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The Photochemistry and Photophysics of DNA

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Our DNA is constantly being subjected to chemical and physical changes. Understanding the molecular dynamics of this biological stress and how it leads to mutation and the onset of cancer represents a key scientific challenge. During evolution cells have evolved an enormous array of weaponry to minimise the risks of mutation, however, under certain conditions things can go badly wrong. A primary example is the over exposure of sunlight to skin. The initial photophysical processes that take place following from the initial absorption of a photon to chemical reaction occur in the ultrafast (femtoseconds to picoseconds) time domain. As such studying these reactions falls into the world of ultrafast laser spectroscopy and both linear (pump and probe) and non-linear (2D-IR, stimulated fluorescence) methods are utilised. The major factor of the components that make up DNA, the four nucleic acid bases, that gives them exceptional photo-stability is the fact that they possess exceptional short lifetimes (ps). The presentation will introduce DNA photochemistry and photophysics, the technology used to investigate them and emphasise how time-resolved infrared spectroscopy can be applied to gain insights into structural changes occurring in the ultrafast molecular time frame.

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