Book Reviews

Semiconductors. Their Theory and Practice. G. Goudet and C. Meuleau. Translated by G. King from *Théorie et Pratique des Semiconducteurs* (Editions Eyrolles, Paris). MacDonald & Evans, London, 1957 (order from Essential Books, Fair Lawn, N.J.). xviii + 316 pp. $18.90.

The authors deal with the subject of semiconductors, from basic quantum mechanics through device technology, in one of the first attempts to do this since Shockley's book, *Electrons and Holes in Semiconductors* (Van Nostrand, 1950). Because of the many recent developments in the field of semiconductor technology, this is a welcome addition to the field.

The book is divided into three parts: "General Fundamental Theories"; "The Technology of Semiconductors"; and "The Principal Applications of Semiconductors, Thermistors, and Varistors." The first part gives a concise but clear development of the elements of quantum mechanics, applying the analogy of geometrical and physical optics to classical and quantum mechanics. The band theory of solids is treated in both one and two dimensions, and the Fermi-Dirac statistics are derived as well as discussed. Part 1 concludes with a section on electric current in solids, which includes transition probabilities, conductivity, and the Hall coefficient. All of this occupies only 126 pages but, despite its brevity, the book should provide a useful introduction to the theory of solids, particularly for engineers.

In part 2 the general properties of crystals are discussed. The intermetallic compounds are reviewed, as well as germanium and silicon. A chapter is devoted to the techniques of preparing high-purity crystals, including zone refining and pulling techniques. Another chapter describes measurements used in production and research. Part 2 occupies only 60 pages, but the brief descriptions are clear and, with some 184 references, should be quite useful to both engineers and physicists.

Part 3 discusses semiconductor devices in four chapters, on thermistors and varistors, diodes and rectifiers, crystal triodes and tetrodes, and other devices (photoconductive cells, radioactive batteries, magnetometers, and so on). The basic transistor equations are derived, and equivalent circuits are given. While all of this is done in the short space of 116 pages, the treatments are quite adequate, and a bibliography of 137 papers serves to round out the work.

The authors are to be congratulated; the book provides an excellent introduction to semiconductor physics and technology and should be of use to engineers and physicists, both as an introductory text and as a reference work.

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Excited States in Chemistry and Biology. C. Reid. Academic Press, New York; Butterworths, London, 1957. ix + 215 pp. Illus. $7.50.

"As any area of inquiry develops into exact science it passes through a succession of stages which may be roughly designated Macroscopic, Microscopic, Molecular and Submolecular." This has been fully recognized by chemists who want to have a deeper insight into the mechanism and nature of chemical reactions. Biology is just on the verge of this new development, and the intention of the author is to give a helping hand to both chemists and biologists by outlining "some of the more important physical concepts concerning molecular excitation and interaction." This he does very successfully within a small booklet, which does not overwhelm the reader by its volume and technicality.

Essentially, the book consists of three parts: an outline of quantum mechanics, the discussion of selected biological problems, and an appendix in which the author discusses a few problems of quantum mechanics in more detail.

The first 50 pages are devoted to the mathematical foundations of quantum mechanics, and remain intelligible all the way through, to the well-informed general reader. Then follows the discussion of spectra, excitation mechanisms, and the triplet state, to which latter the author evidently attributes first-rate importance for the understanding of chemical and biological processes. After treating the various mechanisms of inter- and intramolecular energy exchange, the author discusses biological luminescence, vision, and the biological effects of high-energy radiation from the point of view of quantum mechanics. Being a biologist, I cannot help being impressed by the vastness of the field covered and the extent of the underlying information. The physics presented must be of at least equal quality, the author being a physicist and not a biologist.

The appendix deals with the Hamiltonian group theory, the theory of time-dependent perturbations, long-range energy transfer, and transition probabilities. The treatment of group theory is especially welcome, this theory being rather useful in its application and difficult to find in so short and clear a presentation. It is a sound plan to have these subjects covered in an appendix instead of having them break the continuity and reduce the palatability of the main chapters.

The treatment is clear, the outlay simple and transparent. If there is anything to regret, it is that the author did not dwell longer on certain topics and, for instance, give more of a qualitative and symbolistic interpretation of his quantum mechanics. A more detailed treatment of various kinds of spectra might have been useful. The reader should not allow himself to be discouraged by minor shortcomings, such as the sudden appearance of a mathematical symbol which is not explained and which finds no application later or the occasional reference to a wrong equation. Few books are exempt from such minor shortcomings; they detract but little from the value of the service the author has rendered to biologists and chemists by writing this book, lending them a helping hand in their attempt to apply quantum mechanics to their problems.

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Mathematics for Everyman. From Simple Numbers to the Calculus. Egmont Colerus. Translated by B. C. and H. F. Brookes. Emerson, New York, 1957. xi + 255 pp. Illus. $3.95.

This book, subtitled "From Simple Numbers to the Calculus," is a popular introduction to mathematics in which the translators have succeeded in conveying "the spirit and enthusiasm of the original German." It covers, in a more or less descriptive way, elementary algebra, trigonometry, coordinate geometry, and calculus. This is done largely with heuristic arguments rather than exact proofs; for example, "We will not dally at this

point but present the necessary formula without further ado." Similarly, the definitions are not always very precise, as the author recognizes: "It is not our intention to confuse the reader with a series of definitions. That would be the usual textbook approach."

