

Fast Back Electron Transfer Prevents Guanine Damage by Photoexcited Thionine Bound to DNA

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Abstract:

The phenothiazinium dye thionine has a high excited state reduction potential and is quenched by guanine on the femtosecond time scale. Here, we show by gel electrophoresis that irradiation of thionine with 599 nm light in the presence of an oligonucleotide duplex does not produce permanent DNA damage. Upon photoexcitation of thionine weakly associated with guanosine-5'-monophosphate, the reduced protonated thionine radical and neutral guanine radical are detected by transient absorption spectroscopy, indicating that the quenching of thionine by guanine occurs via an electron-transfer mechanism. The observation of radical formation without permanent guanine damage indicates that fast back electron transfer plays a critical role in governing the yield of damage by DNA-binding molecules.

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