# Computational Modeling of Cardiac Dynamics


## Abstract

Computational cardiology is a subfield of Bioinformatics that provides a link between Electrophysiology / Cardiology and Mathematics / Computer-science, in an attempt to create a better understanding of the complex biological processes that occur in the cardiac system.

This presentation focuses on the challenges for mathematicians and cardiologists in the creation of an integrative model of the cardiac electrophysiology to obtain a better understanding of the mechanisms underlying repolarization dependent arrhythmias. These arrhythmias can degenerate into ventricular fibrillation and sudden cardiac death.

Particular attention is paid to models for single ventricular myocytes which contain elements such as stochastic behavior and the simulation of complex regulatory pathways. These models can be considered the third generation in the evolution of cardiac models. The concept of beat-to-beat variability of repolarization illustrates why these more advanced models are required. Furthermore, it is shown how concepts from Systems and Control Theory can play a role in the analysis and control of the macroscopic complexities concerning cardiac dynamics that arise from many (sub)cellular interactions.



**Keywords:** Cardiac electrophysiology, mathematical modeling, emergent complexity, systems and control


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