Title: The Promise and Challenges of 3D Super-Resolution Microscopy and Single-Molecule Tracking in Cells and in Solution

PROF. W. E. MOERNER, STANFORD UNIVERSITY, DEPARTMENT OF CHEMISTRY, STANFORD, CA 94305

WMOERNER@STANFORD.EDU

Abstract: Super-resolution microscopy has opened up a new frontier in which biological structures and behavior can be observed in fixed and live cells with resolutions down to 20-40 nm and below. Examples range from protein superstructures in bacteria to details of the shapes of amyloid fibrils and much more. Current methods development research addresses ways to extract more information from each single molecule such as 3D position and orientation, and ways to insure that the acquired data are both accurate and precise. Indeed, new labels are needed which provide more photons before photobleaching. At the same time, it is worth noting that in spite of all the current focus on super-resolution, even in the "conventional" low concentration, single-molecule tracking regime where the motions of individual biomolecules are recorded rather than the shapes of extended structures, much can still be learned about biological processes with quantitative measurements and analysis. Examples to be presented include studies of the primary cilium, and motions of DNA loci in the yeast nucleus, and photodynamics of a photosynthetic antenna.