MAPPING THYMINE DIMER SPLITTING IN DAMAGED DNA BY PHOTOLYASE

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Photolyases uses light energy to convert UV-damaged cyclobutane pyrimidine dimer (CPD) to normal bases. We observed the formation and decay of semiquinone flavin and CPD anion intermediate, the recovery of hydroquinone flavin in ground state, and the formation of normal thymine bases in real time with femtosecond time resolution. By monitoring the decay and formation of all reactants, intermediates and products, the functional dynamics of the elementary steps during CPD repair have been mapped out. All elementary reaction steps, namely forward electron transfer, back electron transfer, bond breakage and electron return occur in sub-nanosecond scale. These dynamics are synergistically correlated for maximum of repair efficiency through a redox photocycle with no net change of electrons.