The result is a book that is very easy to read, but unfortunately this ease is partly obtained by glossing over the subtle and difficult points, especially in the calculus. The author realizes this to some degree, for he writes (page 175), "The expert in pure mathematics will probably hold up his hands in horror at our exposition. We believe however that it is better to have a rough idea than no idea at all. In any case our method was good enough to satisfy the mathematicians of the seventeenth century and any enthusiastic reader who wishes can pursue the subject further in a more comprehensive book of higher mathematics." How true! But the mathematician, whether he is in pure or applied mathematics, may be excused for balking at the antiquated treatment of the calculus or at such statements as (page 57): "Zero is not in itself a number though it is often treated as if it were; it separates the positive from the negative numbers."

It is a pity that the mathematics is not more accurate and up to date because there can be no question of the author's skill at exposition. His writing is lucid and entertaining, and it seems certain that many people in no position to recognize the inadequacies will find in the book just the thing they had been looking for in mathematics—an easy style, a constant encouragement to continue, and an absence of problems or exercises.

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Essays in Linguistics. Viking Fund Publications in Anthropology, No. 24. Joseph Greenberg. Wenner-Gren Foundation for Anthropological Research, New York, 1957 (order from University of Chicago Press). 108 pp. $3.

This collection of essays will further the increasing awareness of the significance of so fundamental a trait as language to any general science of human behavior.

The first two essays, on "Language as a Sign System" (pages 1–17) and "The Definition of Linguistic Units" (pages 18–34), are the most immediately relevant to general linguistic methodology. Of particular interest is the discussion of the nature of the grammatical analysis of natural languages and of how, given samples of expressions in the system, the linguist attempts to produce an infinite number of additional expressions which belong to the same system. By definition, an infinite number of expressions cannot be listed and, consequently, can only be generated by some set of rules. Current research in syntactic analysis is aimed at clarifying the techniques for deriving such rules and for identifying the units to which the rules apply. In this connection, most linguists will not agree with Greenberg's segmentation of forms like *man* into /m-n/ and /-æ-/ for the singular; rather they would prefer the analysis to reveal the similarity of the singulars *man* and *pan*; Greenberg's suggestion projects onto the singular forms the differences which are apparent in the corresponding plurals, *men* and *pans*. And, indeed, this is Greenberg's purpose: to make explicit the premises on which linguistic analysis is based and to develop the consequences of a rigorous adherence to those premises.

The essays on "Genetic Relationship among Languages" (pages 35–45) and "The Problem of Linguistic Subgroupings" (pages 46–55) contribute to a clarification of the assumptions of historical and comparative linguistics. It has sometimes been maintained that the comparative method involves a fundamental circularity—namely, that one cannot establish phonetic laws without cognates but that one cannot establish cognates without phonetic laws. Greenberg indicates four causes of sound-meaning similarities which may be observed between languages. Of these, two are nonhistorical—chance and symbolism, the latter being Greenberg's cover term for the occasional nonarbitrary connection between sound and meaning as exemplified by onomatopoetic forms and by some nursery words like those for "mother" and "father." "The remaining two—genetic relationship and borrowing—involve historic processes. The two basic methodologic processes then become the elimination of chance and symbolism leading to hypotheses of historic connections and the segregation of those instances in which borrowing is an adequate explanation from those on which genetic relationship must be posited" (page 37). Essentially, the circularity disappears with the establishment of other-than-chance resemblances.

The remaining four essays include a number of original and fruitful notions on such topics as language and evolutionary theory, genetic and nongenetic classifications, function, efficiency and redundancy in language, linguistic universals, and so forth.

The essays in this volume are independent of one another and are in no way intended as a systematic over-all treatment of linguistics. Nevertheless they seem to share two features: a desire to explore the relationship between linguistics and other disciplines—particularly logic, mathematics, anthropology, and psychology—and, in the process, to apply some of the more rigorous techniques developed in these areas to the scientific study of language. The result is a stimulating book, revealing a variety of approaches for the analysis of linguistic phenomena.

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Meat Hygiene. WHO Monograph Series No. 33. World Health Organization, Geneva, 1957 (order from Columbia University Press, New York). 511 pp. Illus. $10.

In this book on meat hygiene, the World Health Organization has compiled papers prepared by 16 of the world's foremost authorities on the subject. The book is interesting, instructive, and beautifully illustrated.

Three of the papers are scientific treatises: those by C. E. Dolman, of the University of British Columbia, on meat-borne diseases; by H. Drieux (Ecole Nationale Veterinaire, Alfort, France), on tuberculosis; and by G. Schmid (University of Berne, Switzerland), on parasites.

The highly authenticated and well-documented papers of Dolman and Drieux highlight the monograph. In his "Epidemiology of Meat-Borne Diseases," Dolman organizes the material in a way that permits a full, convincing and logical presentation. He brings together the many ramifications of the subject of meat-borne diseases in a way that enables the reader to understand the relationship between the many probabilities that tend to confuse the student and even the meat-hygiene practitioner.

Drieux's paper on tuberculosis is a masterpiece. What is remarkable about his paper is that he has taken a subject that many would regard as having been pretty well exhausted by an array of authors and has given it fresh treatment from the meat hygienist's point of view. His paper serves two purposes—the first, of course, to inform the reader fully on the subject matter and the second—which seems to me to be more important—to inform meat hygienists that the science of disease evaluation in terms of fitness for food of an animal carcass is a fascinating and exacting one.

M. M. Kaplan (World Health Organization, Geneva) has a paper on meat-hygiene problems in tropical areas. His account of what might be described as primitive conditions as he sees them from the point of view of a public health official shows how the official's problem is complicated by merging of hygienic, eco-