Mathematical Modeling In Renal Physiology Lecture Notes On Mathematical Modelling In The Life Sciences

MORRIS ROSA

Modeling and Estimation for the Renal System ScholarlyEditions
A classic nephrology reference for over 25years, Seldin and Giebisch’s The Kidney, is the acknowledged authority on renal physiology and pathophysiology. In this 5th edition, such new and powerful disciplines as genetics and cell biology have been deployed to deepen and widen further the explanatory framework. Not only have previous chapters been extensively updated, but new chapters have been added to incorporate additional disciplines. Individual chapters, for example, now provide detailed treatment of the significance of cilia; the role of stem cells is now given special consideration. Finally, there has been a significant expansion of the section of pathophysiology, incorporating the newer findings of cell biology and genetics. If you research the development of normal renal function or the mechanisms underlying renal disease, Seldin and Giebisch’s The Kidney is your number one source for information. Offers the most comprehensive coverage on the market of fluid and electrolyte regulation and dysregulation in 85 completely revised chapters and 10 new chapters Includes 4sections, 62 chapters, devoted to regulation and disorders of acid-base homeostasis, and epithelial and nonepithelial transport regulation Includes foreword by Donald Seldin and Gerhard Giebisch, world renowned names in nephrology and editors of the previous three editions

Exploring Mathematical Modeling in Biology Through Case Studies and Experimental Activities Academic Press
This book illustrates applications of mathematics to various processes (physiological or artificial) involving flowing blood, including hemorheology, microcirculation, coagulation, kidney filtration and dialysis, offering a historical overview of each topic. Mathematical models are used to simulate processes normally occurring in flowing blood and to predict the effects of dysfunctions (e.g. bleeding disorders, renal failure), as well as the effects of therapies with an eye to improving treatments. Most of the models have a completely new approach that makes patient-specific simulations possible. The book is mainly intended for mathematicians interested in medical applications, but it is also useful for clinicians such as hematologists, nephrologists, cardio-surgeons, and bioengineers. Some parts require no specific knowledge of mathematics. The book is a valuable addition to mathematics, medical, biology, and bioengineering libraries.

A Workbench for Physiology and Biomedical Engineering World Scientific
This book is a balanced presentation of the latest techniques, algorithms and applications in computer science and engineering. The papers, written by eminent researchers in their fields, provide a vehicle for new research and development. The proceedings have been selected for coverage in: • Index to Scientific & Technical Proceedings (ISTP CDROM version / ISI Proceedings) Contents:Internet ApplicationsComputing in BiologyHuman Computer InterfaceParallel Computing/TechniquesComputing EducationLearning AlgorithmsCommunication Systems/NetworksInformation Technology/LinguisticsComputing Formalism/AlgorithmsAI/Fuzzy Sets Application and TheoryImaging Applications Readership: Researchers in artificial intelligence, databases, fuzzy logic, neural networks, software engineering/programming, theoretical computer science, machine perception/computer vision, computer engineering, biomedical engineering, biocomputing, bioinformatics, biophysics and computational physics. Keywords:Computing;Parallel Computing;Technology;Imaging Applications;Databases;Bioinformatics
Springer Science & Business Media
Divided into two volumes, the book begins with a pedagogical presentation of some of the basic theory, with chapters on biochemical reactions, diffusion, excitability, wave propagation and

cellular homeostasis. The second, more extensive part discusses particular physiological systems, with chapters on calcium dynamics, bursting oscillations and secretion, cardiac cells, muscles, intercellular communication, the circulatory system, the immune system, wound healing, the respiratory system, the visual system, hormone physiology, renal physiology, digestion, the visual system and hearing. New chapters on Calcium Dynamics, Neuroendocrine Cells and Regulation of Cell Function have been included. Reviews from first edition: Keener and Sneyd's Mathematical Physiology is the first comprehensive text of its kind that deals exclusively with the interplay between mathematics and physiology. Writing a book like this is an audacious act! -Society of Mathematical Biology Keener and Sneyd's is unique in that it attempts to present one of the most important subfields of biology and medicine, physiology, in terms of mathematical "language", rather than organizing materials around mathematical methodology. -SIAM review

Applied Biomechatronics Using Mathematical Models Princeton University Press

Under the motto “Healthcare Technology for Developing Countries” this book publishes many topics which are crucial for the health care systems in upcoming countries. The topics include Cyber Medical Systems Medical Instrumentation Nanomedicine and Drug Delivery Systems Public Health Entrepreneurship This proceedings volume offers the scientific results of the 6th International Conference on the Development of Biomedical Engineering in Vietnam, held in June 2016 at Ho Chi Minh City.

