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Short Communication

An Overview on Gene Delivery By Electroporation Method

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DESCRIPTION

Electroporation is also known as electro permeabilization. It is a microbiological technique that involves applying an electrical field to cells in order to improve the permeability of the cell membrane, allowing chemicals, medicines, electrode arrays or DNA to enter the cell (also called electro transfer). In microbiology, the process of electroporation is frequently used to bring additional coding DNA into bacteria, yeast, or plant protoplasts [1]. If bacteria and plasmids are combined together, the plasmids can be transmitted into the bacteria following electroporation, while cell-penetrating peptides could also be utilized, depending on what is being transferred.

Foreign genes are usually introduced into tissue culture cells, particularly mammalian cells, using electroporation. It is utilized in the production of knockout mice, as well as tumor treatment, gene therapy and cell-based therapy. Transfection is the method of introducing foreign DNA into eukaryotic cells. When applying electroporation cuvettes to transfect cells in suspension, electroporation is remarkably successful [2]. Electroporation has been shown to be effective on *in vivo* tissues, in utero applications, and in novo transfection. Electroporation can also be used to transfection. Cell fusion has also been produced by electroporation. Artificially generated cell fusion can be applied to evaluate and cure a variety of disorders, including diabetes and cancer adherent cells, giving researchers an option to trypsinizing their cells before transfection. Electroporation is carried out using electroporators, which are specially designed appliances that generate an electrostatic field in a cell solution. Pipette the cell suspension into a glass or plastic cuvette with two aluminium electrodes on the sides. A suspension of roughly 50 microliters is generally used for bacterial electroporation. This suspension of bacteria is treated with the plasmid to be transformed before electroporation. Pipette the mixture into the cuvette, set the voltage and capacitance, and place the cuvette in the electroporator. Direct contact between the electrodes and the suspension is required for the process. The quality of the plasmid solution particularly its salt concentration is critical for the electroporation's success. When excessive salt concentrations are present in a solution, an electrical discharge (known as arcing) might occur, reducing the bacteria's viability [3]. Non-Thermal Irreversible Electroporation (N-TIRE), a new technology, has shown to be effective in treating a variety of cancers and other undesirable tissue. Small electrodes (approximately 1mm in diameter) are used to apply short, repeating bursts of electricity at a predetermined voltage and frequency to the target tissue, either inside or around it. The resting Trans Membrane Potential (TMP) is increased by these bursts of electricity, causing nanopores to develop in the plasma membrane. When the amount of electricity delivered to the tissue exceeds the target tissue's electric field threshold, the cells become irreversibly permeable due to the creation of nanopores. As a result of the lack of homeostasis, the cells are unable to repair the damage and die. When the electricity applied with the electrodes is below the electric field threshold of the target tissue, reversible electroporation occurs. The cells can repair their phospholipid bilayer and carry on with their usual functions because the delivered current is below their threshold. Reversible electroporation is commonly used in therapies that entail introducing a medication, gene, or other material into the cell that is not normally permeable to the cell membrane. Because not all tissues have the same electric field threshold, precise calculations must be performed prior to treatment to assure safety and efficacy. High-Frequency Irreversible Electroporation is a relatively modern technology that has been developed (H-FIRE). This approach employs electrodes to provide bipolar high-frequency electrical bursts rather than unipolar low-frequency electrical bursts. This technique has the same success rate as N-TIRE in terms of tumor ablation. H-FIRE, on the other hand, has one significant advantage as it does not produce muscle contraction in the patient, eliminating the requirement for a paralytic drug. Electroporation or the use of high-voltage electric shocks to deliver DNA into cells, may be employed with most cell types yields a high frequency of both stable transformation and temporary gene expression and can be easier than other procedures because it involves fewer stages [4].

CONCLUSION

The main benefit of electroporation is that it may be used to transfect any cell type in a temporary and stable manner. Furthermore, because electroporation is simple and quick, it may transfect a large number of cells in a short amount of time

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once the best electroporation conditions are found. The main disadvantage of electroporation is that it causes significant cell death due to high voltage pulses and only partially effective membrane repair, necessitating the use of more cells than chemical transfection methods. While more modern instrumentation, such as our Invitrogen Neon Transfection System, overcomes high cell mortality by evenly distributing the electrical pulse among the cells and maintaining a constant pH throughout the electroporation chamber, pulse and field strength parameters must still be enhanced to balance electroporation efficiency and safety.

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