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Book Reviews

Guide to flow cytometry methods by W. McLean Grogan and James M. Collins. Marcel Dekker, Inc., 270, Madison Avenue, New York, NY 10016, USA, 1990, pp 240, $119.

This is a very well-written book that describes the application of flow cytometry to many biological areas including immunological, biophysical and oncological disciplines. It has 15 chapters including an appendix with a methods section included at the end of most chapters. The book is clearly presented and excepting a few chapters that discuss theory is generally understandable even by scientists from other areas. This book would indeed be useful to all scientists involved with flow cytometry as well.

A good but simple and well-described introduction is a plus point. The short chapter that follows includes techniques in tissue culture and enzymic digestion to isolate single cells from solid tissues. These techniques can however be viewed only as guidelines since they may have to be modified from case to case. The third chapter on DNA analysis talks about DNA staining, analysis of DNA content, cell cycle staging of synchronous cells with thymidine analogues and DNA distribution of tumor cells during various parts of the cell cycle and its utility in following the prognosis of that disease. In addition, the chapter describes the utility of such approaches in the study of spermatogenesis and includes methods used for such studies. Although the theoretical considerations of the chapter on Light scatter may be hard to follow for all readers, the utility and importance of using forward angle light scatter and 90° light scatter in flow cytometry has been clearly elucidated. The analysis of dual-parameter light scatter and contour plots for various applications using lymphocyte subsets, coated spheres, thymocytes and bone marrow cells can never be under-emphasised. This chapter actually forms a good prelude to the next one on Immunofluorescence which deals with the various techniques of using antibodies to measure cell-surface antigen expression on different cell populations. Methods to conduct two- and three-color analysis, direct and indirect immunofluorescence studies have been described. This chapter would be of great help to immunologists measuring cell-surface antigen expression.

Chapter 7 on Cell sorting deals with one of the most important capabilities of this instrument. The chapter has been well presented and deals with the mechanism, logic functions, droplet selection and deflection, the statistical considerations behind the principle and other problems associated with cell sorting. A list of specific references guides the reader to the methods used for sorting various types of cells. This is followed by three very short chapters dealing with mitochondrial staining, intracellular pH and measurement of intracellular calcium levels. Considering the large number of investigations being carried out in this area, more information about the latter two subjects would have been useful. In addition, there is a disagreement about intracellular free calcium levels leading to some confusion (0·1 nM on p.164 and 0·1uM on p.165). A comparison of the utility of FACS with recent fluorescence-imaging microscopy would have been more informative. The chapter on Fluorescence anisotropy and membrane fluidity describes the theoretical and practical aspects of the measurement of membrane fluidity and anisotropy using membrane probes such as 1–6 diphenyl 1–3–5 hexatriene.

The chapter on Cell surface receptors describes another important application of flow cytometry for the quantitation of cell-surface receptors. The use of Scatchard plots along with the combined utilisation of static fluorimetry and flow cytometry for measuring cell-surface receptors has been elucidated using the three-tube method and per cent occupancy approach. Other chapters include the measurement of glutathione cell membrane potentials and other miscellaneous applications. An

appendix is included that lists the fluorescent stains and membrane dyes used generally along with their spectral characteristics and the sources from which they can be procured.

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Modern NMR techniques and their application in chemistry by A. I. Popov and K. Hallenga. Marcel Dekker, Inc., 270, Madison Avenue, New York, NY 10016, USA, 1991, pp 680, $162.

This volume consists of a collection of articles with the common theme contained in the title. The first article 'NMR properties of nuclei' consists of a good introduction to the basic elements of nuclear magnetic resonance as applicable to liquid-state NMR including various interactions of nuclear spins. A detailed discussion of Bloch equations and their solution, an introduction to relaxation and a brief mention of nuclear Overhauser effect are included. This chapter prepares the ground for future chapters and introduces the subject. The second chapter describes Fourier Transform and its applications to one- and two-dimensional FTNMR. Though available in other books on the subject, it helps focus attention on various aspects of FT and its relevance to NMR. A nice and concise description of product operator formalism and coherence-level diagrams is included in this chapter. Phase cycling, though mentioned, is not described in detail.

