Book Reviews

Quality Assurance Principles for Analytical Laboratories. Second Edition
By Frederick M. Garfield. Pp. ii + 196. Association of Official Analytical Chemists. 1991. Price US$63.00 (USA, Mexico and Canada); US$69.00 (Export).

This forms an excellent bible for a quality assurance programme in a modern laboratory. It gives a simple start up for laboratories wishing to aim for accreditation in, for example, BS 5750 and also for laboratories aiming for an FDA approval. Having a well-defined layout it is very simple to locate any section as required.

Chapter one concerns itself with QA and planning. I think the most important section is the evaluation of costs and benefits. This ensures that senior managemnent can readily see cash savings.

The QA manual ensures that written procedures are both implemented and adhered to. At the moment there is no standard format. However, as pointed out, a company must treat the manual with a profile status that it deserves.

Chapter two is devoted to statistics and control charts. Placing it as such leaves the company with the choice of taking as little or as much of a statistical approach as is needed or required.

Chapter three deals with personnel considerations. This format ensures that a value is there for everybody, be it from the laboratory manager or director down to the most junior of non-supervisory staff. An important section is self evaluation, as I feel that this is of paramount importance to every employee.

Chapter four is devoted to equipment and supplies. It points out the necessity to implement service contracts when purchasing equipment. Many auditors now insist on seeing that regular servicing by competent people is carried out. The section on standards and standard solutions stresses the necessity to formalize both the purchase and use of such.

Chapter five pulls together the need for sample and record handling. This ensures total traceability of all data including raw data. It also ensures the safe storage of any sample as required by the quality manual.

'an excellent bible for a quality assurance programme in a modern laboratory'.

Chapter six deals with sampling and sample analysis. Procedures for sampling must be strict and adhered to, as without a valid sample, analysis is meaningless. Method selection can depend on many attributes, those can include, as the chapter states, 'figures of merit', however, there are other reasons for choice and very often a customer may well have a preferred or reference method, there is also the issue of cost and/or availability of equipment. Finally, staff expertise can determine the choice of method.

The section human error is very important as with the use of electronic data handling it makes tracing of human errors more difficult. Thus a system of corrective actions must be implemented.

Chapter seven deals with proficiency and check samples, it shows the need for method validation and genuine calibration of instrumentation and leads on to intralaboratory testing, which shows the proficiency of both the staff and the instruments, it also highlights any training needs. Interlaboratory testing or 'round robin' testing gives a good idea of both methods and personnel.

Chapter eight deals with audit procedures, which may consist of a visit from an external auditor once or twice a year or on a more frequent basis internal audits. A systematic programme must be set up to select and train auditors and internal audits, just like external, must be systematically planned and carried out.

Chapter nine deals with design and safety of facilities. Ideally we would all inhabit a perfectly designed laboratory; however, most of us inherit a laboratory that we hope to improve.

Chapter ten deals with accreditation. At the outset it must be decided what accreditation is required and how to go about it.

The appendices gives examples of a typical quality manual, FDA audit forms, instrument performance checks, FDA procedures, check sample programmes and accreditation criteria.

I found the book very easy to use, its simple layout made any topic easy to locate and I feel that any member of an analytical team would find it useful in laboratories both large and small.

John Porter and Brian Henshaw

Biosensors and Chemical Sensors. Optimizing Performance Through Polymeric Materials
Edited by Peter E. Edelman and Joseph Wang. *ACS Symposium Series 487*. Pp. xii + 332. American Chemical Society. 1992. Price US$79.95. ISBN 0-8412-2218-5.

This book, edited by two eminent electroanalytical chemists, Peter Edelman and Joe Wang, arose from symposia sponsored by a number of divisions of the ACS at the Atlanta meeting of the ACS in April 1991. As is usual for *ACS Symposia Series*, the book is very well produced from camera ready copy. The typescript is of a relatively uniform standard and the figures are well presented. The index is comprehensive. The area of bio- and chemical sensors based on polymeric materials is one of considerable current research interest and activity, and practitioners in this area will find much of value in this book.

The book contains 25 chapters. The first chapter authored by Hall, provides a very useful and comprehensive overview of biosensors. The level of this review is such that it could be used as source material for a final year option on sensor technology. The remaining chapters are split into four sections.

The first section (Chapters 2–10) deals with permselective membranes and immobilized enzyme systems. All of the papers presented are of a high quality. The reviewer found, in particular, the papers by Belanger and co-workers on the electrochemical characterization of ferrocene derivatives in a perfluoropolymer glucose oxidase electrode (Chapter 4), Gorton *et al.*, on the electrocatalytic oxidation of nicotinamide adenine dinucleotide co-factor at chemically modified electrodes (Chapter 6), Hale and co-workers on the electrical wiring of flavo-enzymes with flexible redox polymers (Chapter 9) and Wang on permselective coatings for amperometric sensing (Chapter 10) to be of particular relevance to his own research.

'It is unusual for a proceedings volume to contain such a large concentration of high quality papers. The editors have done their work well'.

The second section (Chapters 11–15) dealt with electropolymerized thin films. Again all of the papers were of an excellent quality. A highlight was Chapter 12 written by Hillman *et al*, on the analytical applications of the electrochemical quartz crystal microbalance. Again this choice is dictated by the reviewers interests.

The third section (Chapters 16–21) considered polymer membranes on planar substrates. Highlights in this section were the chapter by Reinhoudt (Chapter 16) on molecular materials for the transduction of chemical information into electronic signals by chemical field effect transistors, the excellent review by the Wrighton Group (Chapter 17) on chemically sensitive microelectrochemical devices, and the contribution by Buck and co-workers (Chapter 18) on microelectrodes for *in vivo* cardiovascular measurements. It is difficult to choose highlights here as all of the contributed papers in this section were excellent and the reviewer found much new information in this section of the monograph.

