BIOMEDICAL ENGINEERING DEPARTMENT

Keith J. Gooch, Ph.D.
Associate Professor

Education and Work Experience

1986-1991 BS Chemical Engineering, Virginia Tech, Blacksburg, VA

1991-1995 PhD Chemical Engineering, Penn State

1995-1998 Postdoctoral Fellow, Health Science Technology MIT

1998-2005 Assistant Professor, Department of Bioengineering, Penn

Contact Information

Rm. 290 Bevis Hall
1080 Carmack Rd,
Columbus, OH 43210
Phone: (614) 292-2665
Email: gooch.20@osu.edu

Research Interests

The goals of my laboratory's research are 1) to better understand the factors controlling the growth, differentiation, and remodeling of cells and tissues and 2) to ultimately use this information to improve human health by directing tissue development (e.g., tissue engineering) or modulating tissue states in the body (e.g., preventing or treating disease). This work spans the molecular, cellular, and tissue levels and several different cell/tissues types.

Conduit vessels: Vascular remodeling, a process in which blood vessels change the absolute amount of tissue (i.e., grow or atrophy) and/or change the distribution of the tissue (i.e., change the inner diameter, thickness, or length), is well recognized as a key aspect of many forms of cardiovascular disease but the factors stimulating and the mechanisms regulating vascular remodeling are not well understood. We have used an ex vivo organ culture model to elucidate the roles of aspects the mechanical environment, especially axial loading, in vascular remodeling. Furthermore, our recent work suggests that mechanically induced vascular remodeling can be rationally controlled to aid in the tissue engineering of vascular grafts.

Microvasculature. One major challenge to creating

successful tissue engineering applications is the development of a vascular supply to newly generated or implanted tissue. Towards the goal of creating a microvasculature to support engineered tissues, we have elucidated factors controlling the formation and stability of microvascular networks including the chemical composition of the supporting matrix, the origin of the endothelial cells (e.g., vessel-derived vs. blood-derived "endothelial progenitor" cells), and presence of non-endothelial cell. Using the knowledge from these studies, we have developed tissue-engineered microvascular networks and used these for endothelial cell-based gene therapy system, which permits efficient delivery of a therapeutic protein to circulation.

Islets: The goal of this project is to combine existing understanding of beta cell development with techniques used in the engineering of other tissues in vitro to create tissue-engineered islets. By controlling cell-cell and cell-ECM interactions and the ectopic expression of transcriptional factors, we have significantly (~100-fold) improved the efficiency of islet cell differential in vitro.

Current Lab Members:

Binata Joddar, PhD, Post-doctoral Researcher
Rashmeet Reen, PhD, Research Associate
Mark Stevenson, Graduate student

Adjunct Members:

Edward Green, PhD: Post-Doctoral Fellow at the MBI at OSU

Selected Publications

Clerin V, Nichol J, Petko M, Myung RJ, Gaynor JW and Gooch KJ. Tissue Engineering of Arteries by Directed Remodeling of Intact Arterial Segments. Tissue Eng 9(3):461-72. 2003.

Lawrence AR, Gusic RJ and Gooch KJ. Noninvasive Determination of Perfused Artery Dimensions Ex Vivo Using a Pressure-Diameter Relationship. Biorheology 40 (5):523-9. 2003.

Blunk T, Sieminski AL, Appel, B, Croft C, Courter DL, Chieh JJ, Goepferich A, Khurana JS, and Gooch KJ. Bone morphogenetic protein-9: A potent stimulant of cartilage development and mineralization. Growth Factors 21(2):71-8. 2003.

Sieminski AL and Gooch KJ. Salmon fibrin supports an increased number of sprouts and decreased degradation while maintaining sprout length relative to human fibrin in an in vitro angiogenesis model. J Biomaterials Science. Polymer Edition 15(2):237-42. 2004.

Sieminski AL, Hebbel RP, and Gooch KJ. The Relative Magnitudes of Endothelial Force Generation and Matrix Stiffness Modulate Capillary Morphogenesis In Vitro. Exp Cell Res 297 (2):574-84. 2004.

Schreiber FS, Deramaudt TB, Brunner T, Boretti MI, Gooch KJ, Enders GH, Bernhard EJ, and Rustgi AK. Successful growth and characterization of mouse pancreatic ductal epithelial cells: properties of Ki-ras oncogene. Gastroenterology Jul;127(1):250-60. 2004.

Stanley J. Stachelek SJ, Alferiev I, Choi H, Kronsteiner A, Uttayarat P, Gooch KJ, Composto R, Chen IW, Levy RJ. Cholesterol derivatized polyurethane: characterization and endothelial cell adhesion J. Biomed. Mater. Res. Feb 1;72A (2):200-12.2005

Nichol JW, Petko M, Myung RJ, Gaynor JW, and Gooch KJ. Hemodynamic Conditions Modulate the Growth, Remodeling, and Mechanical Properties of Arteries Subjected to Increased Axial Loading Ex Vivo. Ann. Biomed. Eng Jun 33(6): 721-732 2005.

Gusic RJ, Myung R, Petko M, Gaynor JW, Gooch KJ. Shear stress and pressure modulate saphenous vein remodeling ex vivo. J Biomech Sep;38(9):1760-9 2005.

Gusic RJ, Myung R, Petko M, Gaynor JW, Gooch KJ. Mechanical properties of native and ex vivo remodeled saphenous veins. J Biomech Sep;38(9):1770-9 2005.

Sieminski AL, Hebbel RP, and Gooch KJ. Improved Microvascular Network Formation In Vitro by Human Blood Outgrowth Endothelial Cells Relative to Vessel-Derived Endothelial Cells. Tissue Eng. 11 (9/10) 1332-1345 2005.

Boretti MI and Gooch KJ . Induced Cell Clustering Enhances Islet b Cell Formation from Pancreatic Ductal Epithelial Cell-Rich Cultures in Vitro. Tissue Eng (in press).

Byfield FJ, Tikku S, Rothblat GH, Gooch KJ, Levitan I. OxLDL Increases Endothelial Stiffness, Force Generation And Network Formation. Journal of Lipid Research (in press).

Daxini SC, Nichol JW, Sieminski AL, Smith G, Gooch KJ, and Shastri VP. Micro-patterned Polymer Surfaces Improve Retention of Endothelial Cells Exposed to High Shear Stress. Biorheology (in press).

back to top

Back to BME Home

Last updated: 02/27/2009

If you have trouble accessing this page and need to request an alternate format, contact bmew@osu.edu.