# Optimization of DNA origami substrates for the study of electron-induced DNA strand breaks

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Secondary low-energy electrons (LEEs) belong to the most important intermediates in DNA radiation damage. Strand breaks in the DNA backbone can be initiated by resonant electron attachment at different electron energies.[1] Recent experiments suggest that single strand breaks (SSBs) strongly depend on the nucleotide sequence due to efficient coupling of the electronic states of the nucleobases by stacking interactions.[2] A novel approach using DNA origami templates carrying different oligonucleotide target sequences provides access to efficient and systematic determination of electron induced DNA strand break cross sections (see Figure 1).[3] However, this procedure is very time-consuming and yields results for only two different oligonucleotides. Therefore we optimized the DNA origami design which carries nine well-defined oligonucleotides instead of six (see Figure 2). The damaged oligonucleotides are analyzed by atomic force microscopy (AFM). The well-defined shape of the DNA origami template and the new design with three different oligonucleotides allows for a precise localization and quantification of DNA strand breaks at a single molecule level.

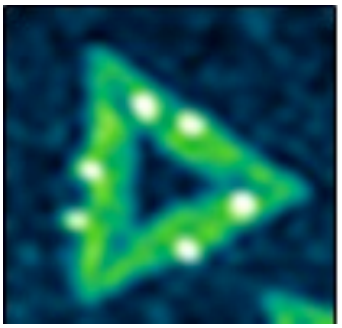

**Fig. 1:** AFM image of a triangular DNA origami structure carrying *six* well-defined oligonucleotides and streptavidine at the 5' end.

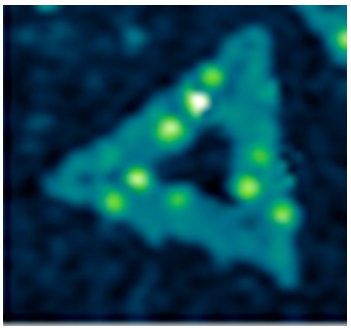

**Fig. 2**: AFM image of a triangular DNA origami structure carrying *nine* well-defined oligonucleotides and streptavidine at the 5' end.

[1] I. Baccarelli *et al* 2011 *Phys. Rep.* **508** 1.
[2] T. Solomun *et al* 2009 *J. Phys. Chem. B* **113** 11557.
[3] A. Keller *et al* 2012 *ACS Nano* **6** 4392.