Chipping Away at Drug Discovery

Biochips as Pathways to Drug Discovery

Edited by *Andrew Carmen* and *Gary Hardiman*.

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Biochips have become indispensable tools to develop new drugs and to improve existing ones. The power of biochips, and in particular DNA arrays, is their ability to experimentally probe gene expression without requiring the experimenter to formulate hypotheses a priori about which genes are up-regulated or down- regulated. Biochips are therefore a snapshot of all cellular processes under a given environmental condition and time, and sometimes lead to unanticipated discoveries. *Biochips as Pathways to Drug Discovery*, edited by Andrew Carmen and Gary Hardiman, describes all aspects of using biochips in the drug-discovery process. One could take a broad view and say that the central focus of the book is the use of biochips to more efficiently use the £20.88 billion of research and development (R&D) monies spent by pharmaceutical companies in 2004.[1] Almost 35% of R&D budgets are allocated to clinical trials, at which point a significant number of drugs fail.[1] Biochips are currently evolving into a predictive platform to determine if drugs will fail in late-stage clinical trials before they progress there.

This book contains 22 chapters and covers a range of topics from toxicogenomics, automated microarrays, quality control and data validation, application of microarrays in particular diseases, use of microarray data in drug discovery, and intellectual property issues. Because much of today's academic research is translational in nature, intellectual property issues are becoming increasingly important to academic institutions, yet most academics are undereducated about such topics. Also extremely important are chapters that describe data validation and quality control. This book is a "must-have" for students who use biochips in their graduate work or others initiating efforts in these areas. This review highlights a few of the chapters in *Biochips as Pathways to Drug Discovery*.

Chapter 1 gives an overview of DNA biochips. It includes a historical description of how DNA microarray technology was developed. It also describes the potential advantages and disadvantages of various DNA microarray technologies. Protein biochips are also discussed and are becoming an increasingly important class of biochips that have a large impact in drug discovery. The best part of this chapter, however, is the end in which the limitations, challenges, and future directions of microarrays are discussed. Issues of sensitivity and reproducibility are critical and must always be considered when carrying out microarray experiments.

Chapter 5, by Nie, McMillan, and Lord, describes the use of microarrays in toxicogenomics and drug safety. Expression profiles can determine which genes are up- and down-regulated in the presence of a therapeutic agent and at a specific time. These profiles can then be correlated with toxicity. If microarrays could predict toxicity of a drug early in the drug-development process, then it could significantly streamline the drug-discovery and screening process. Current concerns with this approach are described.

Chapter 9, by A. Bhattacharjee, describes the use of DNA microarrays in cancer drug discovery. Part of the chapter is dedicated to personalized medicine and application of microarrays in the development of new cancer therapeutics that have diminished side effects. These areas are increasingly important, as results from DNA microarray analysis of cancer tumors can be used to predict outcomes and the efficacy of some drugs.[2] Clearly testing tumors in this manner can significantly improve patient care and patient outcomes.

Chapter 12 describes practical considerations for using DNA microarrays with a focus on caveats associated with these experiments. This chapter is essential reading for those who are starting to use biochips in either academic or industrial research settings.

In summary, *Biochips as Pathways to Drug Discovery* provides a broad yet detailed look at the use of DNA microarrays in drug discovery. If a future edition of this book is published, I would suggest the inclusion of a more detailed account of protein[3] and carbohydrate[4] biochips. Although these platforms are not as developed in drug-discovery efforts, they certainly have potential to be useful in the drug-discovery process.

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