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## ELECTRON MIGRATION IN 5-BROMOURACIL-SUBSTITUTED DNA AND OLIGONUCLEOTIDES IN IRRADIATED AQUEOUS SOLUTIONS

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Results of work by other investigators support the hypothesis that negative charge can migrate in DNA. Charge transfer between nucleotides and electron migration in solid state DNA has been demonstrated, with migration distances as great as 110 bases. Here we report a series of studies on aqueous solutions of DNA and oligonucleotides in which the radiolysis of 5-bromouracil (BU) substituted for thymine is used as a molecular probe to detect and measure the extent of electron migration. For native DNA, such experiments were performed by substituting various amounts of BU for thymine in *E. coli* DNA and assaying for the amount of Br<sup>-</sup> released by the reaction of radiation-produced hydrated electrons with BU to form a highly reactive uracil-5-yl free radical which then abstracts hydrogen from a nearby donor to form uracil. By varying the amount of BU incorporated in the DNA, the average distance between the BU bases was varied. The relative yields of the BU/electron reactions were monitored by measurement of the quantities of Br<sup>-</sup> released which allowed the maximum distance of electron migration to be estimated. Electrons were estimated to have a maximum migration distance of between 6.5-10 bases in BU-DNA which was partially hybrid, and between 8-10 base distances in non-hybrid BU-DNA. In studies on the details of radiolysis of the BU in DNA it was found that the OH radical was half as efficient at producing Br<sup>-</sup> as was the hydrated electron. Superoxide which had previously been shown to transfer negative charge to BU in aqueous solution did not undergo this reaction with BU incorporated in DNA. The CO<sub>2</sub><sup>-</sup> anion radical was found to cause the release of Br<sup>-</sup> from BU-DNA at least as efficiently as the hydrated electron. In studies using oligonucleotides, BU was substituted for thymine at specific locations in defined base sequences using automated phosphoramidite synthesis techniques. Using these single-stranded oligonucleotides with BU located at the 5' end of the sequence, electrons do not appear to migrate more than one base, if any. Evidence for the

presence and extent of electron migration will be presented for double-stranded oligonucleotides of various lengths and sequences irradiated in aqueous solutions.

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