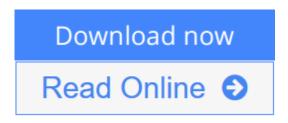# A Primer on Mathematical Models in Biology (Other Titles in Applied Mathematics)

By Lee A. Segel, Leah Edelstein-Keshet

A Primer on Mathematical Models in Biology (Other Titles in Applied Mathematics) By Lee A. Segel, Leah Edelstein-Keshet

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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Editorial Review

About the Author

Lee A. Segel (1932-2005) was a Professor at the Weizmann Institute of Science, Rehovot, Israel, where he served as Chairman of Applied Mathematics, Dean of Mathematical Sciences, and Chairman of the Scientific Council. He was an Ulam Scholar at the Los Alamos National Laboratory, a Fellow of the American Association for the Advancement of Science, and a member of the Santa Fe Institute, where he continued his work on complex adaptive systems. He served as editor or editorial board member of six journals.

Leah Edelstein-Keshet is a Professor in the Department of Mathematics at the University of British Columbia, Vancouver, Canada. Her book *Mathematical Models in Biology* was republished in SIAM s Classics in Applied Mathematics series.

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