

the text and by means of four charts. Few errors have been found; all are unimportant or self-evident.

Apart from its sure value and utility for pyrometer users, the book warrants the attention of all seriously concerned with thermal radiation. Although the book does not contain class problems, its clarity and thoroughness are such that it could well serve for instruction of students.

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Biochimie Comparée des Acides Aminés Basiques. Colloques Internationaux du Centre National de la Recherche Scientifique. Concarneau, 1-5 Juillet, 1959. XCII. By Centre National de la Recherche Scientifique. Centre National de la Recherche Scientifique, 15 Quai Anatole France, Paris 7, France. 1960. 436 pp. 16.5 × 24 cm. Price, 45 NF.

This volume contains the proceedings of a small international conference limited to twenty-seven participants and held at Concarneau, France, in July, 1959.

Following two general contributions (amino acid oxidases (A. Meister) and enzymatic transamination (A. Braunstein)), the contents proceed with a varied group of discussions of the metabolism and enzymology of lysine, histidine, arginine, and their metabolic relatives. The presentations are for the most part brief reviews, sometimes comprehensive (e.g., degradation of ornithine, lysine and hydroxylysine (P. Boulanger), histidine metabolism (A. Mehler), biological role of guanido compounds (N. V. Thoai) and sometimes considerably more restricted (e.g., octopine metabolism (N. V. Thoai and Y. Robin), metabolic products of arginine in plant tissue culture (H. Duranton), γ -guanidobutyrate degradation in fish liver (R. Baret, M. Mourgue, A. Broc)). Two sections of technical interest summarize methods for electrophoretic and chromatographic separation and measurement of basic amino acids (G. Biserte and R. Osteux), and methods for the analysis and preparation of guanido compounds (Y. Robin, N. V. Thoai, J. Roche and L. Pradel). There is no systematic or unifying emphasis on comparative biochemistry, as the title might suggest, but the mass of material reviewed inevitably includes biochemical studies based on higher plants, bacteria, invertebrates and mammals.

The book contains little if any information that has not by this time appeared in print elsewhere. Its chief value would appear to be the convenient provision of a variety of compact and authoritative reviews emphasizing material of current interest over a broad range of topics under the general title. Extensive literature references and many figures and tables (particularly in the methods sections) assist this service; a general index would also have been useful.

The proceedings are chiefly in French (reflecting the predominance of French participants), only six of the twenty-two contributions—comprising about one-fifth of the volume—being in English; brief English summaries, however, precede each presentation. An attractive feature is the inclusion of discussion which followed many of the talks.

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Style Guide for Chemists. By LOUIS F. FIESER, Sheldon Emery Professor of Organic Chemistry, Harvard University, and MARY FIESER, Research Fellow in Chemistry, Harvard University. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, N. Y. 1960. vi + 116 pp. 16 × 23.5 cm. Price, \$2.95.

Late in 1959 Louis F. Fieser received the James F. Norris Award of the Northeastern Section of the American Chemical Society for his distinguished services to the teaching of chemistry, and this little book is an excellent example of one phase of his wide contribution to teaching. In his acceptance address on that occasion, his reminiscences on the Fiesers' experiences in writing and editing gave ample background support for their decision to write a book on helping the chemist to write. It is common knowledge to all chemistry teachers that "Johnny and Janey" cannot compose

good English; this literary deficiency has its roots in the first grade of school and they continue to be stunted by the malnutrition of insufficient experience, practice and drill in reading, chirography, spelling and composition from elementary level to the end of high school. At college age the science instructor can do little to improve the situation other than by helpful advice and detailed criticism of the student's essays and examinations; for this the Fiesers have provided extremely valuable assistance in their "Style Guide for Chemists."

