Low energy electron interaction with biomolecules: from gas to condensed phase- from room temperature to near absolute zero.

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Free electron interaction with biomolecules including nucleobases (NB), aminoacids and others has been investigated in our laboratory in a series of studies in the past few years involving increasingly more complex target situations, i.e., going from the isolated molecule in the gas phase to clusters and mixed clusters in helium droplets. The goal is to explore the transition in chemistry brought about by a change in phase and temperature.

One interesting result in case of NB is that no stable parent anions can be produced by electron attachment (EA). Moreover, at electron energies below about 3 eV the NB molecules dissociate via H-loss yielding $(NB\text{-}H)^-$ and above about 3 eV additionally complex bond breaking reactions are observed yielding a variety of fragment anions also including H^-. By using labelled NB molecules it was possible (i) to demonstrate for the first time bond and site selective EA [1] and in addition to assign some of the resonances in the lower energy range to loss of H from a specific nitrogen site induced also by vibrational modes (Feshbach resonances) from other sites [2]. This bond and site selectivity also exists for the thymidine [3] and valine [4]. Furthermore, in the case of adenine (derivatives) the effect of functional groups at the opposite position of the H-loss site was demonstrated [5]. Finally, pick-up of gas phase biomolecules into superfluid He droplets is a recent tool to form targets in aggregated environments at ultra-low temperature (0.37 K). Free electron attachment to biomolecules and (mixed) clusters of biomolecules embedded in superfluid He (and Ne [6]) has been studied in our laboratory recently for the first time and shows a number of rather novel features [7].

This work was supported by the FWF, Wien, and the European Commission, Brussels.

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