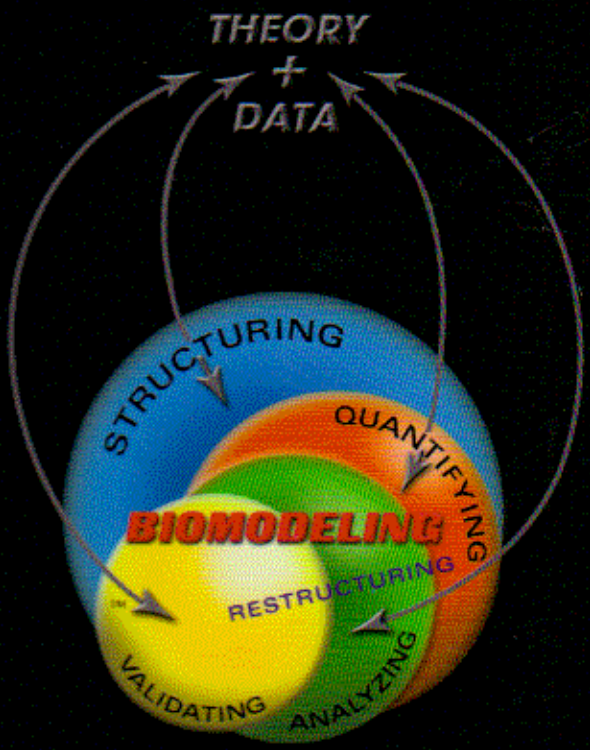
DYNAMIC SYSTEMS BIOLOGY MODELING AND SIMULATION

JOSEPH DiSTEFANO III



"I am just in awe of Joe's ability to start with simple ideas and use them to explain sophisticated concepts and methodologies in modeling biochemical and cellular systems (*Chapters 6 & 7*). This is a great new contribution to the textbook offerings in systems biology."

Alex Hoffman, Director of the San Diego Center for Systems Biology and the UCSD Graduate Program in Bioinformatics and Systems Biology

"*Chapter 1* was a 'page-turner' to be enjoyed straight through… *Chapter 9* – on oscillations and stability – is a true jewel. I have a shelf full of books etc. on nonlinear mechanics and system analyses and modeling, but nothing to match the clarity and deep understanding you offer the reader. You are a great explainer and teacher."

F. Eugene Yates, Emeritus Professor of Medicine, Chemical Engineering and Ralph and Marjorie Crump Professor of Biomedical Engineering, UCLA

"*Chapter 8* is a must read. It so elegantly covers three important areas… namely physiologically-based models of organs and whole-body systems, multicompartmental models applied to such systems, and application of noncompartmental models."

Malcolm Rowland, Professor of Pharmacy, University of Manchester, U.K.

"A very positive feature is the numerous worked examples within the text (*Chapters 4 & 5*), which greatly help readers follow the material… and there are further well thought out analytical and simulation exercises at the end."

Professor Keith Godfrey, University of Warwick, Coventry, U.K.

Dynamic Systems Biology Modeling and Simulation consolidates and unifies classical and contemporary multiscale methodologies for mathematical modeling and computer simulation of dynamic biological systems – from molecular/cellular, organ-system, on up to population levels. The book pedagogy is developed as a well-annotated, systematic tutorial – with clearly spelled-out and unified nomenclature – derived from the author's own modeling efforts, publications, and teaching over half a century. Ambiguities in some concepts and tools are clarified and others are rendered more accessible and practical. The latter include novel qualitative theory and methodologies for recognizing dynamical signatures in data using structural (multicompartmental and network) models and graph theory; and analyzing structural and measurement (data) models for quantification feasibility. The level is basic-to-intermediate, with much emphasis on biomodeling from real biodata, for use in real applications.

Key Features

- Introductory coverage of core mathematical concepts such as linear and nonlinear differential and difference equations, Laplace transforms, linear algebra, probability, statistics and stochastics topics.
- The pertinent biology, biochemistry, biophysics or pharmacology for modeling are provided to support understanding the amalgam of "math modeling" with life sciences.
- Strong emphasis on quantifying as well as building and analyzing biomodels: includes methodology and computational tools for parameter identifiability and sensitivity analysis; parameter estimation from real data; model distinguishability and simplification; and practical bioexperiment design and optimization.
- Companion website provides solutions and program code for examples and exercises using Matlab, Simulink, VisSim, SimBiology, SAAMII, AMIGO, Copasi and SBML-coded models.

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