Sequence, shape, function: a primer to DNA origami

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Advanced molecular self-assembly with ‘DNA origami’ offers a unique route for building custom shaped high-complexity objects that are commensurate in size to biological macromolecules. DNA origami objects can be used as platforms for placing, orienting, and even manipulating biological molecules in user defined ways. Thus, DNA origami objects can not only help improve existing experimental methods in the molecular biosciences but they also open completely new avenues of exploration.

In our laboratory we have set out to develop custom 'nano’ instrumentation based on DNA origami that complements single-molecule-level methods for observing and manipulating biological macromolecules. Among other goals, we seek to enable the study of adhesive interactions between biomolecules in unprecedented detail. We also aim to develop tools for unraveling the conformational dynamics of proteins at work in novel ways. More long term, we hope to be able to create a biologically inspired nanotechnology including devices that are capable of performing complex tasks such as enzymatic catalysis or molecular transport for human purposes.

In my presentation I will focus on an introduction to DNA origami, our near-term applications, and report about some of our efforts in analyzing and improving molecular self-assembly reactions with DNA origami.