Optofluidic Scanning Microscopy for Super-Resolution, Live-Cell Imaging (#8514)

For use in biology, pharmacology, and medical diagnostics

A novel method for analyzing biological specimens uses optofluidic scanning microscopy (OSM) to obtain super-resolution visualization of live cells. The technology will enable imaging of microfluidic experiments in a miniaturized platform and various on-chip configurations.

Georgia Tech's method exploits multifocal excitation using the innate fluidic motion of the specimens, permitting minimal instrumental complexity and full compatibility with various microfluidic configurations. Results include superior resolution, optical sectioning, and enhanced signal-to-noise ratio (SNR).

This OSM system continuously records objects flowing through the microfluidic device, and data are processed in three steps: (1) image stabilization, (2) pinholing and pixel reassignment, and (3) summing and deconvolution. The system allows visualization of circulating cells to examine their native and sphere-like morphology. It also heightens contrast and resolution, enabling the visualization of endocytosed vesicles and aggregates inside cells.

Benefits/Advantages

- **Effective**: Enables super-resolution OSM without the need for mechanical scanning that interrupts the fluidic continuity—as occurs in conventional image scanning microscopy
- **Flexible**: Fully compatible with widely adopted microfluidic systems
- **Adaptable**: Provides opportunity for miniaturization and various on-chip configurations

Potential Commercial Applications

- Biological research
- Drug development
- Pharmacology
- Medical diagnostics

Background/Context for This Invention

Optofluidics enables visualization of diverse anatomical and functional traits of single-cell specimens with new degrees of imaging capabilities. The field merges optics and microfluidics, permitting optical interrogation of biological specimens with high-throughput and cost-effective functionalities integrated on-chip. However, current systems are hampered by low resolution capabilities and/or incompatibility with

general microfluidic devices and operations.

Georgia Tech’s OSM system offers superior resolution, compatibility with widely adopted microfluidic systems, and strong potential for miniaturization.

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More Information

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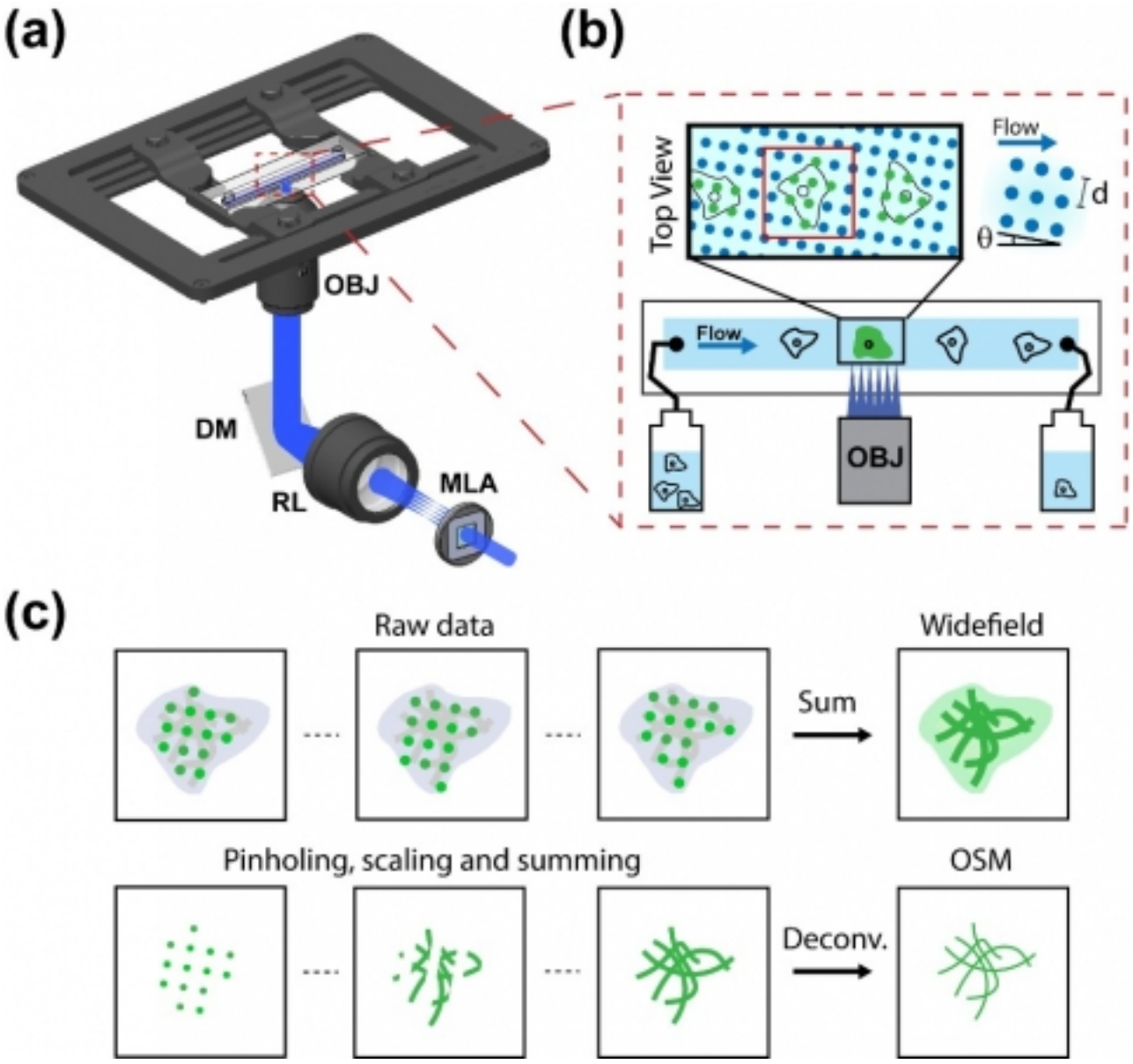
Publications

Optofluidic Scanning Microscopy, Optica, under review



Georgia Tech's Optofluidic Scanning Microscopy. (a) Schematic diagram of the experimental setup for OSM. A microlens array (MLA) generates multifocal excitation, which is relayed to the objective lens (OBJ). (b) The objective lens produces an array of diffraction-limited foci inside the microfluidic channel, illuminating the samples flowing through the device. (c) Key data processing steps of a stabilized object (red-boxed in [b]) include pinholing, pixel reassignment (scaling), and summing and deconvolution, thereby obtaining the final OSM image.

For more information about this technology, please visit:

https://licensing.research.gatech.edu/technology/optofluidic-scanning-microscopy-super-resolution-live-cell-imaging