PREFACE

This volume of *Methods in Enzymology* covers many of the tools and techniques used in systems biology research. Systems biology attempts to understand biological function not as the behavior of individual components (e.g., metabolic enzymes or kinases) but as a complex system, the function of which is largely determined by the interactions of these components. This shift away from what some might consider to be the more traditional paradigms of biological research has necessitated the honing of old techniques and the development of new ones.

Of particular importance for systems biology is the assimilation of acquired data into meaningful mathematical models of biological systems. The meaning is attained by inserting actual parameter values into these models and actual mechanisms. This requires not only a plethora of precise experimental techniques but also mechanistic modeling methods, as well as ways to integrate the two and to convert the data avalanches to dynamically stored understanding. The resulting models can then be used to understand existing behavior and to predict new behaviors, for instance, for when one wishes to cure a disease or produce an important commodity more efficiently than in a chemical factory.

Model-building activities require input from a broad array of individuals with disparate, but complementary, expertise. Part of the massive challenge of delivering successful and meaningful results from systems biology research is having an overview and understanding of the diverse methods that these individuals implement in building up a complete picture of a biological system; it is with this in mind that we have put this volume together.

This volume is divided into several sections. The first is an examination of different strategies in systems biology. This is then followed by a set of chapters examining some of the instruments used.

Sections 3–6 contain chapters examining the techniques required to quantify the properties of biological elements that go toward building models—nucleic acids, proteins, metabolites—in a variety of organisms from bacteria to mammals.

Sections 7 and 8 cover the methods used to assimilate gathered data into meaningful models and interpret the results of running these models. These chapters cover explicit examples of how to build models, the pitfalls that may be encountered en route.

Finally, Section 9 examines the management of systems biology: first, methodology for managing the data associated with the research, and

second, the issues surrounding the management of the research itself. Both of these areas present their own unique problems due to the interdisciplinary nature of the field.

This volume contains techniques and methodologies written by experts in their fields that we, as the Manchester Centre for Integrative Systems Biology, use successfully on a regular basis. We consider systems biology to be one of the most exciting and promising areas of biological research that can only become more prolific over time.

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