Book Reviews

Understanding Mass Spectra: A Basic Approach. By R. Martin Smith (Wisconsin Department of Justice Crime Laboratories) with Kenneth L. Busch (Georgia Institute of Technology), Technical Editor. John Wiley and Sons: New York. 1999. xvii + 290 pp. $59.95. ISBN 0-471-29704-6.

This book aims to provide a basic understanding of electron ionization (EI) mass spectral fragmentation patterns. The contents include a brief overview of mass spectrometric instrumentation, a detailed description of isotopic abundances, a summary of electron accounting, the energetics and kinetics of ion fragmentation, a discussion of the most frequently observed neutral losses and series of fragment ions in EI mass spectra, sections on common types of fragmentation processes, such as alpha-cleavages and various types of named rearrangements, and numerous examples of EI mass spectra along with their interpretation, most related to drugs of abuse. In general, the author accomplishes the stated goal and provides a good foundation for the interpretation of EI mass spectra. A few errors sprinkled throughout the book and the disappointing lack of references prevent the book from being an outstanding one. It should be noted that McLafferty and Turecek's *Interpretation of Mass Spectra* (University Science Books, 1993, a bargain at $34.00) is an excellent book that essentially covers the same material, albeit with a different organization in which EI fragmentation patterns are collectively described by classes of compounds, and with extensive referencing of the primary literature. Novices in the field of mass spectrometry should be aware that the newer ionization methods, such as FAB, electrospray ionization, and matrix-assisted laser desorption/ionization generally produce even electron ions, not the odd electron molecular ions observed in EI mass spectra, and require a substantially different set of guidelines for interpretation of fragmentation patterns. Thus, the book is more limited in scope than the title implies.

Chapter 1, entitled Instrumentation, includes a description of mass analyzers, the electron ionization source, and a very nice discussion of library searches. A few deficiencies in the chapter emerge, such as the misleading statement that the fragmentation patterns of protonated molecules are analogous to those of the molecular ions produced by EI, the omission of any description about electric sectors that should be included in the section on sectors, the omission of the liquid SIMS technique (a method that has largely supplanted FAB) from Table 1.1, and the misguided statement on p 3 that "bond strengths in organic compounds range from approximately 10−20 eV". Since quadrupole ion trap instruments currently have a large market share for routine GCMS applications, a section discussing how ionization/fragmentation in ion traps differs from that of conventional ion sources would have been timely and informative to many readers. The omission of references from this chapter and throughout the book, a serious shortcoming, means that readers really cannot rely on the book as a comprehensive resource.

Chapter 2 provides an excellent description of isotopic abundances. The material is clearly organized with thoroughly presented examples. Chapter 3 covers a solid overview of electron accounting. The statement on p 83 that both odd electron and even electron fragment ions are frequently produced from even electron precursor ions is not well documented nor commonly accepted. Moreover, the errant statement about the strengths of bonds in organic molecules, "70 eV is more than three to four times the energy need to break even the strongest bonds in most organic molecules", warrants correction. Chapter 4 is an informative discussion of common neutral losses and series of fragment ions observed in EI mass spectra, a chapter supported by many fine mass spectral examples. Chapter 5 covers the alpha-cleavage process in great depth, also with numerous excellent mass spectral examples. A few of the fragmentation schemes have minor errors, such as the misleading placement of the fishhook arrows in 5.2, 5.10, and 5.12, in which the fishhook is not terminated at the right place. For example, in 5.2, the uppermost fishhook should terminate at the carbon, not at the carbon−carbon bond, and in 5.10 the uppermost fishhook should terminate at the oxygen, not at the carbon−oxygen bond. Common rearrangement reactions, such as the gamma-hydrogen rearrangement and retro Diels−Alder reaction, are described in Chapter 6.

Chapter 7 provides a sound set of guidelines for writing mechanisms of mass spectral fragmentation reactions. The guidelines are well formulated and are followed by nicely selected examples. Several more detailed examples of the interpretation of mass spectral fragmentation patterns are given in Chapter 8. Unfortunately, the visual quality of some of the schemes degrades, meaning that some of the "+" symbols are shrunk to a size that renders them as a dot (as seen in 8.5, 8.6, 8.7, 8.12, 8.15, and Figure 8.21). Chapter 9 provides detailed answers to the dozens of problems scattered throughout the earlier chapters.

In general, the book is a nicely organized, well-written text that should be useful to those interested in interpreting electron ionization mass spectra. The lack of references is disappointing, but the book is still recommended for those who want to understand fragmentation patterns of ions generated by EI.

Jennifer S. Brodbelt, *The University of Texas at Austin*

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HPLC: A Practical Guide. By T. Hanai (Health Research Foundation, Kyoto, Japan). Royal Society of Chemistry: Cambridge, UK. 1999. x + 134 pp. £42.50. ISBN 0-85404-515-5.

This book is aimed at providing undergraduate students and laboratory staff with the practical knowledge required for undertaking HPLC in both academic and industrial settings.

The book assumes some knowledge of basic chromatographic principles as it jumps straight in with the resolution equation, rather than the usual simple retention equations. Terms are explained well after this, though, and Chapter 1 sets up the rest of the book quite well.

Chapter 2 summarizes the instrumentation required for HPLC in detail, although it does cover some rarely encountered HPLC instrumentation such as the flame ionization detector. The time constant information also seemed somewhat redundant for a practical guide. A useful troubleshooting guide balances this.

Chapter 3 has excellent coverage of the types of stationary phase used in HPLC. The comprehensive coverage is only slightly spoiled by the use of company data sheets as references rather than peer-reviewed articles. This is somewhat understandable, as the type of information being referenced is not frequently encountered in the peer-reviewed literature. Chapter 4 has a similarly detailed coverage of the eluents used for HPLC, and the same minor criticism from Chapter 3 can be applied here as well.

Chapters 5 and 6 deal with the mathematical calculations involved in HPLC and the physical chemistry underlying the separations, respectively. While these are integral parts of any chromatographic separation, they are on the fringe of what is usually found in a practical guide.

Overall, the book is a useful guide to HPLC and fulfils its purpose with regard to the intended target audience. Although many of the references are old, the book does not purport to be an up-to-date anthology. As many of the basic concepts referred to were elucidated many years ago, the age of the references is understandable. There was only one clear error, and that was where the wrong table was referred to in the text. As this was an obvious error, it should not confuse the reader. I expect that this book will be removed regularly from my shelf to introduce new undergraduate or graduate students to the field of HPLC, or to refresh my memory on key points.

Anthony Andrews, *Ohio University*

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