

# ML 13

## INTERACTION OF PROTEINS WITH CHARGED COLLOIDS

M. Ballauff

*Physical Chemistry I, University of Bayreuth, Universitaetsstrasse 30, 95440 Bayreuth, Germany (matthias.ballauff@uni-bayreuth.de, <http://www.chemie.uni-bayreuth.de/pci/>)*

We review recent experiments on the interaction of proteins with anionic polyelectrolytes in aqueous solution [1]. Data from literature demonstrate that proteins can form soluble complexes with linear polyelectrolytes even on the “wrong side” of the isoelectric point, that is, for pH values above the isoelectric point of the proteins under which the polyelectrolytes and the proteins are like-charged. All data published so far demonstrate that this type of adsorption becomes weaker with increasing ionic strength. A much stronger interaction is found if the polyelectrolyte chains are grafted onto solid surfaces to form polyelectrolyte brushes. Here it has been shown that spherical polyelectrolyte brushes consisting of a core of ca. 100 nm diameter and long attached polyelectrolyte chains strongly adsorb proteins at low ionic strength (“polyelectrolyte-mediated protein adsorption”; PMPA). Virtually no adsorption takes place onto the spherical polyelectrolyte brushes at high ionic strength. A critical comparison of data obtained on free polyelectrolytes and on polyelectrolyte brushes shows that both phenomena can be traced back to patches of positive charge on the surface of the proteins. Moreover, we discuss the driving force of the PMPA-process in terms of the Donnan-pressure inside the brush layer. Here we find a good correlation that demonstrates that release of counterions during the process of adsorption is the main driving force [1,2]. All data demonstrate that these novel composite particles of colloids and proteins have an interesting potential for future applications as e.g. for enzyme immobilization.

1. A. Wittemann, M. Ballauff, “*Interaction of proteins with linear polyelectrolytes and spherical polyelectrolyte brushes in aqueous solution*”, *Phys. Chem. Chem. Phys.*, **2006**, 8, 5269
2. F.A.M. Leermakers, M. Ballauff, O.V. Borisov, “*On the mechanism of uptake of globular proteins by polyelectrolyte brushes: A two-gradient Self-consistent field analysis*”, *Langmuir*, **2007**, 23, 3937