
Books

Physical Chemistry of High Polymers. By Maurice L. Huggins. 175 pp. John Wiley & Sons, Inc., New York, 1958. \$6.50. *Reviewed by Stuart A. Rice, Institute for the Study of Metals, University of Chicago.*

The physical chemistry of high polymers has made remarkable progress in the past fifteen years, and Dr. Huggins has been in the forefront in this development. The book being reviewed is, to some extent, a record of those aspects of the field to which the author has contributed most. As is then to be expected, the sections on solution thermodynamics and molecular structure (x-ray) are best. Other topics dealt with are synthesis and configuration of chain molecules, plastic and viscous flow, and elasticity.

It is difficult to decide for whom this book was intended. It certainly cannot serve as a graduate text nor an introductory text for chemists or physicists interested in pursuing the subject since it is too narrow in scope and superficial in treatment. In the opinion of this reviewer it will best serve as a general book for the intelligent layman or scientist in a completely different field desiring a general description without much detail. The reviewer hopes that this book will help to correct an unfortunate oversight by which Dr. Huggins is denied credit due him for his very early suggestion of helical structures in proteins (1943).

Mind and Matter. By Erwin Schrödinger. 104 pp. Cambridge U. Press, New York, 1958. \$2.75. *Reviewed by J. C. Polkinghorne, Trinity College, Cambridge, England.*

The Tarner Lectures at Trinity College, Cambridge, are delivered every three years on "the philosophy of the sciences and the relations or want of relations between the different departments of knowledge". In 1956 the lecturer was Professor Schrödinger and he discussed the strange intellectual world of science, built on the pattern of our sensual perceptions yet ultimately excluding these perceptions from its picture. The first thing that we know about a sodium flame is that it is yellow, yet when we know all about atomic spectra what has happened to this yellowness? The baby has been thrown out with the bath water. The knowledge of the intellect and the knowledge of the senses form a paradox of relation and want of relation.

Though the picture that we form of the world depends on our private perceptions we do agree about what it seems to be like. Schrödinger can only explain

this by supposing that in fact we are not many separate selves but only one Self—a point of view more congenial to the Eastern mind than to the Western. He finds satisfaction that the Upanishads and the experiences of some mystics agree with this. Yet many others, Isaiah for example, have had equally profound experiences of Otherness and there are as many religions of Transcendence as of Immanence. No doubt to explain the unanimity of our experience by supposing a "real world" behind it raises philosophical difficulties but it is surely clear that no simple solution can be found of this problem that has perplexed wise men for centuries. While one sees that Johnson did not logically refute Berkeley by vigorously kicking the table, yet one feels that the advantage was with the Doctor.

Having declared myself to be a naïve plain man I must also confess that I got much pleasure and stimulation from reading these lectures. Schrödinger has many interesting things to say; for example in his opening chapter where he wishes to have consciousness always present in the universe so that its development is never a drama played to empty stalls—and since he apparently finds the idea of God too hard or too easy a solution of this problem—he argues that consciousness is always present where there is learning and adaptation. At times his style is less easy than usual and he seems too anxious to give us the German for it, but there are also many of the felicities of style and exposition that we have come to expect from him.

