

## All-or-None Principle and Weakness of Hodgkin-Huxley Mathematical Model

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**Abstract :** Mathematical and computational modellings are the necessary tools for reviewing, analysing, and predicting processes and events in the wide spectrum range of scientific fields. Therefore, in a field as rapidly developing as neuroscience, the combination of these two modellings can have a significant role in helping to guide the direction the field takes. The paper combined mathematical and computational modelling to prove a weakness in a very precious model in neuroscience. This paper is intended to analyse all-or-none principle in Hodgkin-Huxley mathematical model. By implementation the computational model of Hodgkin-Huxley model and applying the concept of all-or-none principle, an investigation on this mathematical model has been performed. The results clearly showed that the mathematical model of Hodgkin-Huxley does not observe this fundamental law in neurophysiology to generating action potentials. This study shows that further mathematical studies on the Hodgkin-Huxley model are needed in order to create a model without this weakness.

**Keywords :** all-or-none, computational modelling, mathematical model, transmembrane voltage, action potential

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