BOOK REVIEWS

Chromatography: Concepts and Contrasts

James N. Miller. Pp. xiv + 297. Wiley. 1988. Price £34.50. ISBN 0 471 84821 2.

Too often the different chromatographic techniques of GLC, HPLC and TLC have been treated in texts and monographs in isolation and their common origins and principles have been masked by the differences in their technologies. However, in this book James Miller has deliberately sought to emphasise their similarities and the close relationships between the methods.

The theme is maintained for over a third of the book as the underlying theory of retention and separations is discussed from a physico-chemical viewpoint. The approach is considered and modern but without becoming overwhelmed by the physics of diffusion and partition. In turn, the background to distribution, kinetics, the molecular interactions and optimisation, which includes a discussion of band broadening and van Deemter plots, are considered. For details the reader is often directed to the literature. These sections lead to the common areas of qualitative analysis, quantitation and a comparison between chromatographic methods.

The remaining chapters cover the individual methods. The instrumentation and methods of GC, LC in columns and LC on planar surfaces are considered in turn. The final two chapters deal with the specialised areas of SFC, coupled detectors, chiral separations and derivatisation and briefly with the selection of a method. The book is at its thinnest in parts of these method-specific areas. GLC detectors receive only limited coverage, with five pages on the TCD, two pages on the FID and a further two pages on all the remaining detectors. All the HPLC detectors (except LC - MS) are covered in five pages. However, for each method there is a comprehensive discussion of the different stationary phases and mobile phase selection.

All methods of chromatography have grown so much in recent years that it is inevitable that not all aspects can be covered in depth in a book of this size and James Miller has usefully emphasised one aspect of chromatography that will be especially valuable to any user who wants to gain a deeper understanding of the background of the techniques.

Roger M. Smith

Analytical Isotachophoresis

P. Boček, M. Deml, P. Gebauer and V. Dolník. *Electrophoresis Library, Volume* 1. Pp. xviii + 237. VCH. 1988. Price DM156; £57. ISBN 3 527 26444 2 (VCH Verlagsgesellschaft). 0 89573 477 X (VCH Publishers).

This book aims to provide an understanding of the theory, instrumentation and application possibilities of analytical capillary isotachophoresis, to give a broad audience of chemists a comprehensive guide to the field and to allow those concerned to solve appropriate analytical problems. The book is mainly based on the authors' research work, but takes into consideration recent developments of this technique performed in other laboratories. In the various chapters about 546 references are given, of which, of course, some are identical.

After a historical survey in Chapter 1, in Chapters 2 and 3 some basic explanations are given of the various electrophoretic principles via generally accepted equations. These chapters are followed by basic information on analytical capillary isotachophoresis in Chapter 4. Amongst others, the principles of the same velocity, self-sharpening effect and concentration and dilution effect are discussed. Moreover, attention is given to the specific zone properties characteristic of this technique. How these properties can be used for qualitative and quantitative evaluation of the isotachopherograms is described in Chapter 5. To help potential users of isotachophoresis, in Chapter 6 attention is given to optimising electrolyte conditions and to explaining some properties deviating from the "generally expected" ones.

In Chapter 7 both commercial instrumentation and those developed in various laboratories are described. For the more physico-chemical scientists, in Chapter 8 an extensive mathematical model is given. In Chapter 9 some specific systems, such as the use of spacers and carriers and non-capillary systems, are described.

The book is completed with practical aspects, a few recommended electrolyte systems and trouble-shooting (Chapter 10), and applications as published by various researchers (Chapter 11). From the items described in the latter chapter, it is clear that isotachophoresis nowadays is applied not only to the separation of low relative molecular mass substances, such as cations, anions and amino acids, but also to separations of peptides and proteins. The analyses are taken from scientists working in bio(medical), environmental, industrial and analytical laboratories.

The book reviewed here, however, substantially overlaps another monograph.[1] This may be expected, because all that is written in Ref. 1 is still valid. Amongst others, the computer program (developed by J. L. Beckers) and the qualitative information about numerous solutes in recommended electrolyte systems are still used by various researchers. Therefore, it is especially unfortunate that more information on the various solutes in recommended electrolyte systems was not included together with information on "old," commonly used, electrolyte systems. This would have made it a "bench-book." On the other hand, it is an excellent review of work, both performed and collected by the "Brno group," and will certainly be of value to have on the shelf.

Reference

1. Everaerts, F. M., Beckers, J. L., and Verheggen, Th. P. E. M., "Isotachophoresis: Theory, Instrumentation and Applications," Elsevier, Amsterdam, Oxford, New York, 1976.

