will describe the stereochemistry of the C-19 methyl group in the heteroyohimbine series.

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BOOK REVIEWS

Monographs in Statistical Physics and Thermodynamics. Volume 2. Thermodynamics with Quantum Statistical Illustrations. By P. T. LANDSBERG, Professor of Applied Mathematics, University College, Cardiff, Great Britain. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1961. x + 499 pp. 16 × 23.5 cm. Price, $14.50.

"Thermodynamics" by Landsberg is a welcome addition to the growing class of original monographs on theoretical thermodynamics. The opening three chapters, which comprise the meat of the volume, discuss the general theory. With the help of the conceptual apparatus of elementary topology, the author provides the most critical analysis yet available of the Carathéodory theory of entropy and absolute temperature and the thermodynamic theory of the third law. The fourth and fifth chapters, which we shall discuss later, are concerned with applications of the fundamental principles. A series of appendices amplifies some of the discussion in the preceding chapters. The book concludes with a selected bibliography with comments (it was amusing to note that, according to Landsberg, Gibbs' papers on thermodynamics were "published round about the turn of the century"). Worthwhile references are distributed throughout the volume. Many fine and unusual problems are inserted at appropriate intervals. A particularly valuable set is to be found on p. 95 where various shades of meaning of the terms "reversible" and "quasi-static" are analyzed.

It must not be thought that "Thermodynamics" is free from defects. Several criticisms can be leveled against it. The principal one is that the book is difficult to understand. This is due in part to a slightly ponderous style, but more profoundly it is related to the difficulty of maintaining mathematical rigor without loss of physical clarity. If deductive rigor is to be retained, it is necessary to adopt postulates and these are quite arbitrary from the mathematical viewpoint. However, if they are to be satisfactory to the physical scientist, they must represent idealizations of reality, preferably in the form of inductions from experiment. Landsberg understands this; yet the rationalizations which he presents for his postulates are not always entirely satisfactory. For example, the chemist may be dissatisfied with section 21 in Chapter IV on "the extension of thermodynamics to open and non-equilibrium systems." There, a vague and misleading impression is first given that open systems in equilibrium must be accorded the same treatment as systems not in equilibrium. Then, the important matter of defining the energy and entropy of open systems is evaded by the adoption of a definition (p. 129) of "simple" systems for which energy and entropy are asserted to exist and an assumption (p. 136) that many systems are simple. It is not clear whether his definition and assumption apply to electrochemical systems and other complex thermodynamic systems of interest. In this instance, generality has not hurt the mathematics, although it has resulted in a loss of physical clarity. Chapter IV, whatever its defects, is in the classical spirit of the earlier chapters. Chapter V on "Combinations of Thermodynamics and Statistical Mechanics" is, on the other hand, not in the same spirit, but is largely a sophisticated introduction to the statistical mechanics of ideal gases and radiation. In the later sections such diverse topics as "temperature dependent energy levels," "transition probabilities" and "thermodynamics as a precursor of quantum mechanics" are also discussed. The chapter is interesting and valuable, although it is not so penetrating as the first three and it does detract from the unity of the monograph.

Although it is not uniformly outstanding, "Thermodynamics" should be studied by every advanced student of theoretical thermodynamics and particularly by prospective authors of elementary textbooks on thermodynamics. Landsberg has surely achieved more than his modest ambition to "contribute something to our understanding of thermodynamics and to the exposition of its principles."

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Free Radicals in Biological Systems. Proceedings of a Symposium held at Stanford University, March, 1960. Edited by M. S. BLOIS, JR., H. W. BROWN, R. M. LEMMON, R. O. LINDBLOM and M. WEISSBLUTH. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1961. xviii + 387 pp. 16 × 23.5 cm. Price, $14.50.

The role of free radicals in biological systems is a question of considerable interest to biologists, chemists and physicists. The importance of the problem is evident from the list of biological processes in which free radicals have been put forward as decisive participants: enzymatic oxidation–reduction, photosynthesis, vision, carcinogenesis, radiation damage, synthesis of biological polymers and aging. The field has been in an increasingly active state of development especially since the development of the electron spin resonance (ESR) technique (1946) and the first use of this technique to observe free radicals in biological materials (1954). ESR studies have now led to detailed experimental evidence regarding the biological roles of free radicals. The widespread occurrence of free radicals in oxidation–reduction enzyme systems has been demonstrated. Detailed quantitative kinetic investigations of ESR signals in such enzyme systems have established new mechanisms and thermodynamic constants not available from conventional biochemical experiments. Characteristic ESR signals have been observed in photosynthetic systems and their kinetic properties analyzed. Free radicals have been observed in living animal tissues, and their relation to physiological processes described. A distinctive difference between free radical concentrations in normal and cancer tissue has been reported. The ESR technique has been used to demonstrate a clinically important difference between normal and pathological liver samples.

The field is in its infancy and many unsolved problems stand in the way of its further development. Among these are the need for ESR spectrometers capable of analyzing living systems with high sensitivity and high resolving power; improvement of methods for quantitation of ESR signals in terms of free radical concentration; development of criteria for associating an ESR signal with a particular substance in complex systems; techniques for observing short-lived ESR effects in irradiated tissues; methods for ESR observations on biological samples larger than 0.1 ml. (the present maximum); development of experimental strate-