Mathematical Modeling And Simulation Of Drug Release From

Mike Jess

Assessing Bioavailability of Drug Delivery Systems, Jean-Maurice Vergnaud, Iosif-Daniel Rosca, 2005-05-26 Exploring how to apply in vitro/in vivo correlations for controlled release dosage forms, Bioavailability of Drug Delivery Systems: Mathematical Modeling clearly elucidates this complex phenomena and provides a guide for the respective mathematical modeling. The book introduces mathematical modeling methods for calculating the profiles of plasma levels obtained with controlled release dosage forms and provides examples and case studies to illustrate the techniques employed. The author has considerable experience in investigating mathematical fundamentals that are related to pharmaco- and toxicokinetics, modified-release drug products, physiologic pharmacokinetics and statistical treatment in clinical situations. The mathematical models he has developed are particularly powerful because they account for such major parameters as the kinetics of drug release controlled by diffusion or by erosion, and the kinetics of absorption into and elimination out of the plasma. They are also able to solve the problem of determining the drug level in plasma as a result of patient non-compliance, incorrect dosage, and incorrect frequency and to determine the best dosage forms necessary for therapy. Using master curves, the book highlights the inter-variability of the patients often expressed by different responses towards a drug. Thus, after evaluating a patient's pharmacokinetic parameters, the dose can be adapted to the patient, with the expectation of decreasing the side effects for each patient. Using dimensionless numbers in repeated doses, either for the time or for the plasma drug concentration, makes the master curves useful for every drug, providing that its pharmacokinetics was linear. These master curves address clear information either to the patients or to the therapists in a didactic and easy way. The patients can see from first look the effects of non-compliance and therapists can see the dramatic effects of inter-variability of patients towards a drug. Drug discovery and dosage forms have become an increasingly time-consuming and expensive process. The development of a single drug can leave behind more than 10 to 15 years of work. Discussing time and cost-effective methods as alternatives to conventional in vivo methods, the book helps you analyze and integrate in vitro/in vivo correlations and apply them to patient care and drug consultation situations.

Understanding Drug Release and Absorption Mechanisms, 2007 Demand for better reliability from drug delivery
Demand for better reliability from drug delivery systems has caused designers and researchers to move away from trial-and-error approaches and toward model-based methods of product development. Developing such models requires cross-disciplinary physical, mathematical, and physiological knowledge. Combining these areas under a single cover, Understanding Drug Release and Absorption Mechanisms builds a firm understanding of all elements needed to conceive, build, and implement successful models of drug release. Written by experts with broad industrial and academic experience, this book discusses the underlying physical principles, shows how to build mathematical models based on these principles, and finally compares the resulting models with experimental results. The authors begin by introducing the basics of modeling, physiological details of gastrointestinal and dermal absorption pathways, rheology, mass transport and thermodynamics, dissolution and partitioning, as well as size effects on the dissolution of crystallites. From this baseline, the authors explore applications in drug release from various delivery systems, specifically matrix systems, microemulsions, and permeability through membranes. Working systematically from theory to working models, Understanding Drug Release and Absorption Mechanisms: A Physical and Mathematical Approach demonstrates the steps involved in designing, building, and implementing realistic and reliable models of drug release without unrealistically simplifying the theoretical parameters.

**Mathematical Modeling of Pharmacokinetic Data**
David W. A. Bourne

A concise guide to mathematical modeling and analysis of pharmacokinetic data, this book contains valuable methods for maximizing the information obtained from given data. It is an ideal resource for scientists, scholars, and advanced students.