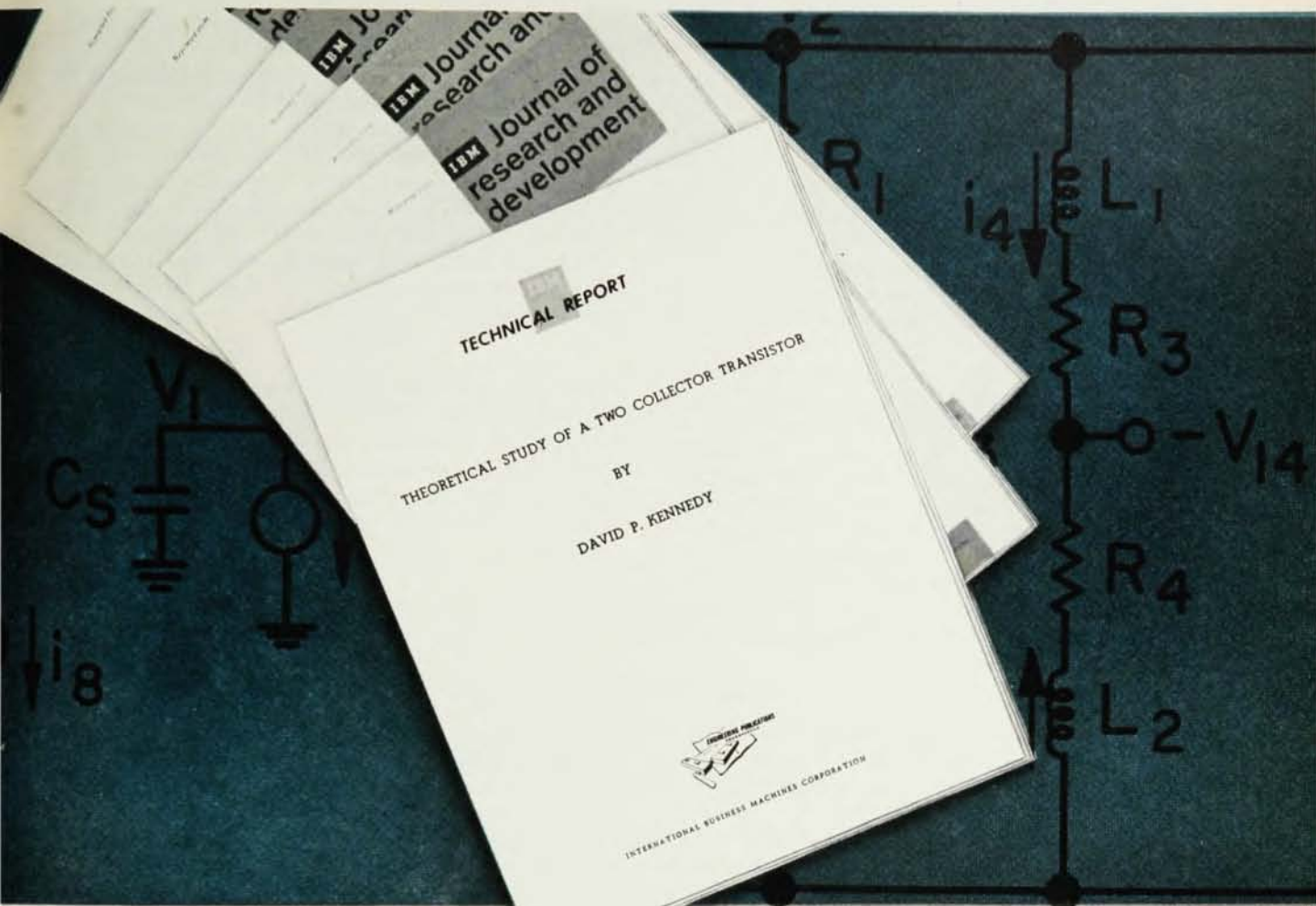
Introductory Physics: An Historical Approach. By Herbert Priestley. 515 pp. Allyn & Bacon, Inc., Boston, Mass., 1958. \$7.50. *Reviewed by Richard T. Weidner, Rutgers University.*

This general elementary textbook is intended primarily for the nonscience student taking a terminal course in physics in which the historical and cultural aspects are emphasized. (Of course, no student specializing in physics need ever study in a formal way any of the nontechnical aspects of physics.)

All of the usual topics are here, arranged in their typical sequence from units and vectors to atomic and nuclear physics. But there is a difference. In introducing each new topic, the author gives a concise, lively, and yet discerning résumé of its historical origins, often with judicious quotations from original research writings and detailed references to available sources for further reading. Certainly no student using this text can evade learning that the development of physics was often tortuous, that theory and experiment are complementary, that physics is open-ended. In addition, the reader is rewarded with fascinating anecdotal tidbits, e.g., lenses are so named because they look like lentil beans, Oersted's report on the effect named for him was probably the last scientific discovery to be written in Latin. Professor Priestley has, moreover, mercifully saved the reader from those profound depths of insight into the historical foundations of physics that are to be

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The treatment of each topic, after the historical background has been explored, is authoritative if not inspired. Considerable attention is given to the mechanics of the solar system, a subject often slighted, and to modern physics. Each chapter is followed by numerous problems, typically thirty, of which about one-third are well-chosen noncomputational questions. The typography is spanking. There is, however, too much material to be "covered" in a two-semester course, so that some choice of topics must be made; and when force, momentum, and energy (not to mention vis viva and historical asides into the disorderly gropings of early mechanics) are all introduced in a single chapter, one wonders whether a student can keep straight all these new ideas.

