Self-vascularizing Antifibrotic Biomaterials—A Pilot Study
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Introduction
A major problem in tissue engineering is vascularisation of an implant/tissue, or at least the peri-implantational area. Furthermore, once a fibrotic capsule is established, the approach of small blood vessels to the implant is blocked. As a novel vascularization strategy, we have recently proposed to use prolyl hydroxylase inhibitors (PHi) as they possess both angiogenic and antifibrotic effects [1, 2]. We seek to develop a biomaterial with both vascularization and antifibrotic properties by incorporating PHi into electrosprun medical grade poly-e-caprolactone/collagen and electrosprayed hyaluronic acid hydrogel, Heprasil™ (mPCL/Col-Hep) scaffolds.

Materials and Methods
mPCL/Col-Hep scaffolds were prepared as previously described [3], with PHi such as 2,4-pyridinedicarboxylic acid (PDCA) and ciclopiroxolamine (CPX) (Sigma, St Louis, MO) incorporated into the Heprasil™ (Glycosan BioSystems, Salt Lake City, UT) component during electrospraying. As a preliminary study, WI-38 fibroblasts were seeded onto each construct and cultured for 14 days. Scanning electron microscopy (SEM) and hematoxylin and eosin (H&E) staining were used to analyze cell attachment and infiltration. To assess efficacy of the PHi, vascular endothelial growth factor (VEGF) ELISA was used to quantify VEGF produced by fibroblasts.

Results
Successful attachment, proliferation and infiltration of fibroblasts were observed by SEM and H&E of scaffold cross-sections after 14 days of culture (Fig. 1). In response to the incorporated PHi, there was an increase in the amount of secreted VEGF by day 7 (Fig. 2). This will serve to signal endothelial cells to form capillary-like-structures in future co-culture studies. Collagen secretion will be monitored in future studies to confirm the antifibrotic property of the biomaterial.

Discussion and Conclusions
Infiltration of cells is vital for vascularization of a construct, and this was successfully demonstrated in this study. A combination of PHi with mPCL/Col-Hep has potential as a self-vascularizing and antifibrotic biomaterial.

References

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Disclosures
GDP is a founder and holds equity in Glycosan BioSystems. The other authors declare no competing interests