**DNA Origami with Site Specific Docking of Nanoparticles and a Red Fluorescent Protein: Construct Design and AFM assisted Analysis**

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DNA origami structures have allowed for the arrangement of different functionalities with great precision on the nanoscale. The DNA Origami consists of a scaffold strand, staple strands to allow for the folding of helices to specification of design and modification staple strands. The functionalities, which can be programmed into the construct, can be useful in array nanopatterning. Programmable functionalities include proteins, specific DNA structures, nanoparticles and various chemical modifications. The intrinsic ability to be programmed with functionalities and the size of DNA Origami make it a versatile tool and a good candidate for visualization using atomic force microscopy (AFM) and fluorescence microscopy.

Presented here are AFM images which confirm proper formation of a cross shaped DNA origami platform (~100nm x 100nm in size) with 5nm gold nanoparticles decorating one of the arms of the cross. The required design calls for as many as 3 particles per DNA origami. Reaction conditions are optimized with the goal being to increase the percentage of fully decorated DNA origami.

Another labeling approach currently in process involves encoding a site-specific Tris-Nitrilotriacetic Acid (Tris-NTA) modification in the DNA construct which will allow for the binding and immobilization of a protein with a 6-Histidine tag in the presence of NiCl21. The Ni2+ displays a six-coordinate octahedral structure in which sites are chelated by 2 Histidine residues and the tetra-coordinating NTA ligand2,3. dsRed His-tagged fluorescent protein was selected over other fluorescent proteins due to the proteins excitation wavelength, emission wavelength and quantum yield. AFM analysis will yield important topographic architectural information about the construct. AFM and fluorescence imaging will be used to confirm site-specific binding of the dsRed fluorescent protein to the precise position on the DNA Origami construct. Binding of a protein or other functionalities to DNA Origami unlocks other uses for DNA as a way to manipulate and pattern molecules on the nanoscale.

References:

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Keywords: DNA Origami, NTA, AFM, His-tagged proteins