Preface

The introduction of microarrays in the early nineties by Fodor and co-workers, represented a major conceptual revolution in the field of parallel experimentation. At that time, the progress in microelectronics had achieved the level necessary to provide the technology upon which the first generation of microarrays was developed. It became possible to synthesize tens to hundreds of thousands of oligomers (peptide or nucleotide based) on a small, well-defined area of a glass slide, using standard photolithographic protocols. Thus, light-directed synthesis met the demands of molecular diversity generation as well as high-throughput screening in a simple and appealing fashion. The potential of this miniaturization technique was quickly realized by other researchers, and a few years later the gene-chip was introduced by Schena and co-workers as a method for tracking genetic diversity. Since microarrays provide massive quantities of data, this research tool became an important technology in genomic projects. In this issue of *Combinatorial Chemistry & High Throughput Screening*, we present a series of timely and insightful reviews dealing with several distinct applications of microarrays.

One of the most important benefits of monitoring the transcriptome lies in its applications in disease management. In cancer, for example, the classification of a tumor type with precise prognostic implications could help determine the optimal therapeutic regimen. This subject is covered in an in-depth discussion by Kim, who describes some recent studies on the potential and limitations of microarrays to impact clinical management of selected tumor types through molecular classifications, and measurements of prognosis and responses to chemotherapy. The assessment of the toxicity of a given drug candidate is a critical step in the drug development process. Analysis of gene expression profiles of tissues undergoing known toxic events could ideally allow the identification of a limited number of toxicity related genes that could be subsequently used in low-density microarrays to assess drug candidates. Some recent applications and liabilities of this approach are carefully discussed by de Longueville in a review on toxicogenomics.

The strategies employed for immobilization of macromolecules on glass slides have evolved dramatically over the last decade. Glass surfaces have been derivatized successfully with functional groups other than the amino group, offering new modes of attachment of macromolecules. The latest approaches for site-specific immobilization of proteins, peptides and carbohydrates are thoroughly reviewed by Yao.

The advent of microarray technology also significantly impacted the field of immunology. Miniaturized immunoassays performed on a planar platform have proven very sensitive and accurate, opening opportunities for the investigation of protein expression of diseased tissue and cells. The principles and applications of a multiplexed sandwich immunoassay, for a recent innovation in immunoassays, is described in detail by Joos. A comparative analysis of microarray-based and bead-based assay systems is also discussed.

Finally, a genome-based approach can help decipher key issues related to the modulation of the immune system. The use of transcriptional profiling data to define the molecular signature of a specific cell lineage is showcased by Falciani. The challenges and alternatives to performing such analysis in complex biological systems is also discussed.

The reviews presented in this issue leave no doubt that, despite its incipient stage, microarrays have been firmly established as a research tool for the investigation of biological phenomena at the molecular level with high accuracy. This issue is intended to provide the reader an overview of some applications of microarrays in various fields of research.

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