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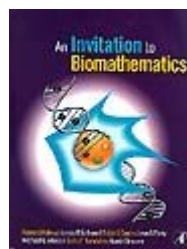
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### An Invitation to Biomathematics

Raina S. Robeva, James R. Kirkwood et al.

[show printer friendly](#) [send to a friend](#)**Publisher:** Academic Press (2008)**Details:** 453 pages, Hardcover**Price:** \$59.95**ISBN:** 978-0-12-088771-2**Category:** Textbook**Topics:** Mathematical Biology, Mathematical Modeling[See the table of contents](#)

### MAA Review

[Reviewed by William J. Satzer, on 12/13/2007]

In an article from *Science* titled "Education for a Biocomplex Future", Louis Gross writes of the need to find ways to "teach entry-level quantitative courses that entice life science students through meaningful applications of diverse mathematics to biology, not just calculus, with a few simple biological examples." The authors of *An Invitation to Biomathematics* quote this approvingly, writing that their book was conceived and executed with exactly that goal in mind. Their efforts have gone amazingly well. They successfully create a path into mathematical biology for students with very modest mathematical backgrounds. Their book puts the biology first and introduces tools from mathematics, statistics and computer science in natural ways, always motivated by the desire to understand biological issues.

The authors begin gently with standard topics: population growth, predator-prey interactions, epidemic models and population genetics. The pace is well-calculated; it begins slowly enough to let students get acclimated, and picks up speed as it moves through the introductory sections. The focus throughout is on model building, validation and refinement.

Although the book begins very gradually, several of the topics it eventually treats are relatively sophisticated, both from the mathematical and the biological sides. The major portion of the book (called "Let's Do Research!") explores eight topics of current research. These include glucose homeostasis, hemoglobin function, ligand binding, bacterial infection, and hormone networks. While the early chapters focus more on ecology and genetics, the latter chapters are heavy on physiology, molecular biology and endocrinology.

The last two chapters — while still in scope for an introductory course — demand a bit more maturity and motivation. A chapter on circadian rhythms looks at the problem of detecting rhythms in confounded data. It raises interesting and difficult problems of data analysis and makes extensive use of nonlinear least squares fits and the fast Fourier transform. (Neither of these is given a full mathematical treatment — they're used largely as well-motivated software tools.) The authors succeed here again in focusing on the biology and weaving in the mathematics in such a way that the student sees it as a

natural and integral part of the process.

The final chapter examines the use of microarrays for the study of gene expression patterns. Here the authors present the problem of identifying and characterizing genes that are under circadian control. The important concepts here are the rhythm analysis of the previous chapter, data normalization to remove trends and bias, and cluster analysis.

This is a book that succeeds remarkably well at what it sets out to do. Prerequisites are slim — a semester of calculus, a semester of general biology and knowledge of introductory statistics — but the authors make this go a long way. The biological questions are treated seriously on their own merits, not as vehicles for teaching mathematical techniques. Nonetheless, a student who works through this book would have seen and worked through a good deal of mathematics.

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Bill Satzer (wjsatzer@mmm.com) is a senior intellectual property scientist at 3M Company, having previously been a lab manager at 3M for composites and electromagnetic materials. His training is in dynamical systems and particularly celestial mechanics; his current interests are broadly in applied mathematics and the teaching of mathematics.

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