MECHANO-NPS (NODE PORE SENSING)

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OTHER INFORMATION

CATEGORIZED AS

» **Biotechnology**

» Health

» **Imaging**

» Medical

» **Medical**

» Devices

» Imaging

RELATED CASES

2017-048-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,383,241	07/12/2022	2017-048

BRIEF DESCRIPTION

The mechanical properties of cells derive from the structure and dynamics of their intracellular components, including the cytoskeleton, cell membrane, nucleus, and other organelles. These, in turn, emerge from cell specific genetic, epigenetic, and biochemical programs, providing a link between cellular mechanics and the underlying molecular state. Differences in mechanical properties reflect on cellular properties with clinical implications, including the metastatic potential, cell-cycle stage, and differentiation state of cells. Yet, many mechanical aspects of various cells and sub-cell organelles remain unknown due to absence of appropriate analysis platforms.

Atomic-force microscopy (AFM) and micropipette aspiration are the gold standards for performing mechanical measurements of cells, as they both provide controlled loading conditions and quantify such cellular properties as elastic modulus and cortical tension. They are, however, burdened by slow throughput, capable of analyzing only just a few cells/hr. Likewise, optical tweezers and microplate rheometry also suffer from low throughput. Various microfluidic based platforms have been proposed for the high-throughput mechanical analysis of cells, including hydrodynamic stretching cytometry, suspended microchannel resonators (SMR), and real-time deformability cytometry (RT-DC). Although each of these methods can analyze populations of cells in a relatively short time, they focus only on a single cellular property. Consequently, these platforms, and the low-throughput traditional methods that under-sample, can neither identify cellular heterogeneity nor classify mechanical sub-phenotypes within a population.

Investigators at UC Berkeley have developed a microfluidic platform, “mechano-node-pore sensing” (mechano-NPS), a rapid and multi-parametric cell screening platform, that simultaneously quantifies cell diameter, transit time through a contraction channel, transverse deformation under constant strain, and recovery time after deformation. This platform efficiently reveals malignant-dependent mechanical phenotypes of cancer and normal epithelial cells, discriminates between sub-lineages of cells with accuracy comparable to flow cytometry, and determines the effects of chronological age and malignant progression on cell elasticity and recovery from deformation – based solely on a cell’s mechanical properties.

SUGGESTED USES

Identification and isolation of cells from heterogeneous cell populations based on their mechanical phenotypes.

Evaluation of cytoskeleton-targeted drugs (e.g. estramustine, colchicine, and paclitaxel), which are often employed in cancer therapies, to provide a new window into drug resistance of cancer cells.

Distinguishing malignant from non-malignant cells, measuring deformability changes in the cytoskeleton, and discriminating between sub-lineages, and among chronological age groups of cells.

High-throughput analysis of viscoelastic properties of cells.

ADVANTAGES

Simultaneous high throughput and multi-parameter analysis of cells.

Simple device design.

RELATED MATERIALS

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Cholesterol-DNA Labeling of Extracellular Vesicles for Amplification Quantitation

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