



Physical Models of Living Systems

By Philip Nelson

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Written for intermediate-level undergraduates pursuing any science or engineering major, *Physical Models of Living Systems* helps students develop many of the competencies that form the basis of the new MCAT2015. The only prerequisite is first-year physics. With the more advanced "Track-2" sections at the end of each chapter, the book can be used in graduate-level courses as well.



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Physical Models of Living Systems By Philip Nelson Bibliography

- Sales Rank: #155529 in Books
- Published on: 2014-12-20
- Original language: English
- Number of items: 1
- Dimensions: 9.06" h x .49" w x 7.49" l, .0 pounds
- Binding: Paperback
- 384 pages

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Editorial Review

Review

"Philip Nelson has done a terrific job.... There are numerous traits that make this text unique among the very many books of biological physics.... The presentation of materials is developed in an innovative fashion.... There is a nice balance between conceptual examples and end-of-the-chapter problems.... This book shows a nice intercalation of fundamental laws, brief descriptions of computational strategies for acquiring quantitative information, as well as their implications in biological physics and areas beyond that, including signaling processes, genetic switches, and cellular oscillators.... Physical Models of Living Systems... will benefit undergraduates as well as others with interests in genomics, proteomics, cellular signaling, bioengineering, regenerative medicine, and synthetic biology." -- Liviu Movileanu in *American Journal of Physics*

Particularly compelling for its smooth integration of biological experiments, physical models, and computational exercises. Readers who complete the text will be well equipped with the computational and mathematical skills needed for a quantitative understanding of a range of biological systems.... Thanks to Nelson's skillful writing and the excellent accompanying online resources, this book will appeal to a broad audience and teach even a beginner how to solve problems numerically." -- Prof. Eva-Maria Collins in *Physics Today*

"[T]his excellent book will appeal to both students and professional scientists in the field of quantitative biology.... [T]he book feels personal in its selection of topics and the training journey on which it takes its readership. In our opinion, the combination of this uniqueness with technical accuracy makes the book a noteworthy and valuable addition to resources for advanced biophysics education... [T]he book conveys rich information, is clearly structured, and provides comprehensive data sets... Nelson shows how computational programming can be used effectively in modeling biological systems at the cellular and molecular levels." -- Dietlind L. Gerloff and Jonghoon Kang in *Cell Biology Education*

"There is growing interest in quantitative biology and biological physics, driven in part by the rising popularity of synthetic biology and systems biology. However, the development of educational materials has not kept pace with this emerging interest. Phil Nelson's marvelous new book nicely fills this gap and will serve as a fantastic resource for the field.... The writing style is clear and accessible, and the examples and homework problems have been carefully designed and presented to enable students to become proficient in key concepts and principles at the interface of physics and molecular biology.... Students and professors alike will love this book."

James J. Collins, Biological Engineering, MIT

"The strong thematic unity of the proposed book is a major strength. What students are most stunned and amazed by is how a handful of basic mathematical concepts (e.g., Poisson statistics, Bayes rules) can be used to understand myriad problems at many levels. Nelson's book communicates these key concepts in a very engaging way. Choice of topic, strong thematic unity, and lucidness are its major strengths.

Aravindhan Samuel, Harvard University

." . . I love the combination of real data along with the simplified mathematical modeling. This is exactly

the kind of thoughtful back-and-forth between the real world and the modeling world that I try to inculcate in my own students."

Ned Wingreen, Princeton University

"This text is beautifully written. It succeeds by presenting a clear and coherent point of view: It is essential to develop quantitative, testable models of biological phenomena and these models are based on the basic physical foundations of nature which are essential for understanding living systems and for developing the modern tools used to investigate their structure and dynamics."

Alex Levine, University of California, Los Angeles

"Excellent conversational tone that Nelson has perfected over time . . . Excellent mixtures of physical and biological examples, with enough technical content that students can appreciate and understand the biology, but without the jargon and details that often prevent abstract concepts from being easily understood - Illustrations and problems for students are great."

Megan Valentine, University of California, Santa Barbara

"This is just the book that one needs to explain to students that mathematical modeling is useful in biology and that just a few mathematical concepts are behind the explosive growth of the biological understanding of the recent years. The interplay between models and experimental data throughout the book is great, and the emphasis on computational solutions with Matlab, with progressing difficulty, allow one to take a complete computer novice into the class."

Ilya Nemenman, Physics, Emory University "

About the Author

Philip Nelson is Professor of Physics at the University of Pennsylvania. He received Penn's School of Arts and Sciences' highest teaching award, and the Biophysical Society's Emily Gray award, for his work in biophysics education.

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