Functional ssDNA for the development of a DNA origami biosensor

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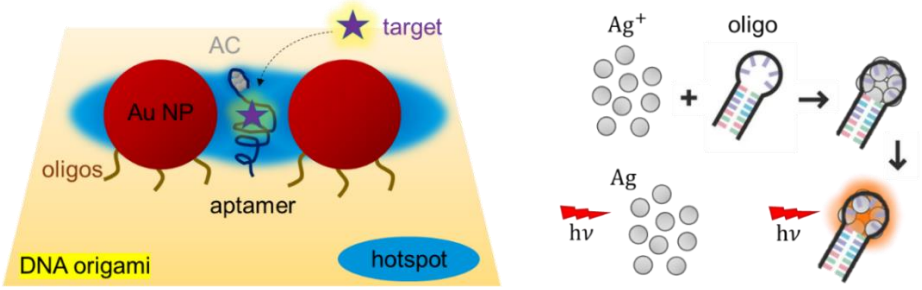
The development of novel biosensors with increased performance strongly relies on the incorporation and combination of various nanotechnologies, such as functional nanoparticles (NPs) and DNA origami [1,2]. On the basis of these technologies, the *DeDNAed* project is creating an advanced bioanalytical sensor-platform with advanced sensitivity and versatility by utilizing SERS as an ultrafast optical analysis method. DNA origami will be used like a “nano-breadboard” to precisely control the nanoscale positioning of biorecognition elements (bioREs) with respect to the plasmonic hotspots of NPs, which are positioned on the DNA origami in a similar fashion, for enabling highly sensitive SERS measurements [3]. To combine these technologies while guaranteeing high spacial precision, we use short oligonucleotide sequences, an established method for the attachment of NP, and active elements to DNA origami [4]. Additionally, the concept includes the integration of metallic atomic cluster (AC) within the bioRE, providing enhanced fluorescence properties compared to other NP based systems while their synthesis is based on novel etching methods that avoid the denaturation of the bioRE [5].

Here we present first findings on the development of an aptamer based bioRE, with a strong focus on the synthesis of the AC and optimization of their fluorescent properties. The bioRE consists of three segments, one for its attachment to the DNA origami, one for the target specific binding and one for the AC coordination. The three segments have been analysed and optimised independently and in combination, verifying their combined functionality. Furthermore, we present the first development iteration of the plasmonic NPs for SERS and their functionalisation for the integration on the DNA origami.



Left: Schematic of a DNA origami scaffold for arrangement of plasmonic NP arrays for signal amplification of SERS measurements with a AC decorated DNA aptamer as bioRE. *Right*: Schematic of oligonucleotide coordinated formation of fluorescent AgACs.

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