developed and then considered in the light of the available experimental evidence which supports or contradicts the theory. Terms, which are all too often loosely used, are here rigorously defined. Absolute statements are generally avoided. The entire volume is detailed and documented with over 1000 references. It is recommended as a valuable book which may well become a classic in the field of pharmacology.

LLOYD J. ROTH
Department of Pharmacology, University of Chicago

Physics

Introduction to Advanced Field Theory. G. Barton. Interscience (Wiley), New York, 1963. x + 163 pp. Illus. $6.50.

There are several approaches to a relativistic quantum theory of elementary particles. When the covariant perturbation method of the Lagrangian field theory met with difficulties, notably in strong (nuclear) interactions, attempts were made, beginning about 10 years ago, to study the essence of field theory independent of a perturbation approach, or even independent of a Lagrangian. This book is an introduction to what has been achieved along that line of inquiry. The fundamental concept is still that of a *field* through which the interactions of fundamental particles are expressed, contrasted to, for example, the pure S matrix approach, which uses directly observable particle properties, momenta, spin projections, and the like to define an S matrix. The very indirect and unobservable nature of a *field* becomes clear in the first two brief chapters when Barton, starting from the particle properties ("Everyone knows that in no experiment is a field ever observed directly"), introduces free fields by definition, and, later on, using an asymptotic condition, defines the so-called interpolating fields in describing the interactions of particles. The interpolating fields go over in the limit, when the particles are widely separated from each other, to the free fields. Despite the fact that the field concept is definitely a mathematical abstraction, carried over from classical physics, we do not understand the quantum theory of fields well enough to see its limitations. In this sense one would like to see what can and what cannot be done by starting with some general and reasonable postulates about the fields. Unfortunately, it is outside the scope of this little book to connect these general principles with the actual physics of fundamental particles; not even some very general results such as the CPT-theorem and the connection between spin and statistics could be included. On the other hand, the book provides a very clear and readable introduction to these general aspects of quantum field theory. An index and a more detailed bibliography would have been useful.

The connection to the conventional field theory is discussed in chapters 3, 4, 5, and 6 (Green's functions and inhomogeneous wave equation) and in chapters 7 and 8. These chapters are followed by a discussion of the general properties of the simplest diagrams, the so-called two- and three-point functions, and by a lengthy discussion of the Lee model. This is a simple soluble, perhaps not too realistic model, on which however some of the properties of field theories can be studied explicitely. The next chapter deals with special problems created by the systems with an infinite number of degrees of freedom. Finally, in the last chapter, Wightman functions and Haag's theorem are briefly discussed. Here one comes to the limitations, or better to a decision, about some of the seemingly reasonable assumptions about the fields. For the assumption of canonical equal time commutation relations and the absence of inequivalent representations of these rules lead to the unphysical result that only free fields can exist. No final solution to this dilemma is presented.

A. O. BARUT
Department of Physics, University of Colorado

Psychology

Motivation: Theory and Research. C. N. Cofer and M. H. Appley, Wiley, New York, 1964, xii + 958 pp. Illus. $12.50.

Thirty-five years ago, while I was enrolled in a course entitled Motivation, a professor-friend of my instructor seriously asked me if there was enough factual material on motivation to justify the title or, for that matter, the course. The answer given was a hesitant, "I suppose so." Today the answer would be a quick affirmative followed by a suggestion that the enquirer have a look at Cofer and Appley's *Motivation: Theory and Research.* Although the authors of this volume modestly say that ". . . a comprehensive, definitive psychology of motivation does not yet exist," they actually have a production that has little in common with the texts and research materials of yesteryear. A notion of the enormity of the changes in this field may be gained from the book's 96 pages of bibliography, a spot check of which indicates that 70 percent of the entries are research reports. Furthermore, in this new book one does not find enumerated for memorization such past fantasies as Overstreet's six ways of capturing attention, McDougall's ten principal instincts, Dunlap's nine fundamental desires, Allport's six prepotent reflexes, Tolman's eight appetites, and other similar circularities. Instead, in eight chapters are presented extensive experimental findings arranged under such headings as bodily conditions, activity, emotion, stress, and reinforcement. Five chapters summerize numerous case records and naturalistic observations under rubrics like instinct, self-actualization, and psychoanalysis. The other three chapters are introductory, historical, and summary.

The organization of the book is really achieved in connection with three current views or theories of causes of, and factors that control, behavior—namely, instinct, homeostasis, and hedonism. A portion is concerned with ethologists' work directed toward discovering energy releasers for fixed behavior called instinct. Next comes the major part of the work, which bears on the notion that living organisms, especially mammals, possess a disposition to achieve and maintain a balanced or homeostatic equilibrium. The remaining material is that which is traditionally regarded as affective or hedonistic. The authors view the homeostatic or equilibratory concept as having widespread utility for motivation, but their own preference for a motivational theory is a variant that they call sensitization- and anticipation-invigoration mechanisms. Thus, invigoration is the key, and it occurs when bodily states or conditions deviate from previous ones. In such states, an organism

is motivated—it reacts to, and is presumedly aroused by, stimuli to which it is less likely to react if the state in question is not present. A simple example of motivated behavior would be the sexual response of the male rat to the female under appropriate hormonal condition.