The final section (Chapters 22–25) considered hydration-dependent polymer applications. A highlight here was the paper on water and the ion-selective electrode membrane (Chapter 23) by Harrison and co-workers. These authors described a novel optical arrangement which was used to probe the water distribution with a plasticized poly(vinyl chloride) membrane.

It is unusual for a proceedings volume to contain such a large concentration of high quality papers. The editors have done their work well. The range of topics covered is broad, and the material is presented in an accessible way. The reviewer wishes that more conference proceedings were produced and edited to the same high standards as evidenced in the present volume. The book achieves the aim of presenting an excellent overview of a topical area and should find a home on the shelf of active practioners in the polymer biosensor area.

Michael Lyons
Department of Chemistry
Trinity College, University of Dublin, Ireland

Gas Chromatographic Environmental Analysis. Principles, Techniques, Instrumentation
By Fabrizio Brunner. Pp. xii + 234. VCH (Weinheim). 1993. Price DM98.00; £40.00. ISBN 1-56081-011-4 (VCH Publishers) 3-527-28042-1 (VCH Verlagsgellschaft).

This monograph published by VCH provides an insight into the applications of gas chromatography in environmental analysis and, as is the norm for books dealing extensively with separation techniques, has a couple of chapters (1 and 2) dealing with the theory of chromatography slanted towards GC and conventional GC instrumentation and detectors. With the advent of interfacing GC to sophisticated detectors, in particular mass spectrometry, *viz*. GC–MS, no consideration of GC is nowadays complete without inclusion of combined instrumentation and Chapter 3 is devoted to GC–MS and its ability to solve environmental problems. Neither of Chapters 2 and 3, although having the words environmental analysis in the titles, are particularly oriented to this subject. Chapters 4 and 5 deal with aspects of environmental analysis focusing on volatile organic chemicals and organic micropollutants, respectively. Each chapter is referenced adequately for convenience.

Chapter 1 considers general concepts applied to GC and deals adequately with the theory and fundamentals. However, there are limitations in the treatment of factors contributing to band broadening and the equations involved. The Van Deemter equation is given in a simplified form and is somewhat misleading. A comparison of Van Deemter and Golay equations for packed and capillary columns is unfortunately not considered and the importance of capillary columns as the ultimate in efficiency is thus not highlighted or given the space that is required for the mode of GC that has largely superceded the packed column mode. In particular, there is no mention of the now widely used fused silica open tubular columns with chemically-bonded and cross-linked stationary phases.

The isotherms describing the equilibria for solute concentration between the stationary phase and the mobile phase and partition coefficient K_d, are treated in detail but one or two formulae are confusing because of the symbols employed. Here, although the partition ratio is considered no mention is made of the phase ratio, V_m/V_s, or the fact that K_d is the product of the partition ratio k' and the phase ratio β, or that the latter provides a measure of the openness of the column.

Chapter 1 does deal with concepts of resolution, column capacity and speed of analysis quite distinctly and a good attempt is made to illustrate the chromatography involved generally.

Chapter 2, on instrumentation, commences with an excellent overview of injection techniques and quantitation methods for gaseous compounds, use of gas sampling loops, calibration for low boiling liquids, detectors for gas chromatographic effluents, sensitivity, response factor, detection limits, dynamic range, detector types and operation.

'a very useful guide to environmental analysis using GC and can be recommended in spite of some inconsistencies in presentation and detail'.

Both Chapters 1 and 2 have a useful appendix on HPLC, which it is assumed is included to assist in intercomparison of aspects of the theory and techniques of the two chromatographies.

Chapter 3 deals with mass spectrometry. The schematic diagrams in several instances are not up to a reasonable standard, *e.g.*, single focusing magnetic sector system. The author makes the same mistake as other authors tend to in that the equation is given for the m/z ratio for single focusing but not for the much more, and vitally, important double focusing instrument (for which the schematic diagrams are satisfactory). This is particularly disappointing because of the requirement of accurate mass capability for the application of selected ion monitoring (SIM) in dioxin analysis which is highlighted in Chapter 5.

In addition the interfacing or GC–MS is a little lacking highlighting a jet separator but not considering in detail the direct coupling or open split interface to capillary column which are much more important in environmental analysis and the separation of complex mixtures that require the high performance and efficiency of open tubular columns.

The ion source diagram (there is no discrimination between the features for a quadrupole and magnetic sector facility) lacks refinement professionally as does the thermospray interface for HPLC–MS.

Chapter 3 does provide, however, some useful and well-defined information on MS–SIM in particular, but is inconsistent in style and presentation.

Chapter 4 deals in detail with the analysis of gaseous and highly volatile pollutants and has many good features some of which are results from the author's own laboratory. In particular, the considerable problems of adsorption and desorption of volatile organics are highlighted. The chapter covers monitoring of sulfur gases, preconcentration techniques using adsorbents, evaluation of adsorbents, the solvent

desorption method, CFCs, examples of miscellaneous analytes, analysis of VOCs in water and body fluids, static and dynamic headspace, and purge/trap techniques.

Chapter 5 on sample preparation and analysis of organic micropollutants again draws on the considerable experience of the author dealing in some detail with the principles of extraction, techniques for the extraction of organic micropollutants, from water, soil and solid matrices, living organisms, including clean-up for PAH and PCB, PCDD and PCDF from fly ash, soil/sediment and animal tissue. GC–MS analysis of these pollutants is highlighted with dioxins in particular. Comparison is made with HPLC using a fluorescence detector for the analysis of PAHs. The use of GC–ECD in PCB pollutant analysis and where appropriate GC–MS–SIM(R) are considered with high resolution mass spectrometry focusing on SIM and PCDDs.

This book provides a very useful guide to environmental analysis using GC and can be recommended inspite of some inconsistencies in presentation and detail.

Peter J. Baugh
Department of Chemistry and Applied Chemistry
University of Salford, UK

List of MAK and BAT Values 1993
By Deutsche Forschungsgemeinschaft. *Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area. Report 29.* Pp. xiv + 152. VCH. 1993. Price DM48.00. ISBN 3-537-27558-4.

