical physics. R. V. Southwell. Oxford, Engl.: Clarendon Press, 1946. Pp. vi + 248. (Illustrated.)

This volume, a continuation of the author's earlier monograph on *Relaxation methods in engineering science* (1940), constitutes an extremely important contribution to the literature of applied physics. It shows that almost any boundary-value problem in two dimensions for which one can write down the partial differential equations, and the solution of which one desires badly enough, can be solved by a sort of brute-force, cut-and-try numerical method of attack. It should go far toward dispelling the common idea that there is nothing that can be done about a two-dimensional problem for which an analytical solution has not or cannot be found, except perhaps to look for a physical analogue which is capable of experimental evaluation.

Southwell, in this volume, shows solutions of problems in torsion of solid and hollow cylindrical shafts, magnetic fields in regions containing iron, conformal transformation, capacity of cables, torsion of shafts of circular section but nonuniform diameter, torsion of tores, temperature distribution, shear stress trajectories, oil pressure and temperature distribution in bearings, flow of gas through convergent-divergent nozzles, plastic torsion, percolation, and shapes of free liquid jets.

The versatility of his methods is perhaps best illustrated by these last examples, in which the hydrodynamic equations are solved for free jets whose very shape is unknown at the start, and by H. W. Emmons' successful application (*N. A. C. A. Tech. Notes*, 1944, No. 932; 1946, No. 1003) of these methods to compressible-fluid-flow problems involving shock waves whose positions are initially unknown.

The relaxation procedure starts by replacing the two-dimensional continuum by a 'net' of points and the partial differential equation by a difference equation relating the function value at a given net point to its values at neighboring points. The finer the net, the closer is the approach of the solution of this difference problem on the net to that of the differential problem in the continuum. A trial-function value is estimated at each net point, and in terms of this trial function a 'residual' is computed, this being the amount by which the difference equation fails to be satisfied at each point. The residuals are then 'relaxed' to zero, or worked out to the boundary where they disappear, by successive and repeated changes in the function values at the various points,