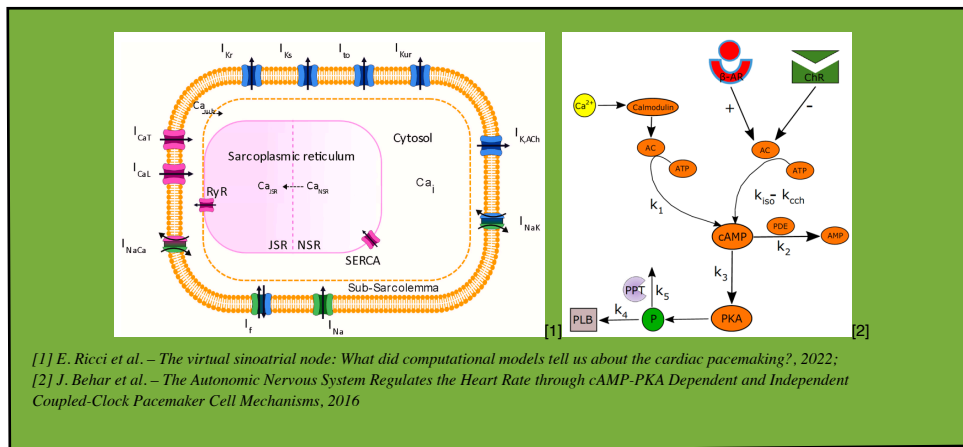


Bachelor Thesis

Implementation of Cholinergic Sinoatrial Cell Reaction

Motivation

The sinoatrial node (SAN) is the driving force behind every single heart beat. It is controlled by the influence of the autonomic nervous system (ANS) and affected by altered electrolyte concentrations typical for chronic kidney disease (CKD) patients. While this could be the main cause for sudden cardiac death (SCD) in haemodialysis (HD) patients the underlying pathomechanisms are not fully understood. Thus, the combination of these two mechanisms could contribute to the high prevalence of SCD in HD patients.



Electrophysiological models offer a powerful tool to enhance the understanding of the physiological processes. Since the beating rate of SAN cells is highly influenced by the autonomic nervous system modelling the cell's reaction to changing external conditions is essential. While the sympathetic nervous system accelerates the frequency of the cell excitation via adrenaline binding to the adrenergic cell receptors, the parasympathetic nervous system decreases the beating frequency due to acetylcholine binding to the cholinergic cell receptors. This binding processes influence different ion channels directly by altering the conductance or indirectly with the help of second messenger molecules.

Task

The main goal of this project is to implement an advanced cholinergic cell reaction based on the knowledge gained from the adrenergic cell reaction and existing implementations of the cholinergic path in similar cell models. This will enable inferring the behaviour of the SAN cell under different health conditions, such as the CKD, which is known to significantly increase the risk of SCD.

Hints

- Programming knowledge in Python or similar language is advantageous
- Basic knowledge of cardiac physiology is advantageous

The weighting of the individual elements can be individually adapted to your ideas.

Research Area

Cardiac Modeling, Single Cell Simulation

Project

Effects of hypocalcaemia & autonomic nervous system stimulation on sinoatrial node cells

Key Words

Simulation, Modelling, Optimisation,

Project Start

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