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Disease Modelling and Public Health **An Introduction to Infectious Disease Modelling** *Modeling Infectious Diseases in Humans and Animals* **Disease Modelling and Public Health** Disease Modelling and Public Health **Modeling and Control of Infectious Diseases in the Host** **Infectious Disease Modelling Research Progress** Organoid Technology for Disease Modelling and Personalized Treatment **Infectious Disease Modeling** *Novel Concepts in IPSC Disease Modeling* **Modeling and Dynamics of Infectious Diseases** *Epidemic Modelling* **Bayesian Disease Mapping Infectious Disease Modeling** New Horizons in Modeling and Simulation for Social Epidemiology and Public Health *Analyzing and Modeling Spatial and Temporal Dynamics of Infectious Diseases* **Mathematical Epidemiology of Infectious Diseases** *An Introduction to Mathematical Modeling of Infectious Diseases* **Microbial Threats to Health A Historical Introduction to Mathematical Modeling of Infectious Diseases** **Mathematical Modelling and Analysis of Infectious Diseases** *Animal Models for the Study of Human Disease Modeling Infectious Disease Parameters Based on Serological and Social Contact Data* **Modeling to Inform Infectious Disease Control** *The Zebrafish* Networks in Systems Biology **Computational Modeling of Infectious Disease** **Modeling the Interplay Between Human Behavior and the Spread of Infectious Diseases** **Infectious Disease Modeling with Interpersonal Contact Patterns as a Heterogeneous Network** *Mathematical and Statistical Modeling for Emerging and Re-emerging Infectious Diseases* **Quantitative Methods for Investigating Infectious Disease Outbreaks** **Assessing COVID-19 and Other Pandemics and Epidemics using Computational Modelling and Data Analysis** 3-Dimensional Modeling in Cardiovascular Disease **Vertically Transmitted Diseases** **Mouse Models of Development and Disease** **Human iPS Cells in Disease Modelling** *Mathematical Tools for Understanding Infectious Disease Dynamics* *Epidemics* **Charting the Next Pandemic** Current Progress in IPSC Disease Modeling

Assessing COVID-19 and Other Pandemics and Epidemics using Computational Modelling and Data Analysis Sep 03 2020 This book comprehensively covers the topic of COVID-19 and other pandemics and epidemics data analytics using computational modelling. Biomedical and Health Informatics is an emerging field of research at the intersection of information science, computer science, and health care. The new era of pandemics and epidemics bring tremendous opportunities and challenges due to the plentiful and easily available medical data allowing for further analysis. The aim of pandemics and epidemics research is to ensure high-quality, efficient healthcare, better treatment and quality of life by efficiently analyzing the abundant medical, and healthcare data including patient's data, electronic health records (EHRs) and lifestyle. In the past, it was a common requirement to have domain experts for developing models for biomedical or healthcare. However, recent advances in representation learning algorithms allow us to automatically learn the pattern and representation of the given data for the development of such models. Medical Image Mining, a novel research area (due to its large amount of medical images) are increasingly generated and stored digitally. These images are mainly in the form of: computed tomography (CT), X-ray, nuclear medicine imaging (PET, SPECT), magnetic resonance imaging (MRI) and ultrasound. Patients' biomedical images can be digitized using data mining techniques and may help in answering several important and critical questions related to health care. Image mining in medicine can help to uncover new relationships between data and reveal new and useful information that can be helpful for scientists and biomedical practitioners. Assessing COVID-19 and Other Pandemics and Epidemics using Computational Modelling and Data Analysis will play a vital role in improving human life in response to pandemics and epidemics. The state-of-the-art approaches for data mining-based medical and health related applications will be of great value to researchers and practitioners working in biomedical, health informatics, and artificial intelligence..

Epidemic Modelling May 24 2022 This is a general introduction to the mathematical modelling of diseases.

Epidemics Feb 27 2020 This book is designed to be a practical study in infectious disease dynamics. It offers an easy-to-follow implementation and analysis of mathematical epidemiology. It focuses on recent case studies in order to explore various conceptual, mathematical, and statistical issues. The dynamics of infectious diseases shows a wide diversity of pattern. Some have locally persistent chains-of-transmission, others persist spatially in consumer-resource metapopulations. Some infections are prevalent among the young, some among the old and some are age-invariant. Temporally, some diseases have little variation in prevalence, some have predictable seasonal shifts and others exhibit violent epidemics that may be regular or irregular in their timing. Models and 'models-with-data' have proved invaluable for understanding and predicting this diversity, and thence help improve intervention and control. Using mathematical models to understand infectious disease, dynamics has a very rich history in epidemiology. The field has seen broad expansions of theories as well as a surge in real-life application of mathematics to dynamics and control of infectious disease. The chapters of Epidemics: Models and Data Using R have been organized as follows: chapters 1-10 is a mix and match of models, data and statistics pertaining to local disease dynamics; chapters 11-13 pertains to spatial and spatiotemporal dynamics; chapter 14 highlights similarities between the dynamics of infectious disease and parasitoid-host dynamics; Finally, chapters 15 and 16 overview additional statistical methodology useful in studies of infectious disease dynamics. This book can be used as a guide for working with data, models and 'models-and-data' to understand epidemics and infectious disease dynamics in space and time. All the code and data sets are distributed in the epimdr2 R package to facilitate the hands-on philosophy of the text.

