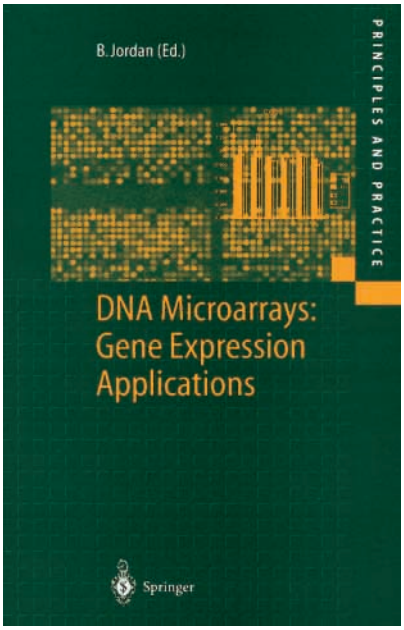
From membranes to chips - a pocket guide to DNA microarray technology



DNA Microarrays: Gene Expression Applications

edited by B. R. Jordan

Springer-Verlag (2001) 140 pages. ISBN 3-540-41508-4
£31.50/$49

Much has been written about DNA microarray technology in recent years. But, for the complete novice, gathering enough information to be able to plan and conduct one's own experiments remains a great challenge. DNA microarrays are now widely used and are increasingly the method of choice for investigating changes in gene expression, and so a guide to the different systems and to data acquisition and analysis techniques would be very welcome. Jordan has assembled a collection of articles aiming to do just that. Part of the Springer 'Principles and Practice' series, the book begins with an historical overview, following the development from Hans Lehrach's colony filters to Affymetrix's oligonucleotide chips. Separate chapters are dedicated to different microarray platforms: cDNA arrays on glass slides; nylon membranes for radioactive or calorimetric detection; and Affymetrix oligonucleotide chips. Each system is explained in detail, complete with protocols and figures of example results including considerations regarding experimental strategy and possible pitfalls.

A separate chapter tackles the issues of data analysis and data mining. Microarray experiments fulfil their promise only if the 'red and green spots' are translated into expression levels in a correct and meaningful way. To obtain biological knowledge from the vast amount of data, skillful application of data mining tools is required. The authors manage to give an easy-to-understand introduction to this complex subject and highlight both the potential and the limitations of currently available methods. With numerous references to original articles, the difficult subject of cluster analysis is well explained. The authors also give a detailed description of Expression Profiler, a software tool that has been developed by the authors at EBI.

The final chapter offers a perspective on future developments, speculating that most laboratories will use commercially available microarray platforms rather than investing time into establishing their own systems. The competition for commercial systems can come only from a large microarray consortium that distributes standardised arrays to academic labs. The need for standardised sets of cDNA clones, preferably covering whole genomes, as well as centralised data repositories is also stressed.

While the book offers a comprehensive source of information, a little too much space is devoted to arrays spotted onto nylon membranes. Although low-density spotting can be useful as a complementary method, cDNA microarrays on glass slides are the most commonly used method. The authors themselves predict that future use of microarrays will mainly consist of commercially available (possibly glass-based) systems. Researchers no longer need to expend precious time and resources figuring out the difficult task of making their own arrays. As the technology comes of age, considerations of experimental strategy, data analysis and reproducibility become the main issues.

This book offers an overview of currently available technology and is clearly very useful as an introduction to the field. However, advances in this fast-moving field are too frequent to be covered in detail. Additional information, in particular about novel developments in spotting technology, hybridisation protocols and data processing, has to be acquired by following the recent literature or accessing sources on the internet.

The editor concludes that "expression measurement is here to stay" - this book can help us to make the most of it.

Almut Schulze
Cancer Research UK, London Research Institute, London, UK

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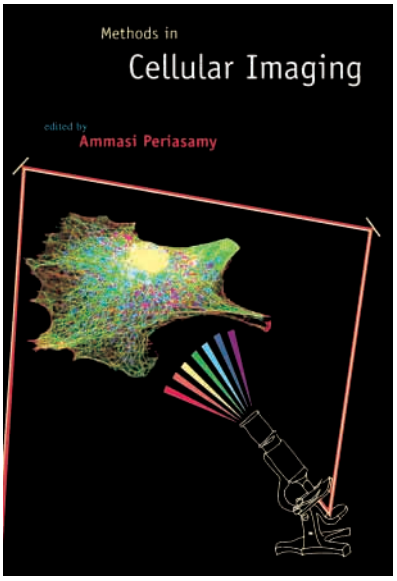
Bright glimpses in a confused scene



