OPEN ACCESS Freely available online

Journal of
Biomolecular Research & Therapeutics

Editorial Note

Development Editor Note: Electroporation

Bindu Madhavi

Department of Biotechnology, Vignan's University, Andhra Pradesh, India

Electroporation is a microbiological technique in which an electrical field is applied to cells in order to improve the permeability of the cell membrane, enabling the entry of chemicals, drugs or DNA into the cell (also called electrotransfer). In microbiology, the electroporation process is also used with the implementation of new coding DNA to convert bacteria, yeast, or plant protoplasts. If bacteria and plasmids are mixed together, the plasmids after electroporation can be passed into the bacteria, while cell-penetrating peptides or CellSqueeze may also be used depending on what is being transferred.

For the introduction of foreign genes into tissue culture cells, especially mammalian cells, electroporation is also highly effective. For instance, it is used in the production process of knockout mice, as well as in the treatment of tumors, gene therapy, and cell-based therapy. Transfection is known as the method of introducing foreign DNA into eukaryotic cells.

While bulk electroporation has many advantages over physical delivery strategies, including low cell viability, such as microinjections and gene arms, it still has limitations. Electroporation miniaturization has been studied to contribute to tissue microelectroporation and nanotransfection using electroporation-based nanochannel techniques to deliver cargo to the cells minimally invasively.

Electroporation has also been used to cause cell fusion as a mechanism. Artificially induced cell fusion can be used to investigate and treat various diseases, such as diabetes, to regenerate central nervous system axons, and to create cells with desirable properties, such as cancer immunotherapy cell vaccines.

With electroporators, purpose-built equipment that generate an electrostatic field in a cell solution, electroporation is carried out. A glass or plastic cuvette that has two aluminium electrodes on its sides is pipetted into the cell suspension. Usually, a suspension of about 50 microliters is used for bacterial electroporation.

The success of electroporation is heavily dependent on the purity of the plasmid solution, especially its salt content. An electrical discharge (known as arcing), which also decreases the viability of the bacteria, could be caused by solutions with high salt concentrations. More attention should be given to the output impedance of the porator system for a more thorough investigation of the operation.

Since the cell membrane is not able to pass current (except in ion channels), it acts as an electrical capacitor. Subjecting membranes to a high-voltage electric field results in their temporary breakdown, resulting in pores that are large enough to allow macromolecules (such as DNA) to enter or leave the cell.

In addition, during injections and procedures in Utero, electroporation can be used to improve cell permeability. In particular, electroporation enables DNA, RNA, shRNA, and all nucleic acids to be transfected more efficiently into the cells of mice and rats. Voltage, repetition, pulses, and length are highly dependent on the effectiveness of in vivo electroporation.

For the introduction of poorly permeant anticancer drugs into tumor nodules, the first medical application of electroporation was used. Due to its low cost, ease of realization and protection, gene electrotransfer soon also became of particular interest. That is, when used for DNA transfer, viral vectors can have significant limitations in terms of immunogenicity and pathogenicity.