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The Open-Access Journal for the Basic Principles of Diffusion Theory, Experiment and Application

Diffusion and freezing transition of rod-like DNA origami on freestanding lipid membranes

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During the last decade, DNA origami has become a powerful tool in research at the nanoscale. The relative ease of constructing functionalized DNA origami structures of a defined shape allows for their applications in membrane biophysics. Recently, we have constructed stiff rod-like DNA origami structures consisting of six DNA helixes, which were functionalized with hydrophobic membrane-binding anchors and fluorescently labeled at defined positions [1]. Selective fluorescent labeling allowed us to determine the translational and rotational diffusion coefficients of the DNA origami rods on lipid membranes by fluorescence correlation spectroscopy, which were found to be in a good agreement with the hydrodynamics-based theory of membrane diffusion. Further, we studied the effect of the surface density of membrane-bound origami structures on their Brownian motion. We found a strong decrease of the translational and rotational diffusion coefficients of membrane-bound nanorods with an increase in their surface density. We compare our experimental findings with results of Monte Carlo simulations of Brownian hard needles in 2D.

This work was supported by the DFG (FOR 877).

References

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