The wish to do good writing comes from within, and the ability only from doing, re-doing and doing some more, but the thoughtful and observant would-be writer can help himself by noting the countless large and small examples to be found in this book and others. "Style Guide for Chemists" is organized in thirteen chapters: some are very short and bluntly instructive (Chapter 6, for example), while others require more space for their broader range of details and applications. Reviewing a textbook often is easy but not so a laboratory manual. This book somewhat resembles the latter, but its preparative descriptions are more easily reviewable. "Concise Writing" (Ch. 1) with its do's and don'ts leads along into "Coherence," which means "connectedness of thought." Every chemist writer should read his own scribbles aloud into a tape recorder, play it back into his own ears, and then apply the Fiesers' Principles of Coherence. "Verbs" come next, transitive, intransitive, active, passive, verbs of action, infinitives, participles and other forms and usages. "Singular and Plural Form" receives attention, also the "Possessive Singular," and the production and loss of "Emphasis." A relatively long chapter is given to "Choice of Words," with many examples (even to Latin borrowings and manufactured verbs), and one almost as long to "Punctuation" (a good addition here would have been a paragraph showing writer and typist how punctuation marks should appear in a manuscript). "Style," a broad and somewhat indefinable quality of composition, is considered briefly, with varied advice to the writer, and contrasts sharply in theme with "Style Sheet," the next chapter. A writer has his literary "Style," a journal or publisher its "Style Sheet," the latter meaning that large and varied collection of seemingly picayune details in which consistency of usage is considered a publishing virtue. Some style details are of general application in good writing and printing and others are fairly specific to the various fields of learning; the Fiesers have collected and classified in twelve pages a host of style details. The topic and content of Chapter 11 on "Proof" does not appear in many style manuals, but it is the rare writer who does not have to read and check his own proofs, and most writers need adult education in the art and science of proof-reading. Skill and sureness in this field come only by long experience, but the four pages here are a good general introduction. "Pronunciation," and "Speaking," too, might be considered to be outside the bounds of a style manual, but oral reading (almost a lost art nowadays) is a wonderful adjunct to fluent composition, and wrong pronunciation renders both reading and speaking painful to audience and lecturer (six pages of text, fifteen of words, then five of text are given to these two topics).

There are available many Manuals of Style, written for various publishing organizations or fields of composition, all of them serving a useful purpose. "Style Guide for Chemists" is "a book written by chemists for chemists." A single reading of it will not convert a semi-literate chemist into a polished writer, but repeated reading of it, as well as consultation and application of its solid and instructive ninety-seven pages, certainly cannot fail to improve the literary work of the members of our profession. May its influence extend through many editions.

DEPARTMENT OF CHEMISTRY
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Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Sauerstoff. Lieferung 4. System Nummer 3. Edited by E. H. ERICH PIETSCH. Verlag Chemie, G.m.b.H., Pappelallee 3, Weinheim/Bergstr., Germany. 1960. xv + 366 pp. 17.5 × 25.5 cm. Price, Kart. DM. 223.—.

This volume on oxygen deals with air, active oxygen and ozone. The literature has been thoroughly surveyed through 1949.

In the 157 pages devoted to air there are described its composition, mechanical and thermal properties, solubility in various media, and the acoustical, magnetic and electrical behavior. The chapter on active oxygen required only 8 pages to review the formation and the chemical reactions of this substance.

The final chapter of 200 pages on ozone lists review literature up to 1959, including the American Chemical Society publication, "Ozone Chemistry and Technology," 1959. The topics covered include the formation and decomposition of ozone, thermodynamic data, the physical properties, the electrochemical behavior and the chemical reactions of ozone with other substances. The description of the methods of formation and decomposition is very thorough, as is the discussion of the reactions of ozone with inorganic substances. Only a brief paragraph is devoted to the reactions with organic compounds. However, pertinent literature references to the latter subject are given; these refer to books and review articles published as late as 1958.

This book conforms to the high standard set by previous volumes of this edition of Gmelin's Handbuch, and it includes German and English tables of contents as well as English headings and subheadings in the margins.

DEPARTMENT OF CHEMISTRY
THE UNIVERSITY OF CONNECTICUT CARL W. MOELLER
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International Series of Monographs on Organic Chemistry
Volume 4. Homolytic Aromatic Substitution. By G. H. WILLIAMS, Reader in Organic Chemistry, Birkbeck College, London. Pergamon Press Inc., 122 East 57th Street, New York 22, N. Y. 1960. vii + 133 pp. 17 X 25.5 cm. Price, \$7.50.

Reactions involving free radical intermediates commonly yield complex reaction mixtures. Careful and critical interpretations of product and rate data have, nevertheless, led to considerable information about the mechanisms. The pace has accelerated markedly with the increasingly accurate data derived through use of infrared spectrophotometry and gas phase chromatography. Yet critical reasoning remains an indispensable ingredient.

The present book emphasizes (according to the preface) the theoretical aspects of homolytic substitution, although preparative aspects are also considered. There is an introduction followed by four chapters on arylation, one on alkylation and one on miscellaneous reactions.

Superficially the book has an authoritative appearance. The style is attractive and so is the typography. Beyond these there are few features to praise.

There are glaring oversights in the coverage of the literature. Thus, in the brief summary of electrophilic substitution there is no mention of the important recent studies by H. C. Brown and his students. Again the old radical mechanism is given on page 39 for the reaction between phenols and diacyl peroxides in spite of recent work of Walling which indicates that it is largely ionic.

