

Development of Interactive Biomaterials for Vascular Morphogenesis

Barrs, R.^{1,2}, Jia, J.¹, Yost, M.³, and *Mei, Y⁴

¹Graduate Research Assistant, Clemson-MUSC Bioengineering Program, Clemson University,

²Department of Surgery, Medical University of South Carolina, ³Associate Professor, Department of Surgery, Medical University of South Carolina, ⁴Assistant Professor, Bioengineering Department, Clemson University, Department of Regenerative Medicine and Cell Biology, Medical University of South Carolina
mei@clemson.edu

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Abstract: Therapeutic angiogenesis holds remarkable promise to treat ischemic diseases and develop viable tissue engineering strategies. As extracellular matrix (ECM) proteins play a central role in physiological angiogenesis, significant efforts have been devoted to developing hydrogels that mimic the provisional ECM to promote angiogenesis. The project aims to leverage our expertise in alginate hydrogels and bioconjugation chemistry to develop interactive biomaterials for vascular morphogenesis. To achieve this goal, we prepared various peptide-functionalized alginate hydrogels to systematically investigate the effects of biological cues and physical properties of the hydrogel on vascular morphogenesis. Using human umbilical vein endothelial cell (HUVEC) as a model, we studied the effects of cell adhesive ligands (e.g., RGD peptides) and vascular growth factor mimetic peptide (i.e., VEGF mimetic peptides) as well as the elasticity of the alginate hydrogel on endothelial network formation. The results from these studies lay down a solid foundation to work with MCC core and establish an enabling framework to rational develop interactive biomaterials for endothelial vascular morphogenesis.