Master Thesis Proposals
Academic year 2013-2014

• **Elaboration of molecular receptors for anion recognition in water.**

  Anions play fundamental roles in a wide range of chemical, biological and environmental processes and much interest has been devoted these last years to the development of synthetic receptors able to recognize them with high selectivity and affinity in water. We are studying several systems with different recognition paradigms (H-binding, Lewis Acid-Base Interaction) which exhibit high affinity towards anions in organic solvents. Due to their poor solubility in water, different strategies are being investigated to make them “water-compatible”. The use of surfactants is one such strategy. The project, undertaken in the framework of a European project in collaboration with the University La Sapienza in Rome, will consist in elaborating micelle/receptor systems and in studying, by calorimetry and NMR, their binding properties towards different anions of biological/environmental importance.

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• **Health hazards of nanoparticles: physico-chemical investigation of their interaction with biological macromolecules**

  The production of nanomaterials has drastically increased these last years. The boom in the number of nanomaterial-containing commercial products and their expected exploitation in almost every industrial sector, leads to a dramatic increase of the exposure level of humans and living organism to these materials and the question of their potential health hazard arises. In order to obtain an integrated view of nanomaterial interactions with biological systems, a detailed understanding of their interaction at the molecular level with biomolecules, such as proteins, lipids, nucleic acids and sugars is essential. The project will consist in studying the interaction between gold nanoparticles and proteins via ITC and NMR experiments.

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Grafting of molecular receptors on photoactive nanoparticles. Localized Surface Plasmons (LSPs), charge density oscillations confined to metallic nanoparticles and metallic nanostructures, can be exploited in the construction of molecular sensors. The sensitivity of the surface plasmon band to the refractive index of its immediate environment offers the opportunity to detect the complexation of guest molecules or environmental changes: the fixation of a specific analyte by a molecular receptor anchored on the surface of the nanoparticle can be detected by a modification of the SPR signal. We propose to investigate the potential of different organic receptors grafted on nanoparticles as selective and sensitive molecular sensors. Specific interest will be paid to gold nanoparticles as their SPR band falls within the visible range, allowing the development of colorimetric sensors.

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