6th International Conference on the Development of Biomedical Engineering in Vietnam (BME6) Academic Press

Beginning with an introduction to kidney function, renal replacement therapies, and an overview of clinical problems associated with haemodialysis, this book explores the principles of the short-term baroreflex regulation of the cardiovascular system and the mechanisms of water and solute transport across the human body from a mathematical model perspective. It synthesizes theoretical physiological concepts and practical aspects of mathematical modelling needed for simulation and quantitative analysis of the haemodynamic response to dialysis therapy. Including an up-to-date review of the literature concerning the modelled physiological mechanisms and processes, the book serves both as an overview of transport and regulatory mechanisms related to the cardiovascular system and body fluids and as a useful reference for the study and development of mathematical models of dynamic physiological processes. Mathematical Modelling of Haemodialysis: Cardiovascular Response, Body Fluid Shifts, and Solute Kinetics is intended for researchers and graduate students in biomedical engineering, physiology, or medicine interested in mathematical modelling of cardiovascular dynamics and fluid and solute transport across the human body, both under physiological conditions and during haemodialysis therapy.

Urea Transporters Mathematical Modeling in Renal Physiology

Recent research has raised concern over the connection between hemoconcentration and post-operative renal dysfunction. Clinical studies often show conflicting conclusions as to the risk factors and causes of renal dysfunction. These inconsistent results are most likely because the causes are due to many variables. One possible explanation for the association between hemoconcentration and renal dysfunction is the difference in plasma protein concentration (PPC) and hematocrit (HM). It is hypothesized that these variations will adversely effect certain renal functions such as glomerular filtration rate (GFR), urine flow rate (UFR), and renal blood flow (RFB). A mathematical model was utilized from previous research and implemented into Simulink© software. The model contains five sub-systems: renal dynamics, protein and compartment volumes, blood pressure, electrolytes, and hormones. The model was validated by comparing results of a simulation using normal parameters to results from the original author's work. This model framework was then used to assess the diferences in GFR, URF, and RBF when PPC and HM were varied together and independently at time periods of 12, 24, and 36 hours post-operatively. It was concluded that the model was valid for the purposes of the project. Results are listed according to dependent variable. It was determined that all values in each set of simulations were within normal ranges of GFR. Therefore, changes in PPC and HM similar to those seen after hemoconcentration do not adversely affect GFR. UFR values tended to be lower than normal ranges during each set of simulations. Even though these values were lower, the results are most likely not clinically significant. Finally it was determined that RBF increased when PPC increased but decreased when HM increased. Therefore, there was little change in RBF when PPC and HM were varied together. This also suggests that RBF is not adversely affected when PPC and HM change in a manner similar to the changes occuring during hemoconcentration. Therefore, this research suggests that the changes in PPC and HM that ocur with hemoconcentration do not adversely affect GFR, UFR, and RBF up to 36 hours post-operatively.

Computational Immunology Springer Science & Business Media

Issues in Kidney Disease Research and Treatment: 2012 Edition is a ScholarlyEditions™ eBook that delivers timely, authoritative, and comprehensive information about Kidney Disease. The editors have built Issues in Kidney Disease Research and Treatment: 2012 Edition on the vast information databases of ScholarlyNews.™ You can expect the information about Kidney Disease in this eBook to be deeper than what you can access anywhere else, as well as consistently reliable, authoritative, informed, and relevant. The content of Issues in Kidney Disease Research and Treatment: 2012 Edition has been produced by the world’s leading scientists, engineers, analysts, research institutions, and companies. All of the content is from peer-reviewed sources, and all of it is written, assembled, and edited by the editors at ScholarlyEditions™ and available exclusively from us. You now have a source you can cite with authority, confidence, and credibility. More information is available at http://www.ScholarlyEditions.com/.

International Conference on Computing and Information Technologies World Scientific

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Exploring Emerging Technologies Springer Science & Business Media

Divided into two volumes, the book begins with a pedagogical presentation of some of the basic theory, with chapters on biochemical reactions, diffusion, excitability, wave propagation and cellular homeostasis. The second, more extensive part discusses particular physiological systems, with chapters on calcium dynamics, bursting oscillations and secretion, cardiac cells, muscles, intercellular communication, the circulatory system, the immune system, wound healing, the respiratory system, the visual system, hormone physiology, renal physiology, digestion, the visual system and hearing. New chapters on Calcium Dynamics, Neuroendocrine Cells and Regulation of Cell Function have been included.