As indicated in its title, this annually updated report lists the German guidelines for the threshold level values for hazardous chemical exposure in the workplace and the biological tolerance values for chemicals in the biological fluids of workers. Although this book is authored by the Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area, it does not specify which agency has the mandate to enforce the regulatory controls based on these guidelines.

This report clearly describes the definitions, reasons, and purposes for deriving the guidelines, as well as the applications and investigative directions in the future.

This Report contains two major parts, one entitled 'Maximum Concentrations at the Workplace', consisting of: I. Significance and usage of MAK values; II. Lists of compounds; III. Carcinogenic working materials; IV. Sensitizing substances; V. Dust and fumes; and VI. Special working materials. The second part entitled 'Biological Tolerance Values for Working Materials', consists of; VII. Significance and usage of BAT values; VIII. Lists of compounds; and IX. Carcinogenic working materials. Among these, section IV is new and did not appear in last year's report. Also, the content of the CAS number index is new, for the convenience of cross-indexing chemicals based on the numerical order of CAS number.

'This report clearly describes the definitions, reasons, and purposes for deriving the guidelines, as well as the applications and investigative directions in the future'.

Many substances, in the form of fibrous dust, are now included in the table of substances with assigned MAK values in this Report. In fact, fibrous dusts of chemicals seem to be a newly added category under scrutiny for their health affect. Classification of listed fibrous dusts is also defined in a detailed table. I have also noticed that the polymeric MDI is now listed in the MAK value table, though the actual MAK value is yet to be established. This may be the beginning of future establishment for MAK for all isocyanates, including polymeric types, as is currently used in the UK.

A separate exposure guideline, 'Technical Exposure Limits' (TRK), is established for a number of carcinogenic and mutagenic chemicals to which MAK values cannot be assigned. The newly established conditions also include: short-term exposure level, 5 × TRK; short-term exposure duration, 15 min (average); frequency per work shift, 5 times; and interval, 1 hour.

Weh-sai Wu
Occupational Health Laboratory,
Ontario, Canada

Handbook on Metals in Clinical and Analytical Chemistry
Edited by Hans G. Seiler, Astrid Siegel and Helmut Sigel. Pp. xx + 754. Marcel Dekker. 1994. Price US$195.00. ISBN 0-8247-9094-4.

This book covers a very large area of analytical chemistry, but despite the inclusion of this term in the Title, it is really mainly concerned with, and will be of most use to workers in clinical chemistry.

The first two short chapters are an interesting overview of metals in clinical chemistry and the uses and limitations of the book, including clinical and toxicological significance. Two further chapters cover the subject of sampling biological materials for trace metal determination and some aspects of quality control.

Analytical methodology is covered concisely in nine chapters, mostly of about 20 pages each, and in most cases an adequate explanation of the principals and limitations of the technique is given. Subjects covered are spectrophotometry, atomic absorption, ion-selective electrodes, voltammetry, ion chromatography, gas chromatography–mass spectrometry, inductively coupled plasma–optical emission spectroscopy and mass spectrometry and neutron activation analysis. Two chapters on solid sampling and the specialist determination of metals in human hair complete the first section of the book. As all the sections are written by different authors, there are variations in the depth of the coverage, but the editors have done a fine job in obtaining consistency, each chapter having a similar form and ending with a comprehensive list of abbreviations and symbols. There are not too many overlaps between chapters and most of them are very well, and as far as I have been able to see, accurately referenced.

The book continues with 42 chapters on the metallic elements, mostly of 10 to 20 pages in length. Not every element is dealt with identically, but broadly the format is; some introductory chemistry of the element, its distribution, uses and physiology followed by the analytical methods. Again, the editors have been successful in persuading the huge number of contributors to follow a broadly consistent format, that is easy to follow, commendably brief, but nevertheless presents a useful summary of the analytical methodology for the elements in question.

The book is generally accurate, with few obvious errors, although the diagram of the optical system of UV/VIS spectrophotometers on page 75, seems to have a novel arrangement of gratings, slits and monochromators! However, the book is not intended for instrumental specialists and it contains a vast amount of information in a concise form which will be of use to its intended audience of clinical chemists. It will also be of use in the laboratory where

knowledge of the properties of metallic elements is needed and it provides a good insight into analytical methodology for metallic elements. At $195.00 the book is not inexpensive, but for the amount of information it contains, it represents reasonable value for money.

Colin Watson
Atomic Spectroscopy Consultancy
Ilford, UK

Concise Encyclopedia of Chemistry
Translated by Mary Eagleson. Pp. 1201. Walter de Gruyter. 1994. Price DM128.00; ös999.00; SwFr124.00. ISBN 3-11-011451-8.

The main intention of this book is to serve as a reference tool for all people associated with chemistry, including chemists and laboratory technicians, lecturers, teachers and students of chemistry, biochemistry, pharmacy, biology or medicine. The book covers a wide field of chemistry in a handy compact volume. As a Concise Encyclopedia of Chemistry the book is well structured to give general information on certain needed aspects of chemistry. It should be kept in mind that the encyclopedia does not replace textbooks of detailed volumes in chemistry, as it is impossible to include all aspects of chemistry.

The encyclopedia has been structured with the entries in alphabetical order. Numbers, Greek letters and configural numbers/letters at the beginning of names are ignored in the allocations of alphabetical order, *e.g.*, 2-Nitro-benzaldehyde is listed under N; α-Oximino ketones is listed under O.

