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From proteins towards polymer-protein conjugates: structure and dynamics properties for bio-technological application

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Polymers have specific, controllable properties such as mechanical strength, biocompatibility, and tailorability of their functional groups, which are important for biological application. When they are attached to proteins, proteinpolymer covalent conjugates combine the impressive biological activities of proteins with the tailorable structures and properties of synthetic polymers.

The aim of my research is to contribute to the description of interactions, structure and dynamical properties of a new class of polymer-protein conjugates, with special attention to protein stability and protein folding. A library of model proteins such as met-hemoglobin, interferone and/or lysozyme complexes with bio-compatibles polymers, with various architectures, will be synthetised. Microscopic properties of the complexes will be put in perspective with bio-functional properties, in order to elucidate preferential structures and relaxation modes of the proteins that are essential for folding and functionality.

In order to achieve the main assignment of the project a fully description of microscopic properties, of the conjugates, will be necessary. On one side, Optical Transient Grating technique and Light Scattering will enable a determination of the visco-elastic parameters, and relaxation modes on the nanosecond timescale. Measurements will be performed at the Laboratoire Interdisciplinaire de Physique (LIPhy) in Grenoble (coord. M. Plazanet). On the other side, structure and dynamics of the conjugates itself and protein/polymer will be investigated by X-ray and neutron scattering techniques. The use of deuterated polymers or proteins will make possible, through neutron scattering, the direct determination of the polymer/protein properties in the conjugates. Measurements will be performed on French and European large scale facilities (coord. D. Russo)

Comparison of different protein conjugates should lead to a variety of original results. With this project we wish to provide a valuable description of the properties of polymer hydrated protein for their potential application for bio-technology. The results could lead to the targeted design of original conjugates.

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