

PREFACE

'Just as we cannot think of spatial objects at all apart from space, or temporal objects apart from time, so we cannot think of any object apart from the possibility of its connections with other things'

Ludwig Wittgenstein – Tractatus Logico-Philosophicus (2.012)

This volume captures the avant-garde of biological systemic research and aims to be an introductory material for undergraduate and graduate students, as well as researchers who wish to immerse themselves in the relevant questions and problems that system biology is facing today. But, what is systems biology? Herein, we provide the opinion of experts in fields impacting systems biology ranging from statistics to ecology, with emphasis given to case studies where the concepts of systems biology are applied to particular problems such as the study of development, environmental response, metabolism in plants and diverse model organisms.

In the first part of this volume, an overview of the systems biology field is presented with a focus on plant systems biology. A fundamental conceptual framework such as Network Theory is covered as well as the progress achieved for diverse model organisms: prokaryotes, due to their 'simplicity', and *C. elegans*, one of the most tractable animal models. The second part of this volume deals with the diverse sources of information necessary for a systemic understanding of plants. Insights are given into the software tools developed for systems biology and how they can be applied for plants and a comprehensive analysis of the data that can be integrated, that is, genome, transcriptome, proteome, metabolome and ionome. Finally, an interesting case study regarding root development is presented as well as important ecological and evolutionary considerations regarding living systems.

Despite huge advances in technology in the genomic era, we are far from having a complete description of the molecular components of biological systems and the ways they interact. In the particular case of Arabidopsis, advances in plant systems biology studies lag behind other model organism in terms of the data sets available (e.g. interactomes). However, this lack of complete information has not precluded creative researchers from taking advantage of systems biology approaches to conduct research to develop testable hypotheses, which in turn fuel a new cycle of systems level research.

After reading this volume, we hope you have more questions about systems biology than when you started reading it. We will consider our book

a success if, after reading it, you discover novel ideas and ways to apply systems biology approaches in your own area of research. When used as an educational platform, we hope this volume will inspire the next generation of young scientists to enter the field of systems biology in the post-genomic era.

An Overview

We would like to thank all the authors who contributed their time and expertise to this volume on systems biology. We believe that the collective chapters in this field of systems biology have great synergies and have contributed to the advancement of the field. We appreciate the enormous amount of insight and information provided by each of the authors. We would like to especially acknowledge Albert Christoferson for his support, organization, and technical writing skills on this volume, as well as for her matching patience in completing this project. We also acknowledge the superb artwork of Susan Smith who created the cover art for this volume, which conveys the science of systems biology in an exceptionally artistic fashion.