European Cells and Materials Vol. 10. Suppl. 5, 2005 (page CS7) ISSN 1473-2262

# Cell Adhesion on Charged Polymer Surfaces

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## INTRODUCTION:

Beside other factors, surface charge is an important parameter for cell adhesion.[1] Also, it has been shown that protein adsorption plays a key role in cell-attachment to uncharged polymers.[2]

In this study we aim at a combined investigation of the influence of the type and density of the charges of polyelectrolyte networks on the adhesion of cells on these layers. To do so, we have used a technique that utilizes polymers with photoreactive benzophenone moieties to generate surface attached polyelectrolyte networks and investigated both the adsorption of a model protein (fibrinogen) and of cells (human microvascular endothelial cells, HMVEC) on these samples.

## RESULTS & DISCUSSION:

The PEL network layers were generated as described in the literature.[3] In brief, benzophenone layers within polymers are UV activated causing a crosslinking reaction with neighboring chains and also with groups of a polymeric substrates. Accordingly, surface attached network layers are formed that do not delaminate even if placed in solvent that leads to significant swelling of the layers.

To study anionic polyelectrolytes we have prepared layers of poly(acrylic acid), poly(*p*-styrene-sulfonic acid sodium salt) (p-SSNa), poly(sulfopropylacrylate potassium salt) (SAK) and of a polymer in which the charged groups (acrylic acid) were diluted with uncharged dimethyl acrylamide (DMAA) residues.

Protein adsorption and swelling of the polymer layers was investigated by surface-plasmon-spectroscopy and surface wave guide-spectroscopy respectively. All of these polymers showed to be protein-repulsive to Fibrinogen as well as to Bovine Serum. In contrast to the expected behavior from studies on non-charged polymers HMVECs seemed to grow well on these surfaces. There, cell adhesion was only observed on surfaces to which proteins adsorbed well. All protein resistant surfaces were also cell repellent. This discrepancy is best illustrated by the behavior of copolymers in which protein- and cell-repellent DMAA residues and cell-attractive styrene sulfonic acid moieties were present. With increasing DMAA and decreasing SSNa content the layers became more and more resistent to the adhesion of HMVECs. This observation is illustrated in Figure 1.

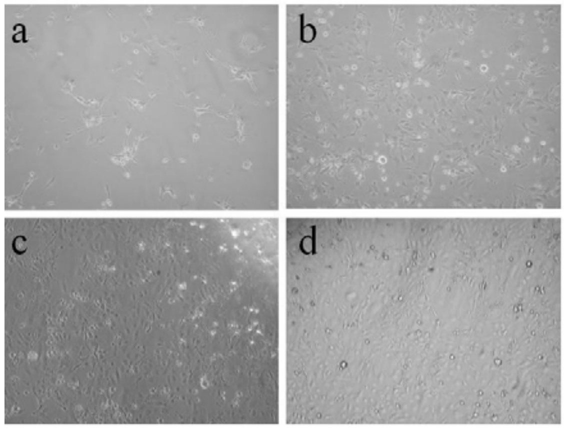


***Figure 1:*** *HMVEC on polyelectrolyte networks composed of DMAA and SSNa with increasing charge density from a) to d). Cell adhesion is largely enhanced when the density of charges is increased.*

On our poster we will present a simple model that explains these findings based on the complexation of Ca-cations from the medium with the anionic groups of the polymers and the extracellular matrixs of the cells. A comparison to the cell adhesion behavior to positively charged polymers will be made.

## REFERENCES:

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**ACKNOWLEDGEMENTS:** Financial support from the DFG (Da-246/3-1) is gratefully acknowledged. Petra Böhringer, Franziska Degenhardt and Natalia Schatz is thanked for technical support.