

METHODS IN MOLECULAR BIOLOGY™

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Biological Microarrays

Methods and Protocols

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Preface

Microarrays are spatially ordered arrays with ligands chemically immobilized in discrete spots on a solid matrix, usually a microscope slide. Microarrays are a high-throughput large-scale screening system enabling simultaneous identification of a large number of target molecules (up to several hundred thousand) that bind specifically to the immobilized ligands of the array. Microarrays represent a promising tool for clinical, environmental, and industrial microbiology since the technology allows relatively rapid screening and identification of large number of specific analytes or genetic determinants simultaneously. The successful use of microarrays requires attention to unique issues of experimental design and execution. This book provides an overview of the methodology and applications of biological microarrays in various areas of biological and biomedical research.

This book presents a significant and up-to-date review of the various biological microarrays, recognition elements, their immobilization, characterization techniques by a panel of distinguished scientists. This work is a comprehensive approach to the biological microarrays area presenting a thorough knowledge of the subject and an effective integration of these biological entities on microarray surfaces in order to appropriately convey the state-of-the-art fundamentals and applications of the most innovative approaches.

This book comprises of 18 chapters written by 50 researchers actively working in USA, Canada, Germany, Spain, Korea, China, and the UK. The authors were requested to adopt a pedagogical tone in order to accommodate the needs of novice researchers such as graduate students and post-doctoral scholars as well as of established researchers seeking new avenues. This has resulted in duplication of some material, which we have chosen to retain, because we know that many readers will pick only a specific chapter to read at a certain time.

We have divided this book into two major sections. The first part (Chaps. 1–9) comprises nine chapters, which are devoted to the application of biological microarrays including DNA/RNA, aptamer, proteins, tissues, oligonucleotides, carbohydrates, biomaterials, cells, bacteria, and virus microarrays. The second part (Chaps. 10–18) describes in detail the different techniques used for generating the microarray platforms. The second part divided into four subsections including photolithography (microfluidic-based approaches and cells and proteins patterns using photolithography), bioprinting (microspotters, microprinting), soft lithography (microcontact, micromolding, microstructure surface based on chemical vapor deposition, permeability of microvascular tubes), and microarray bioinformatics. It covers the theory behind each technique and delivers a detailed state-of-the-art review for all the new technologies used.

This book is intended to be a primary source both on fundamental and practical information of where the biological microarray area is now and where it is headed in the future. We anticipate that the book will be helpful to academics, practitioners and professionals working in various fields to name a few biologist, biotechnologists, biochemists, analytical chemists, biomedical, physical, microsystems engineering, nanotechnology, medicine, food, bioterrorism and security as well as allied health, health care, and surveillance. Since

the fundamentals were also reviewed, we believe that the book will appeal to advanced undergraduate and graduate students who study in areas related to biological microarrays and biosensors.

We gratefully acknowledge all authors for their participation and contributions, which made this book a reality. We give many thanks to Prof. John M. Walker for his guidance and patience. Last, but not least, we thank our families for their patience and enthusiastic support of this project.

Cambridge, MA
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