Methods in Cellular Imaging

edited by Ammasi Periasamy

Oxford University Press (2001) 434 pages. ISBN 1-19-513936-4
£75

Published under the auspices of the American Physiological Society, with

contributions from many of the luminaries in cell imaging, this book promises much. The subject is hot, but, at first sight, the volume is unappealing. The dust jacket design is crude and garish; the colour figures are all bunched together for cheapness of production. The first few chapters are not outstanding. For example, in the introductory discussion of fluorescence, oxygen, which everyone knows is a key player in phototoxicity, is mentioned merely as a possible fluorescence quencher. Brightness of a fluorophore is equated with a high quantum yield, without mention of the need also for a high extinction coefficient. The pioneering work of Carlsson and Mossberg on the suppression of interchannel cross-talk by the use of pulsed lasers and detectors is incorrectly described as a software innovation. Incredibly, Minsky is the citation for the development of laser scanning microscopy (Minsky, 1957). A more serious error is the explanation of differential interference contrast, which is short, snappy and wrong. Only Spring writes like an experienced teacher, and his material is more fully explained in his previous writings.

At this point, I began to wonder whether the book would represent any advance over existing standard works, such as Inoué and Spring, Sluder and Wolf, and Allan (Inoué and Spring, 1997; Sluder and Wolf, 1998; Allan, 1999). Fortunately, the quality rises later. Duchen et al. give useful detail about the imaging of mitochondria and Verkman, Vetrivel and Haggie provide a clear review of fluorescence recovery after photobleaching (FRAP). However, the image processing chapter is, in my opinion, too elementary for the average modern research student, though it might benefit some professors.

Next the subject of multiphoton excitation was tackled. There is an authoritative, introductory, theoretical chapter by So et al., followed by an ostensibly practical one by Diaspro. The latter author turns out to be slightly eccentric. He airily dismisses commercial multiphoton systems as ‘immature’ and advocates the do-it-yourself approach. But his DIY guide is distinctly lacking in practical detail, omitting all mention of YLF lasers or laser safety. Wallace et al. provide an important review of two-photon microscopy in highly scattering real specimens and charmingly named ‘phantoms’. There is a fine review of embryological applications by Dickinson and Fraser, including work in progress with a biological test system for new dyes with large multiphoton cross-sections.

The best parts of the remainder of the book are concerned with methods that are in transit from physics and have not yet quite arrived in biology. Zipfel and Webb give a physicists’ account of the way that both FRAP and fluorescence correlation spectroscopy can benefit from multiphoton excitation, but there is no biologist to explain the significance of the diffusion constants so obtained. Solid, useful reviews follow by König (radiation effects on cells), Herman et al. (fluorescence resonance energy transfer, FRET) and Bastiaens (fluorescence lifetime measurements in the frequency domain), and there is also good teaching by Periasamy (FRET) and Gerritson and Grauw. Enrico Gratton and his associates dazzle us with news from the frontiers of time-resolved imaging spectroscopy. They show how a lab equipped merely with a microscope, two mode-lockable lasers and years of experimental expertise can achieve images with not only high axial resolution but also lifetime information with unprecedented precision without a time-gated detector.

The remaining chapters deal with simpler technologies. Farkas reviews spectral imaging clearly, but, with the commercial release of spectral analysis software, one might wish for more on the algorithms for working out the individual contributions of multiple dyes from the spectral envelope. Axelrod provides a clear account of total internal reflection microscopy (TIRF), but the same figures are slightly better reproduced in his paper listed below (Axelrod, 2001). The basics of laser traps are well explained by Guilford, and there is an update on bioluminescence by Geusz, revealing that aequorin and luciferase have now joined GFP in being transfected into cells. Crucially, however, bioluminescence cannot be imaged effectively by either confocal or multiphoton methods. Finally, a paper on atomic force microscopy by Gad and Ikai shows the possibilities, but also the extreme difficulties, of this instrument.

My general impression is that there are gems here but embedded in a poor matrix, suggesting little or no editing. This is no surprise: what young editor would dare to tackle a luminary at the peak of his or her career to demand better exposition or breadth? An age that values nothing but primary publications gets the review volumes it deserves.

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Brad Amos
MRC Laboratory of Molecular Biology, Cambridge, UK

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