

represented by the radial distribution function. There is no quasi-crystalline or lattice structure; there are no "holes" of definite size or shape, no discrete molecular frequencies or velocities, and no distinguishable "gas-like" and "solid-like" molecules."

"2. The molecules of homogeneous solutions of two non-polar, non-reacting, molecular species may be regarded, for practical purposes, as mixed with maximum randomness except in the immediate neighborhood of their liquid-liquid critical point."

DEPARTMENT OF CHEMISTRY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE 39, MASSACHUSETTS GEORGE SCATCHARD

cis-trans Isomeric Carotenoids, Vitamins A and Arylpolyenes: By L. ZECHMEISTER, California Institute of Technology, Pasadena, California. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1962. xiv + 251 pp. 61 × 23.5 cm. Price, \$10.00.

Between 1927 and 1940, while at the University of Pécs, Hungary, L. Zechmeister reported numerous investigations of the carotenoid pigments. At the early stages of this work, only about a half-dozen, yellow, fat-soluble, carotene-like substances were known. All these pigments were found to be highly unsaturated with 10 to 13 double bonds, most of which occur alternately with single bonds in conjugated systems. With carbon skeletons constructed of isoprenic units, these pigments owe their color to the number and arrangement of the double bonds.

Although many unsaturated substances occur naturally as spatial isomers, each carotenoid pigment was presumed to exist in but one spatial form. Zechmeister and a few others observed, however, that carotenoid pigments are altered when their solutions are heated. This alteration is revealed by a shift of the absorption maxima to shorter wave lengths and by the formation of several interconvertible isomers that may be isolated by chromatography.

Moving to the California Institute of Technology in 1940, Zechmeister studied the several isomers obtained from each carotenoid pigment. This field was rendered even more complex by the discovery of many additional carotenoids, some of which could be readily converted to the more common stable forms. Through his ingenious applications of the chromatographic adsorption method, Zechmeister isolated many of the labile isomers of each carotenoid and determined their properties, particularly their spectral absorption characteristics. In this way he found that the common, most stable isomeric form of each pigment was the "all-trans" form with *trans* arrangement of the groups at the doubly bonded carbon atoms. The less stable isomers contained *cis* arrangements at some of the double bonds. Eventually, the spatial structure of each isomeric pigment was established.

This monograph summarizes the investigations carried out at Cal. Tech. It also correlates this work with that done elsewhere. It is a monument to careful, persistent and imaginative investigation. It illustrates the importance of chemical investigation for the elucidation of molecular biology. It provides a basic framework for even more complicated future studies as, for example, the biosynthesis of the carotenoids and the role of the carotenoids in photosynthesis. Everyone interested in the carotenoid pigments and in related polyene compounds will find this an indispensable book.

ARGONNE NATIONAL LABORATORY
ARGONNE, ILLINOIS HAROLD H. STRAIN

Les Méthodes Analytiques des Lipides Simples. By C. PAQUOT, Directeur du Laboratoire de Lipochimie, C.N.R.S., Mlle. J. MERCIER, Ingénieur, C.N.R.S., D. LEFORT, Chargé de Recherches, C.N.R.S., A. MATHIEU, Ingénieur, C.N.R.S., and R. PERRON, Sous-directeur du Laboratoire de Lipochimie, C.N.R.S. Centre National de La Recherche Scientifique, 71, Boulevard Péreire, Paris 17, France. 1962. 281 pp. Price, 18 NF.

The book presents a complete and excellent treatment of the physical and chemical methods required for the characterization and analysis of lipid substances.

From the physical standpoint, the author includes the latest techniques available such as methods for index of refraction, specific weight, rotatory power, viscosity, melting and solidification temperature, boiling points, visible, ultraviolet and infrared analysis and X-ray diffraction, including a reasonably good treatment of the theory.

Besides the conventional chemical methods, the author has included the latest developments in the application of column, paper and gas phase chromatography to lipid chemistry. Also included are detailed procedures for the identification and de-

termination of chlorophylls, sterols, gossypol, sesamolene, sesamine and antioxidants.

The volume is thoroughly cross-referenced to other standard methods work such as those of the International Union of Pure and Applied Chemistry, the French, German and British Standards organizations as well as the American Oil Chemists' Society methods.

All in all, the book has been presented as a good reference analytical text for investigators in the field of lipid chemistry.

GENERAL FOODS CORPORATION
TECHNICAL CENTER B. F. DAUBERT
WHITE PLAINS, NEW YORK

The Radiochemical Manual. Part One. Physical Data. A Collection of Data for Users of Radioisotopes. Compiled by the Radiochemical Centre, Amersham, Buckinghamshire, England. British Information Services, 45 Rockefeller Plaza, New York 20, N. Y. 1962. 102 pp. 21 × 26.5 cm. Price, \$3.00.

