Imaging Biological Structure and Dynamics from Molecules to Organisms

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The hallmark of life is that it is animate. To gain a better understanding of how inanimate molecules assemble to create animate life, it is necessary to image the structure and dynamics of living organisms noninvasively at many different length scales at high resolution in both space and time. However, there exist inevitable tradeoffs of spatial resolution, speed, non-invasiveness, and imaging depth. I will describe various methods that balance these tradeoffs in different ways: super-resolution fluorescence microscopy for subcellular imaging at the nanoscale; lattice light sheet microscopy for imaging rapid three-dimensional cellular dynamics; and adaptive optics for studying dynamics deep within multicellular specimens.