25f Enhancement of Retroviral Transduction Using Electrical Fields

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Retrovirus-mediated gene therapy is one of the most commonly used modalities to deliver and express the gene of interest in clinical and research area, because of its capability of stable gene integration to the chromosomes of target cells. In order to elevate the efficiency of retroviral transduction, several restrictions such as low virus-cell encounters and short half-lives of retroviruses have to be overcome. Up to date, physical (e.g., spinoculation, magnetofection) and chemical (e.g., polycation, fibronectin) approaches have been reported to augment the efficiency of retroviral transduction. The aim of those biological systems used for the transduction studies was to abridge targeting time and achieve retroviral infection prior to fast retroviral deactivation at physiological temperature. In addition to aforementioned strategies, electrical field is employed in this study to enhance retroviral gene delivery efficiency. The tubular chamber was assembled with ITO-coated plastic sheets on the top and bottom sides which were connected to a power generator. GFP-encoding retroviral vectors were used to infect NIH 3T3 fibroblasts within the electrical field generated in the chamber. Due to electrical attraction, negatively-charged retroviruses can move down and encounter target cells cultured on the bottom surface of the chamber which is connected to the cathode. Our results showed that electrical fields can bring more retroviruses into close contact with NIH 3T3 cells attached and spread on the bottom of the chamber, and thereby enhancing retroviral transduction efficiency. The effects of design and operating parameters (such as chamber height, duration of electrical field exposure, and power intensity) on the efficiency of retroviral transduction will be discussed using engineering analysis.