Co-cultures of Human Endothelial Progenitors and Osteoblasts on Starch-Poly(caprolactone) Contribute to Rapid in vivo Vascularization: A Dynamic Assessment
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Introduction
We have previously shown the benefits of a tissue engineering approach using outgrowth endothelial cells (OEC) derived from human peripheral blood progenitor cells [1] co-cultured with human osteoblasts on a micrometer mesh scaffold of a blend of the natural polymer, starch with the synthetic polymer, poly(caprolactone)(SPCL). Following 7 days of in vitro cultivation, the pre-seeded SPCL scaffold was impregnated with the hydrogel, Matrigel® and implanted subcutaneously in the scid mouse. After 14 d in vivo the construct showed an extensive perfused microcirculation, with numerous human microvessels along with some chimaeric vessels, containing both mouse and human endothelial cells [2].

Materials and Methods
In the present in vivo study the time course of this vascularization process was investigated in a time frame between 2 and 14 days in the scid mouse and compared with the in vivo vascularization of SPCL without pre-seeding in the wild-type mouse over the same time period. Conventional histology and immunohistochemistry were performed to study human and host endothelial cells as well as human osteoblasts and their contribution to host vascularization. An established computer image-based quantitative analysis was used for this investigation [3].

Results
Already after 2 d in vivo there were perfused human microvessels, thus providing evidence for an extremely rapid connection of the in vitro pre-formed vessel-like structures with the host microcirculation. Human osteobalsts seemed to act as pericytes and were detectable in the outer walls of human cell-derived microvessels. In scid mouse SPCL which was loaded with human cells contributed to a higher host vasularization when compared to SPCL alone in the wild-type mouse. At day 5 after implantation SPCL seeded with human cells reached a 4-5 fold higher vascularization than SPCL alone after 14 days.

Discussion and Conclusions
These data underline the potential of in vitro co-cultured human cells to increase host vascularization by functioning as a drug delivery system. Their capacity to influence host vascularization immediately following implantation opens up a new perspective for their successful clinical use. The exact mechanisms involved in the rapid vascular connection remain to be elucidated.

References

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