Electron transfer (ET) process is one of the fundamental reactions in Nature, playing a role in photosynthesis, cellular respiration, enzymatic reactions, drug activations and many others. In living organisms proteins are involved in this process, however its mechanism is not fully understood. Proteins are large biopolymers, with complex spatial structure and, because of this complexity, the simpler models are needed to study ET process. Peptides appeared to be very good electron transfer mediators. But there are some limitations in testing peptides. Efficiency of ET process depends on the secondary structure of the molecule with α-helix found to be the best structural motif. The stable peptide helix requires at least 10 amino acids residues and also the primary sequence has to be carefully chosen. These limitations preclude the investigation of the ET process through short (less than 10 residues) peptide systems.

The aim of this project is design and synthesis of model compounds which form stable helices both in solution and in the solid state. Oligoureas and their derivatives have been chosen as excellent model compounds. They belong to a family of foldamers; i.e. unnatural oligomers able to adopt well-defined and predictable spatial structures. Application of oligoureas and their derivatives for the investigation of the electron transfer process will enable the study of short chain systems, since already 4 urea residues form a stable helical turn. Besides, such foldamers may help to verify the theoretical assumption saying that as the length of the ET mediator increases, the mechanism of ET gradually changes from *superexchange* to *hopping*. We plan to obtain several groups of oligoureas and their derivatives ("hybrides" with γ-amino acids and "chimeras" with α-peptides). Synthesis will be performed in solution, using classical organic chemistry methods, and on the solid support under microwave irradiation. The latter approach shorten reaction time considerably. Helicity of all obtained compounds will be checked using spectral methods. Oligoureas and their derivatives will contain thiol groups (-SH) at *N*- or *C*-terminus. The presence of thiol groups allow the formation of monolayers on conductive materials, such as gold. Thereby, the ET process will be studied by STM and AFM microscopy by molecular junction method (metal-molecule-metal type). The latter enables the determination of the conductance of either a molecular film or single molecules.

The understanding of the rules governing the electron transfer mechanism may help to understand the key biological processes. Moreover, oligoureas possess several unique properties which make them potentially useful as the elements of functional devices for nanoelectronics. Also, in the future, these compounds may be considered as building blocks for the development of artificial enzyme models and bioinspired machinery.