Disease Modelling and Public Health Feb 01 2023 Disease Modelling and Public Health, Part A, Volume 36 addresses new challenges in existing and emerging diseases with a variety of comprehensive chapters that cover Infectious Disease Modeling, Bayesian Disease Mapping for Public Health, Real time estimation of the case fatality ratio and risk factor of death, Alternative Sampling Designs for Time-To-Event Data with Applications to Biomarker Discovery in Alzheimer's Disease, Dynamic risk prediction for cardiovascular disease: An illustration using the ARIC Study, Theoretical advances in type 2 diabetes, Finite Mixture Models in Biostatistics, and Models of Individual and Collective Behavior for Public Health Epidemiology. As a two part volume, the series covers an extensive range of techniques in the field. It present a vital resource for statisticians who need to access a number of different methods for assessing epidemic spread in population, or in formulating public health policy. Presents a comprehensive, two-part volume written by leading subject experts Provides a unique breadth and depth of content coverage Addresses the most cutting-edge developments in the field Includes chapters on Ebola and the Zika virus; topics which have grown in prominence and scholarly output

Novel Concepts in IPSC Disease Modeling Jul 26 2022 The series Advances in Stem Cell Biology is a timely and expansive collection of comprehensive information and new discoveries in the field of stem cell biology. iPSCs - Novel Concepts, Volume 15 addresses how important induced pluripotent stems cells are and how can they can help treat certain diseases. Somatic cells can be reprogrammed into induced pluripotent stem cells by the expression of specific transcription factors. These cells have been transforming biomedical research over the last 15 years. This volume will address the advances in research of how induced pluripotent stem cells are being used for treatment of different disorders, such as liver disease, type-1 diabetes, Parkinson's disease, macular degeneration of the retina and much more. The volume is written for researchers and scientists in stem cell therapy, cell biology, regenerative medicine and organ transplantation; and is contributed by world-renowned authors in the field. Provides overview of the fast-moving field of stem cell biology and function, regenerative medicine and therapeutics Covers spinal cord injuries, type-1 diabetes, liver disease, Parkinson's disease, graft vs. host disease, and much more Contributed by world-renown experts in the field

Modeling the Interplay Between Human Behavior and the Spread of Infectious Diseases Jan 08 2021 This volume summarizes the state-of-the-art in the fast growing research area of modeling the influence of information-driven human behavior on the spread and control of infectious diseases. In particular, it features the two main and inter-related "core" topics: behavioral changes in response to global threats, for example, pandemic influenza, and the pseudo-rational opposition to vaccines. In order to make realistic predictions, modelers need to go beyond classical mathematical epidemiology to take these dynamic effects into account. With contributions from experts in this field, the book fills a void in the literature. It goes beyond classical texts, yet preserves the rationale of many of them by sticking to the underlying biology without compromising on scientific rigor. Epidemiologists, theoretical biologists, biophysicists, applied mathematicians, and PhD students will benefit from this book. However, it is also written for Public Health professionals interested in understanding models, and to advanced undergraduate students, since it only requires a working knowledge of mathematical epidemiology.

Infectious Disease Modeling Aug 27 2022 This volume presents infectious diseases modeled mathematically, taking seasonality and changes in population behavior into account, using a switched and hybrid systems framework. The scope of coverage includes background on mathematical epidemiology, including classical formulations and results; a motivation for seasonal effects and changes in population behavior, an investigation into term-time forced epidemic models with switching parameters, and a detailed account of several different control strategies. The main goal is to study these models theoretically and to establish conditions under which eradication or persistence of the disease is guaranteed. In doing so, the long-term behavior of the models is determined through mathematical techniques from switched systems theory. Numerical simulations are also given to augment and illustrate the theoretical results and to help study the efficacy of the control schemes.

