Breaking the diffraction barrier using the super-resolution microscopy

Sunghoe Chang
Department of Physiology and Biomedical Sciences
Seoul National University College of Medicine

Resolution of conventional optical microscopes even with the highest numerical aperture optics are limited by diffraction to approximately 200 nm. Recent developments of super-resolution fluorescence microscopy techniques, however, allow us to observe three-dimensional biological structures, to measure interactions by multicolor colocalization, and to record dynamic processes in living cells at the nanometer scale, which were not resolvable in conventional fluorescence microscopy. New Super Resolution microscopes such as SIM, STORM, PALM, and STED enables elucidation of structure and function of the nanoscopic machinery within living cells. Using Structured Illumination, the SIM can achieve image resolution of 85 nm with temporal resolution of up to 0.6 sec./frame, enabling super-resolution time-lapse imaging capture of dynamic molecular interactions in living cells. STORM/PALM/STED realize an incredible image resolution with lateral resolution to approximately 20 nm and axial resolution to approximately 50 nm, which is 10 times or more than that of conventional optical microscopes. Utilizing these super-resolution microscopes, it will be capable of multi-spectral two-dimensional and three-dimensional nanoscopy, extending the role of the optical microscope to near molecular level resolution.

CURRICULUM VITAE
(SUNGHOE CHANG)

Education

Ph.D. 1999	Deparment of Physiology & Biophysics
(Neurophysiology)	University of Illinois College of Medicine
	Chicago, Illinois
Feb. 2000- August 2002	Postdoctoral research associate
	Department of Cell Biology
	Yale University School of Medicine
August 2002-January 2009	Assistant, Associate Professor
	Department of Life Science
	Gwangju Institute of Science and Technology, Gwangju, South Korea
2009- present	Associate Professor
	Dept. of Physiology and Biomedical Sciences, Seoul National University College of Medicine, Seoul, South Korea
	Director
	Biomedical Imaging Center, Seoul National University College of Medicine

Recent Representative Publications

1. Kim Y, Ha CM, **Chang S.** SNX26, a GTPase-activating protein for Cdc42, interacts with PSD-95 and is involved in activity-dependent dendritic spine formation in mature neurons. *J. Biol. Chem.* 2013 2013 Oct 11;288(41):29453-66

2. Park J, Jang M, **Chang S**. Deleterious effects of soluble amyloid-<beta> oligomers on multiple steps of synaptic vesicle trafficking. *Neurobiol. Dis* 2013, 55:129-139.
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5. Shin N, Ahn N, Chang-Ileto B, Park J, Kim SA, Ahn SG, Takei K, Di Paolo G, **Chang S**. SNX9 regulates tubular invagination of the plasma membrane through the interaction with actin cytoskeleton and dynamin-2. *J. Cell Sci.* 121:1252-1263, 2008