F. M. Everaerts

The Chemistry and Biology of Benz[*a*]anthracenes

M. S. Newman, B. Tierney and S. Veeraraghavan. *Cambridge Monographs on Cancer Research.* Pp. xiv + 228. Cambridge University Press. 1988. Price £35; $69.50. ISBN 0 521 30544 6.

One third of this book is concerned with the chemistry of the benz[*a*]anthracenes and two thirds with their biology. The first page of the text clarifies the nomenclature of this class of chemicals. This was necessary because different names and numbering systems have, in the past, been used for the same molecule. The following pages discuss succinctly synthetic routes from benzenes and naphthalenes, anthracenes, phenanthrenes and other compounds. No less than 374 compounds are referred to in the 59 pages devoted to these aspects of the chemistry of the benzanthracenes. Each compound mentioned is numbered and its structure is illustrated. Nearly 400 references are cited. To include so much information in so short a space is brilliant!

Biology is construed to consist simply of metabolism, interactions with DNA, RNA and proteins, mutagenicity and carcinogenicity. No serious attempt is made to pander to the

much wider interests of the general toxicologist. Thus no consideration is given to acute or chronic toxicity, effects on reproduction, embryotoxicity, sensitisation, immunotoxicity, etc. If one wanted to criticise the approach to these limited aspects of the biology of the benzanthracenes, it would be to say that the author (Tierney) reviews the knowledge that exists rather than the knowledge that, arguably, *ought* to exist. Thus, much of the text on carcinogenicity concerns studies involving the use of 7,12-dibenz[*a*]anthracene (DMBA) in the production of mammary tumours in rats and little space is devoted to listing the important things we do not know about the toxicity and carcinogenicity of DMBA and other benz-[*a*]anthracenes. Also, throughout the text the two-stage carcinogenesis paradigm is referred to as if it were an established truth, whereas in reality it is no more than an oversimplistic model which by no means explains all the phenomena in carcinogenesis that have been reported. However, it really would be churlish to press home such criticisms, as it is fair to say that the limited aspects of the biology of the benz[*a*]anthracenes considered in the book have been reviewed in a systematically thorough, learned and helpful way. Moreover, this book would probably not have been the place to discuss theories of carcinogenesis or the deficiencies of a particular widely used paradigm. Curiously, whereas the references are both alphabetised and numbered in Part I of the book, in this more discursive Part II an even larger number of references are alphabetised but not numbered.

In summary, this is an excellent short treatise which is packed with information that has been assembled in a logical order.

Francis J. C. Roe

Analyses of Hazardous Substances in Biological Materials. Methods for Biological Monitoring. Volume 2
Edited by J. Angerer and K. H. Schaller. Pp. xviii + 252. VCH. 1988. ISBN 3 527 27012 4 (VCH Verlagsgesellschaft); 0 89573 647 0 (VCH Publishers).

This book from the DFG Deutsche Forschungsgemeinschaft is the second in a series devoted to the analysis of hazardous substances used in the workplace and the metabolites of these substances in blood and urine. The methods are chosen to develop a monitoring strategy for industrially exposed workers, commonly known as biological monitoring, in order to provide an estimate for an individual's exposure to a hazardous substance. While the major part of the analytical section is devoted to methodologies mainly for metals, the aromatic carboxylic acids and phenols are also represented.

The methods which come under the scrutiny of an Analytical Committee Working Group are evaluated by one other member of the group and "selected as acceptable" only if a previously agreed set of criteria can be demonstrated analytically.

The book opens with a very valuable section on digestion procedures for the determination of metals in biological material. Attention has been given to all types of ashing aids and digestion vessels and much valuable information on the pitfalls associated with wet ashing and how they can be avoided. It is also refreshing to see that advice has been given on taking appropriate safety precautions.

The largest part of the book (200 pages) is devoted to a detailed description of analytical methods for the determination of hazardous substances and their metabolites in biological fluids. In the selection of a method, precedence has been given to analytical reliability over simplicity and economy.

The methods are written in precise detail and each is prefaced by a section on the hazardous substance, covering such aspects as toxicity, occupationally unexposed levels and typical precision figures that can be expected from the analysis. It is encouraging to see that the use of quality control material is required to ensure reliability of data.

Within the analytical section, there is the inference, which is clearly stated for cadmium, that the methods are suitable to be termed reference methods. There is a danger in this philosophy that methods thus established will become enshrined in "tablets of stone" and suffer as a result of not being sufficiently open to future analytical developments; in fact, the cadmium method is dated March 1984.

In summary, this is a useful book for the analyst with well documented descriptions of 14 analytical methods. The descriptions are all in a standard format but, as with all methods, each will have to be adapted to the conditions and equipment in the reader's own laboratory.

