Mechanisms of Dark Photochemistry of Interest in Biology: Enhanced Vision and DNA damage

Daniel Roca-Sanjuan*[1]

[1]Instituto de Ciencia Molecular, Universitat de València (ICMOL-UV) – P.O.Box 22085, 46071 València, Spain

Abstract

Dark Photochemistry, as defined in the context of the present conference, implies the production of a "photoprocess" by using a chemiluminophore (for instance, dioxetane or dioxetanone) rather than light to induce the excited-state chemistry [1]. In this process, the bond breaking of the peroxide bond brings the molecular system to the excited state similarly to what happens in chemiluminescence and bioluminescence [2]. However, while chemi-/bioluminescence ends up with light emission, dark photochemistry gives rise to a photochemical product. The photochemical process without light can takes place intra- or inter-molecularly, i.e., in the same molecule as the chemiluminophore or in a different molecule. In this contribution we will show examples of such processes and discuss about some quantum-chemistry findings obtained for the mechanism of production of cyclobutane pyrimidine dimers in DNA [3] and in relation to the possible role that might have dark photochemistry in the enhancement of vision of some deep-sea fish and some patients of photodynamic therapy [4].

W. J. Baader, C. V. Stevani, E. J. H. Bechara, *J. Braz. Chem. Soc.* **26**, 2430 (2015).

P. Farahani, M. Lundberg, R. Lindh, D. Roca-Sanjuán, *Phys. Chem. Chem. Phys.* **17**, 18653 (2015).

S. Premi, S. Wallisch, C. M. Mano, A. B. Weiner, A. Bacchiocchi, K. Wakamatsu, E. J. H. Bechara, R. Halaban, T. Douki, D. E. Brash, *Science* **347**, 842 (2015).

T. Isayama, D. Alexeev, C. L. Makino, I. Washington, K. Nakanishi, N. J. Turro, *Nature*, **443**, 649 (2006).

Keywords: dark photochemistry, retinal, DNA damage, cyclobutane pyrimidine dimers

*Speaker