A Historical Introduction to Mathematical Modeling of Infectious Diseases Sep 15 2021 A Historical Introduction to Mathematical Modeling of Infectious Diseases: Seminal Papers in Epidemiology offers step-by-step help on how to navigate the important historical papers on the subject, beginning in the 18th century. The book carefully, and critically, guides the reader through seminal writings that helped revolutionize the field. With pointed questions, prompts, and analysis, this book helps the non-mathematician develop their own perspective, relying purely on a basic knowledge of algebra, calculus, and statistics. By learning from the important moments in the field, from its conception to the 21st century, it enables readers to mature into competent practitioners of epidemiologic modeling. Presents a refreshing and in-depth look at key historical works of mathematical epidemiology Provides all the basic knowledge of mathematics readers need in order to understand the fundamentals of mathematical modeling of infectious diseases Includes questions, prompts, and answers to help apply historical solutions to modern day problems

Computational Modeling of Infectious Disease Feb 06 2021 Computational Modeling of Infectious Disease: With Applications in Python provides an illustrated compendium of tools and tactics for analyzing infectious diseases using cutting-edge computational methods. From simple S(E)IR models, and through time series analysis and geospatial models, this book is both a guided tour through the computational analysis of infectious diseases and a quick-reference manual. Chapters are accompanied by extensive practical examples in Python, illustrating applications from start to finish. This book is designed for researchers and practicing infectious disease forecasters, modelers, data scientists, and those who wish to learn more about analysis of infectious disease processes in the real world. Connects computational infectious disease analysis to state-of-the-art data science Conveys ideas on epidemiology and infectious disease modeling in a clear, accessible way Provides code examples to elucidate best practices

Modeling and Control of Infectious Diseases in the Host Nov 29 2022 Modeling and Control of Infectious Diseases in the Host: With MATLAB and R provides a holistic understanding of health and disease by presenting topics on quantitative decision-making that influence the development of drugs. The book presents modeling advances in different viral infections, dissecting detailed contributions of key players, along with their respective interactions. By combining tailored in vivo experiments and mathematical modeling approaches, the book clarifies the relative contributions of different underlying mechanisms within hosts of the most lethal viral infections, including HIV, influenza and Ebola. Illustrative examples for parameter fitting, modeling and control applications are explained using MATLAB and R. Provides a multi-scale framework to link within-host infection dynamics (individual level) to between-host transmission fitness (epidemiological level) in viral infectious diseases Includes PK/PD modeling and simulation approaches to improve efficiency and decision-making at preclinical development phases Presents a theoretic approach to schedule drug treatments

Human iPS Cells in Disease Modelling Apr 30 2020 Human iPS cells have a great potential to be cell sources for regenerative medicine because of the promise of infinite self-renewal and the capability to differentiate into multiple cell types. This book focuses on another great potential of human iPS cells, which is the establishment of human disease models using patient-specific iPS cells. Human iPS cells can be easily obtained from a patient's somatic cells and provide the entire information on the patient's genome. Accordingly, we can generate disease

models for inheritable diseases in cell culture dishes using iPS cells. This is a quite new technique but holds tremendous potential for our increased understanding of pathogenesis, and will then be the basis for novel drug development industries. All the authors are leading researchers in this field and they have reported many kinds of patient-derived iPS cells. In this book, they introduce the aspects that could be recapitulated in terms of disease modelling as well as further innovative findings such as novel pathogenetic insights and novel therapies.

Disease Modelling and Public Health May 04 2023 Handbook of Statistics: Disease Modelling and Public Health, Part B, Volume 37 addresses new challenges in existing and emerging diseases. As a two part volume, this title covers an extensive range of techniques in the field, with this book including chapters on Reaction diffusion equations and their application on bacterial communication, Spike and slab methods in disease modeling, Mathematical modeling of mass screening and parameter estimation, Individual-based and agent-based models for infectious disease transmission and evolution: an overview, and a section on Visual Clustering of Static and Dynamic High Dimensional Data. This series covers the lack of availability of complete data relating to disease symptoms and disease epidemiology, one of the biggest challenges facing vaccine developers, public health planners, epidemiologists and health sector researchers. Presents a comprehensive, two-part volume written by leading subject experts Provides a unique breadth and depth of content coverage Addresses the most cutting-edge developments in the field

Modeling Infectious Disease Parameters Based on Serological and Social Contact Data Jun 12 2021 Mathematical epidemiology of infectious diseases usually involves describing the flow of individuals between mutually exclusive infection states. One of the key parameters describing the transition from the susceptible to the infected class is the hazard of infection, often referred to as the force of infection. The force of infection reflects the degree of contact with potential for transmission between infected and susceptible individuals. The mathematical relation between the force of infection and effective contact patterns is generally assumed to be subjected to the mass action principle, which yields the necessary information to estimate the basic reproduction number, another key parameter in infectious disease epidemiology. It is within this context that the Center for Statistics (CenStat, I-Biostat, Hasselt University) and the Centre for the Evaluation of Vaccination and the Centre for Health Economic Research and Modelling Infectious Diseases (CEV, CHERMID, Vaccine and Infectious Disease Institute, University of Antwerp) have collaborated over the past 15 years. This book demonstrates the past and current research activities of these institutes and can be considered to be a milestone in this collaboration. This book is focused on the application of modern statistical methods and models to estimate infectious disease parameters. We want to provide the readers with software guidance, such as R packages, and with data, as far as they can be made publicly available.

