Theoretical modelling of in vivo skin electroporation: degree of electroporation and mass transfer enhancement

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# ABSTRACT

Electroporation involves the application of intense electric fields to tissue in order to increase the rate of cellular drug uptake. As the electric field is applied, it is possible for the cells to become more permeable to the drug by a process called electroporation. In this study, a computational model is presented that couples the electric filed to the cellular degree of electroporation. This in turn is coupled with the mass transport of the drug in the electroporated region. The model captures degree of electroporation, degree of increase in cellular permeability, tissue response to the electroporation, and mass transport into the cells and within the extracellular matrix.

This model developed may be used as a tool to optimise desired electroporation effects. It enables the electrode positions and pulse voltage to be determined to minimise necrosis and maximise reversible electroporation for maximised mass transfer enhancement. This optimisation tool then enables the drug transported into the skin cells to be quantified in the targeted region.