Mechanical Phenotyping Of Single Cells: High Throughput Quantitative Detection And Sorting

Tech ID: 27046 / UC Case 2012-282-0

SUMMARY

UCLA researchers have developed a novel high throughput mechanically activated sorting (MACS) device.

BACKGROUND

Cells are soft, viscoelastic materials whose main structural components are proteins and membranes and whose mechanical phenotype can be significantly altered during pathological transformations. These transformations are mechanically measureable. A mechanically cell measuring device is mechanically activated sorting (MACS). MACS is a single-layer microfluidic device with integrated sensing electronics and valve actuation. MACS are based on established work in the fields of microfluidics and MicroElectrical-Mechanical Systems (MEMS). MEMS devices are capable of accurately measuring mechanical properties of individual cells but are challenging to scale up as each cell has to be placed at a probe tip or flat deformation surface manually. Microfluidics, on the contrary, allow cells to be separated and confined to a flow and placed in a given location consistently. Combining MEMS and microfluidics capabilities, a high-throughput mechanical sorting device was created.

INNOVATION

UCLA researchers have developed a novel mechanically activated sorting (MACS) device. This is the first high throughput device to obtain a direct measure of individual cell mechanical properties. The MACS allows a large population of cells (on the order of magnitude of 10^8 cells) to be analyzed at a rate on the order of 10^3 cells per second based on mechanical properties of the cell.

Heterogeneous populations can now be mechanically sorted and correlated to particular pathologies, genetics, epigenetics, or proteomic structures. This invention is the first high –throughput mechanical sorting device. With detection rates nearly two order of magnitude times faster than the existing technology, MACS divide individual cells into subpopulations based on real-time stiffness measurements.

APPLICATIONS

- Prognosis based on mechanical profiling of single cells
- Sorting subpopulations of cells
- RNAi mechanical screening
- Detection of cell nucleus mechanical properties
- High throughput screening for drugs
- Microgel stiffness testing
- Discovery of enzymes for use in biofuel production
- Cell-wall perturbing compounds

ADVANTAGES

- Permits a large cell sample (10^8 number of cells) to be analyzed on the order of 10^3 cells per second in a relevant time scale (<1 day)
- ~1000x increase in speed via flow
- Heterogeneous population can be sampled
- Ability to sort subpopulation of cells
- Ability to perform proteome-wide mechanical screen for cell and nucleus
- Cost-effective

CONTACT

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INVENTORS

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OTHER INFORMATION

CATEGORIZED AS

- **Medical**
  - Disease: Cancer
  - Research Tools

RELATED CASES

2012-282-0

- Ability to personalize therapies
- High throughput device to obtain a direct measure of individual cell mechanical properties
- Analog processing of data

STATE OF DEVELOPMENT

Laboratory measurements have been performed.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,302,408	05/28/2019	2012-282
United States Of America	Issued Patent	9,423,234	08/23/2016	2012-282

RELATED MATERIALS

- The physical origins of transit time measurements for rapid, single cell mechanotyping. Nyberg KD, Scott MB, Bruce SL, Gopinath AB, Bikos D, Mason TG, Kim JW, Choi HS, Rowat AC (2016) Lab Chip. DOI: 10.1039/C6LC00169F

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Methods for Producing Cultured Meat that has Heterogeneous Composition

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