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Eshan King
Washington University in St. Louis

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Eshan King

Mentor: Matthew Lew

DNA origami is a burgeoning method of folding DNA into arbitrary 2D and 3D nanoscale conformations. Researchers can design origami using commercially available software to fit a broad array of needs, such as DNA scaffolds to hold other molecules in place, nanoscale masks for photolithography, DNA nanorobots, or drug delivery capsules.

Many authors claim that under certain environmental conditions, such as low concentrations of magnesium chloride, DNA origami becomes more flexible. However, the evidence presented is mostly concerned with the static or ensemble conformation of DNA origami through TEM imaging or small-angle X-ray scattering, providing only a loose, subjective measure of flexibility.

There is a need for more direct quantification of the mechanical properties of DNA origami, namely elasticity. Understanding how the elasticity of DNA origami structures changes under different environmental conditions, such as changes in temperature, pH, or metal ion concentration, is crucial for understanding the limitations of DNA origami and building more advanced models of higher order structures.

In this project, we have successfully synthesized DNA origami nanopillars labeled with fluorescent molecules. The nanopillars include biotin modifications at the bottom for attachment to modified substrates, allowing the nanopillar to stand upright. Two Cy5 molecules are attached to the top and bottom of the nanopillars. By studying the orientation distribution of the fluorophores, we hope to infer the range of bending that the nanopillar attains, allowing for more direct observation of the change in flexibility of the nanopillar under different environmental conditions. For instance, we expect the nanopillar to access a greater range of bending at lower concentrations of magnesium chloride, as other researchers have reported that this increases the flexibility of the nanopillar. In addition, we hope to develop a simple model for DNA origami bending, allowing for quantification of the mechanical properties of the DNA origami nanopillars under different environmental conditions.