The Zebrafish Apr 10 2021 "This volume of Methods in Cell Biology is the 3rd, and provides comprehensive compendia of laboratory protocols and reviews covering all the new methods developed since 2004. This new volume on Disease Models and Chemical Screens, covers two rapidly emerging and compelling applications of the zebrafish. * Details state-of-the art zebrafish protocols, delineating critical steps in the procedures as well as potential pitfalls * This volume concentrates on Disease Models and Chemical Screens."--[Source inconnue].

Mathematical Epidemiology of Infectious Diseases Dec 19 2021 Mathematical Epidemiology of Infectious Diseases Model Building, Analysis and Interpretation O. Diekmann University of Utrecht, The Netherlands J. A. P. Heesterbeek Centre for Biometry Wageningen, The Netherlands The mathematical modelling of epidemics in populations is a vast and important area of study. It is about translating biological assumptions into mathematics, about mathematical analysis aided by interpretation and about obtaining insight into epidemic phenomena when translating mathematical results back into population biology. Model assumptions are formulated in terms of, usually stochastic, behaviour of individuals and then the resulting phenomena, at the population level, are unravelled. Conceptual clarity is attained, assumptions are stated clearly, hidden working hypotheses are attained and mechanistic links between different observables are exposed. Features: * Model construction, analysis and interpretation receive detailed attention * Uniquely covers both deterministic and stochastic viewpoints * Examples of applications given throughout * Extensive coverage of the latest research into the mathematical modelling of epidemics of infectious diseases * Provides a solid foundation of modelling skills The reader will learn to translate, model, analyse and interpret, with the help of the numerous exercises. In literally working through this text, the reader acquires modelling skills that are also valuable outside of epidemiology, certainly within population dynamics, but even beyond that. In addition, the reader receives training in mathematical argumentation. The text is aimed at applied mathematicians with an interest in population biology and epidemiology, at theoretical biologists and epidemiologists. Previous exposure to epidemic concepts is not required, as all background information is given. The book is primarily aimed at self-study and ideally suited for small discussion groups, or for use as a course text.

Mathematical and Statistical Modeling for Emerging and Re-emerging Infectious Diseases Nov 05 2020 The contributions by epidemic modeling experts describe how mathematical models and statistical forecasting are created to capture the most important aspects of an emerging epidemic.Readers will discover a broad range of approaches to address questions, such as Can we control Ebola via ring vaccination strategies? How quickly should we detect Ebola cases to ensure epidemic control? What is the likelihood that an Ebola epidemic in West Africa leads to secondary outbreaks in other parts of the world? When does it matter to incorporate the role of disease-induced mortality on epidemic models? What is the role of behavior changes on Ebola dynamics? How can we better understand the control of cholera or Ebola using optimal control theory? How should a population be structured in order to mimic the transmission dynamics of diseases such as chlamydia, Ebola, or cholera? How can we objectively determine the end of an epidemic? How can we use metapopulation models to understand the role of movement restrictions and migration patterns on the spread of infectious diseases? How can we capture the impact of household transmission using compartmental epidemic models? How could behavior-dependent vaccination affect the dynamical outcomes of epidemic models? The derivation and analysis of the mathematical models addressing these questions provides a wide-ranging overview of the new approaches being created to better forecast and mitigate emerging epidemics. This book will be of interest to researchers in the field of mathematical epidemiology, as well as public health workers.

Charting the Next Pandemic Jan 26 2020 This book provides an introduction to the computational and complex systems modeling of the global spreading of infectious diseases. The latest developments in the area of contagion processes modeling are discussed, and readers are exposed to real world examples of data-model integration impacting the decision-making process. Recent advances in computational science and the increasing availability of real-world data are making it possible to develop realistic scenarios and real-time forecasts of the global spreading of emerging health threats. The first part of the book guides the reader through sophisticated complex systems modeling techniques with a non-technical and visual approach, explaining and illustrating the construction of the modern framework used to project the spread of pandemics and epidemics. Models can be used to transform data to knowledge that is intuitively communicated by powerful infographics and for this reason, the second part of the book focuses on a set of charts that illustrate possible scenarios of future pandemics. The visual atlas contained allows the reader to identify commonalities and patterns in emerging health threats, as well as explore the wide range of models and data that can be used by policy makers to anticipate trends, evaluate risks and eventually manage future events. Charting the Next Pandemic puts the reader in the position to explore different pandemic scenarios and to understand the potential impact of available containment and prevention strategies. This book emphasizes the importance of a global perspective in the assessment of emerging health threats and captures the possible evolution of the next pandemic, while at the same time providing the intelligence needed to fight it. The text will appeal to a wide range of audiences with diverse technical backgrounds.--

