Three-dimensional imaging flow cytometry

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Abstract
Imaging flow cytometry (IFC) is a powerful technique that combines the advantages of flow cytometry and optical microscopy. By capturing microscopy images of cells as they move along a liquid stream, IFC provides high-throughput collection of morphological and spatial information from thousands of cells. Recently optofluidic manufacturing technologies have shown their potential in the field of imaging flow cytometry enabling high throughput, and three-dimensional imaging.
The keynote speech will discuss the design and applications of miniaturized optofluidic devices for 3D imaging flow cytometry [1]. First, an optofluidic chip that incorporates light-sheet illumination and automatic sample delivery will be illustrated. This device upgrades a standard inverted microscope to automatic, three-dimensional, Light Sheet Fluorescence Microscope. Then a miniaturized device, based on integrated waveguides will be shown, as a new source for structured illumination microscopy. Finally, the combination of these two technologies will be described to demonstrate automatic imaging of cells at enhanced resolution.
Example applications will be discussed, together with the technological solutions for automatic sample alignment, including automatic imaging of tumour spheroids, Drosophila embryos, and high-resolution imaging of single cells [2].

[1] Paiè, P., Martínez Vázquez, R., Osellame, R., Bragheri, F., and Bassi, A. “Microfluidic based optical microscopes on Chip” Cytometry Part A, 93, 987-996 (2018).
[2] Sala, F., Castriotta, M., Paiè, P., Farina, A., D’Annunzio, S., Zippo, A., Osellame R., Bragheri F., Bassi, A. (2020). High-throughput 3D imaging of single cells with light-sheet fluorescence microscopy on chip. Biomedical optics express, 11(8), 4397-4407.