

SPECIFIC LOCAL INDUCTION OF DNA STRAND BREAKS BY INFRARED MULTI-PHOTON ABSORPTION

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DNA damage by femtosecond laser irradiation currently arises as a powerful tool to understand DNA repair in live cells as a function of space and time. The main advantages of this technique consist in the 3D confinement of the lesions and the reduced phototoxicity. Several studies on the dynamics of DNA repair proteins in living cells have employed Ti : sapphire femtosecond lasers emitting around 800 nm. First reported as being an efficient inducer of cyclobutanepyrimidine dimers (CPDs), multiphoton absorption at this wavelength has meanwhile been shown to generate a broad spectrum of lesions including 6-4 photoproducts (6-4 PPs) and DNA strand breaks (DSBs). The lack of specificity poses a strong limitation to this method as a tool to study individual DNA repair pathways in living cells.

Taking advantage of the ultrabroadband tunability of our previously developed Er/Yb: fiber femtosecond laser source [1] we have therefore compared DNA damage induction at two wavelengths in the near infrared, namely 775 and 1050 nm. A quantitative analysis of the power dependence of different types of DNA lesions allowed us to identify conditions that specifically favor DSBs with respect to UV photoproducts. We explain this selectivity with the different power dependence of the reactions generating strand breaks, mainly involving reactive radical intermediates, and the direct photochemical process leading to UV-photoproducts. With the increasing commercial availability of tunable femtosecond lasers this method can be easily employed in non-specialized laboratories as a tool to selectively induce DSBs in the absence of photosensitizers and at high spatial resolution [2].

[1] D. Träutlein, F. Adler, K. Moutzouris, A. Jeromin, A. Leitenstorfer, and E. Ferrando-May “Highly versatile confocal microscopy system based on a tunable femtosecond Er: fiber source”

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[2] D. Träutlein, M. Deibler, A. Leitenstorfer, and E. Ferrando-May. “Specific local induction of DNA strand breaks by infrared multi-photon absorption”. *Nucleic Acids Res.*, epub ahead of print, doi:10.1093/nar/gkp932 (2009)