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Cooperativity of Integrin-mediated Adhesion on Nanopatterned Substrates CHRISTINE SELHUBER, University of Heidelberg and Max-Planck-Institute for Metals Research, THORSTEN ERDMANN, ULRICH SCHWARZ, University of Heidelberg (BIOMS), HORST KESSLER, Technical University of Munich, JOACHIM SPATZ, University of Heidelberg and Max-Planck-Institute for Metals Research — Surfaces of defined adhesion properties are required for a physical understanding of cell adhesion in vivo. In this work, biofunctional nanopatterns are employed, which allow adhesion ligands to be positioned in a quasi-hexagonal lattice. Such nanopatterns are used to investigate integrin-mediated cell adhesion, which is a highly complex biological process and essential for numerous cell functions. With nanopatterns the distance between adjacent integrin binding sites is precisely defined. Cell culture experiments have revealed that this distance strongly affects cell adhesion and the formation of adhesion clusters, known as focal contacts. To quantify the adhesion cluster formation for different integrin binding site spacings, cell adhesion forces were studied using atomic force microscopy (AFM). The experiments demonstrate that an integrin binding site spacing of 70 nm and more prevents the cooperative formation of early adhesion clusters. In long-term adhesion studies, after several hours of cell adhesion, it turned out that focal contact formation cooperatively increases the local adhesion strength. The obtained results were related to theoretical models on adhesion cluster stability.

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