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Subcellular Mechanics Studied by Nanoscale Manipulation and Ablation

Much of the molecular machinery that sustains life operates at the nanometer scale, and our understanding of these nanomachines is often frustrated by the inability to visualize and manipulate structures and materials on this scale. We are developing and applying new tools and methodologies to quantifiably move, ablate, and track objects with nanometer precision. These tools are broadly enabling for nanotechnology and material science, though our focus is on cell biology, especially the mechanics of the cytoskeleton and mitosis. Optical tweezers, lithography, and "ultrafast" femtosecond-pulsed laser nanoablation, provide insight into the mechanisms underlying microtubule polymerization dynamics, and their role in mitotic chromosome movements.