An Integrated Microfluidic Platform For Selective Extraction Of Single-Cell mRNA

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OTHER INFORMATION

CATEGORIZED AS

- **Medical**
  - Diagnostics
  - Other
- **Research Tools**
  - Nucleic Acids/DNA/RNA
- **Sensors & Instrumentation**
  - Medical

RELATED CASES

2016-628-0

BRIEF DESCRIPTION

The invention is a high-density, single-cell trapping array. A specialized probe tip can be precisely manipulated to non-destructively collect targeted intracellular material from the trapped cells for measurements. Due to the non-destructive nature of the invention, the integrity and function of the trapped cells can be preserved and they can be monitored over time to better understand disease processes.

FULL DESCRIPTION

Single cell genotyping by measurement of messenger RNA (mRNA) within a living cell has become a growing trend in many biomedical research areas such as cancer diagnostics and rare cell identification. These single-cell measurements have gained traction over traditional bulk testing methods because they are sensitive to intracellular heterogeneity and stochastic effects among cell populations, each of which are essential factors in determining key cellular activities. Current single-cell measurements are conducted on closed micro/nanofluidic platforms, which limit access via external instrumentation. Additionally, current measurement methods require cell lysing to isolate and purify genetic materials- a process that is destructive to the cell. These constraints limit the types of measurements that can be performed and, furthermore, are not suitable for monitoring informative time-dependent behavior such as single cell gene expression in response to stimuli.

Researchers at UCI have invented a technology which traps single cells, using a microfluidic, high-density, single-cell trapping array, and non-destructively extracts intracellular molecules using a special probe tip. The probe tip is precisely directed to individual cells. Intracellular material such as mRNA accumulates on the probe tip and can be positioned elsewhere for measurements. The invention constitutes a sensitive, fast, and non-destructive device for conducting high-throughput measurements of intracellular material and processes. Additionally, because the device is non-destructive to cells, it allows for the monitoring of time-dependent cellular responses to stimuli, a critical factor in understanding disease processes.

The platform can be integrated with various external instruments so that complicated manipulations and analyses of single cells can be conveniently performed in a closed microfluidic environment. Samples can be filtered, sorted, and enriched before entering the single-cell analysis region of the chip. After analysis, samples retain their viability and can be subsequently used for analyses and culturing. This opens up possibilities for moving beyond static snapshots of gene-expression profiles and potentially deepens one’s understanding how profiles change over time. For instance, real-time tracking of cell response to drug exposure/treatment is just one unique way to exploit this UCI platform =as a platform in diagnostics and drug development programs.

SUGGESTED USES

-Biomedical diagnostics

-Research into typical and atypical cellular processes

ADVANTAGES

§ Non-destructive

§ No mRNA purification required

§ High sensitivity measurements

§ High-throughput device

§ Adaptable design for trapping particles of various sizes

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,549,277	02/04/2020	2016-628

STATE OF DEVELOPMENT

A working prototype has been developed and tested with successful cell trapping and mRNA extraction.

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