There is a certain shift in emphasis towards chemical substances and their structural formulas. However, apart from chemical elements, their reactions and compounds, the most important natural substances, synthetics, pharmaceuticals, dyes, *etc.*, have been included, as well as the complex atomic and molecular structure of matter, stoichiometry, analysis, catalysis, chemical kinetic reactions and thermodynamics, electrochemistry, colloid chemistry, carbon chemistry and petrochemistry, *etc.*

The Concise Encyclopedia of Chemistry contains around 12 000 entries taken from the fields of general, inorganic, organic, physical and technical chemistry, complemented by some 1600 figures and 300 tables. References have not been given owing to the problem of relatively long life of such encyclopedic works.

Although certain aspects of chemistry and some basic definitions are not included, mainly to keep to a compact volume, the encyclopedia is of a very high standard. Personally, I found the book a very valuable informative publication, which enabled me to quickly and logically obtain information I needed. The encyclopedia is one of those compilations that should be kept near you if you needed information urgently.

J. F. (Koos) van Staden
Department of Chemistry
University of Pretoria, South Africa

HPLC—A Practical User's Guide
Edited by M. C. McMaster. Pp. xii + 212. VCH. 1994. Price £39.50; DM 98.00. ISBN 1-56081-636-8.

HPLC has, in the last two decades, become the preferred method of chemical analysis for the vast majority of purposes particularly in those situations where mixtures of analytes are involved or where analytes are present in complex matrices. It is at first sight surprising, therefore, to find a new text pitched at a non-specialist level dealing with all aspects of this analytical technique.

However, HPLC is now present in all chemical laboratories and on almost every bench in analytical laboratories. It is used by all types and levels of scientific personnel often without a specific training in the technique. The availability of this text in 1994 is most opportune. It will fill a gap that has developed between elementary texts on the technique as a whole that have unavoidably become dated and specialist chromatographic texts dealing either with theoretical concepts or particular and often specialized applications.

The style in which the book is written is most appropriate to the level of the subject material. The preface is well worth reading and few scientists would argue with the author's contention that 'the instrument is the most effective teacher'. This approach is maintained throughout the book and the author's obvious enthusiasm for his subject is, to me, typified by a statement in Chapter 1 that HPLC 'was like having a window on his reaction flask'.

'The availability of this text in 1994 is most opportune'.

The book itself is divided into three parts. Each part contains several chapters and there are five useful appendices including a most restrained and correspondingly useful reference list. Part I, called 'An HPLC Primer', describes why HPLC is used so extensively, how much (in US$) one needs to spend on a system in 1993 and how, practically to get started. Part II deals with optimization of separations both from a theoretical aspect by considering separation modes as well as basic chromatographic theory and from an equipment point of view by detailing the stationary phases available and hardware options. In the theoretical coverage the author should be forgiven for using k′ and K′ indiscriminately to indicate capacity factor and complimented in not including photographs of instrumentation which would date long before the book will. Also included in Part II, are chapters on column maintenance and good practice to extend column life. In general, most of the variables used to modify and optimize separations are reviewed although necessarily somewhat superficially in certain sections such as the coverage of ion pairing in Chapter 7. Part III describes how HPLC is used both in analytical and preparative modes and included in this section is a very readable general chapter on separations of several compound classes and application areas. The last two chapters outline some of the current and future developments including automated data acquisition and treatment and coupled techniques in particular LC–MS.

Overall, this is a very informative book at a very reasonble price which, as the author intends, will be very helpful to many research workers who need HPLC but who would not necessarily wish to be classed as chromatographers.

R. B. Taylor
School of Pharmacy
The Robert Gordon University
Aberdeen, UK

Transition Metal Chemistry—The Valence Shell in *d*-Block Chemistry
By M. Gerloch and E. C. Constable. Pp. xi + 211. VCH. 1994. Price (softcover) DM58.00. ISBN 3-527-29219-5.

This is a textbook aimed at mid-career UK undergraduates that provides a usefully detailed discussion of the theoretical aspects of transition metal chemistry at this level. The material

is, of course, covered in many 'general' inorganic chemistry text books, however, the authors present a more detailed, though not mathematical, description in a refreshing style.

The book is organized along fairly traditional lines with a general introduction briefly covering topics such as ligand types, isomerism and oxidation state. This is followed by a discussion of crystal field theory which includes a useful reprise of atomic orbitals and terms. The two succeeding chapters describe (i) intensities of bands in '*d–d*' spectra and, (ii) spin and magnetism. The former is particularly lucid and valuable as the topic is rarely covered in any detail in the more commonly used general textbooks on transition metal chemistry. The chapter on ligand field theory starts with a description of the molecular orbital model for bonding! The authors, however, subsequently strive to make the point that ligand field theory is something other than MO theory applied to transition metal complexes, and is in fact 'the name given to crystal field theory that is fully parameterized'. This is a clarification that is frequently omitted from many general textbooks, but given the background of one of the authors it is unsurprising to find it prominently featured here. Much of the rest of the book describes the consequences of *d*-orbital filling on the chemistry of transition metal complexes. Most of this is standard fare, however, one notable merit of the book is that the authors make the effort to point out some of the assumptions that are made in presenting this data. For example, when describing the variation in metal–ligand bond lengths with electron configuration, they take care to present their arguments in such a way as to make ambiguities arising from the use of ionic radii (and their magnitude), rather than covalent radii, unimportant. Other topics covered in some detail include the Jahn–Teller theorem, thermodynamic stabilities, redox potentials and reaction rates. The book closes with a short chapter on the lanthanoid elements.

'provides an excellent grounding for undergraduate students in the theoretical aspects of transition metal chemistry'.

Each chapter is concluded by carefully chosen suggestions for further reading and there are a series of special topics, isolated in boxed sections from the main text, scattered throughout the book.

In conclusion this book provides an excellent grounding for undergraduate students in the theoretical aspects of transition metal chemistry. It is clearly superior to the corresponding sections of more general textbooks on inorganic chemistry and yet remains easily accessible to intermediate level students. It should figure strongly on 'recommended texts' lists of many inorganic chemistry courses.