**Understanding Drug Release and Absorption Mechanisms**
Mario Grassi, Gabriele Grassi, Romano Lapasin, Italo Colombo

Demand for better reliability from drug delivery systems has caused designers and researchers to move away from trial-and-error approaches and toward model-based methods of product development. Developing such models requires cross-disciplinary physical, mathematical, and physiological knowledge. Combining these areas under a single cover, Understanding Drug Release and Absorption Mechanisms builds a firm understanding of all elements needed to conceive, build, and implement successful models of drug release. Written by experts with broad industrial and academic experience, this book discusses the underlying physical principles, shows how to build mathematical models based on these principles, and finally compares the resulting models with experimental results. The authors begin by introducing the basics of modeling, physiological details of gastrointestinal and dermal absorption pathways, rheology, mass transport and thermodynamics, dissolution and partitioning, as well as size effects on the dissolution of crystallites. From this baseline, the authors explore applications in drug release from various delivery systems, specifically matrix systems, microemulsions, and permeability through membranes. Working systematically from theory to working models, Understanding Drug Release and Absorption Mechanisms: A Physical and Mathematical Approach demonstrates the steps involved in designing, building, and implementing realistic and reliable models of drug release without unrealistically simplifying the theoretical parameters.
Modeling in Biopharmaceutics, Pharmacokinetics and Pharmacodynamics Panos Macheras, Athanassios Iliadis, 2006-04-26

This book presents a novel modeling approach to biopharmaceutics, pharmacokinetics and pharmacodynamic phenomena. It shows how advanced physical and mathematical methods can expand classical models in order to cover heterogeneous drug-biological processes and therapeutic effects in the body. Throughout, many examples are used to illustrate the intrinsic complexity of drug administration related phenomena in the human, justifying the use of advanced modeling methods.


Since the earliest dosage forms to modern drug delivery systems, came a great development and growth of knowledge with respect to drug delivery. Strategies to Modify the Drug Release from Pharmaceutical Systems will address principles, systems, applications and advances in the field. It will be principally a textbook and a reference source of strategies to modify the drug release. Moreover, the characterization, mathematical and physicochemical models, applications and the systems will be discussed. Addresses the principles, systems, applications and advances in the field of drug delivery. Highlights the mathematical and physicochemical principles related to strategies. Discusses drug release and its possible modifications.

Mathematical Modeling and Simulation in Enteric Neurobiology, Roustem Miftahof, 2009

The lack of scientists equally trained and prepared to understand both mathematics and biology/medicine hampers the development and application of computer simulation methods in biology and neurogastrobiology. Currently, there are no texts for navigating the extensive and intricate field of mathematical and computational modeling in neurogastrobiology. This book bridges the gap between mathematicians, computer scientists and biologists, and thus assists in the study and analysis of complex biological phenomena that cannot be done through traditional in vivo and in vitro experimental approaches. The book recognizes the complexity of biological phenomena under investigation and treats the subject matter with a degree of mathematical rigor. Special attention is given to computer simulations for interpolation and extrapolation of electromechanical and chemo-electrical phenomena, nonlinear self-sustained electromechanical wave activity, pharmacological effects including co-localization and co-transmission by multiple neurotransmitters, receptor polymodality, and drug interactions. Mathematical Modeling and Simulation in Enteric Neurobiology is an interdisciplinary book and is an essential source of information for biologists and doctors who are interested in knowing about the role and advantages of numerical experimentation in their subjects, as well as for mathematicians who are interested in exploring new areas of applications.

Poly(lactic-co-glycolic acid) (PLGA) Nanoparticles for Drug Delivery Prashant Kesharwani, 2023-03-02

