3rd International Conference "Radiation Damage in Biomolecular Systems: *Nanoscale Insights into Ion-Beam Cancer Therapy* *(Nano-IBCT 2014)*"

Boppard am Rhein

Germany

October 27-31, 2014

Book of Abstracts

DETERMINATION OF SEQUENCE-SPECIFIC DNA STRAND BREAKS INDUCED BY VUV RADIATION USING THE DNA ORIGAMI TECHNIQUE

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We have studied the sequence-specific DNA damage induced by VUV photons in an energy range from 6.5 to 9.5 eV on the single-molecule level. By using a novel DNA origami technique, we were able to visualize the photon-induced dissociation of single chemical bonds within complex but well-defined self-assembled DNA nanostructures, deposited on a UV transparent substrate. The method employs atomic force microscopy (AFM) to image and quantify photon-induced bond dissociations within specifically designed oligonucleotide targets that are attached to DNA origami templates [1,2]. Therefore, we were able to determine quantitatively the sequence-specific DNA strand break yields in dependence of the VUV photon energy.

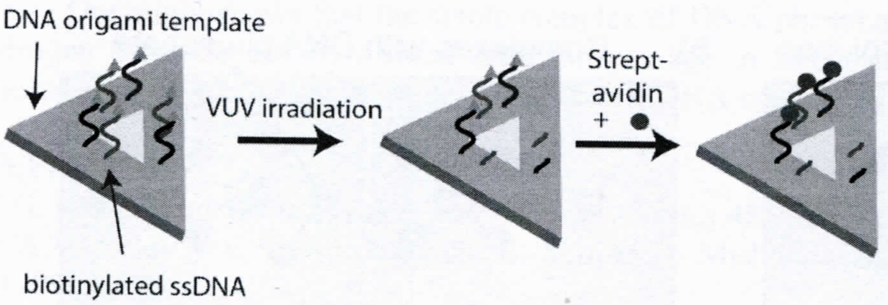

Figure 1: Scheme of the DNA origami triangles, which serve as a support of the oligonucleotide target structures. After the irradiation with VUV photons the remaining intact target structures are visualized for AFM using streptavidin.

We have irradiated DNA origami samples carrying the target sequences 5'-TT(XTX)$_3$TT (X = C, A) with VUV photons at 6.5 eV, 7.3 eV, 8.44 eV, 8.94 eV, 9.14 eV and 9.5 eV. By using AFM for the visualization of DNA single strand breaks in the target sequences we could observe that the relative number of DNA strand breaks increases with the photon flux. Thus, we could establish dose-response curves for all photon energies. The energies were chosen to match either resonances observed in previous experiments (6.5 eV and 7.3 eV) [3], [4], or the ionization potentials (IP) of isolated nucleobases (IP(A) = 8.44 eV, IP(C) = 8.94 eV, IP(T) = 9.14 eV), or to be right above the ionization threshold of all DNA bases (9.5 eV). By comparing the DNA strand break yield of the two target sequences at the different irradiation energies, we can deduce important information about the underlying damage mechanism.

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