Animal Models for the Study of Human Disease Jul 14 2021 Animal Models for the Study of Human Disease identifies important animal models and assesses the advantages and disadvantages of each model for the study of human disease. The first section addresses how to locate resources, animal alternatives, animal ethics and related issues, much needed information for researchers across the biological sciences and biomedicine.The next sections of the work offers models for disease-oriented topics, including cardiac and pulmonary diseases, aging, infectious diseases, obesity, diabetes, neurological diseases, joint diseases, visual disorders, cancer, hypertension, genetic diseases, and diseases of abuse. Organized by disease orientation for ease of searchability Provides information on locating resources, animal alternatives and animal ethics Covers a broad range of animal models used in research for human disease

Infectious Disease Modelling Research Progress Oct 29 2022 This book concentrates on the epidemiology of corruption and disease transmission as a saturable interaction as well as case studies of infectious diseases of global public health concern, namely drug resistant TB, influenza and malaria. It gives the students and researchers in related areas ample information on disease epidemiology and transmission dynamics, and well-elaborated mathematics useful in analysing the proposed models. Great emphasis is not only placed on describing the models, but also on analysing and bringing out results of great epidemiological meaning for public health control and planning.

Modeling to Inform Infectious Disease Control May 12 2021 Effectively Assess Intervention Options for Controlling Infectious DiseasesOur experiences with the human immunodeficiency virus (HIV), severe acute respiratory syndrome (SARS), and Ebola virus disease (EVD) remind us of the continuing need to be vigilant against the emergence of new infectious diseases. Mathematical modeling is increasingly used i

Current Progress in IPSC Disease Modeling Dec 27 2019 Current Progress in iPSC Disease Modeling, Volume Fourteen in the Advances in Stem Cell Biology series, is a timely and expansive collection of information and new discoveries in the field. This new volume addresses advances in research on how induced pluripotent stem cells are used for the creation of new tissues and organs. The creation of iPSC technology allowed the development of disease-specific human pluripotent stem cells. These cells allow researchers to study questions once impossible for some human diseases. This volume addresses iPSCs for vascular tissue engineering, bioprinting, derived lung organoids for pulmonary disorders, skeletal muscle engineering, human kidney organoids, and more. It is written for researchers and scientists in stem cell therapy, cell biology, regenerative medicine and organ transplantation, and is contributed by world-renowned authors in the field. Provides an overview of the fast-moving field of stem cell biology and function, regenerative medicine and therapeutics Covers advances in research on how induced pluripotent stem cells are used to create new tissues/organs Contributed by world-renowned experts in the field

Quantitative Methods for Investigating Infectious Disease Outbreaks Oct 05 2020 This book provides a systematic treatment of the mathematical underpinnings of work in the theory of outbreak dynamics and their control, covering balanced perspectives between theory and practice including new material on contemporary topics in the field of infectious disease modelling. Specifically, it presents a unified mathematical framework linked to the distribution theory of non-negative random variables; the many examples used in the text, are introduced and discussed in light of theoretical perspectives. The book is organized into 9 chapters: The first motivates the presentation of the material on subsequent chapters; Chapter 2-3 provides a review of basic concepts of probability and statistical models for the distributions of continuous lifetime data and the distributions of random counts and counting processes, which are linked to phenomenological models. Chapters 4 focuses on dynamic behaviors of a disease outbreak during the initial phase while Chapters 5-6 broadly cover compartment models to investigate the consequences of epidemics as the outbreak moves beyond the initial phase. Chapter 7 provides a transition between mostly theoretical topics in earlier chapters and Chapters 8 and 9 where the focus is on the data generating processes and statistical issues of fitting models to data as well as specific mathematical epidemic modeling applications, respectively. This book is aimed at a wide audience ranging from graduate students to established scientists from quantitatively-oriented fields of epidemiology, mathematics and statistics. The numerous examples and illustrations make understanding of the mathematics of disease transmission and control accessible. Furthermore, the examples and exercises, make the book suitable for motivated students in applied mathematics, either through a lecture course, or through self-study. This text could be used in graduate schools or special summer schools covering research problems in mathematical biology.

Organoid Technology for Disease Modelling and Personalized Treatment Sep 27 2022 Organoid Technology for Disease Modelling and Personalised Treatment provides a comprehensive overview of current knowledge of the organoid as a human-organ-in-a-dish, a powerful new technology for studying fundamental aspects of human organ development and disease progression in the search for drugs for personalised treatment. This preclinical tool is extensively being utilised as a model for studying human diseases in a dish, which is critical for accurate predictive modelling in precision medicine. The chapters in this book introduces readers to the numerous applications of organoids in various fields of study, as well as ethical considerations associated with organoids. In stem cell biology and regenerative medicine, where chimaera research, biomaterials for tissue vascularisation, gene-editing technologies, and their use in clinical procedures especially issues related to ethical concern over the use of human organoids have gotten much attention. Organoid Technology for Disease Modelling and Personalised Treatment is an excellent resource for in-depth research on one of the most interesting and significant topics in stem cell and regenerative medicine. This book's chapter collection covers a fresh viewpoint on organoid technology that scholars will require reading.