I think the nonpsychologists will find 13 of the 16 chapters readily understandable and that omitting the introductory, the psychoanalytic, and the last chapters will save him from bewilderment.

JOHN B. WOLFE
Department of Psychology, University of Mississippi

Functional Analysis

Topological Methods in the Theory of Nonlinear Integral Equations. M. A. Krasnosel'skii. Translated from the Russian edition (Moscow, 1956) by A. H. Armstrong. J. Burlak, Ed. Pergamon, London; Macmillan, New York, 1964. xii + 395 pp. Illus. $10.

The purpose of this book, which is a translation of the Russian edition published in 1956, is to indicate that many problems encountered in the theory of nonlinear integral equations may be solved by a systematic application of the concept of rotation of a vector field in a Banach space. The material is presented at a rather advanced level and will be accessible to research scientists or graduate students with some previous knowledge of linear operators and the theory of simplicial approximation. Because the volume contains such a wealth of information, I simply list some of the topics covered in each of the six chapters to indicate its scope.

In chapter 1 the author introduces the integral power series of Lyapunov and the operators of Uryson and Hammerstein, which are used as illustrations of the subsequent theory, and gives criteria for the continuity and complete continuity of these operators. This chapter also contains material on the splitting of linear operators and criteria for the weak continuity and differentiability of functionals.

In chapter 2, he presents the Brouwer-Hopf theory of degree of a mapping of n-dimensional polyhedron without boundary onto a sphere and deduces as consequences the Hedgehog theorem, the Brouwer fixed point theorem, and the like. The concept and theory of the rotation of a completely continuous vector field is then given. The Leray-Schauder principle as well as some methods of calculating the rotation are also discussed. The author could have devoted a few more pages to the theory of simplexes and thereby made the introduction of the concept of rotation more independent of other sources of information.

Chapter 3 is devoted to existence and uniqueness theorems for solutions of nonlinear operator equations. The notion of resolvent is used to discuss operator equations $x = Ax$, where A is not necessarily completely continuous. Galerkin's procedure for the solution of such equations is also considered.

Chapter 4 is concerned with the problem of eigenvalues, continuity of the spectrum, continuous branches of eigenfunctions, bifurcation points, and the like. Chapter 5 is devoted to eigenfunctions of positive operators and the Krein-Rutman theory of cones in Banach space. It is shown that the methods can be used to study positive nonmonotonic operators. Chapter 6 deals mainly with the same problems as the previous chapters but for potential operators and by variational methods.

In my opinion, this book is a welcome addition to the literature on functional analysis and its applications. The topics chosen are extremely interesting, the presentation is, in general, sufficiently detailed, and the translation is good.

J. K. HALE
Research Institute for Advanced Studies, 7212 Bellona Avenue, Baltimore, Maryland

Zoology

Annelids. R. Phillips Dales. Hutchinson, London; Hillary House, New York, 1963. 200 pp. Illus. $3.

This is a very welcome volume, clear, informative, and up to date. The emphasis tends to fall on the physiological and on the polychaetes, but this slant coincides with the major competence of the author, a lecturer at the University of London, and constitutes a source of strength. The nine chapters are concerned with general annelid organization, feeding and gut structure, the evolution of Polychaetes, the vascular system and respiration, excretion and body fluids, the nervous system and coordination, the sense organs and behavior, reproduction and development, and finally the origin and classification of Oligochaetes and Leeches.

American readers will be interested to know that the old differences between *Arenicola* at Woods Hole and in Europe continue to be reported. Prosser and Brown, in the latest edition of their *Comparative Animal Physiology*, show no "Bohr effect" in the oxygen dissociation curve of arenicola hemoglobin while Dales reports one, though slight. Other items which are sure to stimulate discussion include the apparent discovery that the biological clock of earthworms makes them learn T-mazes faster at night, and that regeneration, metamorphosis, gonad development, and other functions are controlled by neurosecretory cells in the brain.

The book does not attempt to be another Stephenson. Indeed, it is doubtful whether anyone will produce another magnum opus of those proportions. And Dales very sensibly leaves a detailed account of the systematics of the annelids to Grassé. The usefulness of Dales's book, certainly very great as it is, would have been enhanced had he included some reference to more of the standard monographs. G. C. Dixon's *Memoir on Tubifex*, for example, is not mentioned.

The chapter on reproduction and development invites comparison with the simultaneously published review, "Entwicklungsphysiologie der Anneliden" by O. Hess, in the *Fortschritte der Zoologie*. This review, which covers a much narrower field, presents much more detail, far more on fertilization and the earlier stages of ontogeny, and has a biochemical rather than a physiological approach. It is equipped with a more extensive bibliography in terms of the number of papers cited and includes titles, thus increasing its serviceability. Dales's book is similar to the recently published *Physiology of Earthworms*, by M. S. Laverack. Together they constitute a very useful and in many ways a complementary pair. A curious fact is that, although these books are almost identical in size and format and number of pages (200 versus 206), one costs more than twice the other!