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Commentary

Electroporation is a Transfection Tool in Genetic Engineering

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DESCRIPTION

Electroporation is most commonly used for transient transfection of cells, but stable transfection is also possible. In the bio pharmacy industry, transient transfection can produce up to several grams of protein for characterization and preclinical trials. In this application, plasmid-based electroporation has proven to be reliable and predictable. Electroporation produces similarly stable transfected cells, provided that the DNA is introduced in a linearized form by first treating it with a restriction enzyme[1].

Electroporation is firmly established in the transfection techniques that include viral vectors, chemical or reagent based methods and mechanical gene delivery. However, among chemical, mechanical, and viral transfection approaches electroporation alone provides a reasonable guarantee of success, regardless of target cell or organism. In addition to standard DNA transfer, transfection has been used to introduce interfering RNA into various cell types. This technology enables small, controlled studies of dosing and delivery efficiency. Dosing and delivery issues have real RNA interference applications in treatment [2].

DNA transfection by electroporation is probably an established technique that can be applied to all cell types. It provides high frequency and has high efficiency of transient gene expression. Electroporation has been shown to be effective in delivering plasmid DNA to various tissue types. Electroporation takes advantage of the fact that cell membranes act as electrical capacitors that cannot conduct electricity [3]. When the membrane is exposed to a high voltage electric field, it temporarily collapses, forming pores large enough for macromolecules (and small molecules such as ATP) to enter and leave the cell. Electroporation uses electrical impulses to introduce new species, usually polar molecules, into cells. This technique utilizes weak interactions between phospholipid bilayers that maintain cell membrane integrity. In a typical cell membrane, phospholipids are placed with polar head groups facing outwards and hydrophobic tail groups facing inward. This is an arrangement that blocks the passage of polar molecules. Without some support, polar molecules cannot penetrate. Electroporation introducing DNA into cells using high voltage electrical shock can be used with most cell types, resulting in high frequency of both stable transformation and gene expression is required [4]. It is easier than other methods because it requires fewer steps. In this unit, electroporation of mammalian cells, including ES cells, knock-in transgenic mouse production, *in vivo* electroporation-based cancer treatment and DNA vaccination gene therapy protocols, and production.

The widespread use of electroporation has been largely made possible by the availability of the-shelf devices that are safe, easy to use and provide highly reproducible results. The designs of these machines are quite different, but fall into two basic categories that use different means of controlling pulse width and voltage (the two electrical parameters that determine pore formation). One type uses a capacitor discharge system to generate exponentially decaying current pulses, and the other type produces a true square wave. The capacitor discharger charges the internal capacitor to a certain voltage and then discharges the entire cell DNA suspension [5]. We can change both the size and voltage of the capacitor. Resize the capacitor because the current pulse is a function that decays exponentially (1) the initial voltage, (2) the capacitance setting of the device, and (3) the resistance of the circuit Therefore, more (less than or equal to) charges are stored at voltage, resulting in longer (or shorter) decay times, resulting in different effective pulse widths. In contrast, a square wave generator controls both voltage and pulse width with a solid-state switching device. It can also generate rapidly repeating pulses. Square wave generators are suitable for *in vivo* applications. In addition to pulse duration and amplitude, pulse count and electrode configuration affect delivery efficiency.

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