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Cell permeabilization and exogenous molecule delivery via microwave treatment

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Typical techniques to artificially introducing nucleic acids (DNA or RNA) into cells can be divided into three categories: viral, chemical, and physical. The application space targets usually production of recombinant proteins, the study of the function and regulation of genes, the production of transgenic organisms, and as a method for gene therapy in clinical workflows. Physical means, such as electroporation (via electric pulse treatment) or sonoporation (via ultrasound treatment), can avoid some of the adverse side effects potentially triggered by viral and chemical means, but may less efficient and induce deleterious effects on cell function or surrounding tissue. For instance, electroporation can cause pain to surrounding tissue for in vivo treatments and may reduce cell viability during either in vitro or in vivo treatments. Some cells, such as stem and neuronal cells, remain difficult to transfect by any means. Thus, a physical method that can improve transfection efficiency while eliminating many of the side effects of chemical or viral techniques, particularly for these difficult to transfect cells, would significantly improve workflows requiring nucleic acid delivery into cells.

This paper presents experimental results for plasmid and siRNA delivery to CHO cells using 2.45 GHz microwave exposures in a single mode cavity, and potential mechanistic pathways for molecule uptake. While plasmid delivery efficiency is minimal, siRNA results are promising. This could indicate that microwave exposures may permeabilize the plasma membrane, but not the nuclear membrane.

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