

Mathematical Modelling Of Cardiac Electrical Activity

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This work presents mathematical modelling of cardiac electrical activity using bidomain approach with the main focus on cardiac action potential, an important basic electrical property of the heart. 1.1 Bidomain Model Bidomain model is one of the two differential equation based models for cardiac electrical activity.

[Mathematical Modelling of Cardiac Electrical Activity](#)...

J. ELECTROCARDIOLOGY 20 (3), 1987, 219-226 Mathematical Modeling of Electrical Activity of the Heart BY ROBERT PLONSEY, PH.D. AND ROGER C. BARR, PH.D. SUMMARY This paper reviews the literature on mathematical models of cardiac activation and evaluates these approaches against an analytical approach that includes both structure and membrane properties.

[Mathematical modeling of electrical activity of the heart](#)...

Abstract. We introduce the Hodgkin-Huxley (HH) formulation describing the flow of ionic currents across the membrane of a cardiac cell, paying particular attention to the central concepts of activation and inactivation. We indicate a few situations in which HH-type modeling of cardiac cells has been useful, and show that continuous models of the HH-type break down when one observes phenomena in which single-channel behavior becomes important.

[Mathematical Modeling of the Electrical Activity of](#)...

Mathematical and numerical modelling of the cardiovascular system is a research topic that has attracted remarkable interest from the mathematical community because of its intrinsic mathematical difficulty and the increasing impact of cardiovascular diseases worldwide.

[The cardiovascular system: Mathematical modelling](#)...

Early development of ionic models for cardiac myocytes, from the pioneering modification of the Hodgkin-Huxley giant squid axon model by Noble to the iconic DiFrancesco-Noble model integrating voltage-gated ionic currents, ion pumps and exchangers, Ca²⁺ sequestration and Ca²⁺-induced Ca²⁺ release, provided a general description for a mammalian Purkinje fibre (PF) and the framework for modern cardiac models. In the past two decades, development has focused on tissue-specific models ...

[Mathematical models of the electrical action potential of](#)...

Abstract: Different electrical models of human heart, partial or complete, with linear or nonlinear models have been developed. In the literature, there are some applications of mathematical and physical analog models of total artificial heart (TAH), a baroreceptor model, a state-space model, an electromechanical biventricular model of the heart, and a mathematical model for the artificial generation of electrocardiogram (ECG) signals.

[Mathematical modelling of human heart as a](#)...

Pa'sek et al. consider the role of cardiac T-tubules in the physiological modulation of electrical and contractile activity through development of a mathematical model of ventricular cardiomyocytes in which the cardiac transverse axial tubular system is described as a single compartment, allowing them to demonstrate the effects of this system on Ca²⁺ and K⁺ handling (Pa'sek et al. 2006).

[Mathematical models in physiology—People](#)

Mathematical models have been widely used in the simulation of cardiovascular systems. The human cardiovascular system is highly complex and involves many control mechanisms. The model of Windkessel is a famous example of such a discrete model.

[Mathematical Modelling of Human Heart as a](#)...

do mathematical modeling and simulation (with Scilab and Xcos) for a RRLC circuit (page 6) Electrical voltage and current The electrical voltage (or potential difference) u_{BA} [V] between two points B and A, is defined as the work which would be done (or the energy required) in carrying a unit positive charge from one point to the other.

[Mathematical models and simulation of electrical systems](#)...

Action potential, electrical activity of the heart, cardiac electrophysiology models, Landau-Ginzburg model, Hodgkin-Huxley model, Luo-Rudy model Abstract Nowadays, due to the prevalence of cardiovascular diseases there is extremely high demand not only in the development of new means of treatment and diagnosis, but also in their wider implementation in practice.

[Mathematical Modeling the Electrical Activity of the Heart](#)...

Due to its complexity and importance, cardiac mechanics has been studied extensively both experimentally and through mathematical models and simulation. Models of cardiac mechanics evolved from seminal studies in skeletal muscle, and developed into cardiac specific, species specific, human specific and finally patient specific calculations.

[A short history of the development of mathematical models](#)...

Mathematical modeling of heart provides a better understanding for the complex biophysical phenomena related to electrical activity in the heart. Various electrophysical models have - been developed to simulate electrical properties of cardiac tissue. In this research work monodomain model which is coupled with the single cell FitzHugh-Nagumo model is used to simulation the electrical activities.

[1-INTRODUCTION USER](#)

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For models aimed at EP computational simulation, once the anatomy and structure of the heart have been defined, a mathematical model that simulates the EP behaviour of the myocardium must be plugged in. Figure 9 briefly summarises the main methods and options to model the cardiac EP using EP models.

[Three-dimensional cardiac computational modelling: methods](#)...

Example of mathematical modelling of electrical system for series RLC circuit.

[Mathematical Modelling of Electrical System—YouTube](#)

Due to the extreme complexity of cardiac tissue and its intrinsic nonlinear dynamics, mathematical and computational modelling played (and continue to play) a crucial role in unveiling multiscale emerging phenomena and explaining both regular, and irregular behaviour, up to the description of life-threatening arrhythmias and fibrillation patterns.

[Effective mathematical modelling of fractional diffusion](#)...

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[Mathematically Modelling the Electrical Activity of the Heart](#)

All mathematical models of cardiac cellular electrophysiology are based, at least in part, on the seminal electrophysiological work of Hodgkin and Huxley in the giant squid axon , which quantified the ionic mechanisms underlying the neuronal AP. Based on their work, the cellular AP can be conceptualized as a momentary, active change in the transmembrane electrical potential (the difference between intracellular and extracellular electrical potentials) of an excitable membrane that occurs ...

[Frontiers | Mathematical models of cardiac pacemaking](#)...

Mathematical modelling of drug-ion channel interactions for cardiac safety assessment Abstract: Unintended drug interactions with ion channels in cardiac cells can alter normal electrical activity in the heart.

Mathematically Modelling the Electrical Activity of the Heart Mathematical Modelling of Cardiac Electrical Activity Within a Heterogeneous Bidomain Framework Modeling and Simulating Cardiac Electrical Activity Modeling and Simulating Cardiac Electrical Activity Mathematical Modelling of the Human Cardiovascular System Mathematical Biology And Biological Physics Mathematical Modelling of the Electrical and Mechanical Properties of Cardiac Cells Coupled with Non-muscle Cells Computing the Electrical Activity in the Heart Introduction to Computational Cardiology Mathematical Modeling of Cardiovascular Systems: From Physiology to the Clinic Electrical Heart Activity A Discrete-Event Simulation Model of Myocardial Electrical Activity: Mathematical Electrophysiology An Introduction to Mathematical Modeling in Physiology, Cell Biology, and Immunology Modeling Unipolar and Bipolar Stimulation of Cardiac Tissue Computational Modeling in Biomedical Engineering and Medical Physics Computational Biology of the Heart Electrical Cardiac Activity and Response to Drug Administration: a Mathematical Model Mathematical Modeling of Arrhythmias and Mechano-electrical Feedback in the Heart Computational Cardiovascular Mechanics Mathematical Model of Ventricular Activation in an Anatomically Accurate Deforming Heart Copyright code : b7b975ce93c822ce2ec200d7260a11aa