
Preface

It is now more than a decade ago since systems biology was celebrated as a new promising approach that can predict the behavior of cellular systems through mathematical modeling and simulation. It was the hope of many that, once systems biology helped deciphering mechanisms underlying disease emergence and progression, it is only a short path toward the design of novel, more successful therapeutic approaches.

Although technological advancements allow the generation of ever more detailed snapshots of life across multiple levels of temporal and spatial scales, and despite a wealth of new insights on how life is organized, it is a long way before we are able to translate this improved understanding to achieve a sustainable impact on clinical practice.

To guide this path, there is a need to survey the diverse approaches, the multitude of methodologies, and the myriad of tools that should and will be integrated into customized protocols and workflows for the reliable prognoses of disease outbreak and course, for the identification of therapeutic targets, the development of targeted therapies for individual patients, and for monitoring therapy success and patient well-being.

This book presents trends, initiatives, and recent developments in this emerging field called systems medicine, which has the goal of finding solutions to the challenges described above. We are glad that leading experts have contributed to this first book on systems medicine and provided their insights into the state of the art in the field.

Structure of the Book

This book is structured in four parts. The first part, “A Road Map Toward Systems Medicine,” consists of six chapters that outline the field of systems medicine by defining the terminology and describing how established computational methods from bioinformatics and systems biology can be taken forward to an integrative systems medicine approach. One chapter describes the necessity for redefining training curricula for medical and computational students, and in two chapters the impact is discussed that a systems medicine approach possibly has on handling diseases and patients and on the pharmaceutical industry.

The second part of the book, “Opinions and Perspectives,” provides an outlook on the role that systems medicine may or should play in various medical fields like oncology, neurology, the study of lung diseases, immune-related diseases and therapies, and infectious diseases.

In Part III case studies are presented that demonstrate different facets of the systems medicine approach in action to study, e.g., the human metabolism, chronic obstructive pulmonary disease, transcriptomics, and regenerative stem cell medicine. These chapters nicely illustrate the interdisciplinary combination of computational methods with wet lab experiments.

The fourth part of the book, “Tools and Methodologies,” contains four chapters that introduce tools, resources, and methodologies from bioinformatics and systems biology and shows how to apply these in a systems medicine project.

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