N. J. Smith

High-performance Liquid Chromatography of Biopolymers and Biooligomers. Part A: Principles, Materials and Techniques
O. Mikeš. *Journal of Chromatography Library, Volume 41A*. Pp. xiv + 379. Elsevier. 1988. Price Dfl 285; $150. ISBN 0 444 42951 4 (Volume 41A); 0 444 41616 1 (Series).

This is Volume 41A in the *Journal of Chromatography Library Series*—part of an apparently valedictory monograph by Mikeš.

In an introduction, the author expresses appreciation of the active scientific life at the Institute of Organic Chemistry and Biochemistry at the Czechoslovak Academy of Sciences, Prague, from which he writes that he is due to retire because of age. He expresses thanks also to scientific colleagues, who read the manuscript, and to his wife and daughter, who made important contributions to preparing the manuscript and the subject index.

Mikeš tells us that the book was planned 6 years ago, and since that time the entire field has changed rapidly, to the extent that encompassing it all now would be beyond the capabilities of one person.

The text consists of an Introduction, with bibliography, and chapters covering theoretical aspects and terminology; principles of rapid separation of biopolymers and biooligomers; column packings; instrumentation; laboratory techniques and working methods. A total of more than 1500 references is given and there is a good index of some 31 pages.

The theoretical approach to the subject is both thorough and understandable, and assisted by clear diagrams. The term "HPLC" refers here to high-pressure (and not high-performance) liquid chromatography, and both HPLC and "MPLC" (medium-pressure liquid chromatography) are covered. There are some new or unfamiliar abbreviations (including two reminiscent of astro-physics, or even comedy television from another planet—NARP and PARP, which refer respectively to non-aqueous reversed phases and purely aqueous reversed phases). Reversed-phase chromatography is explained partly with the help of a sketch showing two serious-looking gentlemen, one with his arms in knots, and the caption: "Reversed-phase chromatography—very simple—invert the column."

The relevant separation techniques, including ion-pair reversed-phase chromatography, are covered and explained clearly. The material on instrumentation and column packings also is good. There are references to the use of a variety of detectors, including bioluminescence and chemiluminescence, fluorescence, conductometric, reaction, mass spectrometric, optical activity, refractive index, light-scattering, scintillation and multi-channel types.

As throughout the text, the chapter on laboratory techniques and working methods is arranged in a systematic manner so that its value is enhanced.

In addition to being well planned and thorough, a pleasing feature of the text is the good standard of English employed throughout—it was not translated from Czech (much better English, unfortunately, than often may be found in British, American or international scientific writing).

The volume contains 379 pages, with many references, but what has been written here should not suggest it to be a mere review of the subject. The author is of considerable standing and enhances the material, so that the result may be of great help both to comparative newcomers and to industrial libraries, colleges and research associations (its cost may preclude purchase by many individuals). The intention is that Part B will cover the separation of particular classes of compound, and the reviewer looks forward to the opportunity to read this also.

D. Simpson

Computational Chemistry. An Emphasis on Practical Calculations

Milton D. Johnston, Jr. *Studies in Physical and Theoretical Chemistry*, 56. Pp. xviii + 680. Elsevier. 1988. Price Dfl245; $129 (hardback); Dfl110; $58 (softback). ISBN 0 444 42962 X (hardback); 0 444 42963 8 (softback).

The objective of the author in writing this book was to introduce the chemist to computers and computational methods in order to encourage the reader to use computers for problem solving.

The book consists of three parts. The first gives a general review of mathematical techniques including partial fractions, differentials and complex numbers. It discusses algorithm design, program layout and user interactions. The types of computer, major components and peripherals, languages and available software are all discussed in varying depths. The text is rich with comments and guidance for the new user of computers, albeit in a rather conversational manner. The text contains many program examples, which are given in various versions of BASIC. The book has a strong emphasis on the use of personal computers and follows the industry standard of the IBM PC as most of the examples are written for BASICA or QuickBASIC. However, the student should have little difficulty in adjusting them to other BASICs or languages.

Part II delves more deeply into mathematical methods. The methods of solving algebraic equations, both analytically and numerically, are discussed and the calculation of pH in general acid - base equilibria is used as an example. Numerical methods for obtaining derivatives and integrals are described. Routines for the evaluation of the gamma function and Legendre and Laguerre polynomials are given. Other chapters cover techniques for handling matrices and determinants, solutions of differential equations, model fitting and data analysis and Monte Carlo methods.

The final part gives full program listings for three applications of computers in chemistry: a program to produce, plot and manipulate molecular structures; a suite of programs to generate and plot NMR spectra; and a tutorial program to generate and experiment with fast Fourier transforms.

