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Preface

It has become increasingly evident that the use of large-scale experimental data and the application of principles from systems biology are gaining widespread acceptance in mainstream biology. Systems biology involves the use of global cellular measurements, i.e., genomic, proteomic, and metabolomic, to construct computational models of cellular processes and disease. These approaches involve an integration of experimental and computational techniques and may include: 1) developing models of cellular processes, 2) measuring the response to perturbations of model components, and 3) iteratively formulating and testing new hypotheses for unexpected observations.

A research area that is particularly important to systems biology is the study of gene regulatory networks. Although genome sequencing efforts have been tremendously successful, much is unknown about the regulation of these sequenced genomes. Automatic methods for helping decipher the regulatory mechanism are crucial for understanding the regulatory network as a whole. However, many new challenges are presented when analyzing complete genomes. These challenges include motif discovery in large genomes, leveraging information from multiple genomes, detection of weak signals and incorporating different types of genomic data such as protein localization data and gene expression. Novel methodology will be particularly relevant given the hypothesis that the observed phenotypic differences between organisms with very similar genomes may be due to variations in the gene regulation.

The amount of research in both of these areas has exploded in recent years, as witnessed by the number of research presentations at meetings such as RECOMB, ISMB, PSB, the Biopathways Consortium, and ICSB. The jointly held RECOMB Satellite on Systems Biology and the RECOMB Satellite on Regulatory Genomics provide a forum for addressing these challenges.

This year's workshops also included a special session on Computational Developmental Biology organized by David Gifford. Unique challenges posted by developmental biology include: 1) computational model representations that can express the execution of complex natural programs over time, 2) the identification of key developmental state variables and experimental methods to reliably observe these variables, and 3) the use of computational models to understand developmentally related disease, and to help develop therapeutics including the programming of stem cells as therapeutic agents. Invited speakers at this year's special session addressed the question: "What key developmental biology problems can now be examined from a systems biology perspective, and what data are necessary to do so?". The goal of this special session was to help computational and systems biologists understand both the challenge and excitement of working on development.

August 2006 The Organizing Committee

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