

IMPRS on Multiscale Biosystems

Project description

Title: Stimuli-responsive bioactive hydrogels/LC phases based on glycopolypeptides

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Project description: Stimuli-responsive polymers are promising materials for advanced applications in biomedicine and life science as well as for bioinspired materials research (for instance as mimics of adaptive biological systems). Particularly interesting are synthetic polypeptides because of their unique ability to change conformation or secondary structure (α -helix – β -sheet – random coil) in dependence of external stimuli (pH, temperature, ionic strength, etc.). Usually, the α -helices or β -sheets are hydrophobic and hence insoluble in water, except for some very few examples like glycopolypeptides. Glycosylated poly(L-glutamate)s form stable α -helices in water and should self-assemble into stimuli-responsive bioactive hydrogels or liquid crystalline (LC) phases.

The conformational changes of polypeptide chains depending on environmental conditions (change of pH or temperature, presence of divalent metal ions or proteins) and the possible formation of hydrogels/LC phases at higher concentrations can be assessed by applying *in situ* polarized Raman spectroscopy. Spectroscopic results (Raman, also CD and NMR) will be corroborated with light and X-ray scattering as well as optical and electron microscopy.

With this project, we aim to get new and deeper insights in the stimuli-induced conformational transitions of polypeptides and the specific binding of lectins to glycosylated assemblies, pointing perhaps to new solutions for biomimetic and biomedical applications.

Required background: Polymer and colloid chemistry, biochemistry, physical characterization of soft matter (NMR, CD, FT-IR, and Raman spectroscopy, X-ray scattering and microscopy).

Paper to read before the interview: (1) K.-S. Krannig, H. Schlaad: pH-Responsive Bioactive Glycopolypeptides with Enhanced Helicity and Solubility in Aqueous solution, *J. Am. Chem. Soc.* 2012, *134*, 18542-18545. (2) A. Masic, L. Bertinetti, R. Schuetz, L. Galvis, N. Timofeeva, J. W. C. Dunlop, J. Seto, M. A. Hartmann, P. Fratzl: Observations of Multiscale, Stress-Induced Changes of Collagen Orientation in Tendon by Polarized Raman Spectroscopy, *Biomacromolecules* 2011, *12*, 3989-3996.

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