D. A. Tocher
Department of Chemistry
University College London, UK

Thin-layer Chromatography. Techniques and Applications

By Bernard Fried and Joseph Sherma. *Chromatography Science Series. Volume 66.* Revised and Expanded. Pp. viii + 452. Marcel Dekker. 1994. Price US$165.00. ISBN 0-8247-9171-1.

This is the third, revised and expanded edition of this popular book on thin-layer chromatography (TLC). The second edition was published in 1986. The chapter headings are the same for the two editions but even a precursory reading will indicate that an honest effort has been made to revise and update the material in the earlier edition. The book succeeds admirably in providing an introductory text in TLC spanning the dichotomy between the classical laboratory techniques of conventional TLC and those of the latest developments in modern instrumental TLC. This would be a good start for someone new to the technique as well as a good resource to the general literature to follow up on specialized items of particular interest. The book is extensively and well illustrated. It possesses some of the weaknesses of its predecessor in the sections on method development and scanning densitometry. The book is aimed at the practical chemist but the section on solvent selection is most confusing and not very systematic. The section on scanning densitometry reads like an excerpt from various manufacturers' catalogues listing available options but saying little about their applications. Calibration methods, multiple wavelength scanning, spectrum recording, video integration, *etc.*, are barely mentioned. Also, most of the figures in this section are from the 1970s, and although still relevant, they do not represent the capabilities of modern computer controlled instruments. These are just small criticisms in an otherwise excellent book.

'The book succeeds admirably in providing an introductory text in TLC spanning the dichotomy between the classical laboratory techniques of conventional TLC and those of the latest developments in modern instrumental TLC'.

The text is essentially divided into two parts. The first 235 pages provide a comprehensive review of the practical aspects of planar chromatography, including theoretical considerations, sorbent selection, mobile phase characterization, sample application, development techniques, detection, documentation, preparative techniques, and radiochemical techniques. The balance of material seems about right and the new techniques of forced flow development and automated multiple development are given adequate coverage. The preparative chromatography section is a significant improvement over the earlier version and includes the use of centrifugal processes.

The second section of the book contains a commentary and a collection of experiments for various compound types. This section is heavily biased towards the life sciences with the individual chapters covering organic dyes, lipids, amino acids, carbohydrates, natural pigments, vitamins, nucleic acids, steroids and terpinoids, pharmaceuticals, and miscellaneous compounds. The sections on pharmaceuticals and organic dyes are the least comprehensive and there is no mention of other major application areas of TLC, such as food chemistry, forensics, clinical chemistry, industrial chemistry, *etc.* The experimental instructions are reasonable clear, but in general discuss conventional separation methods and do not use instrumental approaches. The main purpose seems to be to provide a series of introductory experiments for use in university teaching rather than a collection of validated methods for use in industry. The experiments will appeal mainly to an academic audience while the chapter commentaries are a useful introduction to the general literature on the compound classes indicated by the chapter headings.

Overall, this is a good book that is easy to read and virtually free of major factual or typographical errors. I recommend it to anyone looking for an introductory text covering the basics of planar chromatography.

Colin F. Poole
Wayne State University
Detroit, Michigan, USA

Air Monitoring by Spectroscopic Techniques
Edited by Markus W. Sigrist. *Chemical Analysis: A Series of Monographs on Analytical Chemistry and its Applications. Volume 127.* Series editor J. D. Winefordner. Pp. xxi + 432. Wiley. 1994. Price £66.00. ISBN 0-471-55878-3.

Spectroscopic techniques have long been used in monitoring atmospheric composition. For example, the continuous analysers for ozone and carbon monoxide used in monitoring networks around the world are based upon UV and IR absorption, respectively. However, such technologies are well tried and tested and the subject of little current research interest. On the other hand, the techniques such as differential absorption lidar and differential absorption optical spectroscopy to which this book is largely addressed are only now coming of age as widely used and reliable methods. Nonetheless, application of these methods is most commonly for rather specialized research purposes rather than routine monitoring, although commercially available long path absorption devices are steadily increasing their share of the air monitoring market. Also, for a number of short-lived species present in the atmosphere at very low concentrations such as the hydroxyl and nitrate free radicals, the best measurements to date have been based upon long path spectroscopic methods.

'strongly recommended to those requiring knowledge of the theory and applications of spectroscopic techniques in the atmosphere'.

Without doubt, spectroscopic techniques have a very large role to play in both routine and specialized air monitoring applications and their use will increase in the future. In this context, the book is extremely timely and provides an excellent insight into both the theory and application of the more important techniques. There are in all seven chapters, each of them substantial in size and authored by recognized experts in the field. The first chapter by Sigrist is a general introduction that places spectroscopic methods in context and distinguishes between the different available procedures. This is followed by a chapter by Platt on differential optical absorption spectroscopy; as well as basic theory, there is a great deal of valuable applications information drawn from the considerable experience of the author. The third chapter covers another group of very valuable procedures under the title of 'Differential Absorption Lidar'. The author, Svanberg, devotes considerable space to the methodology and hardware, giving a brief overview at the end of monitoring of common atmospheric trace gases and a more substantial review of a case study of atomic mercury monitoring. Chapter 4 by Sigrist deals with laser photoacoustic spectroscopy. This procedure has only recently been applied in air monitoring and its capabilities have yet to be fully established. Chapter 5 by Schiff, Mackay and Bechara reports on the use of tunable diode laser absorption spectroscopy. This is another technique with a fairly strong track record of atmospheric applications and has much potential for further development. Chapter 6 by Hanst and Hanst is on gas measurement in the fundamental IR region. Long-path FTIR was one of the first applications of spectroscopy to atmospheric measurement and played a major role in elucidating the composition of Los Angeles smog; this type of application is described in some depth. The final chapter, perhaps of less immediate application, is on matrix isolation spectroscopy in atmospheric chemistry. This is a technique that has yet to be applied widely to atmospheric measurements, but the chapter makes a good case for its capabilities and possible further applications.

