Surface Electrode Ion Trap for Cellular Analysis (#6970)

A tool for single cell analysis based on surface electrode ion traps that combines the specialization of microfluidics approaches with the speed of modern electronics

Inventors from the School of Chemistry and Biochemistry at Georgia Tech have developed a tool for single cell analysis based on surface electrode ion traps. The approach combines the specialization of microfluidics approaches with the speed of modern electronics. With the developed method, the cells float above the surface in charged droplets trapped by oscillating electric fields. The electrode ion traps are defined by the application of radio frequency electrode voltages and then direct current electrode voltages can be used to transport the droplets over distances and through junctions that can be used for sorting. The traps were developed for shuttling atomic ions for quantum information, but have also been used to transport micro-spheres and charged water droplets. The surface electrode ion traps can be made at various lengths using modern lithography techniques or standard printed circuit boards. The method can be used to manipulate the cellstream at the rate appropriate for the detection method without fear of cell aggregation. In addition, the approach enables cells to be held within charged droplets above printed circuit board surface electrode ion traps and to discriminate cells based on fluorescence markers.

Benefits/Advantages

- Cells contained in charged droplets of solution and levitated above the surface electrode ion trapped by electromagnetic fields
- Enables sorting of cells by optical, chemical, and/or physical properties
- Merging of droplets is controlled allowing researchers to add chemicals and nutrients to cell environment one cell at a time
- Results in faster cell sorting speeds and improved cell viability

Potential Commercial Applications

Cell sorting can be applied to a number of medical, industrial, agricultural or military applications. The developed process could be used in the pharmaceutical and chemical industry to increase the production of desired compounds through the directed evolution of cells. Additionally, the method could be used to explore microbial communities and evaluate the relationship between the microbiome and microbial populations.

Background/Context for This Invention

Fluorescence activated cell sorting (FACS) is the leading technology for sorting individual cells. The FACS approach involves preparing the cells with either internal or external fluorescent tags and utilizing flow cytometry to form single-cell droplets. Although commonly used, FACS is expensive, operationally complex, and requires specialized operation and maintenance.

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More Information

Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/surface-electrode-ion-trap-cellular-analysis

Images: