Targeted Single Cell Electroporation for Gene and Cell Therapy

Requirements of electroporation in cell therapy applications

Efficient intracellular delivery of macromolecules is a critical need for gene and cell-based therapies. Current available methods for intracellular deliveries involve cell characterization and electroporation, which is often limited to bulk destructive and/or labelled approaches, damaging cells, or lacking sensitivity. Therefore, there is a need for non-destructive, label-free, and in-line cell characterization tools in cell therapy applications which can be applied to single cells. Scaling and distributing cost-effective cell therapies to a global population will rely on inexpensive, multi-purpose and automated tools.

Targeted feedback-controlled high efficiency single cell electroporation

Innovators at Georgia Tech have developed a device and technique to perform targeted and highly efficient intracellular delivery of macromolecules to biological cells. This is accomplished by using in-flow, feedback-controlled, and single-cell optimized, low-voltage electroporation in a microfluidic system. The technology integrates single-cell measurements with a real-time feedback control scheme based on measured cell parameters and enables the user to have selective or targeted delivery to certain types of cells from a heterogeneous mixture without the need for any upstream or downstream cell sorting steps.

Summary Bullets

- The technology enables high efficiency delivery and high post-electroporation cell viability compared to current commercial electroporation systems.
- The technology performs in-flow single cell measurements integrated with electroporation unlike current commercial electroporation systems which have no single cell measurement capabilities.
- The technology enables automatic feedback control and real-time optimization of electroporation parameters at the single-cell level unlike current commercial electroporation systems which apply the same parameters to all cells in a batch at a bulk scale.
- The technology enables selected or targeted electroporation and delivery to selected cells or cell types from a mixture of cells unlike current commercial electroporation systems which require upstream or downstream cell sorting steps.

Solution Advantages

- **Efficient:** Removing the need for upstream or downstream cell sorting steps allows high efficiency delivery compared to current commercial electroporation systems.
- **Single cell measurement:** Performs in-flow single cell measurements integrated with electroporation unlike current commercial electroporation systems which have no single cell measurement capabilities.
- **Non-destructive to cells:** High post-electroporation cell viability compared to current commercial electroporation systems.
- **Real-time optimization:** Enables automatic feedback control and real-time optimization of electroporation parameters at the single-cell level unlike current commercial electroporation systems which apply the same parameters to all cells in a batch at a bulk scale.

Potential Commercial Applications

- Cell transfection for developing or implementing cell therapies and gene therapies.
- Optimizing electroporation protocols for different cell types and delivery payloads.

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IP Status

Patent application has been filed : US63/512249

Publications

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Images

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