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[Keynote Speech]: Simulation Studies of Pulsed Voltage Effects on Cells

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Abstract : In order to predict or explain a complicated biological process, it is important first to construct mathematical models that can be used to yield analytical solutions. Through numerical simulation, mathematical model results can be used to test scenarios that might not be easily attained in a laboratory experiment, or to predict parameters or phenomena. High-intensity, nanosecond pulse electroporation has been a recent development in bioelectrics. The dynamic pore model can be achieved by including a dynamic aspect and a dependence on the pore population density into pore formation energy equation to analyze and predict such electroporation effects. For greater accuracy, with inclusion of atomistic details, molecular dynamics (MD) simulations were also carried out during this study. Besides inducing pores in cells, external voltages could also be used in principle to modulate action potential generation in nerves. This could have an application in electrically controlled 'pain management'. Also a simple model-based rate equation treatment of the various cellular bio-chemical processes has been used to predict the pulse number dependent cell survival trends.

Keywords : model, high-intensity, nanosecond, bioelectrics
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