Solid-state NMR of spin 1/2 and spin >1/2 nuclei are dealt with in Chapters 3 and 4, respectively, and form the most comprehensive parts of the book. Both chapters are quite informative and well written. One shortcoming of Chapter 3 is the almost total absence of modern experiments and recent developments in the field, namely 2D NMR of solids, multiple quantum and zerofield NMR. The material covered in Chapter 4 is quite valuable as it brings together works which are distributed over different types of journals. It also focusses attention on 2D NMR of spin >1/2 nuclei. The chapter on quantitative chemical analysis by NMR, Chapter 5, focusses attention on error in intensities and line-widths which can be introduced as a result of artifacts of measurement. Most of the effects are well known but mentioning them under one head may have some advantages. Chapter 6 devotes itself to structure determination of organic compounds by NMR. The structure determination is carried to the level of conformational elucidation without attempting the more popular but risky algorithms of exact 3-dimensional structures by NMR. While both 1 and 2D experiments are discussed the totality of structural inferences are derived on the basis of the coupling patterns and J values and no attempt is made to use the nuclear Overhauser effect in either 1 or 2D experiments. Chapter 7 is devoted to structure determination of inorganic compounds and turns out to be again a very useful chapter. The structure of a variety of organometallic and inorganic compounds as revealed by high-resolution NMR is described. The chapter then goes ahead and discusses the structure of quadrupolar nuclei. This is one example where edited books containing independent chapters written by different authors run into difficulty. The quadrupolar nuclei NMR is discussed under identical heading in Chapters 4 and 7. A variety of quadrupole nuclei are discussed with emphasis on the discussion on boron and aluminium–27.

The difficult subject of equilibrium studies in solutions is aptly handled in Chapter 8. The difficulties and shortcomings of such studies by NMR are pointed out at the beginning and a fairly detailed analysis of such studies is outlined in this brief chapter. A related discussion on reaction kinetics and exchange is given in Chapter 9. The discussion in both these chapters restricts to measurements using conventional techniques, though a brief mention of 2D exchange spectroscopy is made in Chapter 9.

The last chapter covers a very useful review of 2D NMR studies of biomolecules. The chapter starts with a description of selected 2D NMR experiments for study of biomolecules and selects out the most relevant experiments, out of a very large number of available experiments, for structural studies of peptides and proteins *via* proton NMR. The selection is appropriate and accompanied by a crisp analysis of each of the methods. The review is up to date with the inclusion of a few 3D experimental schemes. It

then focusses attention on some of the practical considerations in acquisition and processing of 1 and 2D data. The full algorithm of the determination of 3-dimensional structure of small proteins by 2D NMR is illustrated by application to a representative molecule, namely, *lac*-repressor headpiece.

As a whole the entire volume has several useful contributions and should be available with practising NMR chemist. However, the volume lacks cohesiveness and acts more as a collection of independent articles and as a result does full justice neither to modern NMR techniques nor to their applications in chemistry.

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Handbook of thin-layer chromatography edited by Joseph Sherma and Bernard Fried. Marcel Dekker, Inc., 270, Madison Avenue, New York, NY 10016, USA, 1991, pp 1064, $198.

In separation sciences, chromatography is by far the most important technique. Realising this, Marcel Dekker is publishing a series of monographs on 'Chromatographic science' and this handbook is the 55th volume in this series.

Among the chromatographic techniques, thin-layer chromatography (TLC) is the most versatile and relatively inexpensive and finds very wide application, especially in biological sciences Consequently, there has been a phenomenal growth in the recent past in the introduction of new sorbents, in improving the selectivity and efficiency of sorbents, in the design of solvents to achieve better separation of related compounds as well as in refining the technique. Literature on TLC is extensive and rapidly growing. Therefore, the publication of this handbook is most timely. In fact, in this series, these authors have earlier compiled the literature on *TLC—Techniques and applications* in Volume 17 which was revised and expanded in Volume 35. In addition, monographs on *Quantitative TLC and its industrial applications* (Vol. 36) and on *Modern TLC* (Vol. 52) have appeared in this series. This handbook is the most up-to-date collection of articles on many aspects of TLC.