Purists will insist that *data* is plural. Operationalists will find the statement, "The mass of a body is the quantity of matter in it," devoid of meaning. Some readers will question whether the author's discussion of science and religion or of free will and the Uncertainty Principle is appropriate in an elementary physics textbook; but one cannot help admiring Priestley's forthright, unhedged statement of his position on these matters, or quarrel with his implicit justification for including such noncanonical topics: science does not operate in antiseptic isolation from the affairs of men and the world.

Listening in the Dark: The Acoustic Orientation of Bats and Men. By Donald R. Griffin. 413 pp. Yale U. Press, New Haven, Conn., 1958. \$7.50. *Reviewed by R. Bruce Lindsay, Brown University.*

If anyone still entertains the notion that natural history is the more or less unsystematic study of the large-scale behavior of animals and other living things, reading of this book will surprise and enlighten him greatly. This is the fascinating story of the experimental naturalist using the elaborate resources of present-day physics for the ingenious and decisive solution of a puzzling problem in animal activity, namely the ability of bats to navigate in the dark and indeed to avoid in their flight obstacles of relatively small size.

For the past twenty years the author, with colleagues and students, has been carrying on intensive research to test the suggestion of H. Hartridge (1920) that bats use high-frequency sound in the avoidance of obstacles during flight. The book under review summarizes in masterly fashion the results of these investigations. Thanks to the work of Griffin it is now known conclusively that many bats have the ability to emit ultrasonic radiation up to 150 kilocycles/sec in frequency, and that their ears are also capable of detecting sounds in this range. The navigation of such bats is by the process of echo-location, analogous to sonar as employed in underwater detection.

The author reviews in detail experiments performed

to measure the acoustic output of bats as well as the acuity of their hearing. He describes clearly the tests which have proved beyond the shadow of a doubt that bats use sonar not only in navigation, but also for the pursuit of insect prey. He has used his equipment both in the field and in the laboratory, providing beautiful illustrations of the effective employment of physical apparatus for zoological investigations.

An interesting feature of the work is the author's keen interest in animal orientation in general, including that of man. His book is full of illuminating suggestions bearing on human echo-location and its acuity. This opens up a wide field for further investigation.

The style is clear and graceful and there are many attractive illustrations. The book should have a wide appeal among physicists.

Principles of Noise. By J. J. Freeman. 299 pp. John Wiley & Sons, Inc., New York, 1958. \$9.25. *Reviewed by Joseph G. Hoffman, University of Buffalo.*

The physical origins of noise are only briefly touched upon since this is a text for engineers. For example, the two classic derivations of Nyquist's law for electrical noise are given in terms of the kinetics of electrons in the Drude model, and in terms of modes of oscillation of a transmission line coupling two resistors. These form the fundamentals of the origins of thermal noise for the author's purpose. He has made an excellent compilation of methods of handling noise problems. Four chapters give the engineering mathematics of Fourier analysis, probability theory, stationary random processes, and the Gaussian random process. The other six chapters deal with physical source of noise, equivalent noise generators, noise factor, measurement of a direct voltage, detection of alternating waveforms, and target noise. The format of the substantially mathematical text is attractive and makes for easy reading. The exposition of random processes reflects teaching experience and is highly commendable. There is one appendix: it deals with the current induced by an electron. The table of contents is usually explicit and, along with the adequate index, helps the reader readily find his way among the numerous practical aspects of electrical noise.

Mathematical Theory of Compressible Fluid Flow. By Richard von Mises, completed by Hilda Geiringer, G. S. S. Ludford. 514 pp. Academic Press Inc., New York, 1958. \$15.00. *Reviewed by T. Teichmann, Lockheed Missile Systems Division.*

Though the unfortunate death of Richard von Mises in 1953 prevented him from completing a comprehensive book on compressible flow, his collaborators have combined a skillful elaboration of his lecture notes with his own completed initial chapters, to provide a reasonably homogeneous and embracing work, which can be read with profit by any serious student of theoretical aerodynamics. The book combines, to a remarkable de-