

1. Record Nr.	UNINA9910567787803321
Autore	McCabe Kimberly J
Titolo	Computational physiology : Simula Summer School 2021 -- student reports // editor, Kimberly J. McCabe
Pubbl/distr/stampa	Cham, : Springer International Publishing AG, 2022
Edizione	[1st ed.]
Descrizione fisica	1 online resource (xi, 109 pages) : illustrations (some color)
Collana	Simula SpringerBriefs on computing ; v.12
Classificazione	COM014000MAT003000MAT006000TEC059000
Altri autori (Persone)	McCabeKimberly J
Soggetti	Physiology - Computer simulation Physiology - Data processing Fisiologia Processament de dades Simulació per ordinador Congressos Llibres electrònics
Lingua di pubblicazione	Inglese
Formato	Materiale a stampa
Livello bibliografico	Monografia
Note generali	Description based upon print version of record.
Nota di contenuto	Intro -- Preface -- Acknowledgements -- Contents -- Chapter 1 A Pipeline for Automated Coordinate Assignment in Anatomically Accurate Biventricular Models -- 1.1 Introduction -- 1.2 Methods -- 1.2.1 Semi-Automated Surface Extraction -- Algorithm 1 -- 1.2.2 Biventricular Coordinate System -- 1.2.2.1 Creation of the Coordinate System Cobiveco -- 1.2.3 Mapping Vector Fields -- 1.3 Results -- 1.4 Conclusion -- 1.4.1 Limitations -- References -- Chapter 2 3D Simulations of Fetal and Maternal Ventricular Excitation for Investigating the Abdominal ECG -- 2.1 Introduction -- 2.2 Methods 2.2.1 Geometrical mesh construction -- 2.2.2 Electrophysiological modelling -- 2.2.3 Extracellular potential measurements -- 2.2.4 Fetal ECG extraction using signal processing methods -- 2.3 Results -- 2.4 Discussion -- 2.5 Conclusions -- References -- Chapter 3 Ordinary Differential Equation-based Modeling of Cells in Human Cartilage -- 3.1 Introduction -- 3.2 Methods -- 3.2.1 Mathematical modelling of ATP-sensitive K <sup>+</sup> currents -- 3.2.2 Population of Models -- 3.3 Results -- 3.3.1 Validation -- 3.3.2 Results for the ATP-sensitive K <sup>+</sup> currents

-- 3.3.3 Populations of Models

3.4 Discussion and Conclusion -- References -- Chapter 4 Conduction Velocity in Cardiac Tissue as Function of Ion Channel Conductance and Distribution -- 4.1 Introduction -- 4.2 Models and methods -- 4.2.1 The monodomain model -- 4.2.2 The EMI model -- 4.3 Results -- 4.4 Discussion -- 4.4.1 Influence of ion channel conductance on CV -- 4.4.2 Influence of ion channel distribution -- 4.5 Conclusions -- References -- Chapter 5 Computational Prediction of Cardiac Electropharmacology - How Much Does the Model Matter? -- 5.1 Introduction -- 5.2 Methods -- 5.2.1 Models of Cardiac Electrophysiology -- 5.2.2 Feature Extraction -- 5.2.3 Sensitivity Analysis and Translation -- 5.3 Results -- 5.3.1 Model Translation -- 5.3.2 Translation Discrepancies -- 5.4 Discussion -- 5.5 Conclusion -- References -- Chapter 6 A Computational Study of Flow Instabilities in Aneurysms -- 6.1 Introduction -- 6.2 Methods -- 6.2.1 Baseflow equations -- 6.2.2 Flow perturbations and instability -- 6.2.3 Discretization -- 6.2.4 Computational Methodology -- 6.3 Results -- 6.4 Discussion -- References -- Chapter 7 Investigating the Multiscale Impact of Deoxyadenosine Triphosphate (dATP) on Pulmonary Arterial Hypertension (PAH) Induced Heart Failure -- 7.1 Introduction -- 7.2 Methods -- 7.2.1 Cell Level Changes -- 7.2.1.1 The SERCA Pump and Calcium transients -- 7.2.1.2 Cross-bridge cycling kinetics -- 7.2.2 Organ Level Model -- 7.3 Results -- 7.4 Discussion and Conclusion -- 7.5 Acknowledgements -- 7.6 Supplementary Information -- References -- Chapter 8 Identifying Ionic Channel Block in a Virtual Cardiomyocyte Population Using Machine Learning Classifiers -- 8.1 Introduction -- 8.2 Methods -- 8.2.1 Data

---

Sommario/riassunto

This open access volume compiles student reports from the 2021 Simula Summer School in Computational Physiology. Interested readers will find herein a number of modern approaches to modeling excitable tissue. This should provide a framework for tools available to model subcellular and tissue-level physiology across scales and scientific questions. In June through August of 2021, Simula held the seventh annual Summer School in Computational Physiology in collaboration with the University of Oslo (UiO) and the University of California, San Diego (UCSD). The course focuses on modeling excitable tissues, with a special interest in cardiac physiology and neuroscience. The majority of the school consists of group research projects conducted by Masters and PhD students from around the world, and advised by scientists at Simula, UiO and UCSD. Each group then produced a report that addresses a specific problem of importance in physiology and presents a succinct summary of the findings. Reports may not necessarily represent new scientific results; rather, they can reproduce or supplement earlier computational studies or experimental findings. Reports from eight of the summer projects are included as separate chapters. The fields represented include cardiac geometry definition (Chapter 1), electrophysiology and pharmacology (Chapters 2–5), fluid mechanics in blood vessels (Chapter 6), cardiac calcium handling and mechanics (Chapter 7), and machine learning in cardiac electrophysiology (Chapter 8).

---