This book can be strongly recommended to those requiring knowledge of the theory and applications of spectroscopic techniques in the atmosphere. It is the best currently available overview of the subject area and contains a wealth of valuable information. It will be of value especially to the research community, but may find some applications as further reading for graduate level academic courses.

R. M. Harrison
Institute of Public and Environmental Health
University of Birmingham, UK

Practical High-performance Liquid Chromatography. Second Edition
By Veronika R. Meyer. Pp. xiii + 376. Wiley. 1993. Price £24.95. ISBN 0-471-94132-8.

The second edition of this handbook, devoted to the practical performance of liquid chromatography, is divided into 26 chapters covering all of the relevant aspects of the technique. Included in the first introductory chapter is an extensive bibliography of books devoted to HPLC. There is also a section on software available for purposes other than simple peak integration, which can be run on most personal computers. The author states in the preface that she intended to keep theory to the minimum required for good HPLC practice. The emphasis in Chapters 2 (Theoretical Principles), 8 (HPLC Column Tests) and 24 (Applied HPLC Theory) is therefore on examples of the practical use of the various equations and formulae which describe and explain chromatographic performance.

Chapter 3 is devoted to pumping systems, Chapter 4 to equipment for sample injection and Chapter 5 to detectors. All give a reasonably balanced view of their subject. Chapter 5 is the least self-contained; conductivity detection is discussed in Chapter 15 (Ion-chromatography) and the extremely useful multi-wavelength and software programming possibilities of diode-array detectors are given a very superficial couple of paragraphs in Chapter 20 (Analytical HPLC: Special Detection Possibilities). ICP, IR, MS, AA, NMR and GC detectors are also given a passing mention in this section.

Chapters 6, 7 and 8 describe the nature of stationary phases and the general packing, testing and use of columns. This is supplemented by a series of comprehensive lists of commercially available stationary phases contained in Chapter 26. The various modes of chromatography; absorption, reversed-phase, liquid–liquid partition, chemically bonded phases, ion-exchange, ion-pair, ion, size exclusion and affinity, are discussed in the following chapters (9–17). A short but succinct Chapter 18 on choice of method is followed in Chapter 19 by advice on resolving complex mixtures by modifying the elution profile.

'a "first source" benchbook for teaching, method development and trouble shooting'.

Chapter 20 (Analytical HPLC) discusses all aspects of quantitative analysis including method validation and an excellent description of the sources of integration errors. Preparative methods are described in Chapter 21 and the separation of enantiomers is the subject of Chapter 22.

One of the attempts to update this second edition is the addition of Chapter 23 entitled 'New Prospects'. A variety of relatively new techniques such as micro, capillary and high-speed HPLC are described and their potential assessed. As the format of the book has been designed around the technique and not specific groups of compounds, Chapter 25 lists key review papers on the separation of individual classes of compounds.

There are in excess of 60 books on HPLC cited in the bibliography, many dealing with the practical aspects of the subject. The role and particular value of this publication will therefore be considered by potential purchasers. It is easy to read with a direct and practical style. This makes it particularly attractive as a 'first source' benchbook for teaching, method development and trouble shooting. The use of references as footnotes to the appropriate section offers a ready source of more detailed information, provided that the investigator has access to a well stocked library.

Further editions would require a more radical revision as the addition of extra chapters to include recent advances inevitably leads to fragmentation of related information, diluting the usefulness of the original format.

In summary, this is a valuable source of information (and its practical use) for every laboratory performing HPLC. It is sufficiently attractive in price for students and investigators to have a personal copy.

R. S. Ersser
Clinical Biochemistry
Great Ormond Street Hospital, UK

Beer and Wine Production Analysis, Characterization and Technological Advances

Edited by Barry H. Gump. *ACS Symposium Series 536.* Pp. xi + 276. American Chemical Society. 1993. Price US$59.95. ISBN 0-8412-2714-4.

This book has been developed from an ACS symposium held in San Francisco in 1992 with the texts for the chapters being submitted in about May 1993. In all there are 14 chapters subdivided into four sections: advances in analysis and characterization techniques (two chapters), sensory characteristics and control (five chapters), technological applications in production (five chapters) and advances in home beer and wine making (two chapters). The main title of the book gives a somewhat false impression of the contents. Firstly, the over-all emphasis is very much on wine, which rates nine chapters *versus* four on beer and one on the principles of sensory analysis. Secondly, the book is not really about 'production'. Anyone looking for a text on how to make beer or wine will be disappointed. The subtitle, 'Analysis, Characterization and Technological Advances' gives by far the best impression of the contents, and, not too surprisingly given the origins of the book, the appeal will be very much to the industrial scientist or students engaged on courses in fermentation studies, biotechnology or food science.

'the appeal will be very much to the industrial scientist or students engaged on courses in fermentation studies, biotechnology or food science'.

Individual chapters are all well written with considerable information content although the last two chapters on home production are very much orientated to the situation in the USA and in the case of wine, California in particular. Because of the symposium-derived format, whichever chapter attracts the attention of the reader initially, nearby topics seem to inevitably catch the eye. For example, I am sure that the brewing chemist will want to look at Chapter 5 on beer oxidation control, a topic very central to production and storage of all beers but especially the light lagers which are so popular worldwide today, and then realize that Chapter 4 on flavan-3-ols is well worth reading although directed at the wine chemist and the flavour implications of this group of compounds. Chapter 6 opens up the world of monoterpenes and their glycosides as components of wine aroma discussing the situation during grape berry development, during fermentation and assessing the importance of the enzymatic release of monoterpenes. This serendipitous effect extends through chapters on microbiological methods, genera other than *Saccharomyces*, uses of enzymes, potential applications of biotechnology, ultrafiltration and the dos and don'ts of sensory analysis making the book a very rewarding browse. I think in this way the book will get people out of their often very narrowly defined areas of interest to advantage. It will make an excellent library volume. Because of the price and the range of contents I suspect that it will be a less attractive personal purchase.

