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JENNIFER LIPPINCOTT-SCHWARTZ, PH.D

BREAKTHROUGHS IN IMAGING USING PHOTOACTIVATABLE
FLUORESCENT PROTEINS

APRIL 18, 2013
4:00 P.M.
208 LIGHT HALL

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Upcoming Discovery Lecture:

MICHAEL BROWN, M.D.
University of Texas Southwestern, Dallas

April 25, 2013
208 Light Hall / 4:00 P.M.

VANDERBILT  UNIVERSITY
MEDICAL CENTER

BREAKTHROUGHS IN IMAGING USING PHOTOACTIVATABLE FLUORESCENT PROTEINS

Photoactivatable fluorescent proteins (PA-FPs) are molecules that switch to a new fluorescent state in response to activation to generate a high level of contrast. Several types of PA-FPs have been developed, including PA-FPs that fluoresce green or red, or convert from green to red in response to activating light. The optical “highlighting” capability of PA-FPs has led to the rise of novel imaging techniques providing important new biological insights. These range from in cellulo pulse-chase labeling for tracking subpopulations of cells, organelles or proteins under physiological settings, to super-resolution imaging of single molecules for determining intracellular protein distributions at nanometer precision. The use of PA-FPs in super-resolution imaging of single molecules is a rapidly emerging field of microscopy that improves the spatial resolution of light microscopy by over an order of magnitude (10-20 nm resolution). It is based on the controlled activation and sampling of sparse subsets of photoconvertible fluorescent molecules whose illumination centroids are fitted and then summed into a final super resolution image, revealing the complex distribution of dense populations of molecules within subcellular structures with nanometer precision. The full potential of PA-FPs in conventional, diffraction-limited and super-resolution imaging is only beginning to be realized. Here, I discuss the diverse array of PA-FPs available to researchers and the new imaging techniques they make possible for unraveling long-standing biological questions.



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Jennifer Lippincott-Schwartz received her B.A. from Swarthmore College, her M.S. in Biology from Stanford University, and her Ph.D in Biochemistry from Johns Hopkins University. She did post-doctoral training at the National Institutes of Health (NIH) under the mentorship of Dr. Richard Klausner. She currently serves as Chief of the Section on Organelle Biology in the Cell Biology and Metabolism Branch of the National Institute of Child Health and Human Development at National Institutes of Health and is an NIH Distinguished Investigator.

Lippincott-Schwartz's research uses live cell imaging approaches to analyze the spatio-temporal behavior and dynamic interactions of molecules and organelles in cells. Her group has pioneered the use of green fluorescent protein (GFP) technology for quantitative analysis and modeling of intracellular protein traffic and organelle biogenesis in live cells and embryos, providing novel insights into cell compartmentalization, protein trafficking and organelle inheritance. Most recently, her research has focused on the development and use of photoactivatable fluorescent proteins, which 'switch on' in response to light. One application of these proteins she has put to use is photoactivated localization microscopy, (i.e., PALM), a superresolution imaging technique that enables visualization of molecule distributions at high density at the nano-scale.

Her work has been recognized with election to the National Academy of Sciences (2008) and the National Institute of Medicine (2009), and with the Royal Microscopy Society Pearse Prize (2010) and the Society of Histochemistry Feulgen Prize (2001). Dr. Lippincott-Schwartz is currently Editor for Current Protocols in Cell Biology and The Journal of Cell Science and is on the editorial boards of Cell, Physiology and Integrative Biology. She is President-elect of the American Society of Cell Biology and has had leadership roles in the Biophysical Society. She serves on the advisory board for the Searle Scholar Program and scientific review board of Howard Hughes Medical Institute, and is a non-resident Faculty Fellow of the Salk Institute, La Jolla, CA.
