
Sara J. Liliensiek¹, Joshua A. Wood ², Robert Auerbach¹, Paul F. Nealey¹, Christopher J. Murphy², Sara J. Liliensiek: sjlilien@wisc.edu

¹University of Wisconsin, Madison, Wisconsin, USA and ²University of California, Davis, California, USA

Introduction
To develop an improved vascular prosthetic it is essential to determine the response of endothelial cells and their interaction with different substrate materials. Despite these observations, vascular prosthetics have only recently incorporated biophysical cues including topography as an essential component of the final engineered product. Our strategy is to use the biophysical environment of vascular basement membrane characterized in previous studies¹, to guide the fabrication and design of improved biomimetic substrates containing both submicron and nanoscale features.

Materials and Methods
To simulate vascular basement membrane features, polyurethane substrates containing either anisotropically patterned surfaces of parallel ridges and grooves or isotropic patterned pores with features that ranged in size from 200 – 2000 nm were fabricated. These surfaces were used to characterize the impact of topographic cueing on endothelial behaviors including orientation/elongation, migration and proliferation.

Results
We found that all cell-types exhibited orientation and alignment with the most pronounced response on anisotropic ridges ≥ 800 nm. HUVEC cells were the only cell-type examined to demonstrate a decrease in proliferation in response to the smallest topographic features regardless of the topographic geometry (FIG 1). All cells migrated preferentially parallel to the long axis of the ridges, with the greatest increase in cell migration being observed on the 1200 nm pitch. However, migration on isotropic pores did not vary on topography when compared to planar controls. Overall, our data demonstrate that cells from large and small vessels respond differentially to topographic cues.

Discussion and Conclusions
Our data suggest that selected topographic features and size scales should be considered in the design parameters of vascular prosthetics. Future work will incorporate other biophysical cues, including compliance, into our substrate design parameters. These studies have relevance to our fundamental understanding of vascular endothelial cell matrix interactions in health and disease. Specifically, they will aid in the development of improved plasticware design for *in vitro* studies utilizing endothelial cells, contribute to the development of novel strategies in tissue engineering and will advance the development of cardiovascular prosthetics.

References

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Disclosures
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