It contains 31 articles divided into two parts. In the first, Principles and practices of TLC are discussed and the articles cover the basic technique, materials and apparatus, theory and mechanism of TLC, optimization, sorbents, pre-coated and high-performance TLC, modern instrumentation, gradient development, overpressured TLC, TLC coupled to mass spectrometry, preparative TLC, thin-layer radiochromatography and the application of flame ionization detectors in monitoring compounds on chromatograms. In addition, there are also useful and informative articles on theoretical foundations of optical quantification and on photographic documentation. Articles on the application of TLC for the separation of amino acids and their derivatives, peptides and proteins, carbohydrates, lipids, phenols, steroids, toxins, hydro- and lipophilic vitamins, antibiotics, natural pigments, synthetic dyes and pesticides are assembled in Part Two. It also contains important chapters on enantiomer separations and on the separations of inorganic and organometallics, pharmaceuticals and drugs, and polymers and oligomers.

All the articles are contributed by recognised experts, are authoritatively written and contain a wealth of information. This book will be a valuable source of knowledge and information and would be appreciated by any scientist who practises TLC.

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General topology by M. G. Murdeshwar (II edition), Wiley Eastern Ltd, 4835/24, Ansari Road, Daryaganj, New Delhi 110 002, 1990, pp 375.

According to the author's preface, this book is written with students in the Indian universities in mind. The first edition of this book appeared in 1983. Around the same time, at least two other books appeared on the same subject, one by J. Munkres and the other by K. D. Joshi. As such, while commenting on one of them, it is not easy to ignore the other two books.

Murdeshwar's book consists of 357 pages, divided into twenty-one chapters. These are: Set theoretic background, Topological spaces, Bases and subbases, Neighbourhoods, Constructs, Filters, Nets, Continuous functions, Constructs revisited, Compact spaces, Connected spaces, T_0, T_1 and T_2 Spaces, R_0, R_1, Regular and T_3 spaces, Pseudo-metric spaces, Completely regular spaces and Tychonoff spaces, Normal and T_4 spaces, Countability axioms, Locally compact spaces, Compactification, Uniform spaces, and Complete spaces. A list of uncommon abbreviations and a list of notations and symbols precede the contents. At the end of the book, there is a good index of key words used, a list of errata, bibliography for future reading, a list of references and all of which aid in making the book more user-friendly. There is also a table of topological properties of various spaces, which comes quite handy as reference source for examples and counter examples.

This book has quite a few unusual and pleasant features. Chapter 0 contains a list of set-theoretic results. It is not surprising that the author has received some laudable comments on this score. In the preface to the first edition, the author adds 'A Word to the student', in which, amongst other suggestions, he urges the students to 'draw diagrams (Venn and/or commutative) whenever possible', while studying. Such useful 'class-room comments' are strewn throughout the book. In one place, the author takes pains to caution the reader to distinguish between the symbols Φ and ϕ. At another place he explains the phrase 'abuse of language'.

Another unusual aspect of the book is to break away from the 'Definition–lemma–proposition–theorem–corollary–exercise' format. The author wherever possible, has adopted the 'Theorem-definition' style, which is quite suitable and time saving in presenting this subject. However, all exercises are bunched at the end of each chapter, except in Ch. 18 wherein they are divided into several sections. The author promises to carry out this to the other chapters, in future editions. In a number of places (such as in using Alexander-subbase theorem to prove the compactness of a closed interval) you will find some simplifications of proofs that are generally offered.

There are some unpleasant parts too in the book. I will recount them briefly and try to avoid vagary.

