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Revealing structure (and dynamics?) with high-throughput super-resolution microscopy

Single molecule localization microscopies (SMLM)—such as STORM, PALM, and PAINT—occupy a special niche in the biologist's toolbox because they provide the best resolution in fluorescence microscopy. Yet, many important biological questions remain out of reach due to challenges in acquiring and handling statistically significant SMLM datasets. Previously, we created high-throughput PALM by building an automated microscope to image hundreds of bacteria cells, live, 3D, and across cell cycle. However, eukaryotic cells are much larger. We have now constructed a novel microscope to acquire large field of view images in an automated way. To achieve this, we combined a large-detector scientific CMOS camera with an optimized laser illumination field and software developed in our group. We can now acquire multicolor PALM or STORM images of multiple eukaryotic cells, or hundreds of bacteria cells in a single image. Together with our multi-field-of-view approach, we can collect terabytes of data in a few hours. This provides unique opportunities and challenges for understanding the organization of biological specimens.

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