Poly(lactic-co-glycolic acid) (PLGA) Nanoparticles for Drug Delivery is a comprehensive guide to PLGA nanoparticles for targeting various diseases, covering principles, formation, characterization, applications, regulations and the latest advances. Sections
introduce the fundamental aspects of PLGA nanoparticles for drug delivery, including properties, preparation methods, characterization, drug loading methods, and drug release mechanisms, along with a focus on applications. Application of PLGA nanoparticles for the treatment of cancer, inflammatory, cerebral, cardiovascular, and infectious diseases, as well as in regenerative medicine, photodynamic and photothermal therapy, and gene therapy, are all explained in detail. The final chapters explore recent advances and regulatory aspects. This book is a valuable resource for researchers and advanced students across nanomedicine, polymer science, bio-based materials, chemistry, biomedicine, biotechnology, and materials engineering, as well as for industrial scientists and R&D professionals with an interest in nanoparticles for drug delivery, pharmaceutical formulations and regulations, and development of innovative biodegradable materials. Presents the fundamentals of PLGA nanoparticles, including properties, preparation, characterization, and biofate and cellular interactions Provides in-depth coverage of a broad range of specific applications of PLGA nanoparticles across disease treatment, regenerative medicine and therapeutic areas Offers a methodical approach to PLGA nanoparticles in drug delivery that is supported by data tables, illustrative figures and flowcharts

*Engineering Polymer Systems for Improved Drug Delivery* Rebecca A. Bader, David A. Putnam, 2014-01-17 Polymers have played a critical role in the rational design and application of drug delivery systems that increase the efficacy and reduce the toxicity of new and conventional therapeutics. Beginning with an introduction to the fundamentals of drug delivery, Engineering Polymer Systems for Improved Drug Delivery explores traditional drug delivery techniques as well as emerging advanced drug delivery techniques. By reviewing many types of polymeric drug delivery systems, and including key points, worked examples and homework problems, this book will serve as a guide to for specialists and non-specialists as well as a graduate level text for drug delivery courses.

*Degradation of Implant Materials* Noam Eliaz, 2012-08-21 This book reviews the current understanding of the mechanical, chemical and biological processes that are responsible for the degradation of a variety of implant materials. All 18 chapters will be written by internationally renowned experts to address both fundamental and practical aspects of research into the field. Different failure mechanisms such as corrosion, fatigue, and wear will be reviewed, together with experimental techniques for monitoring them, either in vitro or in vivo. Procedures for implant retrieval and analysis will be presented. A variety of biomaterials (stainless steels, titanium and its alloys, nitinol, magnesium alloys, polyethylene, biodegradable polymers, silicone gel, hydrogels, calcium phosphates) and medical devices (orthopedic and dental implants, stents, heart valves, breast implants) will be analyzed in detail. The book will serve as a broad reference source for graduate students and researchers studying biomedicine, corrosion, surface science, and electrochemistry.

*Computational and Mathematical Models in Biology* Carla M.A. Pinto, Clara Mihaela Ionescu, 2024-01-09 This book provides the most valuable and updated research on computational and mathematical models in biological systems from
influential researchers around the world and contributes to the development of future research guidelines in this topic. Topics include (but are not limited to): modeling infectious and dynamic diseases; regulation of cell function; biological pattern formation; biological networks; tumor growth and angiogenesis; complex biological systems; Monte Carlo methods; Control theory, optimization and their applications.

**Exploring Computational Pharmaceutics** Defang Ouyang, 2024-11-12 Provides an extensive and up-to-date overview of the theory and application of computational pharmaceutics in the drug development process. Exploring Computational Pharmaceutics - AI and Modeling in Pharma 4.0 introduces a variety of current and emerging computational techniques for pharmaceutical research. Bringing together experts from academia, industry, and regulatory agencies, this edited volume also explores the current state, key challenges, and future outlook of computational pharmaceutics while encouraging development across all sectors of the field. Throughout the text, the authors discuss a wide range of essential topics, from molecular modeling and process simulation to intelligent manufacturing and quantitative pharmacology. Building upon Exploring Computational Pharmaceutics - AI and Modeling in Pharma 4.0, this new edition provides a multi-scale perspective that reveals the physical, chemical, mathematical, and data-driven details of pre-formulation, formulation, process, and clinical studies, in addition to in vivo prediction in the human body and precision medicine in clinical settings. Detailed chapters address both conventional dosage forms and the application of computational technologies in advanced pharmaceutical research, such as dendrimer-based delivery systems, liposome and lipid membrane research, and inorganic nanoparticles. A major contribution to the development and promotion of computational pharmaceutics, this important resource: Discusses the development track, achievements, and prospects of computational pharmaceutics Presents multidisciplinary research to help physicists, chemists, mathematicians, and computer scientists locate problems in the field of drug delivery Covers a wide range of technologies, including complex formulations for water-insoluble drugs, protein/peptide formulations, nanomedicine, and gene delivery systems. Focuses on the application of cutting-edge computational technologies and intelligent manufacturing of emerging pharmaceutical technologies. Includes a systematic overview of computational pharmaceutics and Pharma 4.0 to assist non-specialist readers. Covering introductory, advanced, and specialist topics, Exploring Computational Pharmaceutics - AI and Modeling in Pharma 4.0 is an invaluable resource for computational chemists, computational analysts, pharmaceutical chemists, process engineers, process managers, and pharmacologists, as well as computer scientists, medicinal chemists, clinical pharmacists, material scientists, and nanotechnology specialists working in the field.

