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Low-energy electron interactions with hydrated DNA and complex biological targets[1]

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We have theoretically and experimentally examined low-energy (5-50 eV) electron induced damage of hydrated DNA targets. In particular, we have modified a multiple scattering "path approach" to theoretically calculate low-energy (5-50 eV) electron diffraction and incident electron intensity at particular sites within a hydrated DNA double-strand. Constructive interference associated with water in the DNA major grooves occurs and can enhance the experimentally observed DNA damage probability. We associate the observed enhancements in the break probability as a function of incident electron energy with diffraction and decay of compound core-excited Feshbach resonances. These excitations are localized at the hydrated DNA interface but can decay by autoionization and lead to damage at sites spatially removed from the initial excitation. Diffraction can enhance damage but the inherent spatial specificity is not preserved. We have also begun studies to examine spatially and chemically resolved plasma mediated desorption of small molecules from complex targets such as cell membranes.

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