Synthesis and characterization of biomimetic thermoresponsive microgels and their ability to bind proteins and bacteria in solution and on surfaces.

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Multivalent binding processes at cell surfaces play a crucial role in cellular processes such as signalling, communication, sensing, adhesion or bacterial infections. [1, 2] To obtain a better understanding of these processes and to control and utilize them our particular aim is to mimic these complex interactions and investigate them in a temperature-controlled fashion on surfaces and in solution. Recent studies showed that binding strength can be enhanced by controlling the elastic modulus and the ligand density.

To study and control theses effects we synthesized bioligand bearing thermoresponsive microgels based on poly(*N*-isopropylacrylamide) and investigated their temperature-dependent binding affinities toward different receptors. Various functionalization techniques, different bioligands and different microgel morphologies were investigated. Microgels were characterized by a range of analytic tools to determine ligand functionalization, swelling properties, and morphology.
We expect that the temperature-controlled phase transition of the microgels leads to an increase of affinity above their lower critical solution temperature (LCST) due to increased ligand density and reduced steric repulsion at their surface. In solution we tested the binding properties of our systems via Bradford assay, an agglutination assay and turbidimetry. Surface studies were done with AFM, fluorescence microscopy and microplate-based adhesion inhibition assays, overall confirming increased affinities above LCST.

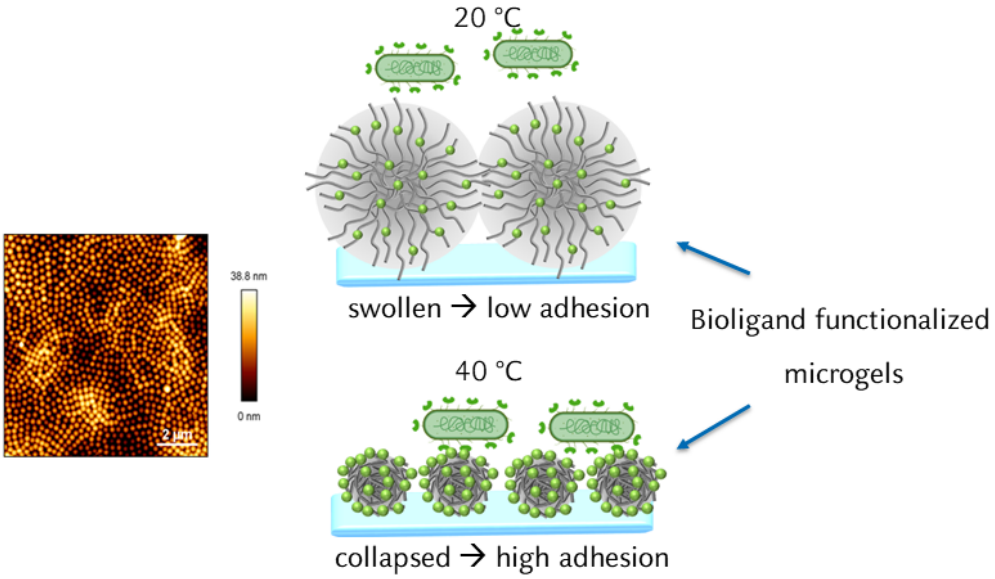

Figure 1 On the left an AFM image of a microgel surface is shown. Bioligand functionalized P(NIPAM)-microgels, which are bound to surfaces and their temperature dependent swelling degree and the resulting binding of bacteria towards them.

[1] L. L. Kiessling, J. C. Grim, *Chem. Soc. Rev*. **2013**, *42*, pp. 4476–91.
[2] D. J. Muller, J. Helenius, D. Alsteens, Y. F. Dufrene, D. J. Müller, Y. F. Dufrêne, *Nat. Chem. Biol.* **2009**, *5* (6), 383-390.

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