1. While it is laudable that the author has shown considerable amount of originality and daring, in introducing new and realistic notations and terminologies, such as *'reverse'*, it would have been prudent not to introduce a plethora of abbreviations. This hampers in smooth reading of the book though it may save some printing space and time.
2. In any branch of mathematics, we do not study merely the 'objects' but also the inter-relation between them. In this respect, while studying topological spaces, I feel the study of continuous functions should not be postponed till the Seventh chapter.
3. The treatment of the Cartesian product is not satisfactory, even though it has been quite very elaborate. To begin with, right in Ch.0, the notation $evl\{f_i : X \to Y \mid i \in I\}$ has been introduced, rather inappropriately, instead of the standard notation $\Pi_{i \in I} f_i$. (Note that, this latter notation is justified by (0·7), on page 11 of the book.) The author does not spare any effort in explaining why the Tychonoff topology is 'chosen' in preference to the box topology on the product space. But he misses to emphasize the most basic property (8·15(i)) of the Tychonoff topology, which makes it the only correct choice. This 'Universal property' should not be ignored even if we are avoiding the categorical language. More or less similar comments hold with respect to the treatment of the quotient topology also. Perhaps, one may attribute these drawbacks as offshoots of postponing to introduce the concept of continuous functions.
4. The long list of errata, even in the second edition is a poor comment on the book on its own. I had to spend a considerable amount of time in figuring out the meaning of the symbol $C^*(X, \mathcal{T})$, since the symbol 'I' on page 228 is not printed properly. Also the author could have avoided the eye-sores such as starting a sentence with a mathematical symbol, as in "f is $\mathcal{T}$ - u continuous..."

Amongst other things, the omission of proper maps, the inclusion of the concepts such as R_0 and R_1, the unnecessary rigor shown in the treatment of Alexandroff-compactification, the comment on page 87 regarding sum topology, etc., point out to one thing: this book is suitable for students who want to specialize in 'Point-set-topology', rather than to those who want to acquire a working knowledge of 'General topology'. Despite all the good points in it, I find it difficult to recommend this book to the latter class of students as a text/reference book. Nevertheless, I hope the author will write more books and I wish him good luck.

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Numerical treatment of eigenvalue problems, Vol. 5 edited by J. Albrecht *et al.* Birkhauser Verlag AG, Klosterberg 23, CH-4010, Basel, Switzerland, 1991, pp 243, SFr 88. Indian orders to Springer Books (India) Pvt Ltd, 6, Community Centre, Panchasheel Park, New Delhi 110 017.

The problem of determining the eigenvalues of a (partial) differential operator under suitable boundary conditions is a very important one since it models the study of vibrations in several physical systems. Approximation of these problems by the finite difference or finite element methods leads to the generalized algebraic eigenvalue problem, which is an important and challenging problem of numerical linear algebra. The matrices will be large, as a large number of nodes will be needed to discretize the system, and they will be sparse, *i.e.*, with a lot of zeroes amongst the coefficients, especially if the finite element or finite difference method is used. Efficient algorithms have to take into account these factors also.

The book under review is a collection of papers presented at a conference held at Oberwolfach in 1990, in honour of one of the leading numerical analysts of this century, the late Prof. L. Collatz.

Since only iterative methods are available for the calculation of eigenvalues, we need to know a sufficiently small interval wherein the desired eigenvalue lies. Upper bounds are usually easy to obtain, especially using variational methods like the Rayleigh quotient. However, the calculation of lower bounds is far from being evident. Some of the papers in this collection address this problem.

A second group of papers considers methods of approximation of eigenvalue problems for partial differential equations. These include approximation by finite element methods, rational approximation, domain decomposition methods and also problems involving singular domains.

A third class of papers describes the computation of eigenvalues occurring in specific areas of applications like the problem of the oscillation of a wheel rolling on a rail, problems of vibrating plates, problem in quantum chemistry and a problem taken from the theory of ARMA models. An interesting contribution in this category is a paper by an engineer listing a variety of eigenvalue problems which arise in engineering and posing a large number of specific open questions.

Finally, there are papers devoted to the numerics of eigenvalue problems for large, sparse matrices, and more specifically, how they arise from the discretization of eigenvalue problems in partial differential equations. Questions of preconditioning and stability of algorithms are discussed. New variants of iterative methods based on variational methods are described.

The accent today in computational linear algebra is on parallelization or the use of multiprocessor computers. This requires a complete rethinking on the existing algorithms. The papers in this volume, unfortunately, do not treat this aspect of the problem except for some brief mention in some places.

This book should be of interest to those working in the area of computation of eigenvalues, be it from the mathematical or applications point of view.

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