

Technical and Biological Applications of Photoactivation Localization Microscopy (PALM)

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Key to understanding a protein's biological function is the accurate determination of its spatial distribution inside a cell. Although fluorescent protein markers allow the targeting of specific proteins with molecular precision, much of this information is lost when the resultant fusion proteins are imaged with conventional, diffraction-limited optics. In response, several imaging modalities that rely on the stochastic activation and bleaching of single molecules [1-3], and that are capable of resolution below the diffraction limit (~200 nm), have emerged. In this talk, I will discuss superresolution imaging of biological structures using photoactivation localization microscopy (PALM). A particular emphasis will be placed on recent technical advances, including dual-color PALM [4] and the PALM-imaging of living cells. Biological examples will focus on the organization of bacterial chemoreceptors and the spatial distribution of proteins within adhesion complexes.

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[2] M. J. Rust, M. Bates, and X. Zhuang, "Sub-diffraction-limit imaging by stochastic optical reconstruction microscopy (STORM)," *Nat. Methods*, **3**, 793-796 (2006).

[3] S. T. Hess, T. P. K. Girirajan, and M. D. Mason, "Ultra-High Resolution Imaging by Fluorescence Photoactivation Localization Microscopy," *Biophys. J.*, **91**, 4258-4272 (2006).

[4] H. Shroff, C. G. Galbraith, J. A. Galbraith, H. White, J. Gillette, S. Olenych, M. W. Davidson, and E. Betzig, "Dual-color superresolution imaging of genetically expressed probes within individual adhesion complexes," *Proc. Natl. Acad. Sci. USA*, **104**, 20308-20313 (2007).