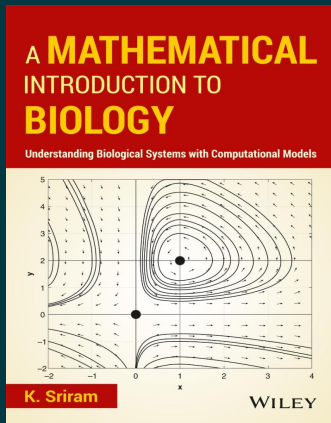




A Mathematical Introduction to Biology: Understanding Biological Systems with Computational Models

By [K. Sriram](#)

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Description

This book is perfect for a one-semester course called "Introduction to Mathematical Biology," which is a 4-credit winter course. It provides a well-organized and complete learning experience, making it great for both students and teachers in mathematical biology. Discover the dynamic intricacies of metabolic, signaling, and genetic network motifs with "A Mathematical Introduction to Biology: Understanding Biological Systems with Computational Models." This book elegantly intertwines mathematics and life sciences to reveal the roles of feedback and feedforward patterns embedded within network structures, uncovering the mechanisms that govern living systems. Customised for both students and instructors, it offers an engaging and accessible approach to bridging the gap between mathematics and biology.

Spanning 19 comprehensive chapters, this book covers essential topics such as constructing differential equation models based on the principles of mass-action kinetics and Michaelis-Menten kinetics. It delves deeply into the feedback and feedforward mechanisms that form the backbone of signaling, metabolic, and gene regulatory network motifs. By applying dynamical systems theory to adaptation models, MAPK signaling pathways, the cell division cycle, and circadian rhythms, this resource becomes indispensable for understanding biological complexity.

Problems, examples, and downloadable instructor resources—including programmable MATLAB codes and lecture slide decks for each chapter—make it an ideal companion for both independent study and classroom instruction. This book aims to the undergraduate and postgraduate students who are studying computational or mathematical biology courses and professionals working in the biotechnology and pharmaceutical industries who may find the foundational knowledge useful.

About the Author

K. Sriram

K. Sriram is an Associate Professor at IIT-Delhi, where he has been a faculty member since 2012. Over the past 12 years, he has taught various courses in the Department of Computational Biology. He has developed courses like Systems Biology, Introduction to Mathematical Biology, Introduction to Quantitative Biology, Computational Neuroscience, Cell Biology, and Biochemistry tailored for undergraduate, postgraduate, and PhD students in the sciences and engineering disciplines. He is currently offering a course on Introduction to Mathematical Biology to master's and PhD students of Computational Biology, and this book is the culmination of notes used in that course. His research interests lie in systems and mathematical biology, and he has published numerous papers in reputable international journals

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1. The first step in the process of creating a mathematical model is to define the problem and the system to be modeled. This involves identifying the variables and parameters that will be used in the model, and determining the relationships between them. 2. The second step is to choose a mathematical framework for the model. This could be a differential equation, a stochastic process, or a computational model, depending on the nature of the system and the data available. 3. The third step is to collect data and validate the model. This involves comparing the model's predictions with experimental data to ensure that the model is accurate and reliable. 4. The fourth step is to use the model to make predictions and test hypotheses. This could involve simulating the system under different conditions, or using the model to analyze experimental data. 5. The fifth step is to communicate the results of the model to the relevant stakeholders. This could involve writing a report, giving a presentation, or publishing a paper. 6. The sixth step is to refine the model and repeat the process as needed. This involves identifying areas where the model needs to be improved, and making changes to the model and the data collection process. 7. The seventh step is to use the model to inform decision-making. This could involve using the model to predict the outcome of different actions, or to identify the best course of action. 8. The eighth step is to monitor the system and update the model as needed. This involves collecting new data and comparing it with the model's predictions to ensure that the model remains accurate and reliable. 9. The ninth step is to share the model and the results with the scientific community. This could involve publishing a paper, or presenting at a conference. 10. The tenth step is to use the model to inform policy-making. This could involve using the model to predict the impact of different policies, or to identify the best policy for a given situation.

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