Mathematical Physiology Editora E-papers

With the availability of high speed computers and advances in computational techniques, the application of mathematical modeling to biological systems is expanding. This comprehensive and richly illustrated volume provides up-to-date, wide-ranging material on the mathematical modeling of kidney physiology, including clinical data analysis and practice exercises. Basic concepts and modeling techniques introduced in this volume can be applied to other areas (or organs) of physiology. The models presented describe the main homeostatic functions performed by the kidney, including blood filtration, excretion of water and salt, maintenance of electrolyte balance and regulation of blood pressure. Each chapter includes an introduction to the basic relevant physiology, a derivation of the essential conservation equations and then a discussion of a series of mathematical models, with increasing level of complexity. This volume will be of interest to biological and mathematical scientists, as well as physiologists and nephrologists, who would like an introduction to mathematical techniques that can be applied to renal transport and function. The material is written for students who have had college-level calculus, but can be used in modeling courses in applied mathematics at all levels through early graduate courses.

Springer

Inspired by the Research Collaboration Workshop for Women in Mathematical Biology, this volume contains research and review articles that cover topics ranging from models of animal movement to the flow of blood cells in the embryonic heart. Hosted by the National Institute for Mathematics and Biological Synthesis (NIMBioS), the workshop brought together women working in biology and mathematics to form four research groups that encouraged multidisciplinary collaboration and lifetime connections in the STEM field. This volume introduces many of the topics from the workshop, including the aerodynamics of spider ballooning; sleep, circadian rhythms, and pain; blood flow regulation in the kidney; and the effects of antimicrobial therapy on gut microbiota and microbiota and Clostridium difficile. Perfect for students and researchers in mathematics and biology, the papers included in this volume offer an introductory glimpse at recent research in mathematical biology.

Biomedical Modeling and Simulation on a PC Springer Science & Business Media

Order the Set Medical Physics and save almost 25€. Medical Physics covers the applied branch of physics concerned with the application of concepts and methods of physics to diagnostics and therapeutics of human diseases. The first part, Physical and Physiological Aspects of the Body, covers those body systems that have a strong physical component, such as body mechanics, energy household, action potential, signal transmission in neurons, respiratory and circulatory system as well as visual and sound perception. The second part of this volume, Imaging Modalities without Ionizing Radiation, introduces sonography, endoscopy, and magnetic resonance imaging. The second volume complements the imaging modalities with the use of ionizing radiation: x-ray radiography, scintigraphy, SPECT, and PET. This first part is followed by chapters on radiation treatment of tumors, in particular x-ray radiotherapy, proton and neutron radiation therapy, and brachytherapy. The last part treats aspects of diagnostics and therapeutics beyond radiology, including laser applications, multifunctional nanoparticles and prosthetics. The present volume connects the basic principles of physics with the functionality of the body and with physical methods used for diagnostics and therapeutics. covers the first part of the entire field, including the physics of the body and imaging methods without the use of ionizing radiation. provides an introduction for Bachelor students to the main concepts of Medical Physics during their first semesters guiding them to further specialized and advanced literature. contains many questions & answers related to the content of each chapter. is also available as a set together with Volume 2. Contents Part A: Physical and physiological aspects of the body Brief overview of body parts and functions Body mechanics and muscles Elastomechanics: bones and fractures Energy household of the body Resting potential and action potential Signal transmission in neurons Electrophysical aspects of the heart The circulatory system The respiratory system Kidneys Basic mechanism of vision Sound and sound perception Part B: Imaging modalities without ionizing radiation Sonography Endoscopy Magnetic resonance imaging Questions & answers

Computing and Information Technologies Academic Press

This 121st IMA volume, entitled MATHEMATICAL MODELS FOR BIOLOGICAL PATTERN FORMATION is the first of a new series called FRONTIERS IN APPLICATION OF MATHEMATICS. The FRONTIERS volumes are motivated by IMA pro grams and workshops, but are specially planned and written to provide an entree to and assessment of exciting new areas for the application of mathematical tools and analysis. The emphasis in FRONTIERS volumes is on surveys, exposition and outlook, to attract more mathematicians and other scientists to the study of these areas and to focus efforts on the most important issues, rather than papers on the most recent research results aimed at an audience of specialists. The present volume of peer-reviewed papers grew out of the 1998-99 IMA program on "Mathematics in Biology," in particular the Fall 1998 em phasis on "Theoretical Problems in Developmental Biology and Immunol ogy." During that period there were two workshops on Pattern Formation and Morphogenesis, organized by Professors Murray, Maini and Othmer. James Murray was one of the principal organizers for the entire year pro gram. I am very grateful to James Murray for providing an introduction, and to Philip Maini and Hans Othmer for their excellent work in planning and preparing this first FRONTIERS volume. I also take this opportunity to thank the National Science Foundation, whose financial support of the IMA made the Mathematics in Biology pro gram possible.

