Charge Transport in DNA Duplex/Quadruplex Conjugates†

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Abstract:

DNA conjugates containing adjacent duplex and guanine quadruplex assemblies have been designed to explore charge transport into quadruplex architectures. The quadruplex assemblies have been characterized structurally using circular dichroism and by assaying for chemical protection. Using an intercalating rhodium photooxidant, noncovalently bound or tethered to the duplex end, oxidizing radicals are found to be trapped in the folded quadruplex. Damage is observed almost exclusively at the external tetrads of the quadruplex. Little damage of the center tetrad is observed, due most likely to lowered efficiency of radical trapping within the quadruplex core. This pattern of damage is distinct from that observed for repetitive G sequences within duplex DNA. The data indicate, furthermore, that in the conjugates examined, the guanine quadruplex provides a more effective trap than a 5'-GG-3' guanine doublet within duplex DNA. Within these assemblies, sufficient base-base overlap must exist at the duplex/quadruplex junction to allow for charge migration. This funneling of damage to the quadruplex, as well as the unique pattern of damage within the quadruplex, requires consideration with respect to the analysis of oxidative DNA damage within the cell.