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Pushing the envelope of super-resolution microscopy for sustained live imaging of rapid subcellular processes

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Yeung Kin Man Academic Building

Abstract

The long-standing dilemma when studying subcellular dynamics with optical microscopy is how to acquire the greatest spatiotemporal information with high fidelity and quantifiability but the least photobleaching and phototoxicity possible. In this talk, I will report our latest advances of how to synergize the developments in both optical front-end and algorithmic back-end methodology to address these challenges, and apply them to a wide variety of fragile and rapid evolving subcellular bioprocesses at ultrahigh spatiotemporal resolution for unprecedented long-time, multi-color imaging.

Biography

Dr. Dong Li is Xinghua chair professor and New Cornerstone investigator at school of life science, Tsinghua University. He received B.E. in optical engineering at Zhejiang University in 2006, and Ph.D. in electronic and computer engineering at Hong Kong University of Science and Technology in 2011. Then he spent four years for postdoctoral research of developing super-resolution microscopy at Janelia Research Campus, Howard Hughes Medical Institute. Dr. Dong Li's group focuses on developing super-resolution microscopy (SIM) for high-speed and long-term live imaging, and exploring their applications in biological research. Dong Li's research synergizes the developments in both microscope hardware and algorithmic software to push the boundary of SR live-cell imaging. From the perspective of microscope hardware, we first built the high NA total internal reflection structured illumination microscopy (TIRF-SIM, Science 2015), grazing incidence SIM (GI-SIM, Cell 2018), 3D-SIM and nonlinear SIM systems, high-speed lattice light sheet microscopy, and 3-D high spatiotemporal resolution biomechanics microscopy. From the perspective of algorithmic software, we devise the deep Fourier channel attention network (DFCAN, Nat Methods 2021, 2025), and rationalized deep learning (rDL) architecture (Nat Biotech 2023, 2205). These techniques enable investigate a wide variety of fragile and rapid evolving subcellular bioprocesses at ultrahigh spatiotemporal resolution for unprecedented long-time, multi-color imaging.