



# **A Primer on Mathematical Models in Biology (Other Titles in Applied Mathematics)**

*Lee A. Segel, Leah Edelstein-Keshet*

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This textbook grew out of a course that the popular and highly respected applied mathematician Lee Segel taught at the Weizmann Institute and it represents his unique perspective. It introduces differential equations, biological applications, and simulations and emphasizes molecular events (biochemistry and enzyme kinetics), excitable systems (neural signals), and small protein and genetic circuits.

*A Primer on Mathematical Models in Biology* will appeal to readers because it combines clear and useful mathematical methods with applications that illustrate the power of such tools and includes many exercises in reasoning, modeling, and simulations.

**Audience:** This book is intended for upper level undergraduates in mathematics, graduate students in biology, and lower-level graduate students in mathematics who would like exposure to biological applications.

**Contents:** Chapter 1: Introduction; Chapter 2: Introduction to Biochemical Kinetics; Chapter 3: Review of Linear Differential Equations; Chapter 4: Introduction to Nondimensionalization and Scaling; Chapter 5: Qualitative Behavior of Simple Differential Equation Models; Chapter 6: Developing a Model from the Ground Up: Case Study of the Spread of an Infection; Chapter 7: Phase plane Analysis; Chapter 8: Quasi Steady State and Enzyme-Mediated Biochemical Kinetics; Chapter 9: Multiple Subunit Enzymes and Proteins: Cooperativity; Chapter 10: Dynamic Behavior of Neuronal Membranes; Chapter 11: Excitable Systems and the FitzHugh-Nagumo Equations; Chapter 12: Biochemical Modules; Chapter 13: Discrete Networks of Genes and Cells; Chapter 14: For Further Study; Chapter 15: Extended Exercises and Projects; Appendix A: The Taylor Approximation and Taylor Series; Appendix B: Complex Numbers; Appendix C: A Review of Basic Theory of Electricity; Appendix D: Proofs of Boolean Algebra Rules; Appendix E: XPP Files for Models in this Book.

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