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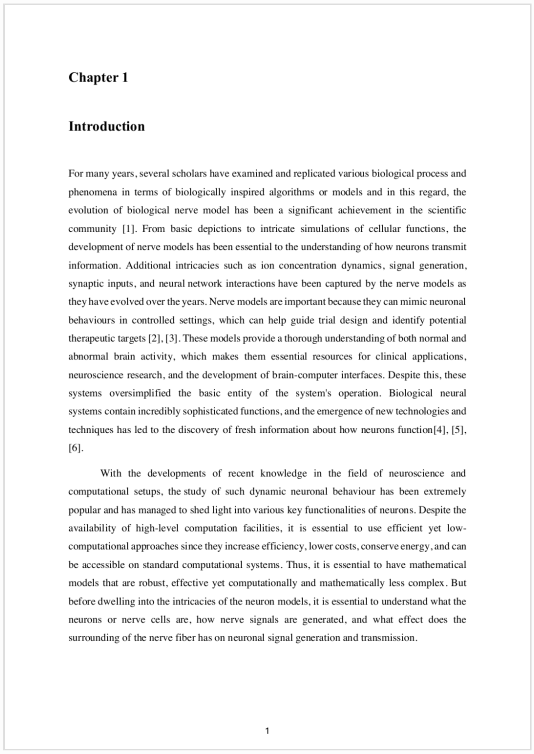

Chapter 1

Introduction

For many years, several scholars have examined and replicated various biological process and phenomena in terms of biologically inspired algorithms or models and in this regard, the evolution of biological nerve model has been a significant achievement in the scientific community [1]. From basic depictions to intricate simulations of cellular functions, the development of nerve models has been essential to the understanding of how neurons transmit information. Additional intricacies such as ion concentration dynamics, signal generation, synaptic inputs, and neural network interactions have been captured by the nerve models as they have evolved over the years. Nerve models are important because they can mimic neuronal behaviours in controlled settings, which can help guide trial design and identify potential therapeutic targets [2], [3]. These models provide a thorough understanding of both normal and abnormal brain activity, which makes them essential resources for clinical applications, neuroscience research, and the development of brain-computer interfaces. Despite this, these systems oversimplified the basic entity of the system's operation. Biological neural systems contain incredibly sophisticated functions, and the emergence of new technologies and techniques has led to the discovery of fresh information about how neurons function[4], [5], [6].

With the developments of recent knowledge in the field of neuroscience and computational setups, the study of such dynamic neuronal behaviour has been extremely popular and has managed to shed light into various key functionalities of neurons. Despite the availability of high-level computation facilities, it is essential to use efficient yet low-computational approaches since they increase efficiency, lower costs, conserve energy, and can be accessible on standard computational systems. Thus, it is essential to have mathematical models that are robust, effective yet computationally and mathematically less complex. But before dwelling into the intricacies of the neuron models, it is essential to understand what the neurons or nerve cells are, how nerve signals are generated, and what effect does the surrounding of the nerve fiber has on neuronal signal generation and transmission.

1

Modeling and Simulation of Extracellular Space and its Role in Signal Transmission

by Biswajit Das

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