Bio-Scaffold Versus Synthetic Scaffold Interactions with Seeded Stem Cells in Dynamic Flow Culture Environments

Chia-Pei Denise Hsu[1], Brittany A. Gonzalez[1], Asad Mirza[1], Sharan Ramaswamy[1]
[1]Florida International University, Miami, FL, USA

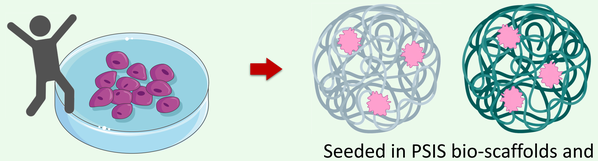
CV-PEUTICS Cardiovascular Therapeutics Lab

FIU Engineering & Computing Biomedical Engineering

INTRODUCTION

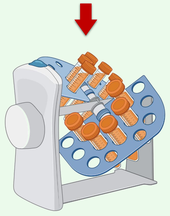
Elastin is an important component of extracellular matrix in cardiovascular tissue regeneration. The objective of this study is to determine whether porcine small intestinal submucosa (PSIS) bio-scaffolds can better promote this tissue regeneration from bone marrow stem cells compared to polyglycolic acid poly L-lactic acid (PGA-PLLA) synthetic scaffolds under physiologically-relevant flow environments.

METHODS

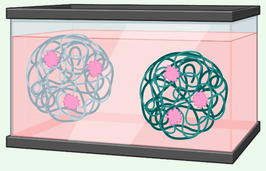


Human bone marrow stem cells

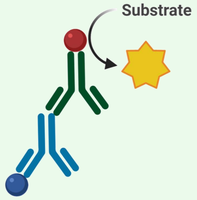
Seeded in PSIS bio-scaffolds and PGA-PLLA synthetic scaffolds



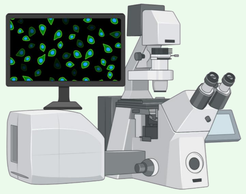
Seeded scaffold strips were placed in rotisserie for 8 days



Then conditioned in a bioreactor under physiologically relevant flow environment for an additional 14 days

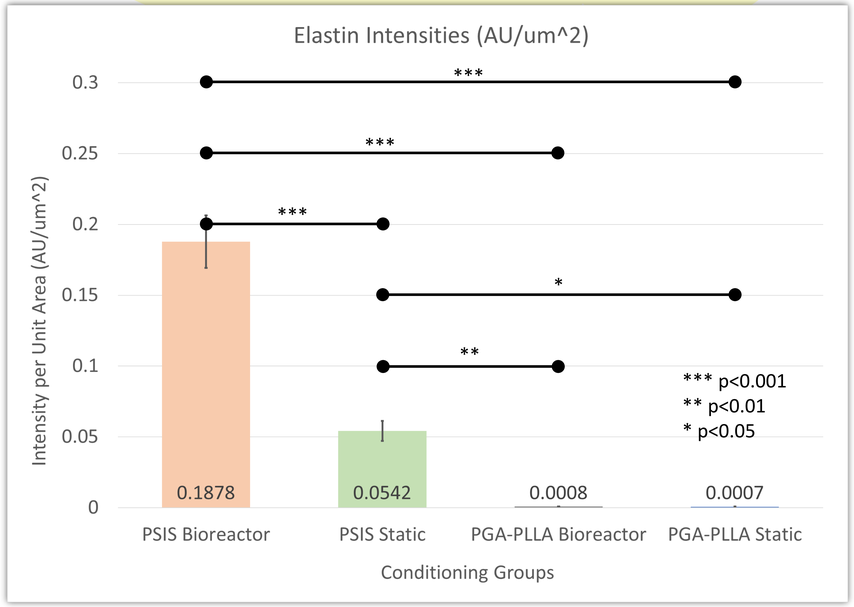


Samples were sectioned and stained with elastin antibodies



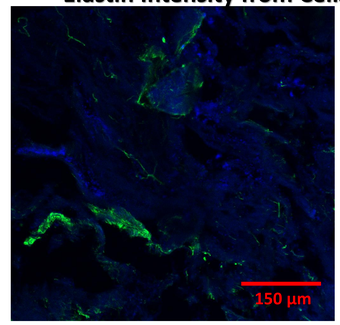
Stained samples were imaged using a confocal microscope

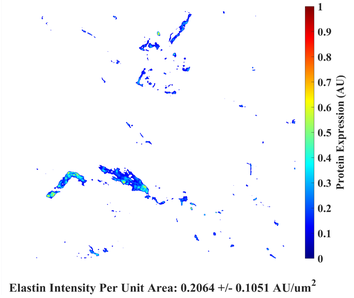
Bio-scaffold facilitates **higher production of elastin from seeded stem cells** compared to synthetic scaffold, particularly under dynamic oscillatory flow conditions



RESULTS

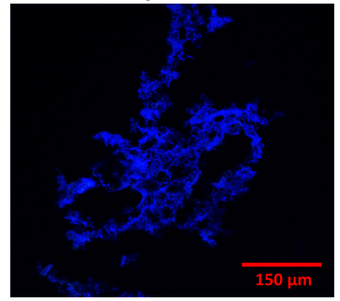
Elastin Intensity from Cells Seeded in PSIS Bio-scaffold

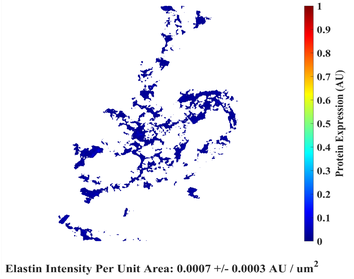




Elastin Intensity Per Unit Area: 0.2064 +/- 0.1051 AU/um^2

Elastin Intensity from Cells Seeded in PGA-PLLA Synthetic Scaffold





Elastin Intensity Per Unit Area: 0.0007 +/- 0.0003 AU / um^2

CONCLUSION & DISCUSSION

Stem cells seeded in PSIS bio-scaffolds facilitate higher production of elastin, particularly under oscillatory flow mechanical conditions compared to PGA-PLLA synthetic scaffolds. Bio-scaffolds extracellular components with flow stimulation will allow bone marrow stem cells to communicate and secrete engineered matrix components, such as elastin that will be useful for enhancing cardiovascular regeneration.

ACKNOWLEDGEMENTS

- Research funding from the Florida Heart Research Foundation is gratefully acknowledged
- A dissertation year fellowship (DYF) from Florida International University's, University Graduate School (UGS) for Chia-Pei Denise Hsu is gratefully acknowledged