High-Speed Fluorescence Microscopy: Lighting up the Future of Life Sciences

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Fluorescence microscopy is an indispensable method in biomedical studies as it elucidates morphological details of complex organisms. Over the last few decades, the spatial resolution of fluorescence microscopy has dramatically improved with the emergence of laser-scanning confocal fluorescence microscopy and recently developed super-resolution techniques, significantly contributing to the evolution of life science. On the other hand, its temporal resolution (imaging speed) has been overlooked and limits its usage. Therefore, we have been developing high-speed fluorescence microscopic techniques to open up new frontiers in life science. I will present on recently developed high-speed fluorescence microscopy techniques and their applications to imaging flow cytometry [1,2] and 3D imaging along with data analysis using machine learning. I will also discuss the future of high-speed fluorescence imaging, which will lead to the integration of photonics, informatics, and life sciences.

Reference:
[1] H. Mikami, *et al*., Ultrafast confocal fluorescence microscopy beyond the fluorescence lifetime limit", Optica 5(2) 117-126 (2018).
[2] H. Mikami, *et al*., "Virtual-freezing fluorescence imaging flow cytometry", Nature Communications 11, 1162 (2020).

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Education/Career:

2020-present	Professor, Hokkaido University
2017-2021	PRESTO researcher, Japan Science and Technology Agency
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2006-2014	Researcher, Central Research Laboratory, Hitachi, Ltd.
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Research Interests

Fluorescence microscopy, high-speed imaging, wavefront control, computational imaging