J. C. Slaughter
Department of Biological Sciences
Heriot-Watt University, UK

Introduction to Modern Vibrational Spectroscopy

By Max Diem. Pp. xiii + 286. Wiley. 1993. Price £49.50. ISBN 0-471-59584-5.

There is now a very wide range of texts available on vibrational spectroscopy, covering every level of the subject, from that appropriate for a first year undergraduate course through to the most advanced treatises aimed solely at the *cognoscenti*. This book falls between these two extremes, the aim of the author is to present an introduction to IR and Raman spectroscopy suitable for graduate and senior undergraduate students. My over-all impression of the book is that, like the curate's egg, it is good in parts.

The first three chapters provide an introduction and theoretical background to molecular vibrations. Although a minimum knowledge of quantum mechanics is assumed, the treatment of molecular vibrations goes far beyond that expected in an Honours Degree course in chemistry, and requires an understanding of matrix manipulation and coordinate transformations. Applications of symmetry to the interpretation of vibrational spectra are dealt with in Chapter 4. Although pitched at a level appropriate for an undergraduate student there is insufficient detail to provide a satisfactory explanation of group theoretical methods. Chapter 5 gives a good general introduction to the Raman effect and includes brief sections on some of the more modern aspects such as resonance Raman scattering, time-resolved methods, non-linear Raman effects and SERS.

'an introduction to IR and Raman spectroscopy suitable for graduate and senior undergraduate students'.

Experimental techniques for the measurement of spectra are discussed in Chapter 6, which includes mention of both dispersive and interferometric instrumentation. In this chapter there is a particularly detailed section on Fourier transforms, although the mathematics may prove intimidating to most students. There then follows two chapters concerned with the interpretation of vibrational spectra of some small organic molecules (Chapter 7) and biological molecules (Chapter 8). Both chapters are well written and it is pleasing to see a discussion on biological molecules such as proteins and nucleic acids, and their components, in view of the growing importance of spectroscopy in this area. However, it is disappointing that no inorganic examples are given, in view of the importance of vibrational spectroscopy to inorganic chemists. The final chapter is dedicated to the complementary techniques of vibrational circular dichroism and Raman

optical activity. Although experimentally difficult these methods have now been developed to the extent that useful stereochemical information can be derived from biological macromolecules. Whilst it is justifiable to mention these in such a text the length of this chapter is out of proportion to the other topics.

There is a clear lack of balance within the book and it appears that prominence is given to the author's own areas of interest. However, my major criticism concerns the immense number of mistakes. Typographical errors can be found on almost every page but there are also some errors of fact that are seriously misleading. This book is clearly aimed at graduate students in the USA. In the UK it is most likely to be useful to PhD students and other researchers, although some chapters might be suitable supplementary reading for undergraduates.

T. J. Dines
Department of Chemistry
The University, Dundee, UK

Composition and Analysis of Heavy Petroleum Fractions
By Klaus H. Altgelt and Mieczyslaw M. Boduszynski. *Chemical Industries Series 54.* Edited by H. Heinemann. Pp. ix + 496. Marcel Dekker 1994. Price US$175.00. ISBN 0-8247-8946-6.

This book forms part of a series concerned with various aspects of the chemical industries under the over-all editorship of Heinemann. It can be considered to be a specialist update of the well known work by Altgelt and Gouw entitled *Chromatography in Petroleum Analysis* (1979). This volume is concerned with the analysis of specific heavy petroleum fractions, defined by the authors as 'those components with boiling points generally above 345 °C'. Analysis of these extremely complex hydrocarbon mixtures has always been difficult, but it is becoming economically and environmentally important to ascertain exact details of the composition of these potentially valuable refinery feedstocks.

The book is divided into 12 chapters, each with a modern bibliography. It covers three areas: nomenclature and physico-chemical properties of heavy petroleum fractions; separation and structural characterization of these fractions; and distillation principles, in particular the new concept of an atmospheric equivalent boiling point (AEBP) scale. This stratagem enables the entire boiling range of petroleum from light distillates to vacuum residues to be delineated in terms of molecular mass and thereby allows different crude oils and fractions to be compared on a rational basis.

Although all of the book is of interest, for the analytical chemist only Chapters 6, 7, 8 and 9 are of particular relevance.

Chapter 6 gives an outline of chromatographic procedures available for the separation of the various compound classes found in petroleum, *i.e.*, saturates, aromatics, polars or acids, bases, neutrals. Techniques discussed include: gas chromatography, high-performance liquid chromatography and supercritical fluid chromatography, each used in conjunction with a variety of detectors. The chapter also contains a number of useful analytical protocols, explained in terms of flow charts, for complete fractionation of the hydrocarbon moieties.

'Overall, the book is timely and deals comprehensively and concisely with a difficult topic. It provides a valuable insight into the terminology, composition and modern methods of analysis for high-boiling crude oil fractions'.

Molecular characterization by mass spectrometry is described in Chapter 7. The basic principles and modes of ionization (GC–MS, LC–MS, FAB–MS, MS–MS) are defined followed by their specific application to petroleum. The section is easy to follow and adequately punctuated by figures and tables, but possibly the authors have attempted to cover too many ionization techniques in too short a space and as a result the over-all treatment becomes somewhat superficial.

Chapter 8 covers structural elucidation by nuclear magnetic resonance and provides a good account of this complex and developing subject. Much of the work described is still very novel for crude oil characterization even though it has been used for some time for the analysis of coal derived liquids. The chapter concentrates on modern pulse-sequence and two-dimensional techniques and concludes with specialist protocols for computer assisted functional group analysis.

The remaining analytical section gives a 'pot-pourri' of auxiliary methods such as infrared, ultraviolet and X-ray spectroscopy and pyrolysis that can be used in combination with other techniques to provide additional structural information on the distillate fractions, usually for the identification of hetero-atom species.

