450e Electrokinetic Gun Nanofluidic Platform for Gene and Drug Delivery

Shengnian Wang, Yubing Xie, Chee Guan Koh, Changchun Zeng, and L. James Lee

We developed a nanofluidic device, targeting efficient delivery of genes and drugs into live cells. A polymer layer composed of nanochannels is integrated onto a microfluidic device and electric force is applied to enhance the transport efficiency of genes and drugs into a large population of live cells. Nanochannels provide focused electric field, significantly accelerating species inside. Species with high momentum could overcome the permeability barrier of cell membrane when cells are fixed close to the outlet of nanochannels. Therefore the delivery of genes and drugs can be accomplished efficiently when conjugated to moving species. In this study, NIH 3T3 cells are used and nanochannels with different geometries are studied. Nanoparticles and fluorescence dyes are used to demonstrate the concept at first. 2D microfluidic platforms are constructed to visualize the transport process. Different genes (GFP & SeAP) are then introduced into cells, followed by the transfection and cytotoxicity study. Compared to conventional methods, our approach can provide low invasion to cells, less potential healthy problem and higher transfection efficiency.