COMMENTARY

Cell Vaccines for Cancer Immunotherapy

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INTRODUCTION

Electroporation, or electropermeabilization, is a microbiology technique in which an electrical field is applied to cells in order to increase the permeability of the cell membrane, allowing chemicals, drugs, or DNA to be introduced into the cell (also called electrotransfer). In microbiology, the process of electroporation is often used to transform bacteria, yeast, or plant protoplasts by introducing new coding DNA. If bacteria and plasmids are mixed together, the plasmids can be transferred into the bacteria after electroporation, though depending on what is being transferred cell-penetrating peptides or CellSqueeze could also be used. Electroporation works by passing thousands of volts (~8 kV/cm) across suspended cells in an electroporation cuvette.[2] Afterwards, the cells have to be handled carefully until they have had a chance to divide, producing new cells that contain reproduced plasmids. This process is approximately ten times more effective than chemical transformation. Electroporation is also highly efficient for the introduction of foreign genes into tissue culture cells, especially mammalian cells. For example, it is used in the process of producing knockout mice, as well as in tumor treatment, gene therapy, and cell-based therapy. The process of introducing foreign DNA into eukaryotic cells is known as transfection. Electroporation is highly effective for transfecting cells in suspension using electroporation cuvettes. Electroporation has proven efficient for use on tissues in vivo, for in utero applications as well as in ovo transfection. Adherent cells can also be transfected using electroporation, providing researchers with an alternative to trypsinizing their cells prior to transfection. One downside to electroporation, however, is that after the process the gene expression of over 7,000 genes can be affected. This can cause problems in studies where gene expression has to be controlled to ensure accurate and precise results.Although bulk electroporation has many benefits over physical delivery methods such as microinjections and gene guns, it still has limitations including low cell viability. Miniaturization of electroporation has been studied leading to microelectroporation and nanotransfection of tissue utilizing electroporation based techniques via nanochannels to minimally invasively deliver cargo to the cells. Electroporation has also been used as a mechanism to trigger cell fusion. Artificially induced cell fusion can be used to investigate and treat different diseases, like diabetes,[7][8][9] regenerate axons of the central nerve system, and produce cells with desired properties, such as in cell vaccines for cancer immunotherapy.[11] However, the first and most known application of cell fusion is production of monoclonal antibodies in hybridoma technology, where hybrid cell lines (hybridomas) are formed by fusing specific antibody-producing B lymphocytes with a myeloma (B lymphocyte cancer) cell line.

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