

Abstract Submitted
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The role of ion electrophoresis in electroporation-mediated molecular delivery JIANBO LI, HAO LIN, Rutgers University — Electroporation is a widely applied technique to deliver active molecules into the cellular compartment, to perform a variety of tasks such as gene therapy and directed stem cell differentiation. In this technique, an electric field transiently permeabilizes the cellular membrane to facilitate molecular exchange. While the permeabilization process is relatively well-understood, the transport mechanisms for molecular delivery are still under debate. In this work, the role of ion electrophoresis in electroporation-mediated molecular delivery is investigated using numerical simulations. The result indicates that ion electrophoresis is the dominant mode of transport in the delivery of small charged molecules. Furthermore, the achievable intracellular concentration is strongly influenced by the conductivity difference between the cytoplasm and the buffer, a phenomenon known as “field-amplified sample stacking”. The result agrees well with the fluorescence measurement by Gabriel and Teissié (1999), and suggests a new possibility to simultaneously improve cell viability and efficiency in electroporation-mediated molecular delivery.

Jianbo Li
Rutgers University

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