Mouse Models of Development and Disease May 31 2020 Mouse Models of Development and Disease, Volume 148 in the Current Topics in Developmental Biology series, highlights new advances in the field, with this volume presenting chapters describing Mouse models of Charcot-Marie-Tooth disease, Mouse models in palate and craniofacial development, Uterine morphogenesis, Improving the translatability of mouse models of Alzheimer's disease, Mouse models for the study of clustered protocadherins, Mechanisms of organ regeneration in the spiny mouse,

Comparative studies of organ vascularization, Modeling human urinary tract development and hereditary malformations, Innervation in organogenesis, Between embryo and adult: somatic growth of the kidney, and Mouse models in the study of Notch signaling. Provides the authority and expertise of leading contributors from an international board of authors Presents the latest release in the Current Topics in Developmental Biology series Updated release includes the latest information on Mouse Models of Development and Disease

Analyzing and Modeling Spatial and Temporal Dynamics of Infectious Diseases Jan 20 2022 Features modern research and methodology on the spread of infectious diseases and showcases a broad range of multi-disciplinary and state-of-the-art techniques on geo-simulation, geo-visualization, remote sensing, metapopulation modeling, cloud computing, and pattern analysis Given the ongoing risk of infectious diseases worldwide, it is crucial to develop appropriate analysis methods, models, and tools to assess and predict the spread of disease and evaluate the risk. Analyzing and Modeling Spatial and Temporal Dynamics of Infectious Diseases features mathematical and spatial modeling approaches that integrate applications from various fields such as geo-computation and simulation, spatial analytics, mathematics, statistics, epidemiology, and health policy. In addition, the book captures the latest advances in the use of geographic information system (GIS), global positioning system (GPS), and other location-based technologies in the spatial and temporal study of infectious diseases. Highlighting the current practices and methodology via various infectious disease studies, Analyzing and Modeling Spatial and Temporal Dynamics of Infectious Diseases features: Approaches to better use infectious disease data collected from various sources for analysis and modeling purposes Examples of disease spreading dynamics, including West Nile virus, bird flu, Lyme disease, pandemic influenza (H1N1), and schistosomiasis Modern techniques such as Smartphone use in spatio-temporal usage data, cloud computing-enabled cluster detection, and communicable disease geo-simulation based on human mobility An overview of different mathematical, statistical, spatial modeling, and geo-simulation techniques Analyzing and Modeling Spatial and Temporal Dynamics of Infectious Diseases is an excellent resource for researchers and scientists who use, manage, or analyze infectious disease data, need to learn various traditional and advanced analytical methods and modeling techniques, and become aware of different issues and challenges related to infectious disease modeling and simulation. The book is also a useful textbook and/or supplement for upper-undergraduate and graduate-level courses in bioinformatics, biostatistics, public health and policy, and epidemiology.

Infectious Disease Modeling Mar 22 2022 This volume presents infectious diseases modeled mathematically, taking seasonality and changes in population behavior into account, using a switched and hybrid systems framework. The scope of coverage includes background on mathematical epidemiology, including classical formulations and results; a motivation for seasonal effects and changes in population behavior, an investigation into term-time forced epidemic models with switching parameters, and a detailed account of several different control strategies. The main goal is to study these models theoretically and to establish conditions under which eradication or persistence of the disease is guaranteed. In doing so, the long-term behavior of the models is determined through mathematical techniques from switched systems theory. Numerical simulations are also given to augment and illustrate the theoretical results and to help study the efficacy of the control schemes.

Vertically Transmitted Diseases Jul 02 2020 Infectious diseases are transmitted through various different mechanisms including person to person interactions, by insect vectors and via vertical transmission from a parent to an unborn offspring. The population dynamics of such disease transmission can be very complicated and the development of rational strategies for controlling and preventing the spread of these diseases requires careful modeling and analysis. The book describes current methods for formulating models and analyzing the dynamics of the propagation of diseases which include vertical transmission as one of the mechanisms for their spread. Generic models that describe broad classes of diseases as well as models that are tailored to the dynamics of a specific infection are formulated and analyzed. The effects of incubation periods, maturation delays, and age-structure, interactions between disease transmission and demographic changes, population crowding, spatial spread, chaotic dynamic behavior, seasonal periodicities and discrete time interval events are studied within the context of specific disease transmission models. No previous background in disease transmission modeling and analysis is assumedand the required biological concepts and mathematical methods are gradually introduced within the context of specific disease transmission models. Graphs are widely used to illustrate and explain the modeling assumptions and results. REMARKS: NOTE: the authors have supplied variants on the promotion text that are more suitable for promotionin different fields (by virtue of different emphasis in the content). They are not enclosed, but in the mathematics editorial.