"There is now an astonishing diversity of radioactive materials at the disposal of those who use them in medicine, research and industry. More than 150 different radioisotopes are offered commercially, many of them 'off the shelf' and in quantities ranging from microcuries to megacuries. Superimposed on this range of isotopic species is an almost unlimited number of variants of chemical and physical forms." So begins this manual of the physical (radioactive) properties of radioisotopes and their availability through the U. K. Radiochemical Centre at Amersham. The format is different from a catalogue issued by the Oak Ridge National Laboratory but has the same objective of acquainting habitual and potential users of radioisotopes with the array of substances at their command. This manual makes reference to a "catalogue of radioactive chemicals and radiation sources" (also issued by the Radiochemical Centre) for current prices and fuller information.

The expansion of the uses of radioisotopes, labeled compounds and special sources has been accompanied by an expansion of the numbers of suppliers. In the United States much of the specialized service, e.g., synthesis of C¹⁴-labeled organic compounds, has been taken over by private companies. In the U. K. these functions have apparently remained with the Radiochemical Centre. It behooves the would-be user of radioisotopes to study all sources of supply because the services offered by different suppliers are not necessarily identical. One may be able to furnish the radioisotope in exactly the desired form, another may have produced his material for a different purpose. One of the features of the Radiochemical Centre which one can glean from their manual is that many of their products are furnished with absolutely standardized disintegration rates.

In addition to the central table, the manual has other listings classified in terms of: beta energies and gamma energies vis-a-vis half-lives, approximate minimum activities for detection, sources for radiography and thickness gaging, etc.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA I. PERLMAN
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Paramagnetic Resonance. An Introductory Monograph. By G. E. PAKE, Washington University, Saint Louis, Mo. W. A. Benjamin, Inc., 2465 Broadway, New York 25, N. Y. 1962. xv + 205 pp. 15 × 23 cm. Price, paperbound, \$4.95; cloth-bound, \$6.95.

Professor Pake's monograph will be welcomed by many students and researchers in paramagnetic resonance. The book is a refinement and enlargement of lecture notes for a course in EPR given at Stanford University. It presumes one year of quantum mechanics as a background. This book is perhaps the first unified treatment of EPR by an author concerned chiefly with teaching the subject in an orderly way.

The book opens with a basic description of the cause of the resonance signal, a brief history of research in paramagnetism, and a classification of paramagnetic materials. The next chapter covers rotating coordinates, the Bloch equations, rapid passage and saturation effects; and it outlines experimental techniques. Separate chapters are devoted to the effects of crystal electric fields, dipolar and exchange interactions between electrons, ions and radicals dissolved in liquids, and spin-lattice relaxation. A short chapter introduces more sophisticated theories of line shapes and relaxation, based mostly on Kubo and Tomita. A final chapter is devoted to specialties: ferromagnetic and conduction-electron resonance, masers and double resonance. An appendix of 20 pages lists observed EPR constants for various crystals.

Professor Pake presents all topics both verbally and mathematically, often with considerable skill. The description of precession in the rotating frame is unusually good. Rapid pas-

sage and saturation are treated very clearly. The discussion of crystal-field effects is satisfying and wisely does not introduce group theory or high order symmetries. The book is generous with references, particularly to Abragam's "Principles of Nuclear Magnetism."

Some sections, nonetheless, are a bit puzzling. After the fine classical treatment, the section on quantum mechanics and line shapes does not really come up with any line shapes. Later, there is no attempt to explain the intrinsic nature of the Fermi contact or the electron exchange interactions, although the effects of the interactions are discussed at length. Proper explanations and derivations for these interactions are subtle and scarce. It would seem desirable for any introductory book to devote a few paragraphs to them.

The book favors physics rather than chemistry. Free-radicals are included, but the chemist expecting to learn about negative spin densities and distributed dipolar interactions will not find them. Very few experimental results on radicals are presented, despite the long appendix on ionic and crystal constants. As far as it goes, the chapter on free-radical and ion spectra in liquid solution is lucidly written. The practicing EPR chemist, however, will want to complement Pake, much as an NMR chemist might complement Abragam, with a book devoted to chemical aspects of the resonance phenomenon.

The book is pleasant to read. Those who have listened to Professor Pake in person will hear him speaking from the pages of this book. It is recommended to everyone interested in EPR.

U. S. ARMY ELECTRONICS RESEARCH
AND DEVELOPMENT LABORATORY EDWARD H. POINDEXTER
FORT MONMOUTH, NEW JERSEY

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February 10, 1963-March 10, 1963

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