Biological contexts for DNA charge transport chemistry

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Many experiments have now shown that double helical DNA can serve as a conduit for efficient charge transport (CT) reactions over long distances *in vitro*. These results prompt the consideration of biological roles for DNA-mediated CT. DNA CT has been demonstrated to occur in biologically relevant environments such as within the mitochondria and nuclei of HeLa cells as well as in isolated nucleosomes. In mitochondria, DNA damage that results from CT is funneled to a crucial regulatory element. Thus, DNA CT provides a strategy to funnel damage to particular sites in the genome. DNA CT might also be important in long-range signaling to DNA-bound proteins. Both DNA repair proteins, containing Fe-S clusters, and the transcription factor, p53, which is regulated through thiol-disulfide switches, can be oxidized from a distance through DNA-mediated CT. These observations highlight a means through which oxidative stress may be chemically signaled in the genome over long distances through CT from guanine radicals to DNA-bound proteins. Moreover, DNA-mediated CT may also play a role in signaling among DNA-binding proteins, as has been proposed as a mechanism for how DNA repair glycosylases more efficiently detect lesions inside the cell.