An Introduction to Mathematical Modeling of Infectious Diseases Nov 17 2021 This text provides essential modeling skills and methodology for the study of infectious diseases through a one-semester modeling course or directed individual studies. The book includes mathematical descriptions of epidemiological concepts, and uses classic epidemic models to introduce different mathematical methods in model analysis. Matlab codes are also included for numerical implementations. It is primarily written for upper undergraduate and beginning graduate students in mathematical sciences who have an interest in mathematical modeling of infectious diseases. Although written in a rigorous mathematical manner, the style is not unfriendly to non-mathematicians.

3-Dimensional Modeling in Cardiovascular Disease Aug 03 2020 Written by physicians and surgeons, imaging specialists, and medical technology engineers, and edited by Dr. Evan M. Zahn of the renowned Cedars-Sinai Heart Institute, this concise, focused volume covers must-know information in this new and exciting field. Covering everything from the evolution of 3D modeling in cardiac disease to the various roles of 3D modeling in cardiology to cardiac holography and 3D bioprinting, 3-Dimensional Modeling in Cardiovascular Disease is a one-stop resource for physicians, cardiologists, radiologists, and engineers who work with patients, support care providers, and perform research. Provides history and context for the use of 3D printing in cardiology settings, discusses how to use it to plan and evaluate treatment, explains how it can be used as an education resource, and explores its effectiveness with medical interventions. Presents specific uses for 3D modeling of the heart, examines whether it improves outcomes, and explores 3D bioprinting. Consolidates today’s available information and guidance into a single, convenient resource.

Bayesian Disease Mapping Apr 22 2022 Since the publication of the second edition, many new Bayesian tools and methods have been developed for space-time data analysis, the predictive modeling of health outcomes, and other spatial biostatistical areas. Exploring these new developments, Bayesian Disease Mapping: Hierarchical Modeling in Spatial Epidemiology, Third Edition provides an up-to-date, cohesive account of the full range of Bayesian disease mapping methods and applications. In addition to the new material, the book also covers more conventional areas such as relative risk estimation, clustering, spatial survival analysis, and longitudinal analysis. After an introduction to Bayesian inference, computation, and model assessment, the text focuses on important themes, including disease map reconstruction, cluster detection, regression and ecological analysis, putative hazard modeling, analysis of multiple scales and multiple diseases, spatial survival and longitudinal studies, spatiotemporal methods, and map surveillance. It shows how Bayesian disease mapping can yield significant insights into georeferenced health data. The target audience for this text is public health specialists, epidemiologists, and biostatisticians who need to work with geo-referenced health data.

Modeling Infectious Diseases in Humans and Animals Mar 02 2023 This textbook provides information on simple epidemic models, hosts heterogeneities, temporally forced models, stochastic dynamics, spatial models and controlling infectious diseases.

Mathematical Tools for Understanding Infectious Disease Dynamics Mar 29 2020 This book explains how to translate biological assumptions into mathematics to construct useful and consistent models, and how to use the biological interpretation and mathematical reasoning to analyze these models. It shows how to relate models to data through statistical inference, and how to gain important insights into infectious disease dynamics by translating mathematical results back to biology.

Microbial Threats to Health Oct 17 2021 Infectious diseases are a global hazard that puts every nation and every person at risk. The recent SARS outbreak is a prime example. Knowing neither geographic nor political borders, often arriving silently and lethally, microbial pathogens constitute a grave threat to the health of humans. Indeed, a majority of countries recently identified the spread of infectious disease as the greatest global problem they confront. Throughout history, humans have struggled to control both the causes and consequences of infectious diseases and we will continue to do so into the foreseeable future. Following up on a high-profile 1992 report from the Institute of Medicine, Microbial Threats to Health examines the current state of knowledge and policy pertaining to emerging and re-emerging infectious diseases from around the globe. It examines the spectrum of microbial threats, factors in disease emergence, and the ultimate capacity of the United States to meet the challenges posed by microbial threats to human health. From the impact of war or technology on disease emergence to the development of enhanced disease surveillance and vaccine strategies, Microbial Threats to Health contains valuable information for researchers, students, health care providers, policymakers, public health officials. and the interested public.

Networks in Systems Biology Mar 10 2021 This book presents a range of current research topics in biological network modeling, as well as its application in studies on human hosts, pathogens, and diseases. Systems biology is a rapidly expanding field that involves the study of biological systems through the mathematical modeling and analysis of large volumes of biological data. Gathering contributions from renowned experts in the field, some of the topics discussed in depth here include networks in systems biology, the computational modeling of multidrug-resistant bacteria, and systems biology of cancer. Given its scope, the book is intended for researchers, advanced students, and practitioners of systems biology. The chapters are research-oriented, and present some of the latest findings on their respective topics.

