DNA Origami Forks for Single Molecule SERS

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The field of DNA nanotechnology has had a remarkable impact on a number of areas such as biophysics, diagnostics, biomolecular structure determination and drug delivery. The core of this field is to take DNA out of its biological context and using its physical and chemical properties to create various nanostructures[1]. The specific base-pairing nature of DNA allows for rational design of self-assembled highly specific nano-structures[2].

In the past few years, DNA origami based structures have been successfully utilized in label-free detection using the principle of Surface Enhanced-Raman Spectroscopy (SERS). The field is still evolving, with a demand for more complex and highly specific structures. Our aim is to develop a DNA origami structure that could capture a single target molecule and then is coupled with nano-particles for SERS measurements. One could use such system for detection of dyes or biomolecules, an example would be heme containing proteins.

Hemeproteins or heme containing proteins are very important for proper function of various organisms. They are a large class of proteins that is highly abundant and have diverse biological functions[3]. One of these proteins is Cytochrome C which is found in plants, animals and some unicellular organisms, and it's highly conserved across the spectrum of these species. The heme in Cytochrome C is contained in a hemin moiety and it's essential for the electron transport chain in mitochondria[4]. Here, we present initial SERS measurements of Cytochrome C and the strategy to place a single protein into the SERS hot spot using DNA origami.

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