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The impact of intercellular communication in complex pre-vascularized tissue equivalents

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A promising approach in reconstructive surgery for the wound coverage after surgical interventions is the use of artificially generated pre-vascularized tissue equivalents. In our group we developed a pre-vascularized buccal mucosa equivalent in a tri-culture of primary buccal epithelial cells, fibroblasts and microvascular endothelial cells successfully, based on the collagen matrix Bio-Gide® from Geistlich. A successful pre-vascularization at superficial areas of the matrix was demonstrated. However, so far the generation of pre-vascularized structures within the tissue equivalent was restricted to only superficial areas of the matrix. Besides the great advances, it is not completely understood yet, why the used endothelial cells did not migrate in depth of the tissue equivalent in order to form vascular structures. To understand the cell biological background for the reduced migration willingness of endothelial cells, we investigated the intercellular communication in monocultures and co-cultures of primary microvascular endothelial cells and buccal fibroblasts based on the collagen matrix Bio-Gide®. To achieve this objective we analyzed the secretion patterns of relevant angiogenic factors such as VEGF, Ang 1, Ang 2, bFGF and eNOS and evaluated their effect on cellular parameters such as viability, proliferation, migration and tube formation. The results showed complex interactions of the investigated growth factors. A distinct influence of the co-cultivation, the spatial separation and the used collagen matrices on the expression patterns of the primary cells could be demonstrated. The co-cultivation of endothelial cells and fibroblasts led to increased levels of VEGF, bFGF, eNOS and Ang-2 compared to the monocultures. Interestingly, a spatial separation of the two cell types as well as the cultivation on the used collagen matrices enhanced this effect additionally. The gained results help us to understand the cellular interaction in complex multi-cultures and may lead to optimized cultivation approaches for tissue engineering of complex tissues.

Speaker Biography

Martin Heller has completed his PhD in Biology at the Max Planck Institute of Polymer Research Mainz in 2013. Afterwards he worked as Postdoc at the University Medical Center of Mainz and started to study Medicine in April 2014. His focus of research is the modification of biomaterials in the context of artificially generated tissue equivalents in complex multi-cultures of primary human cells

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