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## Preface

In this book we seek to provide a detailed introduction to a range of simulation and modeling techniques that are appropriate for use in the biosciences. The book is primarily intended for bioscientists, but will be equally useful for anybody wishing to start simulation and modeling in related fields. The topics we discuss include agent-based models, stochastic modeling techniques, differential equations, and Gillespie's stochastic simulation algorithm. Throughout, we pay particular attention to the needs of the novice modeler. We recognize that simulation and modeling in science in general (and in biology, in particular) require both *skills* (i.e., programming, developing algorithms, and solving equations) and *techniques* (i.e., the ability to recognize what is important and needs to be represented in the model, and what can and should be left out). In our experience with novice modelers we have noticed that: (i) both skill and technique are equally important; and (ii) both are normally lacking to some degree.

The philosophy of this book, therefore, is to discuss both aspects—the technical side and the side that concerns being able to identify the right degree of abstraction. As far as the latter area is concerned, we do not believe that there is a set of rules that, if followed, will necessarily lead to a successful modeling result. Therefore, we have not provided a list of such rules. Instead, we adopt a practical approach which involves walking the reader through realistic and concrete modeling projects. In doing so, we highlight and comment on the process of abstracting the real system into a model. The motivation for this approach is that it is akin to apprenticeship, allowing the reader both to observe practical expertise and to generate personal understanding and intuition, which will ultimately help them to formulate their own models.

Included in the book are practical introductions to a number of useful tools, such as the Maxima computer algebra system, the PRISM model checker, the Repast Symphony agent modeling environment, and the Smoldyn cellular modeling environment. Some of the chapters also include exercises to help the reader sharpen their understanding of the topics. The book is supported by a website, <http://www.cs.kent.ac.uk/imb/>, which includes source code of many of the example models we discuss.

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