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Site Selective Bond Cleavage Upon Dissociative Electron Attachment - A Tool to Control Chemical Reactions.[1]

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Free electron attachment to gas phase nucleobases (NB) and these molecules embedded in superfluid He droplets and Ne clusters is studied experimentally. For most of the biomolecules studied so far, the dominant reaction channel is $e^- + NB \rightarrow (NB^-)^{\#} \rightarrow (NB\text{-}H)^- + H$. (1) For the DNA bases adenine (A) and thymine (T) the attachment cross section in the electron energy range between 1 and 3 eV reveals several narrow resonances. By using partially deuterated and methylated NB molecules it is possible to assign these resonances to the loss of hydrogen from a specific nitrogen site [1]. The complementary reaction channel of (1) is the formation of H^-. For the formation of H^- from A and T the attachment cross section shows several resonances in the energy range between 5 and 12 eV. Experiments with partly deuterated T and methylated NB show that the different peaks in the H^- ion yield can be associated to the loss from the different molecular sites [2,3]. The energy dependence for H^- abstraction from the carbon sites shows a remarkable resemblance to the energy dependence of strand breaks observed in plasmid DNA [4] suggesting that this reaction may be an important initial step towards strand breaks. Free electron attachment to NB embedded in superfluid He droplets exhibits a novel two-step process for electron energies higher than 5 eV. From an initially formed H^- an electron is transferred to the opposite neutral radical and forms the $(NB\text{-}H)^-$. References [1] S. Ptasiñska et al., *Angew. Chem. Int. Ed.* **44** (2005) 6941 [2] S. Ptasiñska et al., *Angew. Chem. Int. Ed.* **44** (2005) 1647 [3] S. Ptasiñska et al., *Phys. Rev. Lett.* **95** (2005) 093201 [4] B. Boudaiffa et al., *Science* **278** (2000) 1658

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