Single-Pixel Optical Technologies For Instantly Quantifying Multicellular Response Profiles

Tech ID: 28995 / UC Case 2017-999-0

SUMMARY

UCLA researchers in the Department of Mechanical & Aerospace Engineering and the Department of Pathology & Lab Medicine have proposed a new platform technology to actuate and sense force propagation in real-time for large sheets of cells.

BACKGROUND

In multicellular organisms, chemical gradients, electrical impulses, and force propagation transmit signals to elicit cell responses distal to the signal origin. Technologies that detect and quantify electrical and chemical signals are well-established, but those for detecting mechanical cell responses have many limitations. Most technologies for quantifying cell mechanical properties (e.g., atomic force microscopy, optical tweezers) are limited to sub-cellular, single-cell, or several-cells-at-a-time scale. Another recently developed method, muscular thin film, allows for quantification of the average ensemble traction force exerted by a group of cells but cannot provide information about individual cell contributions. Since most cells in the body reside within interconnected two- and three-dimensional sheets and clusters, there is a need for technology that can measure changes in mechanical properties across large distances and numbers of cells while maintaining sub-cellular resolution.

INNOVATION

The inventors propose a new platform technology, SPOTs (Single-Pixel Optical Technologies), to actuate and sense force propagation in real-time for large sheets of cells. This will be the first enabling approach for simultaneous and quantitative measurement of multiple mechanical properties (viscoelasticity, deformability, traction force, angular and rotation force, force propagation) of millions of interconnected or discrete cells with sub-cellular resolution.

APPLICATIONS

- Mapping cell signaling pathways
- Cell differentiation
- Biomass profiling
- Study and diagnosis of cardiomyocyte-related diseases

ADVANTAGES

- Real-time monitoring
- Measurements of multiple cellular mechanical properties
- Use of single-pixel imaging for quantitative data
- High signal-to-noise ratio
- Five orders of magnitude higher throughput than state-of-the-art technologies

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	11,782,046	10/10/2023	2017-999

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INVENTORS

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OTHER INFORMATION

KEYWORDS

cell mechanics, cell deformation, real-time imaging, cell signaling, biomass profiling, cell force propagation, single-pixel imaging, real-time, cell traction, mechanical sensor

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Engineering**
  - Engineering
  - Other
- **Imaging**
  - 3D/Immersive
  - Medical
  - Remote Sensing
- **Medical**
  - Diagnostics
  - Imaging
  - Research Tools
- **Research Tools**
  - Other
- **Sensors & Instrumentation**
  - Biosensors
  - Position sensors
  - Scientific/Research

RELATED CASES

2017-999-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Mechanisms and Devices Enabling Arbitrarily Shaped, Deep-Subwavelength, Acoustic Patterning
- Plasmonic Nanoparticle Embedded PDMS Micropillar Array and Fabrication Approaches for Large Area Cell Force Sensing
- Self-Locking Optoelectronic Tweezer And Its Fabrication
- A Device For Continuous Focusing And Rotation Of Biological Cells And Its Application For High Throughput Electrorotation Flow Cytometer

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