Infectious Disease Modeling with Interpersonal Contact Patterns as a Heterogeneous Network Dec 07 2020 In this thesis, we study deterministic compartmental epidemic models. The conventional mass-mixing assumption is replaced with infectious disease contraction occurring within a heterogeneous network. Modeling infectious diseases with a heterogeneous contact network divides disease status compartments into further sub-compartments by degree class and thus allows for the finite set of contacts of an individual to play a role in disease transmission. These epidemiological network models are introduced as switched systems, which are systems that combine continuous dynamics with discrete logic. Many models are investi- gated, including SIS, SIR, SIRS, SEIR type models, and multi-city models. We analyze the stability of these switched network models. Particularly, we consider the transmission rate as a piecewise constant that changes value according to a switching signal. We establish threshold criteria for the eradication of a disease or stability of an endemic equilibrium using Lyapunov function techniques. Simulations are also conducted to support our claims and conclude conjectures. We test constant control and pulse control schemes, including vaccination, treatment, and screening processes for the application of these infectious disease models. Necessary critical control values are determined for the eradication of the disease.

New Horizons in Modeling and Simulation for Social Epidemiology and Public Health Feb 18 2022 An introduction to state-of-the-art modeling and simulation approaches for social and economic determinants of population health New Horizons in Modeling and Simulation for Social Epidemiology and Public Health offers a comprehensive introduction to modeling and simulation that addresses the many complex research questions in social epidemiology and public health. This book highlights a variety of practical applications and illustrative examples with a focus on modeling and simulation approaches for the social and economic determinants of population health. The book contains classic case examples in agent-based modeling (ABM) as well as essential information on ABM applications to public health including for infectious disease modeling, obesity, and tobacco control. This book also surveys applications of microsimulation (MSM) including of tax-benefit policies to project impacts of the social determinants of health. Specifically, this book: Provides an overview of the social determinants of health and the public health significance of addressing the social determinants of health Gives a conceptual foundation for the application of ABM and MSM to study the social determinants of health Offers methodological introductions to both ABM and MSM approaches with illustrative examples Includes cutting-edge systematic reviews of empirical applications of ABM and MSM in the social sciences, social epidemiology, and public health Discusses future directions for empirical research using ABM and MSM, including integrating aspects of both ABM and MSM and implications for public health policies Written for a broad audience of policy analysts, public planners, and researchers and practitioners in public health and public policy including social epidemiologists, New Horizons in Modeling and Simulation for Social Epidemiology and Public Health offers a fundamental guide to the social determinants of health and state-of-the-art applications of ABM and MSM to studying the social and economic determinants of population health.

An Introduction to Infectious Disease Modelling Apr 03 2023 Mathematical models are increasingly used to guide public health policy decisions and explore questions in infectious disease control. Written for readers without advanced mathematical skills, this book provides an introduction to this area.

Disease Modelling and Public Health Dec 31 2022 Part B, Volume 37 addresses new challenges in existing and emerging diseases. As a two part volume, this title covers an extensive range of techniques in the field, with this book including chapters on Reaction diffusion equations and their application on bacterial communication, Spike and slab methods in disease modeling, Mathematical modeling of mass screening and parameter estimation, Individual-based and agent-based models for infectious disease transmission and evolution: an overview, and a section on Visual Clustering of Static and Dynamic High Dimensional Data

Mathematical Modelling and Analysis of Infectious Diseases Aug 15 2021 This book discusses significant research and study topics related to mathematical modelling and analysis of infectious diseases. It includes several models and modelling approaches with different aims, such as identifying and analysing causes of occurrence and re-occurrence, causes of spreading, treatments and control strategies. A valuable resource for researchers, students, educators, scientists, professionals and practitioners interested in gaining insights into various aspects of infectious diseases using mathematical modelling and mathematical analysis, the book will also appeal to general readers wanting to understand the dynamics of various diseases and related issues. Key Features Mathematical models that describe population prevalence or incidence of infectious diseases Mathematical tools and techniques to analyse data on the incidence of infectious diseases Early detection and risk estimate models of infectious diseases Mathematical models that describe the transmission of infectious diseases and analyse data Dynamical analysis and control strategies for infectious diseases Studies comparing the utility of particular models in describing infected diseases-related issues such as social, health and economic

Modeling and Dynamics of Infectious Diseases Jun 24 2022 This book provides a systematic introduction to the fundamental methods and techniques and the frontiers of OCo along with many new ideas and results on OCo infectious disease modeling, parameter estimation and transmission dynamics. It provides complementary approaches, from deterministic to statistical to network modeling; and it seeks viewpoints of the same issues from different angles, from mathematical modeling to statistical analysis to computer simulations and finally to concrete applications.