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Second International Congress on Biological and Health Sciences Abstract Book

ONLINE 24-25-26-27 FEBRUARY 2022

ISBN: 978-605-71368-0-0



SECOND INTERNATIONAL CONGRESS ON BIOLOGICAL AND HEALTH SCIENCES ABSTRACT BOOK

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Editor

Ulaş ACARÖZ

Published: 15/03/2022

ISBN: 978-605-71368-0-0

Editor's Note

The first 'International Congress on Biological and Health Sciences' was organized online and free of charge. We are very happy and proud that various health sciencerelated fields attended the congress. By this event, the distinguished and respected scientists came together to exchange ideas, develop and implement new researches and joint projects. There were 23 invited speakers from 11 different countries and also more than 400 submissions were accepted. More than 50 countries contributed to the congress. We would like to thank all participants and supporters. Hope to see you at our next congress.

Best wishes from Turkey

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Estimating Currents from Action Potentials Using Single and Multi-output Neural Network Models

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Abstract:

Ion channels are water-filled pores formed by membrane proteins abundant in excitable cells' plasma membranes. Ion channels are responsible for converting signals into biological responses. They are primarily engaged in the generation of short-term action potentials via the combined activity of particular ionic currents. The goal of this study is to provide a neural network model that was used to predict 13 ionic currents (such as sodium and calcium channels) from different action potential (AP) shapes. We use a single-cell model to perform electrophysiological simulations and obtain AP and 13 current shapes based on variations in the ion channel conductance in cardiomyocytes, which we then compare to experimental results. Constantly increasing and decreasing the conductance of each ion channel produces 880 different sets of AP shapes and current shapes, as well as one standard AP shape and 13 standard current shapes without causing any changes in the conductance of any other ion channel. Next, we calculate the AP difference shapes and feed them into our neural network along with the passage of time, in order to demonstrate how the dynamics of action potential induction, movement of the action potential, and the release of neurotransmitters affect the function of ion channel function. As a starting point for these calculations, the Hodgkin-Huxley model is utilized. In this study, we demonstrate that using only AP shapes and MATLAB's neural network tool, it is possible to predict changed ion channel currents with high prediction accuracy.

Keywords: neural networks, numerical modeling, membrane proteins, ionic currents, action potential