Overall, the book is timely and deals comprehensively and concisely with a difficult topic. It provides a valuable insight into the terminology, composition and modern methods of analysis for high-boiling crude oil fractions. The subject matter of the book is very specialized, which coupled with its cost, will unfortunately limit its appeal to those outside of the petroleum or allied industries.

G. A. Mills
Department of Chemistry
University of Portsmouth, UK

Instrumentation In Analytical Chemistry. Volume 2
Edited by J. Zyka. *Ellis Horwood Series in Analytical Chemistry.* Pp. 336. Ellis Horwood. 1994. Price £69.00. ISBN 0-13-472226-4.

This volume is a collection of 16 chapters, written by various scientists all resident in Prague, and covers topics in analytical chemistry ranging from electroanalysis to gas chromatography and X-ray methods. As one would expect from the legacy left in this city by Jaroslav Heyrovsky, there is a large concentration of effort on electroanalytical methods, including discussion on recent advances in chemically modified electrodes, stripping analysis and electrochemical sensors. These topics dominate the first six chapters of the book, and are written by well-renowned experts in this area of research. Following a small chapter dealing with automatic methods, which deals mostly with automatic analysers and only briefly alludes to flow injection analysis, the next three chapters concentrate on particular aspects of gas chromatography (GC) relating to identification of bacteria, pyrolysis GC of synthetic polymers, and immobilized stationary phases in capillary GC. The volume then continues with chapters on Fourier transform

'in effect it is a collection of mini-reviews, and those readers wishing to delve deeper into any of the topics would have to consult other more specialist texts'

infrared spectroscopy, laser Raman spectrometry, electron probe microanalysis, X-ray diffraction of polycrystalline materials, radioimmunoassay and finally, the use of surfactants in analytical chemistry. As this long list of topics suggests, it has not been possible for authors to give detailed

discussions on their respective areas of interest. This is the main criticism I have about the book, since in effect it is a collection of mini-reviews, and those readers wishing to delve deeper into any of the topics would have to consult other more specialist texts or the primary literature. The title of the book is also slightly misleading, since the material mostly deals with instrumental methods, rather than with 'instrumentation' *per se*. I would not, therefore, recommend it for individual purchase. It could, however, be a useful reference text in libraries, as introductory material for undergraduate or taught postgraduate students in analytical chemistry/science.

Malcolm R. Smyth
School of Chemical Sciences
Dublin City University, Ireland

Video Review

Capillary Electrophoresis: An Introduction to the Principles and Practice. A Video
By David Goodall, Anne Hodgson and Simon Hill. York Electronic Centre, University of York. Running time 33 min. Price £95.00.

Capillary electrophoresis (CE) is now a widely accepted and valued technique for the separation of both large and small molecules and numerous applications have been reported, particularly in the fields of biotechnology, pharmaceuticals, the water industry and food science. There are, however, areas where its unique resolving power, ease and economy of use are not fully recognized. The Centre for Science and Instrumentation have produced an educational video in order to promote interest in and understanding of the technique. York University is well placed to produce an authoritative version having been in the forefront of the promotion of CE in the UK. York was the venue for the first international seminar in the UK devoted to CE and the University also organizes annual short courses in CE.

The introduction to the video describes the advantages of CE and demonstrates various uses to which CE is now being applied including a short but impressive film showing direct CE sampling from a single cell of the ganglia of a pond snail, exemplifying the very small volumes required for this technique. Although examples of a number of instruments are briefly shown all further explanations are demonstrated using a home-made CE apparatus.

'the excellent live film of the detail of the practise of CE is a unique and valuable feature'.

The principles of the zone electrophoretic separation of ionic species including the crucial part played by electroosmotic flow are clearly and factually described using computor generated graphics, thankfully without recourse to spurious analogies. The determination and calculation of electrophoretic mobility using simple equations is well reinforced by a measured commentary. The separation of neutral analytes using micellar electrokinetic chromatography (MECC) is explained *via* clear graphics although the popular and growing field of chiral separations is not covered. A good theoretical approach to the optimization of both zone electrophoresis and MECC is included, which demonstrates the greater predictability of CE as compared with HPLC.

Injection techniques, including electrophoretic stacking, are described and dramatically illustrated using live film of the moving zones in a real capillary, obtained with a Dermascope video microscope. The sharp boundaries and plug flow characteristics of electrophoresis are clearly seen and this aspect will be of interest to both the experienced and to the newcomer. A variety of detection methods are covered and again live film shows the use of fluorescence detection employing illumination by ultraviolet (UV) light. Although indirect fluorescence is briefly mentioned the important field of indirect UV for the detection of inorganic ions is not explained. The section on detection is completed with a comparison of expected detection limits and the interfacing of CE with mass spectrometers. An example of an electrospray illuminated by a helium–neon laser after gold coating the capillary is shown.

The particular difficulties and advantages involved in the analysis of proteins by CE are explored in some detail and an interesting scanning electron micrograph of the cross-linked agarose gel used in a gel filled capillary for the separation of proteins by molecular mass illustrates the mechanism of this technique.

The video concludes with examples of some of the important applications of CE. Disappointingly the electropherograms are only briefly described and are difficult to see on a small TV screen. The computer redrawn electropherograms do not effectively demonstrate one of the most important aspects of CE, its potential for high efficiency, high resolution separations. The lack of detail in these examples may be a lost opportunity to motivate potential workers in this field.

Despite these misgivings the video is well worth braving the introductory music for the exceptionally clear explanations of the principles of the technique which, in this case, may be more readily appreciated in video than in a textual presentation. In addition the excellent live film of the detail of the practise of CE is a unique and valuable feature.

The video is recommended to students and technical staff having a knowledge of other separation techniques but requiring a basic understanding of the principles of CE. It will also be useful to those introducing newcomers to the technique and those wishing to promote interest in CE.

David Ryder
FMC Corporation (UK) Ltd.
Manchester, UK