

pears to be especially useful in that the entries are collected under specific subject headings, as "Deposition techniques for boron," "Time-of-flight spectrometry in the range 1 e.v. to 10 kev.," etc. Frequently-used neutron cross section curves, range-energy data for charged particles, and some nuclear decay schemes are included in appendices.

To summarize, this book is written for those readers who are in need of a comprehensive and up-to-date survey of the various methods of neutron counting and neutron spectrometry. It might profitably be read by those contemplating, or engaged in, neutron experiments, and by students interested in general techniques of experimental nuclear physics and chemistry.

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The Chemistry of Lignin. Supplement Volume. Covering the Literature for the Years 1949-1958. By FRIEDRICH EMIL BRAUNS and DOROTHY ALEXANDRA BRAUNS. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1960. x + 804 pp. 16 × 23.5 cm. Price, \$18.00.

The discovery of that component of woody plant materials now known as "lignin" is usually traced back to the pioneering experiments of the French botanist-chemist, Anselme Payen, who disproved the then prevalent notion that wood was a uniform product by successfully separating it into a series of crude, but varying fractions. His observations led Payen to postulate the presence in wood of an "incrusting material" which since has come to be known as "lignin." This work was published by Payen in the *Comptes rendus* in a series of papers beginning in 1838.

In 1960, the chemical structure of lignin was still unknown. This is certainly in no way due to any lack of attention by the researcher. The intervening century and one-quarter has witnessed the contribution by hundreds of organic and bio-chemists of thousands of papers on lignin to the chemical literature. Unfortunately, the result has been a huge volume of disorganized, unrelated, and many times, conflicting masses of observations, data, hypotheses, theories and speculations which have thus far defied a rational and unified interpretation. This status is well illustrated by the undue enthusiasm generated by K. Freudenberg's wistful analogy with the order existing in other natural polymers. The authors of this monumental treatise, of course, could not have known that this forced analogy would be followed later by a retraction (*Chem. Ber.*, 93, 2138 (1960)).

None has worked harder to bring some order to this chaotic state of the lignin literature than Friedrich Emil Brauns, formerly of the Institute of Paper Chemistry in Appleton. His first effort in this respect was "The Chemistry of Lignin," published by Academic Press Inc. in 1952. This was an exhaustive survey of the total lignin literature up to the mid-twentieth century, and it became the standard encyclopedic reference work for lignin investigators.

The new volume, coauthored by Mrs. Brauns, is subtitled "Supplement Volume. Covering the Literature for the Years 1949-1958." In addition to a review of the lignin literature of the specified decade, the work also includes reference to some papers which were unavailable for inclusion in the original volume, principally from the Japanese and Russian literature.

Students of Brauns' first book will find some innovations in the present volume. One is the authorship of the chapter on the linkage of lignin in the plant by J. W. T. Merewether of Australia. The organization of the new book is consistent with the older work. Most of the original chapters, such as color reactions, isolation, determination, physical properties, composition, etc., have been retained and expanded with the one exception that the predominantly biochemical approach to the study of the mechanism of formation of lignin in growing plants is reflected in the change of the title of the original chapter, "Theories on the Formation of Lignin," to a more adequate one, "The Biosynthesis of Lignin." With this slight limitation, readers of the first volume will experience no difficulty in finding their way through the volume under review.

Grateful lignin chemists should have no fault with the Brauns' efforts. But if this commentator may be permitted one reservation, it must concern the Brauns' back-breaking

attempt to be neutral and objective in their evaluation of recent published work. To be sure, the endeavor was a most noble one. However, in a number of instances, detailed descriptions are provided for experiments from which little or no constructive conclusions can be derived. This can be somewhat frustrating to the reader who may be seeking a critical evaluation of the really pertinent information in some specific area of lignin chemistry. This reviewer is tempted to remark that in such cases, omission would have represented the greater part of valor. Perhaps the problem can be illustrated by the observation that the first century of lignin research was summarized in Brauns' first book in 749 pages of text. Now, the most recent decade has required 751 text pages of the same size and print.

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Liquids and Liquid Mixtures. By J. S. ROWLINSON, M. A., D. Phil., F.R.I.C., Senior Lecturer in Chemistry, The University of Manchester. Academic Press Inc., 111 Fifth Avenue, New York, N. Y. 1959. ix + 360 pp. 14.5 × 22.5 cm. Price, \$12.50.

This book should give benefit and pleasure to all physical chemists who have maintained an interest in one of the classical areas of their science. It is concerned with the bulk equilibrium properties of pure liquids and of non-electrolyte solutions, exclusive of liquid helium and of high polymers. Surface and transport phenomena are not treated.

The work fulfills a need that is well stated in the author's preface. Significant theoretical developments of the last few years have emphasized the desirability of studying the behavior of liquid mixtures in close juxtaposition to that of pure liquids, a view which was largely obscured during the heyday of the lattice model.

Rowlinson divides his text into three parts, each comprising three chapters. The first part is a phenomenological account of the thermodynamic properties of pure liquids. After a brief introductory chapter on the nature of the liquid state, the author presents a thorough collection of thermodynamic relations, including those for changes of thermodynamic functions along the saturation curve. A valuable feature is the tabulation of critically selected (often recalculated) data for some common liquids. The section on pure fluids is completed by a chapter on the critical state, in which the unresolved problems are clearly set forth.

In the second section, the macroscopic discussion is extended to mixtures. Chapters 4 and 5 deal with mixtures under ordinary pressures, and include a well chosen and up-to-date selection of the experimental data for binary mixtures, expressed in terms of the excess thermodynamic functions. The sixth chapter describes liquid mixtures at higher pressures, including critical phenomena, and is somewhat reminiscent of the classical work of Kuenen. Here again, the author's collection of thermodynamic formulas is catholic (Random example: dp/dT along a binary critical solution curve, which is *not* given in the works of Guggenheim, Hildebrand-Scott or Lewis-Randall-Pitzer-Brewer), and there are many illustrative diagrams. Very little attention is paid to systems of more than two components.

The third section is an economical and masterly discussion of intermolecular forces and of the equilibrium statistical mechanics of liquids pure and mixed. The emphasis here is on corresponding states and on conformal mixtures, following the path traversed by Longuet-Higgins, Scott, Brown, Prigogine and others. Molecular distribution functions are introduced at an early stage in the discussion of pure liquids, and recur in the classification of the various approximate treatments of mixtures by means of Brown's molecular fluctuation integrals. The older theories, including those based on lattice models, are given scant attention in such a non-historical account, but they appear as special cases.

Inevitably the last section of Rowlinson's work will invite comparison with the corresponding parts of the book by Prigogine with Bellemans and Mathot, which contains more of the theoretical details and proceeds more inductively, but at some expense of final unity. Rowlinson, in addition to correcting several practically significant errors