**Encapsulation of Active Molecules and Their Delivery System** Shirish Sonawane, Bharat A. Bhanvase, Manickam Sivakumar, 2020-03-24 Encapsulation of Active Molecules and Their Delivery System covers the key methods of preparation of encapsulation, as well as release mechanisms and their applications in food, biotechnology, metal protection, drug
delivery, and micronutrients delivery in agriculture. The book also provides real-life examples of applications in food and other industries. Sections encompass (i) Synthesis and characterization methods of micro- and nanocarriers as the delivery systems, (ii) Up-to-date encapsulation techniques in the areas of pharmaceuticals, nutraceuticals and corrosion, (iii) The release methods of the encapsulated materials, and (iv) Industry perspectives, including scale up of the processes. Focuses on encapsulation processes in chemical and materials engineering and biotechnology Provides a relevant resource for the pharmaceutical and food industries Presents wide coverage on the entrapment of molecules that scales-up to industrial sized needs

*Drug Delivery Systems: Advanced Technologies Potentially Applicable in Personalised Treatment* Jorge Coelho, 2013-03-15 This book is part of a series dedicated to recent advances on preventive, predictive and personalised medicine (PPPM). It focuses on the theme of “Drug delivery systems: advanced technologies potentially applicable in personalised treatments”. The critical topics involving the development and preparation of effective drug delivery systems, such as: polymers available, self-assembly, nanotechnology, pharmaceutical formulations, three dimensional structures, molecular modeling, tailor-made solutions and technological tendencies, are carefully discussed. The understanding of these areas constitutes a paramount route to establish personalised and effective solutions for specific diseases and individuals.

*Polysaccharides in Advanced Drug Delivery* Akhilesh Vikram Singh, Bang-Jing Li, 2020-02-28 This book contains selective chapters from eminent experts working in the interdisciplinary arena of material science and its use in drug delivery. From their recent research experience, the readers can achieve a wide vision on the new and ongoing potentialities of polysaccharides and its application in the field of advanced drug delivery. This book contains selective polymers that were recently explored in the field of drug delivery such as starch, konjac, chitosan, alginate and other natural polymers originated from sea. It also has one chapter exclusively on nanotechnology that explains multifaceted application of natural polymer in the field of advanced drug delivery. Note: T& F does not sell or distribute the Hardback in India, Pakistan, Nepal, Bhutan, Bangladesh and Sri Lanka.

*Cardiovascular Mathematics* Luca Formaggia, Alfio Quarteroni, Allesandro Veneziani, 2010-06-27 Mathematical models and numerical simulations can aid the understanding of physiological and pathological processes. This book offers a mathematically sound and up-to-date foundation to the training of researchers and serves as a useful reference for the development of mathematical models and numerical simulation codes.

