Field:

Chemistry/Biochemistry

Session Topic:

Super-resolution Imaging

Speaker:

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Much of our knowledge of the life of a cell comes from our ability to see the small structures within it. In fact, it is the invention of light microscopy that discovered the cell and thus established the field of cell biology. Nowadays, light microscopy, especially in the modern form of fluorescence microscopy, is still the favorite of many biologists. It allows the observation inside a live sample and can highlight the structure of interest through molecule-specific labeling. However, conventional light microscopy has one major limitation: the inability to resolve two objects closer than half the wavelength of the light because of the phenomenon called diffraction. Their images would look blurry and overlapped no matter how high the magnification is. This resolution limit, unfortunately, lies exactly at the length scale of most intracellular structures.

To surpass this limit, we have developed a super-resolution microscopy technique, Stochastic Optical Reconstruction Microscopy (STORM). It relies on the ability to record light emission from a single molecule in the sample. Using probe molecules that can be switched between a visible and an invisible state, STORM determines the position of each molecule of interest. These positions ultimately define a structure. STORM allows us to resolve cellular features an order of magnitude smaller than what can be seen with conventional fluorescence microscopy. We have further added the power to study three-dimensional structures and ability to visualize interactions between cellular components by labeling each of them with a distinct color. Using STORM, we have imaged various cellular structures previously not observable using light microscopy. Our work has demonstrated the potential of STORM to provide more detailed understandings of biological processes at the molecular level.

REFERENCES:

B. Huang, M. Bates, X. Zhuang, "Super resolution fluorescence microscopy", *Ann. Rev. Biochem.*, 78, 993-1016 (2009)