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Autore	Elise Dumont
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Sommario/riassunto

DNA stores and passes the genetic information of almost all living organisms. Its molecular structure and their intramolecular interactions are particularly suitable to maximize stability against oxidative stress and UV-light absorption. Yet the protection and repair strategies are still error-prone: DNA lesions are produced, including the most complex and highly mutagenic ones. An important threat to DNA stability comes from photosensitization, i.e. from the dramatic multiplication of radiation-induced defects mediated by the presence of organic or organometallic dyes compared to the direct exposure to UVA radiation. Moreover, the photo-induced production of singlet oxygen generates an extremely high oxidative stress on DNA that, in vivo, normally results in extended cellular apoptosis. Elucidating the processes leading to DNA damages, from the production of a simple radical entity to deleterious lesions, as well as the opportunities of repair by devoted enzymes, is a cornerstone towards the development of more efficient protection strategies. Sensitization and selective production of DNA lesions can also be exploited to induce the selective apoptosis of cancer cells upon exposition to radiation or to oxidative stress, for instance in the field of photodynamic therapy. The importance and relevance of the field is witnessed by the impressive amount of high-level papers dealing with this complex subject, and notably tackling the structural elucidation of DNA and DNA-drug adducts, the mechanisms of formation of DNA lesions (including the

precise detection of the final lesion products), as well as the influence of the lesions on the DNA stability and dynamics and the consequences on the ease of repair. Due to the complexity of the field lying at the frontiers between chemistry, physics and biology, multidisciplinary strategies allying modeling and experience are needed. This topic aims at giving an extended overview of the current research in the domain, with fundamental contribution from the leading groups in the field of DNA reactivity, structural characterization, photo-chemistry and photo-physics, as well as repair mechanism. It will therefore be a fundamental guide for scientists wanting to address the field of DNA lesion and repair, but also more generally for researchers working in rational drug design or in the development of biomarkers and medical imaging techniques.