

Assessing Endothelial Cell Behavior in an in vitro PEG-DA Hydrogel Cell Culture Assay of
Idiopathic Pulmonary Fibrosis

(Technical Report)

The Struggle to Diminish Inequities in the U.S. Healthcare System

(STS Research Paper)

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
School of Engineering and Applied Science
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Biomedical Engineering

by

Tara Tavakol

May 11, 2023

Preface

How may healthcare be improved? Good healthcare systems develop state-of-the-art treatments, but they must also be accessible. High costs of treatment limit access to healthcare in the United States. Uninsured people are much less likely to seek treatment, contributing to worse overall health among the uninsured.

Idiopathic Pulmonary Fibrosis (IPF) is a rare and fatal lung disease of poorly understood etiology. When mechanical and biochemical triggers change cell microvasculature, IPF may follow. To help researchers improve IPF treatment, the project team studied this mechanism. With an established hydrogel endothelial and pericyte cell culture assay with tunable stiffnesses, we examined the effects of mechanical stiffness along with VEGF or PDGF+FGF on cell viability and morphology. Because PEG-DA hydrogels may replicate the extracellular matrix environments of diseases, such hydrogels were prepared with stiffnesses of 20 kPa, 10 kPa, and 2 kPa, mimicking various levels of IPF severity and lung microvasculature. Results demonstrated improved vessel formation for cells in hydrogels of low stiffness, indicating disruption in vessel formation for stiffer gels.

To diminish racial inequities in healthcare in the United States, advocacies, health professionals, philanthropies, and others publicize the problem and demand policy reform. While social justice advocacies, public health professionals, and medical professionals generally agree that racial and other inequities pervade the U.S. healthcare system, they disagree about the best means of redressing them. Some maintain that incremental reform can make the current system sufficiently equitable; others, however, contend that the system in itself perpetuates historical inequities, and must be reconstructed.