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DNA photosensitization: Irreversible lesions caused by non-covalent binding with organic dyes

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Although diverse DNA photo-stability mechanisms exist, organic dyes near DNA can induce damages through indirect light absorption. Hence, understanding the underlying mechanisms involved in photosensitized DNA damage is crucial to describe and possibly anticipate photobiological risks, as well as to design anticancer phototherapies. Here, we present the results concerning our latest studies on different reactivities induced by common organic dyes, through multiscale molecular modeling techniques coupled to spectroscopy experiments. Especially, the photochemistry of benzophenone – a paradigmatic DNA photosensitizer and its implications in the competitive processes of hydrogen abstraction and energy transfer to DNA will be described. Electron transfer is also considered by the interaction of DNA with two fluorescent dyes widely used in cellular biology: Nile blue and Nile red. Finally, the potentialities of a very recently synthesized novel carbazole in photosensitizing DNA through two-photon absorption will be reported. Especially, it will be shown how it can induce DNA strand break upon photoionization with the production of a solvated electron. The main advantage is the low-energy (infra-red) irradiation required also in the absence of molecular oxygen, i.e. a prodrug of great interest for the potential treatment of solid tumors.

Biography

Marco Marazzi after completing PhD at the University of Alcalá, Madrid (Spain) in 2013, was a Humboldt Fellow at the Karlsruhe Institute of Technology (Germany). Starting from 2015, he is a Researcher at the French National Center for Scientific Research (CNRS) and at the University of Lorraine in Nancy (France). Always interested in photoinduced processes of biologically relevant systems, he studied organic molecular switches applied to peptide conformational changes, channelrhodopsin as an optogenetic tool, and DNA photosensitization via type I and II processes. His expertise covers a broad range of modeling techniques.

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