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Cells "Feel" Their Surroundings – Implications for Biomedicine and Drug Delivery

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Cell-based research is a booming sector in life science. In vitro assays on cultured cells greatly foster the development of novel therapy concepts for a broad range of diseases, and upcoming techniques such as tissue engineering will soon bring benefits in the field of regenerative medicine. Especially the beginning era of Nanomedicine, including e.g. the specific targeting of cells with drug-loaded particles, fundamentally depends on a profound initial characterization of the interaction process with the external surroundings.

It is thus of pivotal importance to continue increasing our knowledge on the regulatory feedback mechanisms that govern a cells behavior, especially those which are directly triggered by the cellular microenvironment. While mostly neglected in the past, recent findings gave impressive proof that living cells are able to "feel" the stiffness, topological and viscoelastic properties of their proximate surroundings, and actively correspond to the hereby derived structural information [1]. It was shown that the mechanical configuration of the extracellular matrix can influence a cell's adhesion, migration, growth and differentiation to the same extent as do soluble factors present in the medium [2]. Also the responses to other external stimuli – such as drug treatment – are often influenced by the substrate a cell is attached to. The consequences that arise thereof, for cells on biomedical scaffolds as well as for cells in the body that shall be affected by pharmaceutical treatment, are of evidential interest for the developing of effective novel therapies.

Here, the first results of an interdisciplinary cooperation with aim to further elucidate this issue are presented, showing that deeper insights can be gained by combination of mechanically tunable culture substrates and highly sensitive analytical tools such as Atomic Force Microscopy.

[1] Rehfeldt F, Engler AJ, Eckhardt A, Ahmed F, Discher DE. Discher D.E.: Cell responses to the mechanochemical microenvironment – Implications for regenerative medicine and drug delivery. Adv Drug Deliv Rev. 2007; 59: 1329–1339. doi:10.1016/j.addr.2007.08.007

[2] Yeung T, Georges PC, Flanagan LA, Marg B, Ortiz M, Funaki M, Zahir N, Ming W, Weaver V, Janmey PA. Effects of substrate stiffness on cell morphology, cytoskeletal structure, and adhesion. Cell Motil Cytoskeleton. 2005; 60: 24–34. doi:10.1002/cm.20041

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