However, the most serious deficiency of this work is the confused and non-critical reasoning employed throughout. One example will have to suffice. The key step in the arylation reaction is written as follows: $R' \cdot + ArH \rightarrow ArR' + (H \cdot)$ (page 38).

The meaning of this equation is clarified in these words: "It therefore follows that the only chain-termination reaction which is consistent with the above observations is the reaction between $R' \cdot$ and ArH , producing the unsymmetrical diaryl ArR' , and not an inactive solvent radical, *but the highly reactive hydrogen atom*" (the italics are mine).

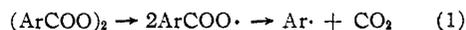
This should suffice to explain the author's intent, but he has some second thoughts which he offers the reader in a footnote. Here he suggests that biphenyls are produced by reaction of a " σ -complex" (nature undefined) written as $[Ar'-Ar-H] \cdot$ with a peroxide molecule. Much later on (page 49) he tosses out yet another suggestion: $[R-Ar-H] \cdot$ is now an intermediate "following the suggestion of Waters." And among the reactions proposed for this intermediate is the conventional disproportionation in which a hydrogen atom is abstracted by some other radical.

Regarding the above there is an interesting and significant bit of by-play in the literature. A few years ago Williams

co-authored a review article covering much the same ground as the present book (D. R. Augood and G. H. Williams, *Chem. Revs.*, 57, 123 (1957)). In the review the hydrogen ejection step is clearly presented in eq. 14, p. 131, and also in Scheme III on p. 133. I would definitely interpret these as the mechanisms preferred by the authors. Now it is well known that such a step must be endothermic by the difference in relevant C-C and C-H bond dissociation energies. Thus such a step cannot be important in the arylation process. Mention of this deficiency was made by E. S. Lewis and M. C. R. Symons (*Quart. Revs.*, 12, 230 (1958)). This prompted an indignant rejoinder (*J. Chem. Soc.*, 1871 (1959)) that Williams had never advocated hydrogen ejection but that Lewis and Symons had not read the review carefully. It is difficult to know just which statements of Williams we are to accept as official.

It is possible to discover reasons why it might be hazardous to examine the mechanisms of arylation too closely. Considerable effort has been spent in determining isomer ratios and relative reactivities in arylation reactions. From these Williams has calculated partial rate factors and has written at length on the theoretical bases for the results. It would be unpleasant if it should turn out that the actual mechanisms do in fact invalidate this whole approach. It is, nevertheless, desirable to analyze the rationale briefly to show what theoretical significance such results may be expected to have, apart from their obvious empirical practical significance.

Present studies of the reaction of benzoyl peroxide and benzene can be summarized by the mechanistic steps



Although these are the major primary reactions occurring in dilute solutions, it must be emphasized that other reactions also occur, the number and variety increasing with increasing peroxide concentrations. Thus dihydrobiphenyl produced by reaction 4 is a product at low peroxide concentration (0.01 M) but is not readily found at conventional concentration (0.1 M). Presumably this is the result of radical attack leading to dehydrogenation of the dihydrobiphenyl, though radical addition remains a possibility.

Now a major premise must be made by those who seek to base partial rate factors on a determination of the isomer distribution among, say, the chlorobiphenyls obtained from the decomposition of benzoyl peroxide in chlorobenzene. This premise is that the isomer distribution is determined by step 2. Obviously the calculations can be run through without any assumption at all, but then the whole procedure is merely a numbers game. Consideration of the implications of steps 3 and 4 and their counterparts with other radicals affords little justification for the required tacit assumption that exactly the same fraction of every one of the isomers of $ArAr'H \cdot$ will ultimately give the same ratio of biphenyl to other products. Yet without this or its equivalent assumption, what useful theoretical conclusions are possible?

Nevertheless, from the practical point of view it is reasonable to predict that detailed studies will tend to substantiate the so-called partial rate factors for homolytic arylation. Of the fifty numbers quoted in the table on page 73, more than half are between 0.6 and 1.5. Only one is larger than 10. For comparison, nitration, a typical electrophilic reaction, exhibits a range of partial rate factors of over 10^6 . Correcting a 3 to a 2 or even a 1 will not constitute a very significant change. Such numbers as these do not make serious demands on theory.

In conclusion it should be noted that the monographs in these series are not very long. At a price of almost 6 cents a page and with a virtual captive market in the world's technical libraries, the venture should prove highly profitable to the publisher.

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