Women in Mathematical Biology Springer

Anais do IV Simpósio Brasileiro e I Simpósio Internacional de Biologia Matemática e Computacional

Proc. of the Fourth Brazilian Symp. on Mathematical and Computational Biology vol.2: First International Symposium on Mathematical and Computational Biology Walter de Gruyter GmbH & Co KG

I have long had an interest in the life sciences, but have had few opportunities to indulge that interest in my professional activities. It has only been through simulation that those opportunities have arisen. Some of my most enjoyable classes were those I taught to students in the life sciences, where I attempted to show them the value of simulation to their discipline. That there is such a value cannot be questioned. Whether you are interested in population ecology, pharmacokinetics, the cardiovascular system, or cell interaction, simulation can play a vital role in explaining the underlying processes and in enhancing our understanding of these processes. This book comprises an excellent collection of contributions, and clearly demonstrates the value of

simulation in the particular areas of physiology and bioengineering. My main frustration when teaching these classes to people with little or no computer background was the lack of suitable simulation software. This di rectly inspired my own attempts at producing software usable by the computer novice. It is especially nice that software is available that enables readers to experience the examples in this book for themselves. I would like to congratulate and thank the editors, Rogier P. van Wijk van Brievingh and Dietmar P. P. Moller, for all of their excellent efforts. They should be proud of their achievement. This is the sixth volume in the Advances in Simulation series, and other volumes are in preparation.

Mathematical Modelling of Haemodialysis Springer

Divided into two volumes, the book begins with a pedagogical presentation of some of the basic theory, with chapters on biochemical reactions, diffusion, excitability, wave propagation and cellular homeostasis. The second, more extensive part discusses particular physiological systems, with chapters on calcium dynamics, bursting oscillations and secretion, cardiac cells, muscles, intercellular communication, the circulatory system, the immune system, wound healing, the respiratory system, the visual system, hormone physiology, renal physiology, digestion, the visual system and hearing. New chapters on Calcium Dynamics, Neuroendocrine Cells and Regulation of Cell Function have been included. Reviews from first edition: Keener and Sneyd's Mathematical Physiology is the first comprehensive text of its kind that deals exclusively with the interplay between mathematics and physiology. Writing a book like this is an audacious act! -Society of Mathematical Biology Keener and Sneyd's is unique in that it attempts to present one of the most important subfields of biology and medicine, physiology, in terms of mathematical "language", rather than organizing materials around mathematical methodology. -SIAM review

Biological Fluid Dynamics: Modeling, Computations, and Applications CRC Press

Understanding how a therapy will impact the injured kidney before being administered would be an asset to the clinical world. The work in this thesis advances the field of mathematical modeling of the kidneys to aid in this cause. The objectives of this work are threefold: 1) to develop and personalize a model to specific patients in different diseased states, via parameter estimation, in order to test therapeutic trajectories, 2) to use parameter estimation to understand the cause of different kidney diseases, differentiate between potential kidney diseases, and facilitate targeted therapies, and 3) to push forward the understanding of kidney physiology via physiology-based mathematical modeling techniques. To accomplish these objectives, we have developed two models of the kidneys: 1) a broad, steady-state, closed-loop model of the entire kidney with human physiologic parameters, and 2) a detailed, dynamic model of the proximal tubule, an important part of kidney, with rat physiologic parameters.

Volume 1: Physical Aspects of Organs and Imaging Springer

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A Mathematical Model of the Effects of Hemoconcentration on Renal Function SIAM

This volume contains the Proceedings of the AMS Special Session on Biological Fluid Dynamics: Modeling, Computation, and Applications, held on October 13, 2012, at Tulane University, New Orleans, Louisiana. In recent years, there has been increasing interest in the development and application of advanced computational techniques for simulating fluid motion driven by immersed flexible structures. That interest is motivated, in large part, by the multitude of applications in physiology and biology. In some biological systems, fluid motion is driven by active biological tissues, which are typically constructed of fibers that are surrounded by fluid. Not only do the fibers hold the tissues together, they also transmit forces that ultimately result in fluid motion. In other examples, the fluid may flow through conduits such as blood vessels or airways that are flexible or active. That is, those conduits may react to and affect the fluid dynamics. This volume responds to the widespread interest among mathematicians, biologists, and engineers in fluid-structure interactions problems. Included are expository and review articles in biological fluid dynamics. Applications that are considered include ciliary motion, upside-down jellyfish, biological feedback in the kidney, peristalsis and dynamic suction pumping, and platelet cohesion and adhesion.

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