Unfortunately, it was not clear whether it is possible to obtain machine readable versions of the examples and other programs listed in the book. One has to be dedicated to enter 1600 lines of code, as is required to use the NMR spectra program given!

This book has obviously been a "labour of love" and contains a great deal of the useful knowledge and experience gained by the author during his involvement with computers. Although it is a long book, it attempts to cover too much ground. It is not a detailed guide to BASIC or MS-DOS, or a formal guide to program design and structured programming, or a reference book of computational solutions to mathematical methods. The author follows the IBM PC standard but does not discuss in any depth the vast amount of commercial and public domain software available for this family of computers, preferring to encourage the reader to develop or enhance software for his or her own needs.

If the contents of this book had been a lecture course, it would have been excellent, but its value as a textbook is limited.

J. Huddleston

Quantitative Gas Chromatography for Laboratory Analyses and On-line Process Control

Georges Guiochon and Claude L. Guillemin. *Journal of Chromatography Library, Volume* 42. Pp. xii + 797. Elsevier. 1988. Price $165.75; Dfl 315. ISBN 0 444 42857 7 (Volume 42); 0 444 41616 1 (Series).

In this latest volume in the *Journal of Chromatography Library* series the authors have set out to produce a comprehensive account of quantitative analysis as it applies to gas chromatography. Over the years a prodigious number of papers, reviews and books have been produced on this important subject and it must have been a Herculean task to bring all of the most significant material together in one volume. It is hardly surprising that the book runs to 800 pages.

The text is most certainly comprehensive. Starting with simple definitions and basic principles of chromatography the content proceeds through an account of the theory of gas chromatography and the chromatographic process, techniques and methodology of gas chromatography and every aspect of quantitative analysis. An example of the comprehensive nature of this book is the discussion of the measurement of peak areas. This ranges from the use, problems and pitfalls of using computers to the dubious pleasure of cutting and weighing peaks from the chromatogram, not forgetting the use of the planimeter. Does anybody still use the last two methods?

The authors' monumental efforts have resulted in a very readable and interesting text. It is a most creditable volume containing something for everyone using gas chromatography in almost any application. I should like to be able to recommend it to all present and potential users of the technique. Unfortunately, I fear that at around £90, it will be out of the reach of all but the most committed or affluent reader. Nevertheless, this book should find its way on to the library shelves of any organisation having a serious interest in gas chromatography. With some evidence that the pace of development in gas chromatography is slowing there is perhaps the consolation that much of the content will not date too rapidly and this excellent book could remain a useful reference source for some time to come.

B. A. Colenutt

Advances in Electrophoresis. Volume 1

A. Chrambach, M. J. Dunn and B. J. Radola. Pp. x + 441. VCH. 1987. Price DM154; £56. ISBN 3 527 26741 7 (VCH Verlagsgesellschaft); 0 89573 669 1 (VCH Publishers).

The purpose of these annual volumes is to assemble multiple sources with respect to electrophoretic techniques into a central "review bank" that is easily and readily available to everyone using electrophoretic methods. It is especially devoted to those scientists using these techniques, but cannot follow their development in the original literature. This first volume contains eight reviews, of which seven are devoted to the separation and detection of proteins and one also to smaller anions and cations.

The first review (110 pp. and 587 references) is written by M. J. Dunn and gives a good description of two-dimensional polyacrylamide gel electrophoresis. The second is written by C. R. Merill and describes the detection of proteins separated by electrophoresis (30 pp. and 98 references). It is a concise report and pleasant to read.

The third review (36 pp. and 149 references) describes well protein blotting as a tool for the analytical biochemist. Much practical information is given. The review of N. C. Stellwagen (52 pp. and 155 references) deals with the electrophoresis of DNA in agarose and polyacrylamide gels. It is also well written with considerable information.

Next, a review on affinity electrophoresis is given by K. Takeo (52 pp. and 207 references). In this chapter he describes various approaches and in Table 2 gives a nice synopsis of affinity electrophoresis with reliable literature sources.

In the section on recent trends in capillary isotachophoresis by P. Gebauer, V. Dolník, M. Deml and P. Boček (82 pp. and 239 references) a good review is given of the potential of this, for many biochemists still unknown, technique. A simpler explanation of the technique could have been given than, *e.g.*, in Figs. 1, 2 and 4.

The review on preparative gel electrophoresis of proteins (19 pp. and 30 references) is too short and perhaps therefore lacks clarity. The last review on red cell enzyme markers in forensic science, methods of separation and some important applications (50 pp. and 141 references) is a clear and concise report, which can be read almost as a novel.

In conclusion, this volume is valuable to have on the shelf, especially because so many references are given by various experts in the field of electrophoresis.

F. M. Everaerts