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Super-resolution imaging of intrinsically fast moving flagellates

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Recent developments in super-resolution microscopy made it possible to resolve structures in biological cells at a spatial resolution of a few nm and observe dynamical processes with a temporal resolution of ms to μ s. However, the optimal structural resolution requires repeated illumination cycles and is thus limited to fixed cells. For live cell applications substantial improvement over classical Abbe-limited imaging can be obtained in adherent or slow moving cells. Nonetheless, to our knowledge a large group of cells, intrinsically fast moving flagellates could not yet be addressed with super-resolution microscopy. These include pathogens like trypanosomes, the causative agents of sleeping sickness in humans and Nagana in cattle. Attempts to immobilize these cells include drug treatment or embedding in agarose or gelatin gels. However, these methods either have unwanted side effects or are not sufficient for super-resolution imaging because they do not efficiently suppress the flagellar beat. Here, we present a novel hydrogel embedding and quantify its biocompatibility and immobilization efficiency. We characterize both the cells and the gel with respect to their autofluorescence properties and find them suitable for single-molecule fluorescence microscopy (SMFM). We apply SMFM to track individual Atto647N-labeled membrane proteins on the surface of immobilized trypanosomes and achieve a localization precision of 30 nm and a temporal resolution of 25 ms.

Biography

Susanne Franziska Fenz has studied Physics in Wurzburg and Heidelberg. She has received her PhD in 2009 from the University of Bonn, Germany. As a Post-doctoral fellow she moved to Leiden University in the Netherlands to work on single-molecule fluorescence microscopy of living cells. Her current interests include biomimetics, cell adhesion and diffusion in crowded membranes as well as super-resolution microscopy.

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