*Multiscale Modelling in Biomedical Engineering* Dimitrios I. Fotiadis, Antonis I. Sakellarios, Vassiliki T. Potsika, 2023-05-05 Multiscale Modelling in Biomedical Engineering Discover how multiscale modeling can enhance patient treatment and outcomes In Multiscale Modelling in Biomedical Engineering, an accomplished team of biomedical professionals delivers a robust treatment of the foundation and background of a general computational methodology for multi-scale modeling. The
authors demonstrate how this methodology can be applied to various fields of biomedicine, with a particular focus on orthopedics and cardiovascular medicine. The book begins with a description of the relationship between multiscale modeling and systems biology before moving on to proceed systematically upwards in hierarchical levels from the molecular to the cellular, tissue, and organ level. It then examines multiscale modeling applications in specific functional areas, like mechanotransduction, musculoskeletal, and cardiovascular systems. Multiscale Modelling in Biomedical Engineering offers readers experiments and exercises to illustrate and implement the concepts contained within. Readers will also benefit from the inclusion of: A thorough introduction to systems biology and multi-scale modeling, including a survey of various multi-scale methods and approaches and analyses of their application in systems biology Comprehensive explorations of biomedical imaging and nanoscale modeling at the molecular, cell, tissue, and organ levels Practical discussions of the mechanotransduction perspective, including recent progress and likely future challenges In-depth examinations of risk prediction in patients using big data analytics and data mining Perfect for undergraduate and graduate students of bioengineering, biomechanics, biomedical engineering, and medicine, Multiscale Modelling in Biomedical Engineering will also earn a place in the libraries of industry professional and researchers seeking a one-stop reference to the basic engineering principles of biological systems.

**Plant and Algal Hydrogels for Drug Delivery and Regenerative Medicine** Tapan Kumar Giri, Bijaya Ghosh, 2021-06-12 Plant and Algal Hydrogels for Drug Delivery and Regenerative Medicine offers a materials-focused and systematic overview of biopolymeric hydrogels utilized for biomedical applications. The book details the synthesis and characterization of plant and algal-based hydrogels, with each chapter addressing a separate polysaccharide hydrogel type. Specific applications in drug delivery and regenerative medicine are also discussed, highlighting the efficacy, biocompatibility, benefits and challenges for each polysaccharide hydrogel subtype. There is increasing demand for biomaterials which reduce/prevent the host response, inflammation and rejection, hence this book provides a timely resource. Biopolymeric hydrogels have skyrocketed because of their necessity in in vivo applications. They create an environment similar to living tissue, which is both biocompatible and biodegradable. Plant and algal polysaccharides in particular are well-equipped with functional groups that are easily modified for beneficial results. Systematically covers each plant and algal polysaccharide hydrogel subtype, from starch-based hydrogels to pectin and alginate-based hydrogels Provides an end-to-end description of the synthesis, characterization and application of biopolymeric hydrogels for drug delivery and regenerative medicine Appeals to a diverse readership, including those in biomedicine, pharmacy, polymer chemistry, biochemistry, materials science, biomedical engineering, and other biotechnology related disciplines

**Controlled Drug Release Of Oral Dosage Forms** Jean-Maurice Vergnaud, 1993-07-31 Numerical analysis of matter transfer is an area that pharmacists find difficult, but which is a technique frequently used in preparing controlled drug
release and oral dosage forms. This book provides clear and straightforward information enabling the reader to carry out numerical analysis of matter transfer - a vital process when looking at the formulation of oral dosage forms with controlled drug release. The drug is dispersed in a polymeric matrix either biodegradable or not, the basis of which is the transfer of the liquid and the drug through dosage form. Information on this diffusion is found either through mathematical treatment when the problem is simple, or through numerical analysis for more complex problems. Professor Vergnaud demonstrates and clarifies these, modelling the process of drug delivery by using numerical analysis and computerization. A simulation of the process is provided, together with a determination of the effects of all parameters, and the author uses both mathematical and numerical models to predict the preparation of new dosage forms able to fulfil specific conditions.

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Introduction

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