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## Think Outside of the Box—Think Genomic

Review of: *Discovering Genomics, Proteomics, and Bioinformatics*,  
by A. Malcolm Campbell and Laurie Heyer; 2003; 352 pp.,  
Benjamin/Cummings (San Francisco, CA); ISBN 0-8053-4722-4

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As a computational genomics researcher, one of the most important challenges I've encountered (with myself and with my students) is the ability to "think genomic." Even people with strong quantitative and biological interdisciplinary backgrounds have to be able to think outside of the box to freely traverse between the single molecule and the genomics/proteomics perspectives. *Discovering Genomics, Proteomics, and Bioinformatics*, a book by A. Malcolm Campbell and Laurie Heyer, bridges an important knowledge gap by illustrating how individual molecule studies can be related to whole genome/proteome studies using bioinformatics techniques.

The book contains chapters on the discovery and analysis of whole genome and whole proteome sequences; methods to evaluate the expression and interaction of these sequences; techniques that can be used to integrate all the resulting sequence, expression, and interaction data; and medical applications of these technologies. Throughout the book, a significant amount of effort is expended to ensure that the topics being discussed are not too abstract for either the biologist or the informaticist by focusing on practical real-world problems and solutions.

The book begins by introducing us to basic biological issues and relates this to the sequencing of whole genomes and the questions that the genome sequences can answer. Chapters on variation within these sequences are next, which immediately showcase the complexity of these sequences to the reader. The book then dives into technologies to measure expression of large numbers of genes in a genome, focusing on issues related to both basic and applied DNA microarray research.

The authors then tackle the subject of proteomics, spending brief amounts of time on protein tertiary structures, protein interaction networks, and protein expression. They then return to the genomic perspective by describing how the individual genes and proteins, along with controlled expression and interactions, work together to form both simple and complex integrated circuits that regulate essential functions in a cell or an organism.

Finally, the authors put all this material into perspective by presenting medical case studies to highlight the transition

from genetics to genomics, focusing on the topical medical problems of muscular dystrophy and obesity.

The book frames the issues being discussed in the form of questions, such as "What have we learned from the human genome draft sequences?" This makes it ideal for focusing on specific issues, particularly when learning or teaching. Furthermore, almost all of the questions being posed are intriguing and exciting, a necessity for stimulating critical thought and improving problem-solving skills.

The book is written clearly, as difficult concepts in areas ranging from the mathematical and computational sciences to physics and chemistry are presented in an easy-to-understand manner. The structure of the book makes it amenable for use in a classroom. Each chapter focuses on a set of goals, but there are several tangents to maintain the interests of self-motivated students, including: "Discovery Questions" that challenge critical thinking skills by requiring solutions to problems that will involve application of the concepts learned in the chapter; "Math Minutes" that delve in depth into the quantitative nature of some of the bioinformatic analyses used to gain an understanding of the biology; and "Media Menus" that point to extended resources from the book's Web site ([www.geneticsplace.com](http://www.geneticsplace.com)), which is included as a companion. Since the fields covered by the book are in rapid flux, the latter in particular will ensure that the interested reader will have access to the latest developments in the field.

The companion Web site, which complements the book, is comprehensive and contains interesting and useful information that would make the text version bulky. Going through the Web site is like taking a tour through a factory that engages in all aspects of genomics, proteomics, and bioinformatics discussed in the book. The Web site also contains similar information related to the other genetics and bioinformatics books, which can be explored further.

Besides using the Internet, the book takes advantage of the CD-ROM technology to better illustrate the points being made, including the use of large-scale figures. For the instructor, an additional guide contains pictorial answers to questions that can be used in a lecture presentation. The structure of the book also makes it easily amenable to a hands-on tutorial in whole genome bioinformatics as well, one that can also be used to complement a wet-lab experience.

The bioinformatics aspects of this book are not treated in separate chapters but rather integrated with the genomics and proteomics descriptions, making it easy to illustrate to

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students that it is another useful tool on a biologist's workbench. Perhaps the only (minor) criticism that can be made is that the amount of time spent dealing with issues related to proteomics is less than the amount spent on genomics.

This is one of the first textbooks that clearly focuses on cutting-edge genomics and proteomics research, as well as the bioinformatics techniques used to uncover biological insight. Besides being used in a classroom setting, it can serve as a reference for both informaticians and biologists who are

working on whole genome/proteome approaches to understanding organismal biology.

In summary, *Discovering Genomics, Proteomics, and Bioinformatics* does two very important things: It illustrates how to traverse the bridge between traditional single molecule studies and novel genomics/proteomics studies using bioinformatics as a tool. Further, it does so in a manner that a student who is new to either (or both) of these fields can clearly grasp the underlying biological and informatics concepts.